Growth Effects of Foreign Direct Investment: the Role of Host Country Factors

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Declaration

I hereby certify that this is my own original work except where otherwise acknowledged in the text. Section 7.2 contains work that is my contribution to the following joint publication:

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Abstract

This thesis contributes to the ongoing debate over the impact of foreign direct investment (FDI) on host country economic growth. Interest in this issue has grown in recent years, motivated by disparate findings on the effects of FDI and its increasing importance in the global economy. In the recent literature, much attention has focussed on the role of host country factors in determining the nature and growth effects of FDI. However, there is no consensus on precisely which host country factors matter and the role of some factors has not been systematically examined.

This thesis presents new empirical evidence on the FDI-growth nexus, focussing on the impact of host country trade and FDI policies and investments in human capital. In the general analytical literature and country case studies, attention has been placed on host country FDI policies as a key determinant of the growth effects of FDI. However, as yet no cross-country analysis of this issue has been undertaken due to the limited availability of systematic quantitative indicators of FDI policies. To address this deficiency, a new cross-country dataset on FDI policies is compiled and applied to separate cross-country analyses.

In order to provide a richer understanding of the linkages between the growth effects of FDI and host country trade and FDI policies and human capital, the thesis examines how each of these factors influences the nature of multinational enterprise (MNE) production. Industry-level data on the operation of overseas United States MNE affiliates are used to examine two factors which are hypothesised to be important for understanding how FDI promotes host country economic growth. These are the determinants of MNE affiliate export orientation and the determinants of technology transfer to MNE affiliates. In addition, national level data are used to investigate the growth effects of FDI, conditional on host country factors.

The results support the hypothesis that these host country factors influence both the nature of MNE production and the growth effects of FDI. Liberal FDI policies and open trade policies, in particular, are found to encourage more export oriented MNE affiliate production while liberal FDI policies are also found to have a strong positive influence on technology transfer to MNE affiliates. There is also weaker evidence that open trade policies and higher levels of host country human capital encourage technology transfer. Finally, consistent with these findings, the results suggest that the

growth effects of FDI are stronger where liberal FDI and open trade policies are adopted while the evidence on human capital is less conclusive.

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Chapter 1

Introduction

"Successful development ... requires a mechanism for ensuring adequate flows of the large quantity of disembodied ideas that are used in production. The government of a poor country can therefore help its residents by creating an economic environment that offers an adequate reward to multinational corporations when they bring ideas from the rest of the world and put them to use with domestic resources." Romer (1993)

"Today's policy literature is filled with extravagant claims about positive spillovers from [FDI]... At the national level, the effect of [FDI] on economic growth is weak, and disappears as more country characteristics are controlled for." Rodrik (1999)

"Several country studies have found no evidence of technology spillovers from multinational investments, leading – so it seems – to a more-or-less widespread view among informed observers that, whatever its merits, reliance on multinationals does not convey gains in terms of technological development. But these countries are hardly exemplars of effective development strategy; accordingly, one might want to shy far away from postulating generalities on the basis of findings about them." Westphal (1998)

1.1 Introduction

The role of foreign direct investment (FDI) in promoting economic growth is an issue that continues to generate debate amongst researchers and the wider community. An optimistic view asserts that FDI plays an important role in connecting countries to the international economy, thereby providing domestic firms and workers with opportunities to gain access to new markets and technology. In contrast, a more sceptical view argues that FDI is either no different from any other form of investment or, worst still, may impede domestic development by stymieing local entrepreneurship. Popular sentiment, as expressed through anti-globalisation movements, parallels these views by highlighting concerns over the influence of large global corporations.

Official attitudes to FDI are also diverse. Spurred by popular distrust and nationalistic sentiment, particularly in former colonies, many regimes have traditionally viewed FDI with suspicion and others have adopted an overtly hostile policy stance. Today almost

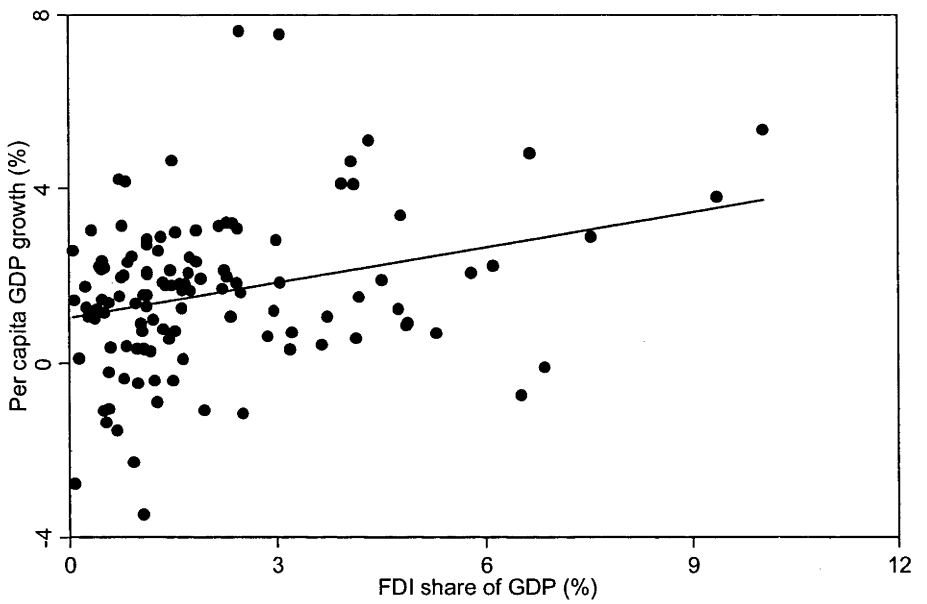
all countries impose some form of restriction on the flow of FDI and the operations of multinational enterprises (MNEs). Furthermore, some countries, particularly in parts of Africa, the Middle East and Latin America, maintain major barriers to FDI.

The broad trend in recent years, however, has been for authorities in most countries to adopt a more welcoming attitude to foreign investors. A broader range of sectors and large scale privatisation projects are now open to foreign capital while fewer conditions are being imposed on investors. Authorities in an increasing number of countries have gone further by offering incentives to lure new FDI, including tax concessions.

The positive view of FDI is supported by the observation that MNEs have a record of playing a major role in the industrial development of some of the fastest growing economies over the past half century. During the 1960s and 1970s, MNEs were at the forefront of labour intensive manufacturing in countries such as Hong Kong, Malaysia and Singapore and are today again at the forefront of these industries in China, Mexico and Vietnam. MNEs engaged in more sophisticated forms of manufacturing and services also play a leading role in some of the fastest growing industrialised economies, such as Ireland and modern day Singapore.

Nevertheless, the correlation between FDI and growth across countries over the last three decades suggests the impact of FDI on host economies is far from homogenous (figure 1.1). Across a large sample of countries the correlation between FDI and growth is positive but weak. However, the experiences of many individual countries differ markedly from the average and there are many instances where countries receiving relatively high inflows of FDI over an extended period have achieved relatively poor growth outcomes.

Figure 1.1: FDI and growth, 1970 to 2005



Source: UNCTAD online FDI database and World Bank World Development Indicators online database.
Notes: based on net FDI inflows, real GDP per capita growth and averages of annual observations over the period 1970 to 2005.

The results from detailed empirical studies, which control for a variety of other determinants of growth, also suggest the relationship between FDI and growth is complex.[1] A growing literature, drawing on firm, industry or national level data seeks to identify whether the presence of MNEs or the inflow of FDI raises host country productivity. The results of many studies fail to report a consistent positive link and indeed some find evidence of a negative effect on productivity. In addition, many of the studies that do report positive results have been criticised by Rodrik (1999), Carkovic and Levine (2005) and others for suffering from methodological weaknesses.

1.2 Hypotheses and aims of the thesis

It is perhaps unsurprising that FDI does not always exert the same impact on host country growth. Beginning in the 1970s, various hypotheses have been proposed arguing that host country factors influence both the nature of MNE production that a country attracts and the benefits that accrue from any given flow of FDI. The earliest contribution to this literature is by Bhagwati (1973; 1978; 1985) who argues that prevailing import-substitution bias in the policy regime causes allocative inefficiencies.

[1] This literature is reviewed in chapter 3.

As a consequence, it is shown that under some circumstances FDI inflows can reduce host country welfare (Brecher and Diaz-Alejandro 1977).

More recently, others, including Balasubramanyam et al. (1996), Borensztein et al. (1998) and Moran (1998; 2001), have highlighted how a broader range of host country factors impact on the nature of MNE production and the ability of the host economy to benefit from FDI. These contributions draw on elements of two areas of economic theory. The first area is endogenous growth theory, which focuses on how new knowledge, particularly disembodied knowledge, is accessed and put to use by economic agents. The second area is FDI theory, which explains the motives for different patterns of international investment and production.

Two aspects of MNE production which are argued to influence gains from FDI are technological sophistication and export orientation. First, FDI associated with more technologically advanced MNE affiliates is expected to facilitate higher productivity gains for the host country. MNE affiliates employing more advanced techniques are likely to operate at higher levels of productivity, thereby making a larger direct contribution to host country output. Perhaps more importantly, the presence of higher technology MNE production deepens the pool of knowledge that local firms can access and put to use in their own production processes. This creates more opportunities for local firms to reap productivity gains from FDI.

Second, MNE export oriented facilities tend to feature a number of characteristics that make them particularly conducive to increasing host country productivity. They tend to employ more technologically advanced production techniques, engage in lager scale production and are more likely to establish the kind of linkages with local firms that give rise to positive externalities. All of these factors increase the prospect of productivity gains for the host country.

Theories of FDI and multinational production predict that both the technology used by MNE affiliates and the degree of export orientation will be influenced by a number of host country factors. As a consequence, these theories also provide a link between host country factors and the growth effects of FDI. First, it is well established that technology transfer involves non trivial costs. Host country factors alter both these costs and the benefits of technology transfer. Absorptive capacity, FDI policies and the degree of market competition are all hypothesised to play a role. Second, theories of

FDI predict that a variety of host country factors, including trade and FDI policies, will affect the prospect of a country attracting export oriented MNE production.

A limitation of the existing empirical literature is that it provides little systematic evidence on the role of host country FDI policies in influencing gains from FDI. A second weakness of many studies examining the growth effects of FDI is that they tend to focus on the role of individual factors, rather than considering multiple factors. In addition, most studies do not consider the possibility that host country factors have complementary effects, where the impact of one host country factor depends on another factor.

This thesis aims to deepen the current literature devoted to examining how host country factors impact on the growth effects of FDI. In order to provide a more comprehensive study, evidence from inter-related analyses of how host country factors affect both the nature of MNE production and also the growth effects of FDI is presented. In each case the role of a number of different factors is considered. However, building on the existing literature, particular attention is placed on trade and FDI policies as well as human capital.

The thesis makes four main contributions to the literature. First, it presents a new cross-country dataset on FDI policies. Second, these policy indicators are used to generate new evidence on the role of FDI policies in influencing both the nature of MNE production and the growth effects of FDI. Third, updated evidence is also presented on the impact of trade policies and human capital. Fourth, by focussing on the same host country factors and applying the same proxy variables throughout each analysis, the study provides coherent evidence linking host country factors, MNE production and the growth effects of FDI. In addition, the analysis of the growth effects of FDI examines evidence on complementarities between multiple host country factors, reflecting the importance of different factors in shaping the underlying nature of MNE production.

In each empirical analysis presented in the thesis careful attention is paid to appropriate methodology, including model specification, samples used and estimation techniques. In all cases cross-country panel data are used. While this type of data has limitations, particularly with respect to comparability, it offers a number of advantages. First, it is invariably more reliable making generalisations about results from studies using

cross-country data than those focusing on particular countries. By their very nature country studies do not explicitly control for country specific factors which may be central to the findings.

Cross-country panel data also offers methodological advantages. This type of data often provides a far richer source of information on variables of interest which is important when undertaking any formal statistical analysis as sufficient variation is always a prerequisite for successful identification. Analysing many economic issues, including the determinants of growth, the data requirements are great because it is long run relationships that are of interest and many explanatory variables tend to evolve slowly.[2] Panel data also enables an assessment of dynamic relationships and the use of more sophisticated techniques which have the potential to address some of the problems facing researchers, including endogeneity bias.

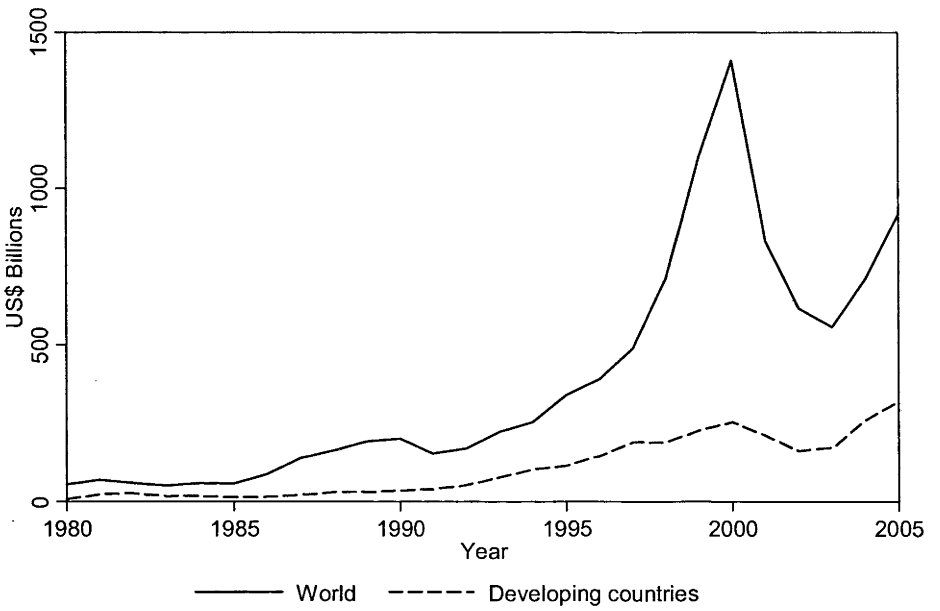
1.3 The importance of FDI

The importance of understanding the impact of FDI on host country growth is underscored by the growing role of FDI in the global economy. FDI flows have expanded rapidly over the past few decades, driven by a combination of more liberal policies, changes in technology and the emergence of large corporations with global interests. As a consequence, FDI represents an increasingly important facilitator of international economic integration. It is also a major source of external finance for many economies and plays an ever more important role in augmenting domestic capital formation and contributing to output.

Over the past few decades the value of global FDI flows has risen strongly (figure 1.2). Since 1970, the earliest year that FDI flows data are available for a large number of countries, global flows have grown at an average annual rate of over 15 per cent, rising from US$13.4 billion in 1970 to US$916.3 billion in 2005. Growth in FDI flows was particularly strong through the 1990s, driven in large part by merger and acquisition activity (UNCTAD 2004). In 2005 the global stock of inward FDI stood at just over US$10.1 trillion, up from around US$561.4 billion in 1980.

[2] Indeed in the case of some variables, such as those relating to geographic factors, cross-country variation is the only form of variation.

Figure 1.2: FDI inflows, 1980 to 2005



Source: UNCTAD online FDI database.
Notes: based on annual net FDI inflows.

While the trend increase in FDI since 1970 has been strong, global FDI flows have exhibited volatility, not least in the years since 2000. After reaching US$1.4 trillion in 2000, annual world FDI inflows fell by over 60 per cent in the period to 2003. Various factors are likely to have contributed to this decline. This includes a moderation from the unprecedented growth in flows around 2000, a sharp drop in the number of large privatisation projects and a slow down in the pace of FDI policy liberalisation (UNCTAD 2004). In the past two years FDI flows have recovered, although are yet to reach the peak levels of 2000.

Historically, FDI flows have been concentrated amongst industrialised countries and a small number of dynamic and or resource rich developing countries.[3] Between 1970 and 2005 industrialised countries accounted for around 70 per cent of FDI inflows and almost 90 per cent of all FDI outflows. Over this period some of the largest and most advanced economies, including the United States (US), Germany, the United Kingdom (UK) and later Japan, were the top source of FDI. However, although average FDI inflows were highest to the United States, relatively small but highly internationally integrated economies such as Belgium and the Netherlands were also amongst the top recipients of FDI.

[3] The classification of developing countries in this chapter follows UNCTAD.

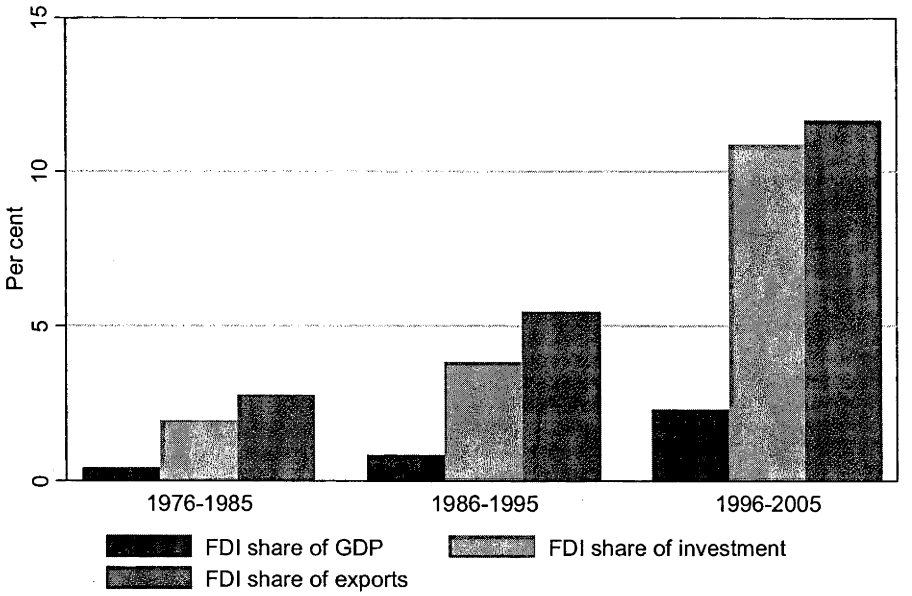
In recent years FDI flows have remained concentrated amongst industrialised economies. However, as illustrated in figure 1.2, since around 1990, the share of FDI flowing to developing countries has risen and key emerging economies are now amongst the top recipients of FDI inflows. Between 1990 and 2005, the developing country share of annual global FDI inflows increased from around 25 per cent to 40 per cent, leading to an increase in the developing country share of the world stock of inward FDI from around 20 per cent to just under 30 per cent.

The distribution of FDI amongst developing countries has also changed. During the 1970s the value of FDI flowing to developing countries was relatively evenly spread amongst Africa, Asia and Latin America, with the Middle East comprising a smaller share. Since then, however, there has been a significant increase in the share of FDI going to Asia, especially East Asia. One driving force of this redistribution and the overall increase in FDI to developing countries is China. In recent years China accounted for around a quarter of all FDI inflows to developing countries and in 2005 was host to a stock of US$317 billion of FDI, second only to Hong Kong amongst developing countries.

Another recent trend has been a strong rise in outflows of FDI from developing countries, which in total accounted for around 17 per cent of global outflows in 2005 (UNCTAD 2006). The source of these flows is highly concentrated with the top five countries accounting for around two thirds of the stock of outward FDI from all developing countries. Excluding offshore financial centres, the most important sources of developing country FDI include Hong Kong, Russia, Singapore, Taiwan and Brazil.

The trend increase in FDI flows has outstripped growth in world output, thereby increasing the importance of FDI in the international economy. During the 1970s, FDI inflows accounted for around half of one per cent of world GDP and in recent years has risen to around 2 per cent of GDP. The share of FDI in GDP has increased for both industrialised and developing countries but slightly more so in the case of developing countries where FDI as a proportion of GDP rose above 3 per cent in 2005.

Figure 1.3: FDI share of world GDP, investment and exports



Source: UNCTAD online FDI database.
Notes: based on net FDI inflows and averages of annual observations over ten year periods between 1976 and 2005.

Other indicators confirming the rising importance of FDI include the FDI share of world trade and total investment. During the 1970s the ratio of global FDI inflows to world exports averaged just over 3 per cent but rose to around 9 per cent by 2005. This upward trend was evident in both industrialised and developing countries. This increase highlights the importance of FDI as a facilitator of international economic integration. Since the 1970s, the FDI share of investment has also risen sharply, up from around 2 per cent to over 10 per cent.

Some FDI presumably represents a substitute for trade by allowing firms to establish foreign production facilities to serve foreign markets. However, FDI also represents an engine of trade by allowing firms to establish international production networks that engage in international trade in intermediate goods. The evidence presented in chapter 5 indicates the relative importance of this type of FDI may have increased, suggesting that FDI and trade are increasingly complementary.

FDI is an important source of external finance, particularly for developing countries. Whereas FDI flows to developing countries have continued to trend upward since the 1970s, other forms of private external finance have been erratic and have shown no clear tendency to increase. The growing importance of FDI relative to private debt and portfolio equity flows was particularly evident through the 1990s, when FDI soared and

other private flows stagnated. As a result, in recent years the FDI share of long term private external finance in developing countries rose to around two thirds (Nunnenkamp 2004).

Finally, the sectoral composition of global FDI continues to change. Historically, FDI has concentrated in manufacturing and mining related activities, particularly in developing countries. However, since the early 1990s there has been a strong rise in service sector FDI, which in 2002 was estimated to account for around 60 per cent of the world inward stock of FDI (UNCTAD 2004). Once again, advances in technology, particularly with respect to information and communications technology, have played an important role in facilitating this expansion. However, the liberalisation of FDI policies, which in many countries have historically focused on protecting domestic service sectors from foreign participation, has also been critical.

Initially, this rise in service sector FDI was concentrated in industrialised economies, especially those of Western Europe and North America, where multinational trading companies and finance sector institutions expanded their international presence. However, the global share of services FDI locating in developing countries rose sharply through the 1990s, from 17 per cent in 1990 to around 27 per cent in 2002 (UNCTAD 2004). The sectoral allocation of services FDI has also diversified in recent years, expanding fastest in electricity, telecommunications, water supply and business services. With the service sector accounting for the majority of output and employment in most economies, this increase in services FDI represents a sharp rise in the international economic integration of the most economically important sectors.

1.4 Structure of thesis

The thesis comprises six core chapters. Chapters 2 and 3 provide an overview of theory and existing empirical studies, thereby providing an analytical foundation for the empirical analysis presented in subsequent chapters. Chapter 2 introduces the concept of FDI and reviews general theories of economic growth and FDI as well as the intersection of these literatures. The discussion focuses on how FDI enables the transfer of technology and how this relates to endogenous growth theories, particularly those which focus on the process of technology diffusion. Chapter 3 builds on this by discussing theories of how host country factors shape multinational production and how

this relates to host country gains from FDI. This chapter also provides a review of the existing empirical literature.

Although FDI policies have been a focus of debate for sometime, there is a distinct lack of comparable cross-country data on these policies, particularly for developing countries and over longer periods. This motivated the compilation of a new cross-country dataset on FDI policies which is presented in chapter 4. Data were compiled from a wide range of primary and secondary sources and provide information on the presence of joint venture requirements and restrictions on the international movement of FDI for 89 countries over the period 1970 to 2000. The data are used throughout the empirical analyses presented in this thesis.

Chapters 5 and 6 analyse the determinants of MNE affiliate export orientation and technology transfer to MNE affiliates, thereby providing new evidence on factors which influence the nature of MNE production. Building on other studies of this nature, the dependent variable in each analysis draws on industry level data on the operations of US multinational affiliates operating in a number of countries. In both cases a wide range of explanatory variables are incorporated, including the FDI policy indicators introduced in chapter 4 and trade and human capital related variables.

Chapter 7 examines the growth effects of FDI, focusing on how host country trade and FDI policies, as well as human capital, influence this relationship. Following the approach adopted by a large number of studies, the analysis draws on cross-country data and a relatively diverse set of explanatory variables to evaluate the determinants of long run growth. The impact of host country policies on the growth effects of FDI is examined by experimenting with different samples and interaction terms.

Chapter 2

Overview of foreign direct investment and growth theory

2.1 Introduction

This chapter reviews theoretical aspects of the FDI-growth nexus. The discussion first canvasses separate theories of FDI and growth before focusing on the intersection of these literatures which highlights the different mechanisms through which FDI generates host country growth. In conjunction with the following chapter, this chapter provides the analytical foundation for the empirical analysis presented in this thesis.

In contrast to other forms of international capital exchange, FDI provides investors with direct managerial control of foreign assets. This defining characteristic gives rise to unique international linkages which underpins much of the interest in studying the causes and consequences of FDI. The managerial control facilitated by FDI flows allows direct investors to establish foreign production facilities that are integrated with their existing suite of productive assets and which make use of proprietary technology at the disposal of the investor.

While theories of FDI provide an understanding of the motives of direct investors and what FDI represents, growth theory has evolved to explicitly identify the drivers of long run growth. The driving force of growth in these theories is knowledge, which is either disembodied or embodied in workers as human capital.[4] Knowledge features a number of characteristics which differ from other productive inputs which has important consequences for how new knowledge is created and used in the production process.

By highlighting the role of knowledge accumulation and diffusion in the growth process, such theories dovetail theories of FDI which emphasise the importance of technology exchange through direct investors. In this way endogenous growth theory provides an ideal conceptual framework for examining the growth effects of FDI. FDI enables the establishment of more productive foreign affiliated firms which make a direct contribution to the productive capacity of the host country. More importantly, however, these firms may also promote productivity improvements amongst local firms.

[4] Throughout the thesis the terms "disembodied knowledge" and "technology" are used interchangeably.

The remainder of the chapter is organised as follows. Section 2.2 presents a discussion of FDI theories, emphasising how FDI differs from other international capital flows and how it provides a conduit for international knowledge diffusion. Next, section 2.3 presents a review of endogenous growth theory. This begins with an overview of theories which are implicitly concerned with knowledge creation and growth in a closed economy, before turning to theories of international knowledge diffusion. In section 2.4 theories of how FDI inflows generate growth in the host country are discussed while section 2.5 concludes. A brief overview of the Solow-Swan growth model is presented in appendix 2.1.

2.2 Theories of foreign direct investment

According to a widely applied definition, FDI is an investment in an enterprise outside the economy of the investor that represents a 'lasting interest' in the acquisition (IMF 1993). The term lasting interest has critical connotations for what FDI represents, how it is distinguished from other types of international capital exchange and its effect on the recipient country. A lasting interest signals a long term commitment by the investor and the desire and ability to exert some degree of managerial control or influence over the acquisition. Moreover, direct investors are motivated by the opportunity to bring the acquisition within its managerial umbrella. This contrasts with other types of international capital exchange, including portfolio equity investments, where the investor does not generally seek nor gain the ability to exert any meaningful degree of control.

In practice an investment classified as FDI does not require full foreign ownership. In most countries a foreign ownership level of between 10 and 25 per cent is deemed sufficient (Dunning 1993). FDI comprises three types of capital exchange between the direct investor and the acquired entity: equity flows, reinvested earnings and intercom any loans. FDI may represent an investment to acquire a stake in an existing firm, through a merger or acquisition, or to establish a new entity, a greenfields investment. Nevertheless, in each case the investment will give rise to the unique managerial relationship between firms across international borders that characterises FDI.

As with any type of investor, direct investors aim to generate the maximum possible return on their collective portfolio of assets. However, because FDI is uniquely synonymous with managerial influence the manner in which this objective is achieved

differs for direct investors. Managerial influence enables the use of knowledge related assets at the disposal of the direct investor, often referred to in the literature as propriety assets, in conjunction with the acquisition (Hymer 1976; Caves 1996, pp.2-6). Direct investors therefore seek to maximise the return on their portfolio through the direct management of assets.

Propriety assets refer to a potentially large class of assets which incorporate various aspects of knowledge used within the production process. They are synonymous with disembodied knowledge discussed in the context of endogenous growth theory in section 2.3 below and are likely to vary greatly in specificity and tangibility. To illustrate, they may include factors such as product designs, production techniques, marketing expertise as well as other managerial and administrative knowledge. Importantly, in order for such proprietary assets to be utilised in a foreign affiliated firm they must not be tied to a single physical site and must be internationally transferable, within the overall ownership framework created by FDI.

Foreign ownership not only enables the use of propriety assets across national boundaries but provides an incentive for such knowledge transfer. In establishing a firm in a foreign market, direct investors face costs that local investors do not. These costs relate to the management of the firm across national boundaries as well as poorer knowledge of local business networks, laws and consumer preferences. This disadvantage can be offset through the use of proprietary assets which provide a technological edge over domestic firms (Caves 1971; Hymer 1976).

Moreover, due to the dominance of MNEs in the creation and ownership of technology, foreign affiliated firms will often have access to leading technologies through their parent company, in addition to other proprietary assets. For example, according to United Nations (UN) estimates, in 2002 the 700 largest firms in the world, almost all of which were classified as MNEs, accounted for close to half of global research and development expenditure and more than two thirds of global business related research and development (UNCTAD 2005c). By providing the means and incentives for technology transfer from leading innovators, FDI represents a conduit for knowledge diffusion and facilitates the establishment or expansion of foreign affiliated firms that are invariably technologically superior to domestic firms.

In some circumstances the most effective offshore use of proprietary assets may not require direct investment. Rather than establishing foreign affiliated firms through FDI, a direct investor may find it more effective to licence production to a foreign owned firm. Arrangements such as these allow for propriety assets to be made available to other firms under strictly controlled conditions. However, due to certain characteristics of propriety assets, and disembodied knowledge more generally, this will often be problematic or even infeasible, requiring firms to utilise proprietary assets directly in their production processes (Teece 2003).

First, due to the public good characteristics inherent in proprietary assets it may be impractical to devise a contract to protect every aspect of intellectual property. Second, even if these contractual problems can be overcome, certain proprietary assets may only be of value if used in conjunction with other proprietary assets for which it is not possible to devise contracts. Third, negotiating over the parameters for the commercial exchange of technology, particularly pricing, is difficult given the many intangible and tacit elements.

Building on the idea that FDI facilitates the use of proprietary assets, a number of theories have been proposed to explain the existence of MNEs and flows of FDI associated with their activity. Reflecting the particular motives of direct investors these theories are grounded in an international trade and industrial organisation paradigm. They therefore contrast with the traditional interest rate parity approach typically applied in macroeconomic theories of capital flows (Markusen and Maskus 2003).

Dunning (1993) argues that the decision to undertake FDI in lieu of an alternative mode of entry to a foreign market can be explained in terms of FDI conferring advantages along three separate dimensions: ownership, location and internalisation. First, FDI provides the means to maintain *ownership,* thereby ensuring synergies between the full set of assets controlled by a MNE including its human and physical capital as well as propriety assets. Second, FDI provides the opportunity to access and control *location*-specific resources such as low cost or highly skilled labour or natural resources that are unavailable in the home country. Third, FDI makes it possible to *internalise* production occurring in a foreign country. This enables proprietary assets to be used abroad without having to resort to outsourcing, making it easier for firms to protect proprietary assets and ensure quality and supply standards are met.

An alternative way to represent the motives of direct investors is to note that by seeking control of a foreign enterprise the investor will be seeking either access to foreign markets or location specific factors of production. Direct investment undertaken to gain access to foreign markets is often referred to as horizontal or market seeking FDI. In contrast, direct investment aimed to secure access to factors of production is termed vertical or efficiency seeking FDI.

This distinction reflects the different ways in which assets acquired through FDI fit within the existing portfolio of productive assets controlled by a parent company. Foreign assets acquired for market access motives are aligned horizontally with existing MNE processes meaning these are used to replicate certain aspects of the production process associated with existing MNE assets. For example, a production facility located in one country may be replicated in another country to serve that market. In contrast, vertical or efficiency seeking FDI concerns the acquisition of foreign assets that form one part of a vertically integrated international production line.

An additional distinction is also typically drawn between FDI designed to ensure access to natural resources, often termed extractive FDI, and other types of vertical FDI. While both extractive FDI and other vertical FDI are concerned with the incorporation of location specific resources into a global production chain, they differ in respect to how the foreign affiliated firm is integrated in to the host economy. Extractive FDI will often encompass capital intensive production, particularly where it is associated with mining, thereby employing production techniques that may not match the wider comparative advantage of the economy. Such investment projects may also operate in physical isolation to other areas of economic activity. Moreover, the flow of extractive FDI is determined primarily by endowments of natural resources whereas efficiency seeking FDI will potentially locate in any country.[5]

A number of general equilibrium theories, whose origins lie in trade theory, have been developed to explain the flow of FDI between countries. Early examples of these draw a sharp distinction between motivations for either horizontal or vertical FDI. Helpman (1984) devises a model of vertical FDI where the production of a single factor involves two activities that are geographically separable and differ in factor intensity. The first

[5] Throughout this thesis the terms "horizontal FDI" and "market seeking FDI" are used interchangeably, as are the terms "vertical FDI" and "efficiency seeking FDI". Furthermore, vertical or efficiency seeking FDI excludes the special case of extractive FDI.

activity, termed headquarter activity, relates to various managerial and design processes and requires skilled labour. The second activity, dubbed production line activity, requires only unskilled labour.

When factor costs differ between countries, and trade costs are sufficiently low, firms can reduce costs by undertaking vertical FDI and splitting production activities across countries. Headquarter activity will remain in the home country, assuming this is skill abundant. In contrast, production line activity will be relocated to labour abundant countries where wage costs are lower. In this scenario FDI enables the establishment of an offshore production facility which is aligned vertically in the firm's supply chain and specialises in labour intensive production.

The simple vertical FDI model of Helpman can be generalised to explain more complex patterns of international production. Rather than establishing just one offshore, vertically integrated affiliated, firms may establish a supply chain of vertically integrated affiliates, each specialising in the production of a particular component (Hanson et al. 2005). This type of product fragmentation provides MNEs with the advantage of matching the requirements of different production processes to factor endowments in different countries.[6]

An alternative set of models, starting with Markusen (1984), aim to illuminate motivations for horizontal FDI. Rather than focussing on differences in factor costs, these models highlight the implications of trade costs and economies of scale. In the presence of sufficiently high trade costs firms may find it more cost effective to establish foreign affiliated firms to serve a foreign market, rather than through exports. In this way, FDI provides an opportunity for MNEs to circumvent trade costs. The presence of firm level economies of scale, where two plant firms have fixed costs less than double those of an equivalent single plant firm, strengthens the incentive to undertake horizontal FDI.

These theories, which draw a sharp distinction between the motives for horizontal and vertical FDI, provide a clear framework for understanding the underlying motives of investors. However, they do not always explain observed empirical regularities. First, FDI flows both between industrialised economies, with broadly similar factor costs, and

[6] See Yeats (1998) for empirical evidence on the importance of global production sharing and Athukorala (2005) for an analysis of the growing trade in parts and components.

between industrialised and developing countries, where factor costs differ considerably. Second, there is evidence that some firms adopt complex integration strategies that involve simultaneous vertical and horizontal FDI. For example, in an analysis of trade flows between US multinationals and their Canadian affiliates during the 1980s and 1990s, Feinberg and Keane (2006) find that a majority of firms in their sample do not adopt simple vertical or horizontal strategies but rather engage in extensive intra-firm trade.

Motivated by these observations, recent theoretical advances aim to provide a more general framework for explaining patterns of FDI (Helpman 2006).[7] Markusen (2002, ch7-8) proposes a unifying theory dubbed the knowledge capital model which combines elements of earlier horizontal and vertical models of FDI. In this framework the choice between a firm engaging in domestic production only or horizontal or vertical FDI is determined endogenously, on the basis of the characteristics of production and factor endowments across countries.[8]

Yeaple (2003) proposes a theory in which the optimal pattern of international production for an individual firm may involve both horizontal and vertically integrated affiliates. In this model firms produce a final consumption good using labour and an intermediate good. The intermediate good can be produced offshore in a vertically integrated affiliate but this form of production involves fixed costs associated with establishing an international production structure. Hence the potential benefits to engaging in vertical FDI in the form of lower unit costs weigh against additional fixed costs. In this scenario the productivity of the firm and its scale of production play an important role in determining the optimal production configuration, which may simultaneously involve horizontally and vertically integrated affiliates.

In summary, the motives to undertake direct investment contrast with those that drive other types of international capital flows. Direct investors seek control or influence over a foreign entity in order to facilitate the best use of their collective assets, including propriety assets, in order to generate a maximum return on their portfolio. Investors who engage in other types of capital exchange are not driven by the same considerations. This distinction provides a basis for explaining flows of FDI through a

[7] A related literature focuses on the decision to undertake arms length international outsourcing versus internalizing production through FDI (see for example Antras (2003) and Antras and Helpman (2004)).
[8] See Carr et al. (2001) for an empirical assessment of the knowledge capital model.

paradigm other than interest rate parity. Moreover, the motivations for FDI underpin the hypothesis that it represents a mechanism for transferring a range of productive knowledge, in addition to the usual stock of undifferentiated capital associated with other capital flows.

2.3 Endogenous growth theory

2.3.1 Endogenous growth theory in the closed economy

Following the negative finding in the Solow-Swan model that growth could not be driven by the accumulation of physical capital under the assumption of diminishing returns to investment emerged endogenous growth theory. The objective of this literature has been to explicitly identify the factors that allow for a perpetual expansion in economic output, rather than attributing this to some exogenously determined factor, as is the assumption in the Solow-Swan model.[9]

Two ideas characterise the endogenous growth literature. First, knowledge is generally assumed to be the driver of growth and sources of new knowledge are explicitly endogenised. Second, breaking with the neo-classical assumption, constant or increasing returns to factor accumulation are often incorporated. Assuming constant or increasing returns to scale in physical capital accumulation is likely to be problematic. However, this may not be so for other types of inputs, including a broader form of capital that incorporates human capital or disembodied knowledge. In the following section the case of non-diminishing returns to physical capital accumulation is briefly considered, before the key contributions in the endogenous, knowledge based growth theory literature are presented.

The AK model is a simple representation of the economy where output is a linear function of the stock of capital and a constant technology parameter (Rebelo 1991). With this representation of output, the Solow-Swan assumption of diminishing marginal returns to capital accumulation is replaced with an assumption of a constant marginal return to investment. Abstracting from the impact of depreciation, with a fixed savings rate that generates a continual expansion in the capital stock, under this formulation of output, capital accumulation alone is sufficient to generate perpetual growth. The

[9] See appendix 2.1 for an overview of the Solow-Swan growth model.

growth rate of output will simply equal the growth rate of the capital stock which in turn depends only on the savings rate (net of any depreciation).

Hence, unlike the Solow-Swan model, in the AK model changes in the savings rate have a permanent impact on the rate of output growth and exogenous improvements in technology are no longer required to drive growth. The obvious limitation of the AK model is the assumption of constant marginal returns to physical capital accumulation. Arguably, this is an unrealistic representation of the microeconomic foundations of production where, under most conceivable conditions, it is likely that eventually, additions to the capital stock will face diminishing marginal returns. Nevertheless, this simple representation is useful for highlighting the required conditions for capital accumulation to drive perpetual growth.

An important development in the evolution of endogenous growth theory was reconsidering the role of knowledge in the production process and precisely how advances in knowledge are generated. Part of this involved recognising that knowledge has characteristics that are fundamentally different from other inputs to production (Romer 1993). One characteristic of knowledge that sets it apart from other inputs is that it is non-rivalrous. This means that ideas and concepts relating to the application of a particular type of technology by one agent do not preclude the simultaneous use of the same technology by another agent. This contrasts with, for example, an individual piece of machinery which can only ever be used in one application at any point in time.

A second unique characteristic of knowledge is that it is only partially excludable, meaning that once a new innovation is realised, the innovator can not, under most circumstances, completely prevent others from copying and using the new technology. Further, once an innovation has occurred, imitation may incur almost no cost. Legal mechanisms such as patents are designed to restrict access to new innovations, so in some circumstances knowledge can be made excludable. However, in practice such legal protections operate for a limited period and may provide only partial coverage. In some cases patents may be completely ineffective, if for example their legal status is not recognised in some jurisdictions. These special characteristics of technology have important implications for how innovation contributes to the process of economic growth.

An early exposition of a growth model which captures some of the key characteristics of knowledge in the production process is by Arrow (1962). A defining feature of this model is that all improvements in knowledge, which are assumed to be embodied in superior vintages of capital goods, are available to all firms. Implicitly, it is assumed that all new knowledge is a pure public good that is available to all agents at zero cost. As a result, rather than gains from knowledge accumulation being fully internalised by any one individual firm, knowledge inevitably diffuses or 'spills over' to other firms, thereby creating positive externalities from knowledge creation. This contrasts with a scenario where firms undertake investments in a production input with rival and excludable characteristics, such as undifferentiated capital goods where the returns on investment are fully internalised.

A limitation of the Arrow (1962) model is that, in the long run, growth is tied to the rate of population growth, which is assumed to be exogenous. Strictly speaking, therefore, this model does not fully characterise growth as an endogenously determined factor. Romer (1986) builds on the Arrow (1962) framework and the idea of knowledge spillovers to devise a model where the rate of growth is endogenously determined.[10] Citing evidence of rising productivity growth in leading economies over the past few centuries, he assumes increasing, rather than decreasing returns to knowledge accumulation. With this minor modification a simple framework for explaining endogenous growth is established.

Aside from specifying knowledge as the driver of growth, another notable feature of Arrow (1962) and Romer (1986) is the knowledge generation mechanism. In both models, rather than assuming knowledge is created through research and development, it is assumed to accumulate as a by-product of production or 'learning by doing'. To support this idea, Arrow (1962) cites evidence from studies of productivity in the aircraft manufacturing industry. These show that the time taken to build a particular aircraft is inversely related to the number already built, suggesting that productivity

[10] An important variation is that Romer (1986) assumes knowledge is disembodied rather than embodied in different varieties of capital goods.

gains arise simply as result of greater familiarity with a particular design and production process.[11]

An alternative to assuming that new knowledge is disembodied or embodied in new vintages of physical capital is to assume new knowledge is embodied in workers (human capital). Considering human capital as a distinct input of production recognises heterogeneity in the capabilities of different workers which reflects different investments in education and other learning processes. Individual workers, and therefore human capital, do not share the same non-rival and non-excludable characteristics as disembodied knowledge. However, in placing human capital accumulation as an engine of endogenous growth, Uzawa (1965) and Lucas (1988) argue that human capital has other unique properties that have important implications for how it is accumulated and how it enters the production process.

The first point of difference between human capital and physical capital is that higher levels of human capital make it easier to accumulate additional human capital. For example, people who are better at reading can learn more efficiently than those who are illiterate. A second point of difference is that human capital has external effects; people benefit from working and interacting with others who have high levels of human capital. As such, increases in the level of human capital of any one worker not only facilitates an increase in the productivity of that worker but also raises the level of productivity of all other workers.

Under these assumptions human capital accumulation has an external effect analogous to the knowledge spillovers advocated by Arrow (1962) and Romer (1986). Drawing on these two ideas Lucas (1988) devises a model where human capital alone can drive growth, even in the absence of new disembodied knowledge. In this model the rate of output growth is dependent on the rate of human capital accumulation, which is in turn dependent on the amount of resources devoted to education.[12]

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[11] Strictly speaking Arrow (1962) suggested that in this context learning is a by-product of investing rather than producing since it is the process of investing that stimulates new processes and production, and therefore learning.

[12] Lucas (1988) and Stokey (1991) rely in part on an external spillover effect from human capital to generate endogenous growth. However, as noted by Rebelo (1991), this is an unnecessary assumption, even if the specification of diminishing returns to inputs of capital is retained. With constant returns to scale production technology and differentiated types of capital inputs, including both physical and human capital, it is possible for human capital in tandem with physical capital accumulation to drive perpetual

Arguably, there are limits as to how much knowledge any one person can accumulate, raising problems in asserting human capital accumulation as the engine of growth (Romer 1990b). A further problem is that the knowledge embodied within any one person is lost when they pass away. In contrast, neither of these limitations applies to disembodied knowledge. Assuming that the key facets of knowledge can be codified, any innovation can be stored in perpetuity. Countering this argument, Lucas (1988) argues that since education comes about through social interactions between people, human capital effectively passes through successive generations. Hence, the educational attainment of any given generation depends on the human capital of education providers in the preceding generation.

Following on Romer (1986) and Lucas (1988), from the late 1980s onwards a number of endogenous growth theories emerged with the aim of explicitly modelling sources of innovation and incorporating them into a fully specified model of aggregate supply. One stream of this literature builds on the Arrow (1962) and Romer (1986) idea of learning by doing (see for example Stokey (1988) and Young (1991)). An alternative literature focuses on the role of deliberate and costly research and development effort as a driver of innovation. In these models, resources are combined in an innovation sector to produce new technology, rather than assuming this to be a by-product of production as in the learning by doing models. A major contribution of this literature has been to identify the circumstances which underpin the incentives to undertake innovative activity.

One of the first examples of an endogenous growth model based on research and development is Romer (1990a). As in Romer (1986), disembodied knowledge is assumed to grow without bound, is non-rival and is the ultimate driver of long run growth in output. In this model a representative economy features three sectors: a research and development sector, an intermediate goods sector and a final goods sector. New innovations originate in the research and development sector and are embodied in tradeable blueprints (designs). Production in this sector can be characterised by the following equation:

$$\dot{A}_t = \delta H_A A_t \qquad (2.1)$$

growth. Such a specification resembles the AK model discussed above with 'K' referring to an amalgam of capital rather than narrowly defined physical capital.

where A represents the stock of knowledge, H_A the amount of human capital allocated to research and development and the dot script the rate of change with respect to time.

Blueprints, protected from imitation by patents, are sold to firms in the intermediate goods sector, which combine the technology embodied in a particular blueprint with physical capital to produce a unique variety of durable intermediate good, x_i. Hence, in this framework new knowledge is initially embodied in blueprints and then later embodied in new varieties of intermediate goods. The idea that knowledge is non-rivalrous has an important implication for the use of blueprints by intermediate goods producers. Namely, once the producer of an intermediate good has purchased a design for a particular good, the volume of this good that can be produced is limited only by the availability of physical capital.

The last phase of production occurs in the final goods sector where firms combine differentiated intermediate inputs with labour and human capital. As is standard in growth theory, the final output good is assumed to be fungible and is either consumed by households or saved and then used as physical capital in the intermediate goods sector. Production in the final output sector can be characterised by:

$$Y_t = H_Y^{\alpha} L^{\beta} \sum_{i=1}^{A_t} x_i^{1-\alpha-\beta} \quad \alpha > 0, \beta > 0 \text{ and } \alpha + \beta < 1 \qquad (2.2)$$

where Y is final sector output, L unskilled labour and H_Y the amount of human capital allocated to the final goods sector. As denoted by the parameters α and β, final goods production is governed by constant returns to scale and, at any point in time, final goods producers will use all available intermediate goods so as to minimise production costs. Since the stocks of labour and human capital are assumed to be constant, the only source of final sector growth in the model is increases in the variety of intermediate durable goods, driven by innovations in the research and development sector.

As noted, knowledge generated in the research and development sector is purchased by intermediate goods producers. This exchange is problematic if knowledge is assumed to be non-excludable (as in the case of theories featuring knowledge spillovers such as Romer (1986)) since no firms will be willing to pay for knowledge that is freely available. In order to allow for the transfer of resources to innovators, blueprints that embody new knowledge are covered by patents that prevent other firms from

appropriating the commercially acquired knowledge. This in turn provides intermediate firms with market power which they exercise over final goods producers by selling intermediate goods at the monopoly price. Hence, intellectual property protection makes research and development, the driver of new knowledge and ultimately output growth, economically viable. Without such protection intermediate firms would be unwilling to pay firms in the innovation sector for their blueprints and innovation would cease.

There are two important assumptions regarding the process of knowledge accumulation in the Romer (1990a) model, described by equation 2.1. First, increases in knowledge, and therefore ultimately output, are governed by the allocation of resources, namely human capital, to research and development effort. Therefore, a larger stock of human capital yields a permanently higher rate of output growth. Second, the growth of knowledge is linearly increasing in the stock of existing knowledge. This specification is aimed to capture the idea that all advances in knowledge build on the existing stock of knowledge which represents the sum of every innovation that has occurred throughout history.

With the additively-separable treatment of durable intermediate goods in final sector production, the availability of new intermediate goods represents an increase in technology. Each new capital good does not affect the marginal productivity of existing capital goods, nor do they enhance the productivity of existing goods. As such, new capital goods are modelled so as not to displace existing intermediate goods, even though in reality many innovations are superior substitutes for existing products. The assumption that new capital goods do not replace existing goods may only be appropriate for major break throughs, rather than incremental improvements in technology (Barro and Sala-i-Martin 2004). It could also be argued that, in many cases, new technologies enhance existing technologies by allowing them to be applied to new production processes.

An alternative representation of technical progress is that innovation provides the basis for improvements in the quality of existing products. This characterisation of innovation is represented in a number of endogenous growth theories which, like Romer (1990a), have increases in knowledge brought about through research and development as the driver of growth (see for example Segerstrom et al. (1990), Grossman and

Helpman (1991) and Aghion and Howitt (1992)). In these types of models the number of intermediate goods is fixed but the quality (marginal productivity) of each type of good is increasing over time as better designs become available. Therefore, new intermediate goods are assumed to be close substitutes for existing intermediate goods.

This approach to modelling technical change has its genesis in the ideas of Schumpeter (1942), who argues that innovation represents a process of 'creative destruction' where new and superior designs make existing products and techniques obsolete. As in the expanding product variety model of Romer (1990), the existence of patents allows research and development effort to be compensated, providing the incentive for innovation. However, in contrast to the expanding product variety approach, existing blueprints are eventually made redundant so that monopoly rents generated through the existence of patents are temporary rather than permanent.

As noted above, in research and development type endogenous growth models changes in the resources devoted to innovative effort have a permanent impact on the growth rate. In Romer (1990a) for example, an exogenous rise in the employment of skilled labour in the research and development sector will permanently raise the rate at which new technologies are invented and therefore final sector output growth. A similar result is evident in the simple AK model; a permanent increase in the savings rate will yield a permanent increase in the rate at which capital is accumulated and output grows.

As Jones (1995b) notes, such 'scale effects' appear to be at odds with the empirical evidence for industrialised economies. In many of these countries, the quantity of resources devoted to innovation, proxied for example by the number of scientists and engineers engaged in research and development, has risen sharply over an extended period. According to research and development type models this should imply a noticeable increase in the trend rate of output growth. In reality, however, over the past century or more the trend rate of growth in per capita output has been relatively stable in many industrialised economies. On the more direct link between innovative effort and changes in the stock of knowledge, Segerstrom (1998) notes that despite the large increase in resources devoted to innovation through the twentieth century the rate of growth in the number of patents has been stable.

The observation that in industrialised economies growth in knowledge and output appears to be insensitive to increases in innovative effort has led to a reassessment of

the knowledge creation process and attempts to devise endogenous growth models without scale effects. A core assumption of one such model, proposed by Jones (1995a), is that the production of new technology does not exhibit constant returns to scale. He specifies innovation as evolving according to the following equation:

$$\dot{A}_t = \delta H^{\lambda} A_t^{\varphi} \tag{2.3}$$

Whereas Romer (1990a) assumes that the parameters φ and λ are equal to one, Jones (1995a) argues that each of these parameters may be less than one. First, if the stock of all potential knowledge is fixed, then it is likely that innovations requiring the least effort to discover have been discovered first and that future innovation becomes increasingly difficult. This 'fishing out' effect, represented by the parameter φ being less than one means that for a given allocation of resources to research and development, the rate of increase in knowledge slows as the stock of knowledge increases. Second, the marginal productivity of workers engaged in innovation may not be constant, due to congestion that leads to duplication in research effort. This is represented by the parameter λ being less than one. In this case, the creation of new knowledge will not be linear in the allocation of resources to research and development and again, *ceteris paribus*, the growth rate of new knowledge will decline over time.

Assuming decreasing, rather than constant returns in knowledge production has significant consequences for how knowledge and ultimately output growth is generated. Most notably, in the absence of increases in the amount of labour allocated to research and development, diminishing returns to knowledge accumulation will result in the stock of knowledge converging to a constant level. Permanent changes in the allocation of resources to research and development no longer have a permanent impact on the rate of output growth but rather result in changes to the *level* of the stock of knowledge and generate convergence dynamics similar to those exhibited by the Solow-Swan model. In this revised formulation of knowledge creation, growth in knowledge and per capita output is dependent on world population growth which facilitates perpetual increases in the stock of labour working in research and development (Jones 2002).

2.3.2 Endogenous growth theory in the open economy

The endogenous growth models discussed in section 2.3.1 provide a theoretical framework for explaining a process of growth driven by knowledge accumulation, in a

closed economy. The accumulation of knowledge, embodied in various forms, is assumed to occur domestically and there are no channels through which knowledge might be accessed from an external source. This characterisation of the knowledge accumulation, and therefore growth process is arguably inadequate. The non-rival and only partially excludable nature of knowledge suggests that it may diffuse widely. Indeed, in the models discussed above, knowledge diffusion is explicitly assumed to occur between innovators operating within some ill defined border. However, given the wide range of international economic and financial linkages as well as means of communication, it would seem implausible to assume that at least some international diffusion does not occur.

If knowledge diffusion occurs at the global level then a natural characterisation of knowledge is that it is a global rather than national phenomenon. Grossman and Helpman (1991) and Rivera-Batiz and Romer (1991) explore this idea by devising knowledge based models of growth to assess the effects on output of international economic integration. They consider a scenario where two, previously isolated, economies establish channels of communication that enable the diffusion of knowledge. It is assumed that both representative economies are equally technologically advanced. However, the nature of the knowledge stocks in each economy differs, so there is no overlap in knowledge in the two economies.[13]

In this framework, the opening of channels of communication leads to an immediate exchange of knowledge that will result in a jump in the stock of knowledge available to producers in each economy and an associated increase in the level of output. More significant, however, is the impact that the opening of communication channels has for the process of knowledge accumulation in both economies. In an integrated world, researchers in each economy effectively work within a common (global) innovation sector. Assuming constant or increasing returns to scale production in this sector, the bringing together of resources into a global pool drives higher rates of growth in both economies by the same mechanism that drives higher growth in closed economy endogenous growth models. Namely, a greater stock of existing knowledge and a larger

[13] In a product variety model of growth such as Romer (1990) this assumption is represented by each economy having access to the same number of intermediate goods but each set of intermediate goods representing different technologies (or varieties of intermediate goods).

allocation of resources to the collective innovation effort allows for a faster rate of innovation.

These models illustrate how knowledge used in any individual economy might be viewed as a global good. In doing so they provide a framework for illustrating how knowledge diffusion might increase the global stock of knowledge and the rate at which it is accumulated. However, since technological capability is assumed to be homogeneous across countries, these models do not aid our understanding of the factors that might explain differences in access to knowledge and the implications of these differences. This question is the focus of models of knowledge diffusion.

Technological catch-up or convergence describes the process whereby countries acquire new knowledge from a more technologically advanced country.[14] Therefore the notion of technological convergence is premised on the idea that there are differences in technological capability (a technology or knowledge gap) which reflect differences in access to knowledge. The possibility of technological convergence is especially significant for lower income countries which may suffer significant technology gaps and undertake very little innovative activity of their own. However, it is unlikely that any one economy has access to the full global pool of knowledge at any point in time and so technological convergence may be important, even for industrialised economies (Jovanovic 1997).

The idea of technological convergence predates the development of endogenous growth theory. Indeed, writing in the early part of the twentieth century, Veblen (1915) highlighted the importance of foreign innovation as a source of technological improvement during the period of early industrialisation in Germany. Other historical accounts of development and industrialisation also point to the importance of technological convergence. For example, Gerschenkron (1962) presents wide ranging evidence on phases of technological leadership and catch-up in explaining the changing economic fortunes of European powers over several centuries. In particular, he chronicles a number of advances in technology that were initially developed in one location and later imitated by producers in neighbouring countries. Rostow (1963) also refers to a role for technology diffusion in his theory of the phases of development.

[14] Where there are intra-national differences in the available stock of knowledge, technological convergence may also occur at a sub-national level.

Many formal theoretical models of knowledge diffusion and technological convergence emphasise the role of imitation rather than the commercial acquisition of new technology and while some consider specific channels for technology transfer, most aim to illustrate a generic process of diffusion. An early example of such a generic model is by Krugman (1979) who models the world as comprising two regions, one where innovation occurs (the North), and the other where innovations are imitated (the South).

Building on the theory of the product cycle by Vernon (1966), Krugman assumes that imitation occurs once the knowledge to produce a particular good becomes public, which simply occurs following the passing of a fixed period of time. Hence, the natural evolution of global production is for goods to be invented and initially produced in the North and then eventually for production to migrate to the lower cost South. A more recent incarnation of this idea is presented by Segerstrom et al. (1990) who construct a similar model except that innovations in the North are deterministic, arising from the result of research and development effort, rather than evolving at some exogenous rate as Krugman (1979) assumes.

A limitation of these generic models of technological convergence is that they cannot explain determinants of the rate of technology transfer to less advanced economies. As Arrow (1969) notes, if differences in access to technology explain much of the observed variation in global productivity levels and growth, then the natural presumption is that country specific factors must influence the diffusion and uptake of superior technology that has been invented and is utilised elsewhere. Therefore, the aim of a number of models of diffusion has been to provide greater insights on the precise mechanism for technology transfer and to consider impediments to diffusion rather than to assume this occurs through some simple, exogenous osmosis effect. Some specific issues considered in this literature include costs associated with the imitation or transfer of technology and host country policies and endowments that may constrain technology transfer and utilisation.

The imitation and use of an existing, superior technology appears to involve far more than a simple duplication process. In addition to devoting resources to understanding processes and products associated with new technologies, firms may also need to modify these to fit in with their existing organisation. Differences in the operating environment due to factors such as government regulation, legal frameworks or

geography may also require modifications that impose additional resource costs. This suggests that one impediment to knowledge diffusion are costs associated with imitation, a hypothesis supported by empirical studies which imply these are non-trivial (see for example Mansfield et al. (1981), Teece (1977) and Szulanski (1996)).

A model that focuses on the process of knowledge diffusion in the presence of adoption costs is by Barro and Sala-i-Martin (1997; 2004).[15] In this model there are two representative countries, a technological leader, which produces innovations and a follower, which seeks to imitate innovations. Following Romer (1990), each country comprises three sectors. These include a final and intermediate goods sector as well as either an innovation sector (in the lead country) or an imitation sector (in the follower country). As in many other endogenous growth models, advances in technology are represented by increases in the number of intermediate goods available.

Barro and Sala-i-Martin (1997; 2004) assume that the lead country has access to a larger number of intermediate products than the follower country and that the costs of imitation in the follower country are lower than the costs of innovation. However, it is also assumed that adoption costs rise as the follower country gradually masters all available technology in the lead country and therefore closes the technology gap. As a result the rate of imitation, and therefore growth, in the follower country slows as it catches up to the technological leader.[16]

By modifying the assumptions regarding adoption costs in this framework, different patterns of growth and convergence across countries can be produced. For example, Papageorgiou (2002) assumes the cost of adoption is quadratic in the size of the technology gap between the follower and lead economy. This revised specification means that adoption costs are greatest if the technology gap is very large or very small.

As with Barro and Sala-i-Martin (1997; 2004), rising costs are assumed on account of the increasing difficulty that imitators face when trying to replicate technologies near the global frontier. In addition, it is hypothesised that very backward economies will face high costs of adoption due to a lack of capacity to replicate even basic forms of

[15] See also Segerstrom (1991).

[16] Rather than viewing the acquisition of new technology as a process of imitation, this model can also represent technological convergence as occurring through a process of acquiring new technology from abroad through commercial means such as technology licensing. Under this scenario, innovators in the lead country sell their blueprints to intermediate goods producers in the follower country, thereby enabling final sector producers in the follower country to access new varieties of intermediate goods.

technology. Rather than predicting technological convergence for all developing countries, this model suggests that middle ranking developing countries will exhibit rapid convergence due to relatively low adoption costs while the poorest will grow slowly or stagnate due to high adoption costs.

Parente and Prescott (1994) devise a model of technology diffusion and catch-up focussing on specific factors that raise the costs of firms undertaking investments to implement new technology. These barriers to technology adoption encompass a wide range of factors such as legal and regulatory barriers, corruption and political instability. Using data from the US and Japan, the authors argue that low costs of adoption explain rapid convergence in incomes levels, such as that exhibited by Japan and Korea in the second half of the twentieth century. Furthermore, the model suggests that only small increases in adoption costs are required to explain the failure of many countries to move on to a convergence path. Expanding on this idea, more recently Parente and Prescott (1999; 2000) focus on how vested interests with legislative backing (including labour unions) might prevent the adoption and diffusion of new technologies in situations where they stand to lose economic rents.

Other factors that impede technological convergence aside from adoption costs have also be been examined in growth models. Pack (1993) departs from the traditional theoretical assumption that access to any technological improvement will necessarily raise productivity by arguing that some innovations may be unsuitable for some countries. In particular, he argues that the beneficial impact of new technology hinges on whether the technology is suited to a country's factor endowment and stage of development.

Countries endowed with low capital labour ratios, including most developing countries, might only be expected to benefit from access to technologies relevant to labour intensive industries.[17] If government interventions artificially raise the wage-rental ratio, then firms may choose inappropriate capital intensive techniques, giving rise to unemployment, forgone output and welfare losses. In this case, access to new technology may be detrimental to development.

[17] An exception to this rule might be technology and investments associated with resource extraction industries.

Basu and Weil (1998) formalise the idea that capital intensive technology is unsuitable for developing countries. The primary implication of their model is that the diffusion and implementation of new technology is not immediate and automatic. Rather, it takes time, and only occurs as countries accumulate capital and achieve sufficiently high capital-labour ratios which enable them to benefit from more sophisticated and capital intensive production techniques.

Similar in spirit is a model by Acemoglu and Zilibotti (2001). In this model it is assumed that some innovations can only be utilised by skilled workers owing to skill-technology complementarities. Since most research and development is undertaken in industrialised economies for countries abundant in skilled labour, innovations tend be biased towards skill intensive production. As a result, many innovations cannot be utilised in developing economies where skilled labour is scarce.

Earlier work by Nelson and Phelps (1966) argues human capital conditions the rate of technological convergence. They draw a distinction between two different effects human capital accumulation has on the ability of workers to perform a particular task. The traditional view of human capital is concerned with how education and training enables a worker to perform a particular routine. In this sense, the accumulation of human capital allows workers to produce more by undertaking a greater quantity of routine work. In addition, they argue that education also provides the means for workers to adapt to changes in routine which may arise due to advances in technology and other factors.

As a result, better educated workers, especially those involved in decision making processes such as managers, are more likely to incorporate advances in technology at a faster rate. To support their hypothesis Nelson and Phelps (1966) cite empirical evidence on the uptake of the latest pesticides in the agriculture sector. This showed that farmers with higher levels of education were more likely to have the capacity to appreciate the value of new technology and be better positioned to implement it faster and more effectively.

One interpretation of the Nelson and Phelps (1966) hypothesis is that inadequate human capital represents a constraint on the ability of agents to absorb new knowledge, or a lack of absorptive capacity. This issue is canvassed at length by Abramovitz (1986).

He argues that absorptive capacity is difficult to define but is likely to relate to a wide range of supply side factors required to facilitate knowledge diffusion.

Pack (2003) elaborates on the role that human capital plays in facilitating technology diffusion by suggesting that this complementarity arises from the tacit elements of technology. Effective utilisation of superior technology requires judgement and expertise and cannot always be taken 'off the shelf'. Therefore, it is possible that producers using the same material inputs may end up employing two distinct techniques, if the understanding of the tacit elements of technology differ (Evenson and Westphal 1995).

The possibility of complementarity between technology and human capital has also been examined in the labour economics literature with some arguing that this complementarity is the factor which drives the observed link between wage inequality and the speed of technological innovation (Acemoglu 2002). For example, Greenwood and Yorukoglu (1997), show that during periods of rapid innovation, firms need to hire highly educated workers to employ new technology embodied in machinery. This has the effect of driving up demand for relatively skilled workers and therefore wage differentials. [18]

Easterly et al. (1994) and Keller (1996) devise theoretical models of absorptive capacity and technological convergence that link the speed of convergence to the rate of human capital accumulation. They treat all knowledge as a global public good but assume that the utilisation of more advanced technology requires sufficient local technical capability or absorptive capacity, which they define purely in terms of the stock of human capital. They hypothesise that entrepreneurs and workers need to acquire ever higher levels of human capital to attain the ability to work with more advanced technology. In this sense, human capital and technology are bounded complements so that the rate of technology diffusion and growth are ultimately a function of the rate at which human capital is accumulated.

The precise mechanism by which this complementarity is modelled differs between the two models. Easterly et al. (1994) simply assume that education represents attaining the ability to work with new types of technology that exist elsewhere. Keller (1996) takes a

[18] See Bartel and Lichtenberg (1987) for further empirical evidence.

slightly more elaborate approach by incorporating what is essentially a sector for adopting and implementing domestically, foreign innovations. Increases in education play a vital role in this adoption sector since progressively more sophisticated foreign innovations require higher levels of human capital to adopt to domestic use.

To support his emphasis on the importance of ongoing investments in human capital, Keller (1996) cites weaknesses in the link between liberalisation and growth outcomes in some countries. He argues that in some cases reforms have been undertaken to liberalise trade and investment restrictions, thereby opening the channels of technology diffusion, but have failed to achieve significant productivity gains. He argues that in these countries inadequate investments in human capital have prevented the diffusion of technology from abroad, limiting the growth dividend from liberalisation.

Rather than highlighting the role of human capital in ensuring access to the global pool of knowledge, Howitt (2000) devises a multi-country growth model where technological convergence is conditional on all countries undertaking at least some domestic research and development. In this model, growth in each country is governed by domestic innovation that brings about new, higher productivity intermediate capital goods used in final sector production. It is assumed that intermediate goods are not tradeable. However, international knowledge diffusion plays a critical role since knowledge used to produce different intermediate goods in each country is sourced from a common global pool which grows in accordance with innovations that occur throughout the world. In other words, innovation in each country draws upon and contributes to the global stock of knowledge.

In each country productivity is influenced by two factors. The first is the frequency of innovation, represented by the duration between the introduction of new intermediate goods. The second is the size or importance of new innovations which reflects how superior a new intermediate product is compared with an existing vintage.
Howitt (2000) argues that these two effects are offsetting.

A country that undertakes little research and development will innovate infrequently. However, when innovations occur, they will represent a relatively large improvement over existing intermediate products. Conversely, a country that undertakes a greater amount of research and development will produce innovations frequently but they will represent relatively minor improvements over existing intermediate products.

Therefore, the long run rate of productivity growth will be the same for all countries that undertake any amount of research and development. In contrast, countries that undertake no research and development will be unable to generate improvements in the productivity of intermediate goods and will therefore stagnate.

In summary, the hypothesis that knowledge diffuses across national boundaries has profound implications for how knowledge accumulation drives growth. First, if international knowledge diffusion occurs seamlessly then all countries can draw from a common global pool of knowledge, both as a direct input to production and as an input into the innovation process. More significantly, if underdevelopment is in part due to differences in access to knowledge then knowledge diffusion can contribute to convergence in productivity levels.

However, a number of contributions to this literature have suggested that various factors may limit the potential for knowledge diffusion. These include the existence of adoption costs, the possibility that not all technology is suitable for all countries and the possibility that vested interests may prevent domestic firms from utilising superior, foreign sourced technology. Another constraint on technology diffusion which, as argued in chapter 3, is likely to be particularly relevant for diffusion through FDI, is absorptive capacity. According to this hypothesis, the diffusion and utilisation of superior technology requires the availability of other factors of production, particularly human capital.

2.4 Growth effects of foreign direct investment

In this section three main mechanisms through which FDI drives growth in the recipient country are analysed. In the first sub-section a brief examination of theories that emphasise the role of generic international capital flows in promoting capital deepening is presented. These early theories of growth and international capital flows share some key features with the Solow-Swan model, including the assumptions that capital is undifferentiated and there is no explicit role for knowledge transfer. Therefore, although these models provide a starting point for examining the impact of capital flows on growth their use in examining the full impact of FDI is limited.

The other two mechanisms highlighted below reflect the role FDI as a conduit for knowledge transfer. The first concerns the impact of FDI on changes in the efficiency

and structure of local production. This discussion emphasises the role of foreign firms in increasing domestic market competition, generating new supply linkages and enabling economies of scale. The second focuses on how FDI facilitates technology transfer to local firms through knowledge spillovers. Also presented are formal models of growth that feature FDI as the channel for knowledge transfer which build upon the endogenous growth theory literature discussed above.

2.4.1 Capital deepening

MacDougall (1960) presents a simple static analysis of the impact of capital inflows on host country output. In a representative economy the sole factors of production are fixed stocks of labour and capital, a proportion of which is owned by foreign investors. In this framework domestic and foreign capital are assumed to be perfect substitutes and domestic and foreign investors face the same rate of return.

With a fixed labour supply, a marginal increase in the stock of foreign capital leads to a fall in the marginal product of capital and an associated decline in the rate of return on all capital. Therefore, new foreign investment drives down the return for domestic investors. However, this negative impact on national income will be more than offset by an increase in the return to labour arising from the process of capital deepening. An additional benefit will accrue to domestic households if the returns to foreign capital are subject to taxes. In summary, in this simple framework, foreign investment will generate a net increase in host country income, with or without taxes applying to foreign investors.

The process of capital deepening can also be considered in a dynamic framework. Barro et al. (1995) devise an open economy extension of the Solow-Swan growth model that allows for international capital flows. In the closed version of the model, the capital labour ratio and level of assets per worker are always equal. This is because the capital stock is wholly owned by domestic households.

However, in the open economy extension, which allows for foreign borrowing and lending, this condition does not necessarily hold. Current account deficits (surpluses) and the associated build up of foreign debt (assets) reflect the difference between the amount of capital used in domestic production which is owned by domestic and foreign households. For a small economy that faces a given world interest rate, such differences

are determined by the rate of time preference of households compared with the world interest rate.

The results generated from this seemingly simple extension to the Solow-Swan growth model are problematic. Unless the world interest rate equals the rate of time preference of households, agents will either run their capital stock and consumption levels to zero, or continue building their capital stock until they own the full global stock of capital. In addition, the speed of convergence to these unlikely scenarios is infinite so that adjustment is instant.

To address these problems the basic framework is modified to incorporate factors such as heterogeneity in the preferences of households across countries, credit constraints and investment adjustment costs. Therefore, a simple open economy extension of the Solow-Swan model provides limited insights on how international capital flows affect the speed of convergence to the steady-state. By retaining the assumption of diminishing marginal returns, such a framework also ultimately relies on exogenous technological improvement as the long run driver of growth. Moreover, there is no role for capital flows to facilitate knowledge transfer.

2.4.2 Efficiency and market structure

A consequence of the technological superiority of foreign affiliated firms is that their presence is likely to alter the domestic operating environment. This may have important implications for all firms operating within the same market, but especially local firms. Some, but not all of these changes will be beneficial for the performance of domestic industry.

One effect that foreign firms may have is to intensify market competition in the host country. This may lead to a boost in local firm productivity by forcing them to reduce any slack in factor utilisation, thereby increasing X-efficiency (Leibenstein 1966; Keller 2001). Alternatively, it is possible that over the medium to long run the presence of foreign controlled firms with superior technical and financial resources may drive out local firms, resulting in greater industry concentration and, potentially, a fall in national income. This effect is likely to be exacerbated in the presence of trade barriers that restrict import competition and provide a more conducive environment for the rise of monopolistic foreign operators. It is also likely to be of greater significance where

foreign firms enter industries with high fixed costs, where 'market stealing' reduces demand and raises average costs for local firms (Aitken and Harrison 1999).

Another way in which the presence of foreign firms may alter the domestic operating environment and generate productivity improvements amongst local firms is by stimulating additional demand for locally produced goods. This issue is examined in theoretical models by Rivera-Batiz and Rivera-Batiz (1991), Rodriguez-Clare (1996) and Markusen and Venables (1999). The key issue highlighted in these models is the positive impact on the productivity of local firms brought about from increases in the demand for their output generated by the presence of foreign affiliated firms operating in downstream markets.

In each of these models a two sector production framework is used where intermediate goods are supplied by local firms to a downstream market populated by foreign and local firms that produce a final consumption good. Given the dependency between locally owned upstream intermediate suppliers and downstream buyers, the entry of new, foreign affiliated firms spurs demand for local inputs. In the presence of increasing returns to scale in upstream markets, higher demand brings about productivity gains for local suppliers.

In the model by Rodriguez-Clare (1996) the magnitude of this positive external effect is dependent on the extent of linkages between local suppliers and foreign affiliated firms. In turn, linkages are determined endogenously according to the relative costs of foreign affiliates sourcing products abroad and locally. An implication of this setup is that greater benefits from FDI will accrue to local firms when they are competitive suppliers of intermediate products to foreign affiliated firms.

2.4.3 Technology transfer

A key consequence of FDI facilitating knowledge diffusion between MNE parent companies and their foreign affiliates is that it may give rise to local knowledge spillovers. Such spillovers are based on the same concept of knowledge diffusion which forms the cornerstone of endogenous growth theories outlined in section 2.3 above. Like other international linkages such as trade and migration, FDI provides opportunities for firms to benefit from foreign innovations. There are, however, important differences in the mechanics of knowledge diffusion occurring through FDI

which suggest that FDI might be a particularly effective conduit for international knowledge diffusion.

First, FDI spillovers involve local firms acquiring knowledge from a foreign firm operating within the same national boundary. Hence, FDI brings foreign innovators and users of new technology within close proximity of local firms. This is important if the potential for spillovers increases with proximity, as suggested by some empirical studies (see for example Jaffe et al. (1993), Bottazzi and Peri (2003) and Keller (2002)).

Second, as noted in section 2.3.2, some innovations may be unsuitable for some countries while others may require modifications to suit local conditions. This problem is likely to be particularly acute for firms in developing countries which face factor endowments and operating conditions that differ greatly from those faced by firms in industrialised countries, where the bulk of research and development is undertaken. However, as MNEs are directly engaged in foreign production, the technology supplied to MNE affiliates is more likely to be well suited to the operating environment of the host country and therefore beneficial to local operators.[19]

There are a number of channels through which FDI spillovers may occur (Blomstrom and Kokko 1998; Lipsey 2002). Recognising the importance of close economic linkages in promoting knowledge diffusion, each of these revolves around local workers and firms interacting with foreign affiliated firms. The first mechanism is referred to as demonstration effects. This simple mechanism operates by locally owned firms observing how foreign affiliated competitors undertake business and replicating their superior practices. This type of knowledge diffusion occurs between firms engaged in similar activities and, therefore, typically operating in the same sector. Spillovers occurring through demonstration effects therefore usually represent intra-industry or horizontal spillovers.

Second, where foreign affiliated firms trade inputs with local firms, FDI spillovers may also occur up and down the supply chain. This is particularly so where a foreign affiliate has an incentive to assist its local suppliers in upstream markets and customers in downstream markets. Such assistance may be forthcoming when the successful supply of foreign sourced equipment to local firms requires various forms of technical

[19] Nevertheless, as discussed in section 3.2 of chapter 3, host country factors are likely to have a considerable influence on the nature of technology used by MNE affiliates.

assistance. Alternatively, where foreign affiliates rely on local upstream suppliers, they may assist these suppliers in meeting quality and reliability standards. Indeed, where inputs are sourced locally, foreign affiliates are likely to have an incentive to promote knowledge diffusion widely amongst local firms to ensure quality improvements and competition amongst local suppliers (Pack and Saggi 2001).

The third channel is labour mobility. Local workers employed by foreign affiliates may learn about new production technologies before departing to work for a locally owned firm or establish their own business. Knowledge may be acquired through formal training provided by the firm or simply through learning by doing. In this way foreign sourced knowledge becomes embodied in local workers before diffusing more broadly.[20]

The knowledge diffused through FDI is potentially diverse (Todaro 1985; Blomstrom and Kokko 1998). Rather than only comprising 'hard' technology of the type often embodied in capital goods, FDI may also enable the transfer of a wide range of 'soft' technology embodied in proprietary assets.[21] Such knowledge refers to a broad array of practical business knowledge which may not be available through commercial means due to contractual problems or through other diffusion channels such as international trade.

An important example of 'soft' knowledge spillovers facilitated through FDI are 'market access' spillovers which refer to the process of local firms learning how to export from the presence of MNE affiliates (Blomstrom and Kokko 1998; Greenaway et al. 2004). As Keesing (1983) notes, the task of exporting requires additional expertise from producing for local markets. Exporters need to know about differences in the preferences of foreign consumers, negotiate different regulations concerning the sale of goods and learn how to make the best use of international transport and logistics services. With MNE affiliates engaged in international production and distribution they are a potentially rich source of knowledge for local firms facing practical constraints to exporting.

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[20] Fosfuri et al. (2001) also argue that even if MNE technology does not spillover to local firms pecuniary spillovers in the form of higher wages for local workers may occur. If foreign affiliates fear the loss of technology to local rival firms through labour mobility they may be more inclined to pay higher wages to reduce turnover.

[21] The terminology 'soft' and 'hard' technology is taken from Baily and Solow (2001) who, drawing on micro level studies, argue that the former represents an important determinant of international differences in productivity levels.

A theoretical model illustrating the mechanics of FDI spillovers is presented by Wang and Blomstrom (1992). Here, a game theory approach is used to investigate the interaction between foreign affiliates and local firms which produce differentiated, but substitutable, goods. The model therefore examines market interactions that give rise to horizontal spillovers between rival firms. In this framework, it is assumed that local firms possess superior knowledge of local conditions, including consumer preferences, while the subsidiary has an advantage in respect of general production technology. To ensure they can compete against the local firm, MNE parents undertake costly investments to transfer superior technology to their affiliate.

The local firm has the option of responding to the technological superiority of the foreign affiliate by undertaking its own costly investments to learn the superior technologies used by the foreign firm. (In effect this investment represents a partial cost associated with learning by observing that is assumed to be below the full resource cost of acquiring knowledge under license or through innovation.) The investment and acquisition of technology through spillovers raises the productivity of the local firm, making it more competitive. The MNE parent company then has the choice to undertake further investments to ensure its affiliate maintains a technological edge and through this, market share. An equilibrium level of technology transfer from the MNE parent to the affiliate and then on to the local firm through the spillover mechanism is determined on the basis of the costs associated with each firm undertaking investments to acquire superior technology.

There are two important implications from this model. First, in order to benefit from spillovers, local firms may need to invest in a costly learning process. As a result, spillovers are not pure positive externalities in the sense of benefits being conferred at zero cost. Second, the magnitude of the spillover is determined in part by the response of local firms and in part by the willingness of the MNE parent to undertake costly technology transfer. A more competitive operating environment for the foreign affiliate as well as lower costs for transferring technology will both induce greater technology transfer from the parent to the affiliate. Equally, the more willing and able local firms are to undertake learning, the greater will be spillovers to locals firms.

A small number of theoretical models embed FDI related knowledge spillovers within an aggregate growth framework. By assuming that knowledge accumulation underpins

the growth process, these models resemble endogenous growth theories discussed in section 2.3. In knowledge based models of FDI and growth the precise role attached to FDI differs. In one formulation FDI drives growth through a process of technological convergence. Therefore in the terminology used by Romer (1993), FDI spillovers are assumed to fill knowledge gaps in the host country. An alternative representation is that FDI spillovers augment the capacity of the host country to innovate, rather than just mimic existing technologies.

An early contribution, which emphasises technological convergence, is by Findlay (1978). In this model the rate of output growth is specified as a simple function of knowledge accumulation. The model abstracts from the role of innovation in generating new knowledge and assumes that knowledge accumulation occurs solely through transfers of existing knowledge from technologically advanced countries. Drawing on the concept of FDI spillovers, diffusion is modelled as a function of the presence of foreign capital in the economy.

The rate of knowledge diffusion is specified as increasing in the proportion of the capital stock owned by foreigners. This assumption is justified on the basis that a greater proportional representation of foreign entrepreneurs gives rise to greater opportunities for spillovers. Another important feature of the model is that knowledge diffusion is increasing in the size of the technology gap between the host economy and the global technology frontier. This assumption is made on the basis that a larger gap provides the greatest opportunities for catch up.[22]

A more recent theoretical contribution by Baldwin et al. (2005) emphasises the role of FDI in generating knowledge spillovers in the innovation process. A feature of the model is that it combines elements of traditional endogenous growth theory and FDI theory, outlined above in sections 2.2 and 2.3 respectively. The result is a holistic framework in which both the growth mechanism and the decision of firms to internationalise production and become MNEs is endogenised.

The model comprises two representative economies, which each feature two sectors of production. The first is an innovation sector where knowledge capital is created and the

[22] Wang (1990) builds on this model by integrating the spillover concept into a general equilibrium framework where FDI flows between two representative economies are determined by arbitrage conditions.

second a final goods sector. The production of final goods is assumed to require knowledge capital which is not readily tradeable in international markets. Therefore, in order to supply particular products to foreign markets, firms must either export finished products or undertake FDI to establish foreign production facilities. The intermediate option of licensing production knowledge to foreign firms is not considered.

The decision by a MNE to enter a foreign market depends on the profitability of choosing to remain a local firm and supply the home market only, compared with supplying international markets through exports or a foreign production facility. For a given level of demand in both the home and foreign markets, the profitability of selling abroad is determined by two competing factors. On the one hand, firms face fixed costs in establishing foreign production facilities that reduce the profitability of selling to the foreign market through FDI. On the other hand, high export costs, which may reflect transport costs as well as policy induced trade barriers, reduce the profitability of exporting. In summary, there is a two stage decision making process faced by firms; first whether to supply the foreign market and if so through exports or the establishment of a foreign affiliate.

As in the model of endogenous technological change by Romer (1990), growth is assumed to arise solely from the accumulation of knowledge generated in the innovation sector. Building on the FDI spillovers hypothesis, the creation of new knowledge capital is assumed to be a function of the inputs of labour as well as existing knowledge capital owned by both domestic and foreign investors. Therefore, the presence of foreign firms is assumed to support local innovation capacity by making available foreign knowledge for the domestic innovation process. Spillovers occurring in the innovation sector are assumed to take two forms. The first relate to within sector spillovers, characterised by Arrow (1962) and Romer (1986), and the second, cross sector spillovers advocated by Jacobs (1969). The latter reflect learning by local firms from foreign producers in other sectors.

An unresolved issue highlighted by the different approaches to modelling the growth effects of FDI by Findlay (1978) and Baldwin et al. (2005) is whether FDI augments domestic innovation or merely aids technological convergence. If the Findlay 'convergence' specification is correct then one might expect significant FDI spillovers in technologically laggard countries but not necessarily in industrialised countries where

most local firms are presumably operating close to the global frontier. In contrast the Baldwin et al. (2005) approach assumes that all countries will always benefit from FDI, irrespective of their technological status, by virtue of FDI related spillovers supporting domestic innovation.

As discussed in section 3.5 of chapter 3, the empirical evidence suggests that FDI can have a productivity enhancing effect in both developing and industrialised countries, consistent with Baldwin et al. (2005). Nevertheless, it is not possible to refute the Findlay (1978) hypothesis on the basis of these results. If technologies are firm specific, it is possible that firms in some less developed countries will have access to technologies unavailable to firms in more developed countries. In this case FDI may facilitate productivity convergence at the firm level.

2.5 Conclusion

This chapter discusses key aspects of generic FDI and growth theory, as well as theories of how FDI contributes to growth. It was noted that FDI represents a unique form of international capital exchange which provides the means for an investor to gain managerial control of a foreign firm. Theories seeking to explain FDI focus on the advantages of maintaining managerial control of firm assets. They also illustrate how market seeking or cost minimisation motivates give rise to multinational affiliates that are aligned vertically or horizontally within a MNE's supply chain.

The discussion of growth theory focused on theories of knowledge accumulation and diffusion. Motivated by the inadequacies of the Solow-Swan model, the aim of knowledge based endogenous growth models is to provide an analytical framework that aims to identify sources of new knowledge and the manner in which this is used to drive growth. In models of disembodied knowledge, new knowledge is hypothesised to flow from either a learning by doing process or research and development. Since knowledge is only partially excludible and non-rivalrous in consumption, knowledge may diffuse from the source of innovation to other innovators and final users. There are, however, likely to be many barriers to knowledge diffusion, especially across national boundaries.

Since FDI provides managerial control of assets across national boundaries, it facilitates international knowledge diffusion. This has profound implications for how FDI affects host country production and enhances host country productivity. Like other forms of

international investment, FDI facilitates capital deepening. Unlike other international capital exchanges, FDI gives rise to the presence of MNE affiliates that bring about many changes in the operating environment of the host country. These include increasing the intensity of market competition and providing new opportunities for local suppliers to expand the scale of production. In addition, MNE affiliates provide opportunities for the transfer of new technology to local firms, including through spillovers which come about through a variety of market interactions.

Having provided a broad review of relevant theory, the next chapter focuses on hypotheses relating to heterogeneous patterns of MNE production and growth effects of FDI, including the existing empirical evidence.

Appendix 2.1 The Solow-Swan growth model

The neo-classical model of economic growth developed by Solow (1956) and Swan (1956) provides the cornerstone of growth theory. Despite its simple construction, it provides a framework for analysing the dynamics of output, including how an economy evolves to a steady-state equilibrium and balanced growth path. The model also generates two key hypotheses which continue to be debated today. First, in the long run, the accumulation of physical capital will only generate changes in the *level*, rather than *growth* of output per worker. Second, the model provides one possible theoretical basis for the notion of conditional convergence, a hypothesis that is found to have considerable empirical support.

To begin, a representative economy produces output Y using inputs of physical capital K, labour L, and technology A. Output is assumed to feature constant returns to scale and diminishing marginal returns to each input. In per worker form, the output function can be expressed as:

$$y_t = A_t k_t^{\alpha} \qquad 0 < \alpha < 1 \tag{A2.1}$$

where y represents output per worker and k capital per worker. From equation A2.1 it is evident that per worker output can only be increased through changes in the technology parameter or the capital-labour ratio.

Labour and technology are both assumed to grow at constant, exogenously determined rates of n and g respectively. The single good produced in the economy is assumed to be fungible, used for both consumption and investment, and in each period a fixed amount of output (s) is saved. Each unit of saved output is then assumed to yield one unit of new capital, but in each period a fixed percentage of the existing capital stock is lost to depreciation. Hence, the evolution of the stocks of capital, labour and technology can be represented by the following differential equations:

$$\dot{K}_t = sY_t - \delta K_t \tag{A2.2}$$

$$\dot{L}_t = nL_t \tag{A2.3}$$

$$\dot{A}_t = gA_t \tag{A2.4}$$

where δ is the constant depreciation rate and the dot script represents the rate of change with respect to time. From equation A2.2 we can derive the following expression for the evolution of the capital labour ratio:

$$\dot{k}_t = s\left(A_t k_t^{\alpha}\right) - (n + g + \delta)k_t \qquad \text{(A2.5)}$$

To understand how the rate of savings is determined a utility maximising decision is added to the production side of the economy (Ramsey (1928), Cass (1965) and Koopmans (1965)). For simplicity, it can be assumed that consumers seek to maximise the objective function:

$$u = \int_0^{\infty} u(c_t) e^{-\rho t} dt \qquad \text{(A2.6)}$$

where c represents consumption and ρ a discount factor or rate of time preference. It is assumed that ρ is a positive constant, meaning that future consumption is valued less than consumption today. Output is either consumed by households or saved. By assuming a constant depreciation rate δ, growth of the per worker capital stock can be expressed by:

$$\dot{k}_t = k_t^{\alpha} - \delta k_t - c_t \qquad \text{(A2.7)}$$

This equation represents the constraint faced by households. By choosing to consume more today, agents reduce the level of savings and therefore the amount of capital available for future production, which in turn implies lower future consumption. Conversely, by deferring consumption today, agents generate greater savings and higher future levels of production and consumption.

Together, equations A2.6 and A2.7 define the dynamic optimisation problem faced by households. To solve this problem a present value Hamiltonian can be defined as follows:

$$\mathrm{H} = u(c_t) e^{-\rho t} + \lambda_t \left(k_t^{\alpha} - \delta k_t - c_t\right) \qquad \text{(A2.8)}$$

From this the following first order conditions for utility maximisation are derived:

$$\frac{\partial H}{\partial c_t} = \frac{1}{c_t} e^{-\rho t} - \lambda_t = 0 \qquad \text{(A2.9)}$$

$$\frac{\partial H}{\partial k_t} = \lambda_t \left(\alpha k_t^{\alpha-1} - \delta - \rho\right) = -\dot{\lambda} \qquad \text{(A2.10)}$$

This system of equations can be simplified by taking the logs of equation A2.9 and differentiating with respect to time. Further manipulation yields the following expression for the optimal growth rate of consumption (the Euler equation):

$$\frac{\dot{c}}{c} = \alpha k_t^{\alpha-1} - \delta - \rho \qquad \text{(A2.11)}$$

The first two terms on the right hand side of equation A2.11 represent the marginal product of capital net of depreciation. Therefore, the optimal path of consumption represents the difference between the net marginal productivity of capital and the discount rate of households. When the discount rate and net marginal product of capital are equal, the optimal consumption path will be flat. That is, the optimal growth of consumption through time will be zero. Households will only move from this path if their discount rate differs from the net marginal product of capital. For example, if the discount rate is higher (lower) than the net marginal product of capital, it will be optimal for household consumption to fall (increase) through time.

Returning to the determinants of the capital labour ratio and output, the first term on the right hand side of equation A2.5 represents savings per worker while the second term represents net depreciation. Net depreciation is the combined negative impact on the level of capital per worker brought about by depreciation, technological change and population growth. The steady-state equilibrium is defined by a constant capital labour ratio, which in equation A2.6 is the point at which the savings rate is sufficient to exactly offset net depreciation. In the steady-state, aggregate output and the stocks of capital and labour grow at a constant rate, defined by the rate of population growth plus the rate of technological change. This implies that in the steady-state the rate of growth of output per worker is equal to the rate of technological change.

Holding the level of technology constant, changes in the capital labour ratio will be brought about through changes in the savings rate. Specifically, when savings per worker is greater (less) than net depreciation the capital labour ratio will rise (fall), leading to a rise (fall) in output per worker. Significantly, this growth effect resulting from an increase in the savings rate is not permanent. Upon reaching the new steady-state equilibrium, growth in the capital labour ratio and therefore output per worker, returns to zero.

The result that in the long run, increases in the capital labour ratio brought about by capital accumulation will only generate changes in the *level*, rather than *growth* of output per worker is one of the most significant implications of the Solow-Swan model. This result provides the theoretical underpinning for the hypothesis that capital accumulation, brought about through savings and investment, cannot alone provide a source of long run growth. An expansion along a balanced growth path requires exogenous growth in technology. With technology growing at a constant rate g, output per worker will also grow at this rate. Hence, in the long run growth in output per worker in the Solow-Swan model depends on the rate of exogenous technological change.

According to the Solow-Swan model, all economies will converge to a steady-state growth rate dependent on the rates of population growth and exogenous technological change. The model does, however, predict different growth rates during the transition to steady-state equilibrium following changes in the capital labour ratio. From equation A2.5 the rate of change of the capital labour ratio depends on the magnitude of the difference between the savings rate and net depreciation. Therefore, the larger this difference, the faster will be the rate of increase of the capital labour ratio and rate of increase of output per worker.

This result provides the theoretical basis for the notion of classical conditional convergence, which states that the rate of growth during the move towards the steady-state will be proportional to the difference between the current capital labour ratio and its steady-state equilibrium level. However, conditional convergence does not imply that low productivity countries will necessarily experience faster transitionary growth. It is possible that a low productivity country will grow slowly, even compared with a

higher productivity country, if its steady-state equilibrium is achieved at a low level of per capita output that reflects a low savings rate.

Chapter 3

Heterogeneous multinational production and growth effects of foreign direct investment: theory and empirical evidence

3.1 Introduction

Many generic theories of FDI and growth implicitly assume that every dollar of investment generates precisely the same impact on the host economy. There is, however, a growing body of literature which argues that different patterns of multinational production, determined by prevailing host country factors, will have heterogeneous growth effects on the host country. This thesis aims to present new empirical insights on these issues and the objective of this chapter is to articulate the relevant theories and present a review of the existing empirical literature.

The first insights on how host country policies could affect MNE production and the growth effects of FDI were provided by Bhagwati (1973; 1978; 1985). He argued that trade policies alter the incentives for import substitution production which affects the allocative efficiency of MNE production. Later, using a static analysis framework Brecher and Diaz-Alejandro (1977), showed that it is possible for an expansion in import competing production driven by FDI to lead to a net reduction in national income.

More recently, a number of contributions including Balasubramanyam et al. (1996), Borensztein et al. (1998) and Moran (1998; 2001), argue that other differences in multinational production, influenced by a broader range of host country factors, can influence the growth effects of FDI.[23] These analyses draw on theories of FDI to highlight how host country factors influence the nature of MNE production. They also draw on elements of endogenous growth theory, to explain the consequences of these different forms of production for the host country. Many host country factors shape MNE production and therefore influence the growth effects of FDI. However, host country trade and FDI policies, along with investments in human capital, are particularly important.

[23] Balasubramanyam et al. (1996) refer to the hypothesis linking trade polices with the growth effects of FDI as the 'Bhagwati hypothesis'. However, the precise mechanisms linking policies with gains from FDI articulated by Bhagwati differ from the more recent contributions. Most notably, earlier work by Bhagwati does not canvass FDI related spillovers which are central to understanding how FDI impacts on the host economy.

As discussed in chapter 2, the role of FDI as a conduit for technology transfer is at the cornerstone of many theories of FDI and growth. Drawing on this idea, one hypothesis concerning heterogeneous growth effects of FDI contends that host country factors affect the flow of technology transfer through FDI. Absorptive capacity alters the costs of technology transfer to MNE affiliates and therefore the quantity of technology transfers. Absorptive capacity also affects the ability of local firms to learn from the presence of technologically superior foreign affiliates. In addition, it is argued that host country trade and FDI policies influence incentives for technology transfer to multinational affiliates by altering the degree of host country market competition the risks that MNEs face when transferring proprietary assets abroad.

A second hypothesis is that higher export orientation amongst MNE affiliates is more conducive to promoting host country growth and that host country policies influence the export orientation of MNE production.[24] Export oriented multinational production is hypothesised to be more beneficial to the host country owing to technological superiority, larger scale operations and higher quality linkages with local suppliers, all of which increase the prospect of FDI spillovers. At the same time, theories of FDI suggest that more liberal trade and FDI policies, amongst other factors, will tend to increase the export orientation of multinational production by deterring horizontal FDI and encouraging vertical FDI.

The remainder of this chapter is organised as follows. The next section focuses on theories and empirical evidence on technology transfer occurring through FDI, focussing on the role of host country factors. Section 3.3 discusses why MNE export production is particularly beneficial for the host country while section 3.4 examines theories and empirical evidence of how host country factors impact on MNE export orientation. In section 3.5 a review of empirical studies of FDI spillovers and growth is presented, focussing on those which consider the role of host country factors. Section 3.6 concludes while the results from a number of FDI spillover and growth studies are summarised in an appendix.

[24] The export orientation of FDI reflects the quantity of vertical FDI a country receives relative to the quantity of horizontal FDI. Similarly, the export orientation of multinational production refers to the magnitude of multinational affiliate output exported relative to the magnitude of affiliate output sold to the host country market.

3.2 Determinants of technology transfer to MNE affiliates

The discussion in the previous chapter highlights technology transfer as an important channel linking FDI and growth. FDI gives rise to the presence of technologically superior and more productive MNE affiliates which may facilitate technology spillovers to local firms. This section focuses on how host country factors might influence these links by examining the determinants of technology transfer associated with FDI.

Understanding the factors that influence flows of technology is important for two reasons. First, the magnitude of technology transfer to MNE affiliates will influence the productivity of affiliates and the scope for spillovers to local firms, by determining the pool of new technology potentially available (Findlay 1978). Second, host country absorptive capacity influences the ability of local firms to access a given stock of technology used by MNE affiliates. The following discussion examines theory and empirical evidence and is organized around three sets of host country factors cited in existing studies as influencing technology flows. These are absorptive capacity, FDI policies and host country market competition.

3.2.1 Absorptive capacity

The idea that absorptive capacity influences technology transfer to MNE affiliates and spillovers to local firms can be viewed as one particular element of the broader absorptive capacity hypothesis concerning growth and knowledge diffusion discussed in the previous chapter. In the context of FDI, however, absorptive capacity has a distinct interpretation. Namely, supply side factors may constrain the diffusion and utilisation of superior technology made available through MNEs. This includes both constraints on the ability of MNE affiliates to introduce new technology available from the parent company and constraints on the ability of local firms to acquire new technology from MNE affiliates. Accordingly, while FDI flows may provide a potential conduit for international technology diffusion such transfers may not occur without sufficient absorptive capacity.

As noted in chapter 2, a common interpretation of absorptive capacity is premised on the complementarity between human capital and disembodied technology. This arises from better educated workers being more adept at using new technology and being more likely to incorporate technological advances in to their working routine at a faster rate.

As a consequence the greater availability of educated workers is likely to reduce the cost of technology transfer to MNE affiliates (Wang and Blomstrom 1992).

More specifically, higher absorptive capacity may diminish the need to invest in special training for local workers when introducing new production techniques, or such training may be less costly. Alternatively, it may mean that required technical services sourced by foreign affiliates from local firms are less costly and more readily available. Likewise, for local firms sufficient absorptive capacity will mean that local entrepreneurs and their workers have the ability to learn and implement new technical aspects of foreign affiliated production more readily and at a lower cost.

The role of human capital in facilitating the introduction of new technology from foreign investors is formalised in a model of knowledge driven growth by Borensztein et al. (1998). Employing a product variety approach, the rate of growth in final output is contingent upon the rate at which new varieties of intermediate capital goods are introduced. It is assumed that no domestic innovation is undertaken so all new varieties are sourced from abroad by foreign investors. The process of sourcing and installing new technology is assumed to be costly and the decision to install is based on a profitability condition. Human capital helps to facilitate technology transfer by raising the marginal product of new varieties of intermediate goods and therefore the number of varieties that meet the profitability condition.

In a model that employs a similar setup Glass and Saggi (1998) highlight a role for local research and development capacity rather than the embodied knowledge of local workers. Technology transferred through FDI is disaggregated into low and high technology. MNE investments associated with the former can be located anywhere but high technology investments can only viably be located in countries with at least a basic research and development capacity where the costs associated with technology transfer are lower. Hence, this approach is premised on the idea that a threshold level of indigenous technological capability is required before the introduction of new technologies is viable.

Building on the social capability idea of Abramovitz (1986), recent studies have suggested that other supply side factors, in addition to human capital and research and development capability, influence absorptive capacity for FDI. For example, Alfaro et al. (2004) argue that financial sector development is important in ensuring

technology diffusion through FDI. They present a model where local entrepreneurs establish new indigenous enterprises which utilise newly acquired technology from MNE affiliates. The establishment of these new enterprises requires venture capital, borrowed through domestic financial markets. If borrowing costs are prohibitive due to a lack of local financial sector development, new enterprises will fail to emerge and technology diffusion amongst local firms will not occur.

Evidence from both case studies and formal econometric analysis supports the notion that higher human capital enhances technology transfer to multinational affiliates. Case studies support the importance of human capital for technology transfer by highlighting the role of human capital in allowing both MNE affiliates and their local suppliers to introduce new innovations and establish new production facilities. McKendrick et al. (2000) argue that the availability of adequate human capital was an important factor in attracting US electronics firms to establish production in Singapore. In addition, a strong human capital base allowed foreign manufacturers to diversify the nature of production in to more complex and technologically sophisticated lines.

Rasiah (1994) highlights the importance of local subcontractors upgrading their technical and human capital base in order to supply foreign affiliates in the Malaysian electronics industry. This was especially true for many local suppliers that began as small family run businesses and maintained an owner-manager structure. As the presence of foreign operators expanded through the 1980s these small operators were required to expand their technical capabilities to maintain contracts to supply increasingly sophisticated products and meet more exacting standards.

Formal empirical analysis using firm or industry level data also supports the absorptive capacity hypothesis with a number of studies reporting a statistically significant effect from various measures of human capital on technology transfer to MNE affiliates. Blomstrom et al. (1994a) examine the determinants of technology transfer to MNE affiliates in Mexico. Using technology payments by MNE affiliates as a proxy for technology transfer they find that alternative measures of human capital including wages and the ratio of white-collar to blue-collar workers both exert a positive influence on technology transfer. Urata and Kawai (2000) also find that the level of technology transfer from Japanese MNEs to their foreign affiliates is robustly correlated with the level of host country human capital.

3.2.2 Foreign direct investment policies

Restrictive FDI policies reduce incentives for technology transfer by weakening managerial control of MNE affiliates. In this respect, one of the most detrimental policies for technology transfer highlighted in a number of industry and firm level studies are joint venture requirements. These policies require that foreign affiliates comprise a proportion of local equity and therefore prohibit MNEs from establishing wholly foreign owned affiliates. Foreign investors may be less willing to transfer propriety assets to joint ventures for two reasons. First, the parent company may have concerns about knowledge leaking from the affiliate to a rival firm. This idea is consistent with the internalisation motive for FDI where direct investment is undertaken specifically to limit the potential for rival firms to gain access to their propriety knowledge (Beamish 1988).

Second, technology transfer may be less profitable under a joint venture arrangement (Ramachandran 1993). In considering whether to undertake costly technology transfer a parent company faces a trade off between these costs and the higher revenue stream generated by giving an affiliate a greater technological advantage. Where technology transfer costs are fixed and profits diluted due to shared ownership, there will be less of an incentive to undertake technology transfer.

There is considerable evidence that joint ventures receive less technology compared with wholly foreign owned MNE affiliates, supporting the hypothesis that joint venture requirements deter technology transfer. More limited direct evidence is also reported on the adverse impact of other forms of restrictive FDI policies. One of the first empirical studies to consider these issues is Mansfield and Romeo (1980) who examine how the ownership structure of MNE affiliates affects the timing, and therefore vintage of technology transferred by MNE parent companies.

In this study data on technology transfer is compiled from interviews with managerial personnel employed by a sample of US MNEs. They report that the average lag for technology transfer to foreign production facilities is significantly lower for wholly

owned affiliates as compared with joint ventures. Hence, the results suggest that wholly foreign owned affiliates benefit from new innovations faster. [25]

A more formal assessment of this issue, which controls for other determinants of technology transfer, is provided by Ramachandran (1993) who uses Indian firm level data. In this study, technology transfer from the parent company to the affiliate is proxied using the number of staff exchanges occurring between the MNE parent and its affiliate each time an agreement relating to technology transfer takes place. More staff exchanges reflect greater resources and effort on behalf of the parent company to transfer technology to the affiliate. Using this proxy, she finds that fully foreign owned MNE affiliates are the beneficiaries of more technology transfer from their parent companies.

Similar findings are reported in studies using cross-country MNE affiliate data. Desai et al. (2004) use data on technology related payments for US foreign affiliates operating in a number of different countries. They find that the degree of foreign ownership of the affiliate is an important explanatory variable with higher levels of foreign ownership in the affiliate exerting a positive impact on the magnitude of technology transfer.

Urata and Kawai (2000) use firm level data to examine the determinants of technology transfer from Japanese MNEs to their foreign affiliates. Rather than use technology related payments data they proxy technology transfer by estimating differences in the parent and affiliate productivity levels, for comparable production processes. They control for a number of factors including the share of ownership in the affiliate by the parent company. For the full sample they report that the coefficient on the share of ownership is positive and statistically significant, again suggesting that higher levels of foreign ownership encourages greater technology transfer.

[25] In a related study, Smarzynska (2000) examines the determinants of entry mode by MNEs and finds that the choice of a wholly owned affiliate is favoured by higher technology firms. Vishwasrao and Bosshardt (2001) also provide evidence that the liberalisation of FDI policies to allow majority foreign ownership of affiliates spurred a rise in the amount of innovative activity undertaken by foreign affiliated firms in India. Although not technology transfer *per se* research and development by foreign affiliates is likely to involve the use of parent company technology. Therefore, evidence that policy reforms encourage greater innovative activity provides some indirect evidence that such changes also encourage technology transfer.

Finally, evidence from Kokko and Blomstrom (1995) suggests that FDI policies other than joint venture requirements also affect technology transfer to MNE foreign affiliates. FDI policies are assessed using survey responses from MNE affiliates who report being subjected to a range of specific policy restrictions by local authorities. These include requirements to have access to parent company patents, undertake training of local workers, conduct local research and development, use minimum levels of locally produced intermediate inputs and employ minimum levels of local workers. The results from different specifications show that interventionist FDI policies either have no impact or reduce technology transfer to MNE affiliates.

3.2.3 Market competition

In addition to absorptive capacity and FDI policies, host country market competition is hypothesised to influence technology transfer to MNE affiliates. The theoretical model of technology transfer by Blomstrom and Wang (1992) discussed in chapter 2 shows that an underlying motive for MNE parent companies to transfer technology to their affiliates is to ensure a competitive advantage over rival firms. On this basis, affiliates operating within a more competitive environment will receive more technology. There are many factors that influence market competition, including market structure and competition related policies. In addition, trade policies will influence the level of domestic market competition by altering exposure to international competitors (Helpman and Krugman 1989, pp.27-46).

Empirical studies by Blomstrom et al. (1994a) and Kokko and Blomstrom (1995) provide evidence supporting the hypothesis that increased market competition encourages technology transfer to MNE affiliates. Both of these studies use US data on technology payments as a proxy for technology transfer. Given the difficulties associated with accessing data that accurately reflects the degree of competition facing foreign affiliates these studies employ a range of alternative proxies including changes in levels of investment and changes in the market share of domestic firms. The results consistently show a positive link between these proxies and levels of technology transfer to MNE affiliates.

3.3 The benefits of MNE export production

'Export platform' MNE affiliate production features a number of characteristics that make this form of production particularly conducive to generating increases in host

country productivity.[26] This section outlines these arguments, drawing on a number of analytical contributions but especially Balasubramanyam et al. (1996) and Moran (1998; 2001). In section 3.4 the discussion goes further by examining how host country factors influence the export orientation of MNE production. Together, therefore, these two sections outline how host country factors impact on the growth effects of FDI by influencing the export orientation of MNE production.

One reason why MNE export production may be particularly beneficial to the host economy is technological advantage. Export oriented affiliates are more likely to have access to the full stock of propriety knowledge held by the MNE parent company. Like all exporting firms, these affiliates produce for foreign, possibly global, markets and are therefore likely to face more intense competition. In contrast, foreign affiliates oriented towards serving the local market are likely to enjoy some form of protection from foreign competitors, owing to trade policies or other barriers to trade

As a consequence, for export platform MNE affiliates the incentives to draw on every competitive advantage, including that offered by technological resources, is particularly strong. In addition, where these affiliates form part of an international supply chain their importance to the parent company increases. This provides further incentives for the parent company to maintain maximum managerial control and ensure that all resources, including the best available technology and human resources, are made available to each affiliate. These ideas are consistent with the model of FDI spillovers by Wang and Blomstrom (1992) which, as noted above, predicts that MNE affiliates facing the most intense market competition will receive more technology from MNE parent companies.

Case study evidence supports the notion that export oriented multinational production is more technologically advanced. Nunez (1990), for example, examines changes in the pattern of production in the Mexican auto industry during the 1970s and 1980s when production transformed from being primarily domestic oriented to a platform for exporting to the US market. As a result of this reorientation new foreign controlled facilities were established while others were either closed or modernised, to make use of

[26] Here, export platform production excludes the special case of resource extraction and is therefore assumed to be associated with efficiency seeking FDI.

the latest technology and product designs required to compete in the competitive US market.

The technological superiority of export oriented MNE production in the East Asian electronics industry paints a similar picture. Borrus (1994) argues that MNE affiliates exporting to the US were regularly upgraded to keep pace with rapid technological improvements and a short product cycle. In contrast, Japanese MNE affiliates that were established to produce for local markets tended to be much slower in responding to innovations. Balcat and Cornaglia (2002) also show that export oriented foreign affiliates in Italy tend to undertake more innovative activity.[27]

Aside from technological superiority, export oriented affiliates will also invariably introduce innovations and techniques better suited to the host country. As discussed in chapter 2, not all innovations will necessarily benefit producers in every country. In particular, firms in labour abundant countries may not benefit from innovations designed to improve capital intensive production processes. However, in establishing export platform facilities, MNEs will naturally seek to locate production in countries with suitable factor endowments. As a consequence, export oriented FDI is more likely to facilitate transfers of the most suitable forms of technology.

A second factor favouring larger gains from MNE export oriented production relates to linkages with suppliers. Where export oriented affiliates source inputs locally, they may be more likely to establish the type of linkages with local firms that give rise to knowledge spillovers than foreign affiliates serving the host market only (Blyde et al. 2004). For export oriented affiliates, ensuring a reliable supply of local inputs and maintaining quality standards are especially important within the context of international production. Therefore, export oriented affiliates may have a particularly strong desire to establish close commercial relationships with local suppliers which give rise to knowledge spillovers. In addition, since export oriented affiliates are less likely to be in direct competition with local firms, these types of affiliates are less likely to be apprehensive about sharing knowledge with local suppliers.

[27] A detailed analysis of the nature of linkages between the parent company and a vertically integrated foreign affiliate is presented by Terwiesch et al. (2001). They detail extensive transfer of equipment and personnel for the case of a US computer manufacturer establishing a new production line at a wholly owned, export based production affiliate located in Singapore. To ensure the smooth introduction of the new product line a number of Singapore based managers and engineers spent several weeks with designers at the head office in the US prior to the commencement of production and was followed by a team of US engineers spending time in Singapore at the commencement of production.

This hypothesis is supported by Giroud (2003) who examines backward linkages between MNE affiliates and local suppliers in Malaysia. Using survey information collected from a sizeable sample of foreign affiliated firms she identifies various types of cooperation between affiliates and local firms which give rise to knowledge transfer to local firms. These include the direct provision of training for workers employed by local suppliers as well as the provision of advice to technical personnel.

A binary indicator of whether foreign affiliates actively undertake some form of knowledge transfer is constructed and then used as the dependent variable in formal regression analysis. Two characteristics of foreign affiliates which are found to be positively correlated with the propensity to undertake knowledge transfer are the size of the affiliate, measured by the total number of employees, and the degree of export orientation, measured as the share of total output exported by the firm. Therefore, these results suggest that export oriented firms are more likely to establish the type of linkages most conducive to generating knowledge spillovers.

A final reason why multinational export platform production may be more beneficial for the host country is scale. As noted in chapter 2, theories of FDI and host country market structure emphasise the importance of MNE affiliate demand for locally supplied inputs as a means of facilitating productivity gains amongst local suppliers. Whereas affiliates established to serve the host market will be limited by the size of the host country market, export platform affiliates may potentially serve as the global production facility for an entire product line.[28] Therefore, export platform production is likely to provide greater opportunities for local suppliers to reap economies of scale and introduce new varieties of intermediate inputs.

3.4 Determinants of MNE export orientation

The overall export orientation of multinational production within a given country represents the magnitude of MNE affiliate production engaged in exporting relative to local market production. MNE export orientation therefore increases (decreases) when export production increases (decreases) relative to local market production. Theoretical models of FDI discussed in chapter 2 explain the motives for MNEs establishing an affiliate to engage in either export platform or local market production. Therefore, by

[28] For example, the rise of export based electronics manufacturing affiliates in South East Asia by US companies through the 1980s and 1990s saw many of them establish facilities that supplied the bulk of their global market (McKendrick et al. 2000, p.136).

pooling the predictions of these different theories it is possible to identify host country factors that influence the export orientation of MNE production.

To briefly recap from chapter 2, theories of vertical FDI provide the rationale for MNE export platform production (Helpman 1984). In this framework, elements of a vertically separable supply chain are relocated offshore, giving rise to vertically integrated affiliates which export their output. The primary motive for establishing this type of production facility is to enable access to lower cost factors of production which are not readily tradeable, especially labour. Importantly, however, since this type of production is not tied to a particular location it will also be attracted to countries which offer advantages in respect to the broader operating environment.

An alterative set of theories highlights the motives for establishing MNE affiliates to produce for the local market (Markusen 1984). Where trade costs are sufficiently high and where firm level economies of scale sufficiently large, it will be more cost effective for the parent company to serve a foreign market through locally owned production facilities, rather than exporting from the home country. When the predictions of these theories are pooled it is evident that three broad sets of variables are likely to influence the overall export orientation of multinational production. These are market size and factors costs, trade costs and the operating environment. The following section considers these factors in more detail and canvasses the existing empirical evidence.

3.4.1 Market size and factor costs

Horizontal models of FDI predict that larger markets will attract more local market MNE production. In contrast, there are no fundamental reasons why export production should be influenced by host country size. Together, this suggests that larger host market size will tend to reduce the export orientation of MNE production.

However, the empirical evidence on the impact of host country market size on export orientation is mixed. Using data on the export orientation of US MNE affiliates, and GDP as a proxy for market size, Kumar (1998) and Markusen and Maskus (1999) report a strong negative effect, consistent with theory. Hanson et al. (2001) report that GDP is also negatively correlated with export orientation although the significance of this effect disappears when additional explanatory variables are added. Counter intuitively, in a study focussing on MNE affiliates located in developing countries, Shatz (2004) finds

some evidence of a positive impact between export orientation and GDP. One possible explanation for this finding is that factors relating to export capacity in developing countries, including infrastructure, are positively correlated with GDP.

As noted, vertical models of FDI predict that countries with lower factor cost will attract more export platform production. While local market production may also be attracted by lower costs at the margin, the impact is argued to be weaker owing to the primacy of market access for this type of production compared with the footloose nature of export platform production. For example, if production costs in a particular host country rise relative to production costs in other countries the parent company may opt to serve the local market through exports, rather than a local affiliate. However, exporting may not always be viable, not only because of trade barriers but also because gaining effective market access may require a local presence by the MNE. Therefore, lower factor costs are expected to exert a stronger influence on export production and increase overall export orientation.

In an early study employing data on US MNE affiliates, Kravis and Lipsey (1982) examine the determinants of export platform production. They control for labour costs using a measure of unit labour costs and report that this is positively correlated with export production, contrary to the predictions of models of vertical FDI. Braconier et al. (2005) examine the impact of wages for both low and high skilled worker wages on local market and export production. Surprisingly, like Kravis and Lipsey (1982), they find a positive relationship between high skilled wages and all forms of production. However, the coefficient on low skilled workers is negative and larger for export production. This is consistent with models of vertical FDI and the hypothesis that export production is more sensitive to wage costs than local market production. Further support for this hypothesis is provided by Kumar (1994; 1998) and Shatz (2004) who report that alternative wage based proxies of labour costs exert a negative impact on MNE export orientation.

An important counterpart to labour costs is labour quality and a number of studies include human capital related control variables. In addition to controlling for wages Shatz (2004) includes a measure of the average level of host country educational attainment. Surprisingly, he reports weak evidence that this variable exerts a negative influence on export orientation. Hanson et al. (2001) find that export orientation tends

to be lower in higher skilled industries, indicating that export production may be focussed in labour intensive sectors. Therefore, it is possible the findings by Shatz (2004) reflect the effects of industry composition.

3.4.2 Trade costs

Models of horizontal FDI predict that higher trade costs will encourage local market production. At the same time, higher trade costs are likely to deter export platform production, some of which relies on imported inputs, including intermediates produced by other vertically integrated affiliates. Therefore, higher trade costs, which reflect both transport costs and trade policies, will tend to reduce export orientation.

Consistent with theory, many empirical studies report strong evidence that greater openness to trade increases MNE export orientation. Using US data, studies report that trade to GDP ratio based measures of openness are positively correlated with both exports and export orientation (Kravis and Lipsey 1982; Kumar 1998). Studies using different measures of trade policies report similar findings. This includes Shatz (2004), who employs the composite measure of trade openness by Sachs and Warner (1995), and Hanson et al. (2001) who apply data on tariffs and non-tariff barriers. Kumur (1998) also reports evidence that export processing zones encourage export orientation while Shatz (2004) finds mixed evidence on the impact of free trade agreements.

Various proxy variables have been used to capture trade costs. Hanson et al. (2001) proxy trade costs faced by US MNE affiliates using distance to the US and find no evidence of a significant effect. Shatz (2004) experiments with two different proxies which produce statistically significant results. The first is a trade cost measure based on the difference between free on board and freight and insurance inclusive trade values. This variable is negatively correlated with export orientation, as expected. The second measure is a geographic based proxy which reflects access to sea transport. This variable is positively correlated with export orientation, again consistent with the prediction that lower trade costs increase export orientation.

3.4.3 Operating environment

Like lower factor costs, a superior operating environment, including a commitment to liberal FDI policies, is expected to attract MNE export production. This factor is likely to be particularly important where export platform affiliates form part of a complex

international supply chain. Under this arrangement, the success of the entire production line hinges on the reliable functioning of each and every affiliate. Therefore, the parent firm will want to locate affiliates where the prospect of production disruptions and managerial interference is lowest.

A superior operating environment might also attract greater host country market production, at the margin. However, as with the impact of lower input costs, the effect is expected to be stronger for export platform production owing to the primacy of market access for host country market production and the footloose nature of export platform production. Hence, superior operating environments are expected to increase MNE export orientation.

The impact of a range of factors that shape the broader operating environment on MNE export orientation has been assessed in empirical studies. As with many other studies of MNE export orientation, these draw on data for US MNE affiliates. Hanson et al. (2001) and Shatz (2004) both report some evidence that higher corporate taxes are associated with lower export orientation. However, Kumur (1994) finds little evidence of broader incentives, including fiscal incentives, impacting on export orientation.

FDI policies also constitute an important element of the operating environment for MNE affiliates. However, relatively few studies examine this issue closely. Kumar (1994) employs a general indicator of policy restrictions based on the survey responses of US MNE affiliate management. These provide information on whether local authorities prescribe measures such as local content requirements and restrictive employment regulations. Surprisingly little evidence is found to suggest these policies affect MNE export orientation. However, using a broader indicator of investment policies, Shatz (2004) reports evidence that more restrictive FDI policies reduce multinational export orientation.[29]

[29] Indirect evidence of ownership restrictions reducing export orientation is provided by Asiedu and Esfahani (2001), who examine the determinants of the ownership structure of foreign affiliates. After controlling for several production characteristics and host country factors they find that vertically integrated foreign affiliates, that is those involved in exporting, are more likely to be wholly foreign owned.

3.5 Host country factors and heterogeneous growth effects of foreign direct investment: empirical evidence

The empirical literature which examines the impact of FDI on host country productivity can be divided in to three broad groups.[30] All studies are, implicitly at least, linked by the theories of FDI and productivity growth outlined above and in the previous chapter. The first aims to identify FDI spillovers, by examining the impact of FDI on the productivity of local firms using firm or industry level data. The second uses aggregated national data to examine the impact of FDI on the economy at large.

A third group of studies examine FDI spillovers using a framework pioneered by Coe and Helpman (1995). This involves regressing national productivity levels on foreign research and development expenditures, weighted by bilateral FDI flows. This methodology aims to capture the idea that spillovers occurring through FDI will be larger where FDI originates in high innovation countries (see for example Lichtenberg and van Pottelsberghe de la Potterie (2001)).

The general picture from both micro- and macro-level studies is that while there is some evidence in support of FDI enhancing productivity, this effect is not uniform. In some cases evidence of highly significant productivity effects have been reported while in others the evidence is much weaker. Some studies even report evidence of a negative impact on local productivity, consistent with a market stealing or growth immiserizing hypothesis. This general picture of heterogeneous growth effects from FDI is consistent with the hypotheses outlined above that emphasise the importance of host country factors and a growing number of studies have attempted to evaluate these, with mixed results. A brief overview of both micro- and macro-level studies is presented in the following section.

3.5.1 Microeconomic level empirical evidence

In recent years there has been a surge in the number of studies examining the existence of FDI spillovers using firm or industry level data. The most common methodology

[30] A recent empirical study which employs a different approach altogether is by Branstetter (2006). Rather than inferring the presence of FDI spillovers through a productivity effect, this study directly tests whether foreign investment aids knowledge production using data on patent citations. The methodology is based on the idea that if FDI facilitates knowledge diffusion then local firms should be more exposed to the innovative activities of foreign firms and be more likely to cite the patents of foreign investors when lodging their own patent applications. Using firm level data for Japanese foreign affiliates located in the US, Branstetter (2006) reports evidence that FDI facilitates knowledge diffusion both from foreign affiliates to local firms and from local firms to foreign affiliates.

used involves testing whether the presence of foreign affiliated firms has any significant impact on the productivity performance of locally owned firms, controlling for other determinants of productivity.[31] In studies of this nature the proxy used to capture foreign presence varies but is usually measured using the foreign share of employment, assets or sales within an industry. Evidence of a positive impact on local firm or industry productivity arising from the presence of foreign operators is interpreted as evidence supporting the existence of productivity enhancing FDI spillovers. A summary of studies employing this methodology is presented in the appendix.[32]

This field of research was pioneered by Caves (1974) and Globerman (1979) who found evidence of positive FDI spillovers using data on MNE affiliates located in Australia and Canada respectively. Later, Blomstrom and Persson (1983) found evidence of positive spillovers using data for Mexico, representing the first examination of FDI spillovers in a developing country context. These and many studies that followed employed cross section data, often using aggregated industry level data.

A limitation of using cross section data is that it does not allow for the consideration of dynamic relationships which may be important in the context of identifying spillovers. Linkages between domestic and foreign firms that give rise to spillovers may take time to establish while learning by doing associated with knowledge spillovers may not be instantaneous (Liu forthcoming). In addition, panel data provides the usual benefits of allowing for the control of unobservable firm or industry heterogeneity.

Seeking to exploit these advantages, a number of studies have built on the early literature by employing panel data. A noticeable pattern in the results reported from these panel data studies compared with the early cross-section studies is that evidence of positive spillovers is generally less pervasive. Indeed some panel studies report evidence of negative spillovers. These include Haddad and Harrison (1993), Aitken and Harrison (1999) and Djankov and Hoekman (2000) who use data from Morocco, Venezuela and the Czech Republic respectively.

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[31] Other studies have used a variant on this approach to examine how a foreign presence has other indirect effects on local firms, including plant survival (Gorg and Strobl 2003) and the propensity for local firms to export (Greenaway et al. 2004).

[32] For surveys of this literature see Caves (1996), Blomstrom and Kokko (1998), Lipsey (2002) and Gorg and Greenaway (2003). Gorg and Strobl (2001) draw on a number of studies to undertake a meta-analysis of results.

Aside from the use of panel data, an important recent development in this literature has been attempts to separately identify the existence of spillovers within sectors (horizontal spillovers) and across sectors (vertical spillovers). By examining the impact of foreign presence on the productivity of local firms operating within the same sector earlier studies restrict the analysis to examining the presence of horizontal spillovers only. This represents a considerable methodological limitation given the motives of direct investors.

As discussed in chapter 2, one of the primary motives for undertaking FDI is to limit diffusion of proprietary knowledge to rival firms which will typically operate within the same sector. This suggests affiliates will work hard to prevent horizontal spillovers. At the same time, however, there may be sound reasons for affiliates to share knowledge with suppliers and customers in other sectors, if for example doing so leads to improvements in the quality or variety of locally supplied intermediates (Pack and Saggi 2001). On this basis, one might expect stronger evidence of knowledge spillovers across sectors compared to within sectors (Javorcik 2004).

Testing for vertical spillovers involves an extension of the method used to test horizontal spillovers outlined above. However, rather than merely assessing the impact on local firm productivity of foreign affiliates operating within the same sector, the presence of foreign affiliates located in other sectors is also examined. To proxy the strength of inter-sector linkages, data on inter firm trade from input-output matrices are used to weight the foreign presence in upstream or downstream sectors. Therefore this approach captures the idea that inter-sector spillovers will be larger where inter-sector trade between foreign affiliates and local firms is largest, and where the presence of foreign affiliates is most pervasive.

To date, studies employing this technique have used data for developing countries including Lopez-Cordova (2003) for Mexico, Javorcik (2004) for Lithuania, Kugler (2006) for Columbia, Bwalya (2006) for Zambia, and Liu (forthcoming) for China. For industrialised countries, Driffield et al. (2002) examine vertical spillovers using UK data. Significantly, these studies consistently report evidence of vertical spillovers, in many cases for both forward and backward linkages. In contrast, evidence of horizontal spillovers is invariably weaker.

A small but growing number of empirical studies test the absorptive capacity hypothesis outlined above in section 3.2.1. These studies use a simple extension to the spillover methodology pioneered by Caves (1974). This involves testing whether spillovers are contingent on the technology gap between local and foreign firms, which is often proxied using the relative productivity levels of domestic and foreign firms.

One of the first studies to apply this method is Kokko (1994). He reports a negative coefficient on an interaction variable comprising the technology gap and a foreign presence measure. The analysis is then extended to assess whether this result might be due to foreign affiliates using highly advanced technology. This is done by examining the interaction between foreign presence and technological sophistication of the foreign affiliate. This second interaction term is found to be insignificant suggesting that the use of advanced technology by foreign affiliates does not *per se* prevent spillovers but rather sufficient local firm absorptive capacity is the key.

Other studies which examine the impact of technology gaps include Sjoholm (1999b), who uses data for Indonesia, and Jordaan (2005), who draws on Mexican data. Both of these studies report that spillovers are maximised where large productivity gaps exist, consistent with Findlay's (1978) idea that greater technological backwardness provides greater opportunities for spillovers. Finally, using UK data, Girma (2005) reports that positive spillovers are largest for local firms with a medium size technology gap. This intermediate result can be interpreted as providing mutual support for the absorptive capacity and advantage of backwardness hypotheses.

Recent studies have also examined whether the ownership structure of foreign affiliates affect the prospect of FDI spillovers. Using Indonesian data, Blomstrom and Sjoholm (1999) report that both minority and majority foreign owned affiliates generate spillovers of a similar magnitude. However, in a study using Romanian data, Javorcik and Spatareanu (forthcoming) report that both vertical and horizontal spillovers are larger with joint ventures. This result is somewhat surprising given the evidence cited in section 3.2.2 that wholly owned foreign affiliates tend to be more technologically sophisticated. The authors argue that the finding may suggest less advanced technology may be more readily absorbed by local firms.

Another study which examines how firm characteristics affect spillovers is by Blyde et al. (2004) who examine the role of affiliate export orientation using firm level

data for Venezuela. As in other recent studies of spillovers they examine evidence of both horizontal and vertical spillovers and go further by dividing foreign affiliates in to two groups, based on whether a majority of firm output is exported. The results provide direct support that export oriented affiliates facilitate larger spillovers. The presence of all types of foreign firms is found to boost local firm productivity but the presence of export oriented affiliates provides an additional boost. This effect is particularly strong in the case of vertical linkages, consistent with the hypotheses that export oriented firms facilitate strong spillovers to local suppliers.

Relatively few empirical studies have directly examined whether spillovers are affected by the policy environment. Using data for Uruguay Kokko et al. (2001) assesses the impact of the host country trade regime. This is done by separating foreign firms on the basis of the trade regime prevailing at the time of their establishment. Specifically, whether firms were established before or after trade barriers were liberalised in the early 1970s. In this way, firms are classified as being motivated by either import substituting or export producing considerations. Counter intuitively, the results indicate that only firms established under a relatively closed trade regime generate positive spillovers.

However, inferences from this result need to be made carefully. It is possible that differences in spillovers reflect the fact that more established firms generate higher spillovers due to older and more extensive relationships with domestic firms. A study that investigates the relevance of the trade regime using a contemporaneous approach is Kohpaiboon (2006). Using data for Thailand, this study examines whether trade barriers applying across different industries affect the prospect of spillovers. Alternative measures of trade barriers are interacted with a measure of foreign presence and this term is found to be negative and statistically significant in a range specifications. Therefore, this result suggests higher trade barriers reduce spillovers.

3.5.2 Macroeconomic level empirical evidence

Complementing spillover studies which use micro-level data are studies which use aggregate FDI data to examine the economy wide impact of FDI. These studies follow the same general approach adopted by many growth studies of regressing some measure of long run growth on FDI and other relevant control variables.[33] The role of host

[33] A brief review of this literature is presented in chapter 7.

country factors in conditioning the growth effects of FDI has been incorporated in a growing number of studies which adopt this general methodology, with mixed results.

The relevance of host country factors is examined using one of two approaches. First, the FDI variable is interacted with a variable capturing some particular host country factor. Second, data on host country factors are used to divide a universal sample in to sub-samples of countries which are then used to derive alternative estimates using the same generic growth specification. In general, the results from studies adopting these methods tend to suggest that host country factors do matter with a number of studies reporting significant interaction terms and or different results from different sub-samples. However, as is the case with many empirical growth studies, the results are by no means conclusive. Indeed some studies generate contradictory results. In the following section the key contributions in this literature are discussed while a summary of results is presented in the appendix.

Blomstrom et al. (1994b) test the relevance of host country absorptive capacity by estimating general growth equations using different country samples. They argue that a country's level of development will be strongly correlated with a range of factors that shape absorptive capacity, including stocks of human capital. This in turn makes broad indicators of development such as per capita output a valid proxy for overall absorptive capacity. On this basis, they apply growth specifications to two groups of developing countries, one low and the other high income. The results support the absorptive capacity hypothesis with the coefficient on the FDI variable positive and statistically significant for the higher income group only. They also refer to tests using interaction terms incorporating human capital and FDI but find no significant effects using this approach.

Using a developing country sample Borensztein et al. (1998) find that the interaction between FDI and human capital is positive and significant while the FDI variable by itself is negative and insignificant. Consistent with the absorptive capacity hypothesis, these results suggest that human capital and FDI are complementary drivers of growth and that sufficient human capital may be a precondition for countries to benefit from FDI. Balasubramanyam et al. (1999) and Lipsey (2000) also report some support for the importance of absorptive capacity, as determined by human capital but other similar studies report less conclusive results.

Blonigen and Wang (2005) extend the analysis of Borensztein et al. (1998) by adding industrialised countries to the sample. The results change considerably, with neither the FDI variable or the interaction with human capital significant for the full sample. Finally, Ram and Zhang (2002) focus on a sample for the 1990s, a period that saw rapid growth in global FDI flows, and find general support for the growth enhancing effects of FDI but little support for the absorptive capacity hypothesis.

In addition to human capital, other factors that might broadly reflect absorptive capacity have been assessed. For example, Alfaro et al. (2004) test the role of financial sector development. In various specifications, the FDI variable is interacted with different proxy measures of financial development such as domestic commercial bank assets and private credit. They report that the coefficient on each interaction term is positive and significant, supporting the importance of financial sector development. In a similar exercise, Hermes and Lensink (2003) also report a positive interaction. Finally, Durham (2004) tests the relevance of institutional factors by incorporating interactions using proxies for the strength of property rights, the sophistication of business regulations and the extent of host country corruption. The interaction between FDI and the first two of these factors is found to be positive and significant.

The first cross-country empirical assessment of the relevance of host country policies is by Balasubramanyam et al. (1996) who take the approach of applying general growth specifications to different samples of developing countries based on the nature of the prevailing trade regime. Two different methods are used to divide countries into different sub-samples. First, countries in the full sample are ranked according to trade openness proxied using the ratio of trade to GDP. Next, growth rates are regressed on this measure of openness and structural breaks in the relationship between growth and openness used to identify countries with relatively open and relatively closed trade regimes. As an alternative to this approach, countries are also divided in to two sub-samples based on a World Bank classification of trade regimes.

The results suggest that trade policies are important in conditioning the growth enhancing effects of FDI. The coefficient on the FDI variable is found to be positive and statistically significant for the full sample and the sub-sample comprising countries with more open trade policies. In contrast, it is not statistically significant in any of the results based on the sub-sample comprising countries with relatively closed trade

policies. Greenaway et al. (2007) build on this study using updated data and report similar findings. Nair-Reichert and Weinhold (2001) also test the relevance of trade openness, as well as absorptive capacity, using panel data and interaction terms. They find that FDI flows are correlated with growth and that greater openness to trade strengthens this relationship. In contrast, no evidence was found to support the absorptive capacity hypothesis.[34]

Carkovic and Levine (2005) argue that many empirical studies of FDI and growth are based on methods that do not adequately address a number of technical problems highlighted in the growth empirics literature. One of these is adequately controlling for growth determinants. The application of parsimonious specifications which fail to account for the wide range of factors that drive growth may generate misleading results. A second problem overlooked in many studies is endogeneity bias. It is easy to conceive of a scenario where FDI and growth might be simultaneously determined. In fact formal investigations suggest causality does indeed run both ways between FDI and growth (Choe 2003; Li and Liu 2005).

Using a technique that aims to address many of these methodological problems, Carkovic and Levine (2005) examine the impact of FDI on growth and also assess the relevance of a wide range of host country factors. The results from this analysis are mixed but in general do not show any robust correlation between FDI and growth, with the significance of the FDI variable susceptible to the choice of specification. Likewise, interaction terms incorporating FDI along with human capital and trade openness are found to be significant in a minority of specifications only. Therefore, one of the most recent empirical studies of FDI and growth, which is arguably at the current frontier of the literature, reports little evidence that FDI exerts a positive, exogenous impact on growth and it finds no evidence supporting the relevance of host country factors.

3.6 Conclusion

This chapter surveys different theories that link host country factors and the growth effects of FDI which are tested in this thesis. Early contributions argue that trade policies affect the allocative efficiency of FDI while more recent contributions highlight factors more closely aligned with endogenous growth theory, including knowledge

[34] In a related study, Athukorala and Chand (2000) use operational data for US MNE affiliates and find that trade openness exerts a positive impact on the productivity of affiliates.

spillovers. First, absorptive capacity, FDI policies and host country market competition are likely to influence the introduction and diffusion of new technology through MNE affiliates. Second, trade and other policies that shape the operating environment will influence the nature of MNE affiliated production with more dynamic export oriented production attracted by more liberal policies.

In addition to outlining relevant theories, the chapter also presents a review of existing empirical evidence which demonstrates how host country factors affect both the flow of technology to MNE affiliates and the export orientation of MNE production. Consistent with theory, this evidence suggests that more open trade policies and a superior operating environment are associated with increased export orientation. Higher absorptive capacity, measured using a range of variables, appears to enhance technology transfer. Evidence from a number of studies also indicates that wholly owned MNE affiliates are the beneficiaries of higher technology transfer, suggesting FDI policies such as joint venture requirements are likely to impede technology diffusion.

The final section of the chapter examines the existing empirical literature on the growth effects of FDI. One set of studies employs firm or industry level data to examine evidence of FDI spillovers. Although results are far from uniform, the weight of evidence supports the existence of positive spillovers from foreign to local firms. A complementary literature examines the impact of FDI at the macroeconomic level using cross-country data and again the results are mixed.

Many existing studies seek to examine whether host country factors condition the growth effects of FDI. While a considerable number of studies produce results consistent with the relevance of host country factors, there is no clear picture on which of these are most important. A limitation of these studies is that they focus on host country factors relating to either absorptive capacity or trade policies, thereby ignoring broader factors which are likely to be relevant including FDI policies. One of the objectives of this thesis is to fill this gap by examining the role of FDI policies in conjunction with trade policies and human capital.

Having provided the analytical background to the thesis, the next chapter presents a new cross-country dataset of FDI policy indicators. These and measures of trade policies and human capital are then applied to three separate empirical analyses focusing first on the nature of MNE production and then the growth effects of FDI.

Appendix 3.1 Empirical literature summary

Table A3.1: Summary of empirical FDI spillover studies, developing countries

Author(s)	Country	Period	Data	Results
Blomstrom and Persson (1983)	Mexico	1970	CS	+
Blomstrom (1986)	Mexico	1970 & 1975	CS	+
Blomstrom and Wolff (1994)	Mexico	1970 & 1975	CS	+
Haddad and Harrison (1993)	Morocco	1985-1989	Panel	-
Kokko (1994)	Mexico	1970	CS	+
Kokko et al. (1996)	Uruguay	1988-1990	CS	+
Blomstrom and Sjoholm (1999)	Indonesia	1991	CS	+
Chuang and Lin (1999)	Taiwan	1991	CS	+
Sjoholm (1999a)	Indonesia	1980 & 1991	CS	+
Sjoholm (1999b)	Indonesia	1980 & 1991	CS	+
Aitken and Harrison (1999)	Venezuela	1976-1989	Panel	-
Djankov and Hoekman (2000)	Czech Rep.	1992-1996	Panel	-
Kathuria (2000)	India	1976-1989	Panel	?
Kokko et al. (2001)	Uruguay	1988	CS	+
Konings (2001)	Bulgaria, Poland and Romania	1993-1997	Panel	-
Li et al. (2001)	China	1995	CS	+
Damijan et al. (2003)	Bulgaria, Czech Repub., Estonia, Hungary, Poland, Romania, Slovak Repub. and Slovenia	1994-1998	Panel	?
Lopez-Cordova (2003)*	Mexico	1993-2000	Panel	?/+
Javorcik (2004)*	Lithuania	1996-2000	Panel	?/+
Sinani and Meyer (2004)	Estonia	1994-1999	Panel	+
Jordaan (2005)	Mexico	1993	CS	+
Kohpaiboon (2006)	Thailand	1996	CS	?
Kugler (2006)*	Columbia	1974-1998	Panel	?/+
Liu (forthcoming)*	China	1995-1999	Panel	+
Bwalya (2006)*	Zambia	1993-1995	Panel	?/+

Notes: the symbols (+) and (-) denote main results reported in paper show the existence of positive or negative spillovers respectively while (?) denotes very mixed or insignificant results. Multiple symbols summarise results from alternative specifications. 'CS' and 'Panel' denote the use of a cross section or panel data respectively, while (*) denotes the study examines the presence of both horizontal and vertical spillovers.

Table A3.2: Summary of empirical FDI spillover studies, industrialised countries

Author(s)	Country	Period	Data	Results
Caves (1974)	Australia	1962/66	CS	+
Globerman (1979)	Canada	1972	CS	+
Liu et al. (2000)	UK	1991-95	Panel	+
Driffield (2001)	UK	1989 & 1992	CS	?/+
Girma et al. (2001)	UK	1991-96	Panel	?
Dimelis and Louri (2002)	Greece	1997	CS	+
Haskel et al. (2002)	UK	1973-1992	Panel	+
Driffield et al. (2002)*	UK	1984-1992	Panel	+
Castellani and Zanfei (2003)	France, Italy and Spain	1992-1997	Panel	?
Keller and Yeaple (2003)	US	1987-1996	Panel	+
Ruane and Ugur (2004)	Ireland	1991-1998	Panel	?/+
Girma (2005)	UK	1989-1999	Panel	?

Notes: as for table A3.1

Table A3.3: Summary of empirical FDI and growth studies

Author(s)	Conditional effect tested	Data	Results
Blomstrom et al. (1994b)	Absorptive capacity	CS	+
Balasubramanyam et al. (1996)	Trade openness	CS	+
Borensztein et al. (1998)	Absorptive capacity	Panel	+
Balasubramanyam et al. (1999)	Absorptive capacity	CS	+
Lipsey (2000)	Absorptive capacity	CS	+
Nair-Reichert and Weinhold (2001)	Absorptive capacity and trade openness	Panel	-/+
Ram and Zhang (2002)	Absorptive capacity	CS	-
Hermes and Lensink (2003)	Financial development	CS	+
Alfaro et al. (2004)	Financial development	CS	+
Durham (2004)	Absorptive capacity and financial development	CS	+
Blonigen and Wang (2005)	Absorptive capacity	Panel	-
Carkovic and Levine (2005)	Absorptive capacity, trade openness and financial development	Panel	-
Greenaway et al. (2007)	Trade openness	CS	+

Notes: the second column refers to the host country factor(s) tested to condition the growth effects of FDI. The symbols (+) and (-) denotes the main results do or do not respectively support the relevance of the host country factor(s) while multiple symbols denote mixed results.

Chapter 4

FDI policy indicator database

4.1 Introduction

As discussed in chapter 3, FDI policies, along with trade policies, constitute an important element of the overall policy environment that may influence gains from FDI. However, assessing the impact of FDI policies is difficult due to the dearth of data that measures these policies in a systematic way, especially in a cross-country context. This lack of data motivated the compilation of a new dataset on host country FDI policies using qualitative information from a wide range of sources. The dataset is introduced in this chapter and applied in the empirical analyses presented in chapters 5 to 7.

The dataset comprises binary indicators for three different aspects of FDI policies which indicate the presence or otherwise of particular FDI policy restrictions. The first concerns a prohibition on the full foreign ownership of an enterprise (a joint venture requirement) while the other two relate to controls on the transfer of FDI related capital. Although these three variables do not capture the full gamut of relevant policies, they do represent important elements of the overall FDI policy regime. Importantly for the application of this data to the empirical analysis in this thesis, they each represent aspects of the policy environment that are likely to influence the nature of MNE production and therefore the gains from FDI. Specifically, the presence of these restrictions is likely to deter export MNE production and technology transfer to MNE affiliates.

Since the application of this data is concerned with long run issues it was necessary to compile data over an extended period of time. Furthermore, since much of the variation in FDI policies occurs across countries, the aim was to develop a dataset that incorporated a large sample of diverse countries, thereby maximising cross-sectional variation. Reflecting these concerns, the dataset contains annual observations for the period 1970 to 2000 for 89 countries. This coverage is significantly larger than existing FDI regime datasets.

The remainder of this chapter is structured as follows. The next section contains a brief discussion of the nature of FDI policies that have been adopted in different countries.

An overview of existing cross-country datasets that provide information on any aspect of FDI policies, including their limitations, is also presented. Section 4.3 follows with details on the variables included in this dataset, and the method used to compile the data. Also included in this section is a simple analysis aimed at verifying the accuracy of the compiled indicators and an overview of the key features of the dataset. Section 4.4 concludes. In addition, appendix 4.2 contains a brief description of how each of the variables included in the dataset were coded for each country, including references to the sources used.

4.2 FDI policies and existing datasets

4.2.1 The nature of FDI policies

In almost all countries, the establishment and operation of foreign enterprises, and the flow of FDI related capital, are subject to a range of special legislative provisions. Typically, capital account policies will feature a provision that regulates the inflow of new FDI and the outflow of FDI related capital. In addition, special statutes, often referred to as foreign investment codes, detail particular arrangements that apply to foreign enterprises, over and above legislation governing the operation of domestically owned enterprises.[35]

The aim of these codes is to enlarge the scope for domestic control of foreign assets in the belief that doing so can bring about additional benefits for the recipient country. The nature of foreign investment codes vary considerably, ranging from those which provide general guidelines on a narrow range of operational matters to others which are highly prescriptive and wide ranging in their coverage. Together with FDI related provisions in capital account policies, bilateral investment treaties, and an emerging multilateral framework, foreign investment codes provide the policy framework for international direct investment flows and the operation of foreign affiliated enterprises.

Policy restrictions relating to the transfer of FDI related capital, including earnings accruing to foreign capital and proceeds from the liquidation of foreign assets may be set out in either capital account policies and or foreign investment codes. For example, some codes may include guarantees for the full repatriation of profits and liquidated

[35] For descriptive information on the content of investment codes across countries and through different periods see for example Parra (1999), UNCIT (1988), UNCTAD (1994) and UNCTC (1978b; 1983a; 1983b; 1988).

capital. Alternatively, codes may stipulate restrictions such as limitations on the amounts that can be transferred in any particular period, waiting periods that apply to the transfer of any capital (for example within the first year a foreign enterprise is in operation), or special taxes that apply specifically to capital transfers. Where such provisions exist, transfers will also invariably be subject to general exchange controls. Often capital transfers are screened by monetary authorities and may also require prior authorisation. In some countries, transfers of FDI related capital have also been temporarily suspended by monetary authorities due to capital account imbalances.

Foreign investment codes typically specify entry and establishment conditions for foreign investors that apply over and above capital account policies regulating the inflow of foreign capital. Invariably, countries subject all or at least some foreign investment proposals to a screening process. This involves investors providing details on the nature of their investment to a prescribed authority and to demonstrate that any specific entry regulations, such as capitalisation requirements, have been met.

Entry and establishment provisions also prescribe areas where foreign investment is restricted or prohibited (often a 'negative list'). Nowadays, with governments adopting a more open attitude to FDI, these restrictions normally only apply to the most politically sensitive areas such as defence, natural resources, some services such as health, education, transport, utilities and media, as well as other socio-cultural activities. Historically, however, these provisions have been far more wide ranging and rather than adopt a 'negative list', some countries have instead prescribed a 'positive list' of areas where foreign investment was allowed.

Foreign investment codes also often include ownership restrictions which explicitly regulate the share of foreign equity allowed in an enterprise and often require that domestic residents or the state hold a controlling interest. As documented in appendix 4.2, some countries have imposed such ownership restrictions across all sectors. In other instances restrictions are imposed selectively, usually in politically sensitive sectors or where monopolies tend to operate.

As an alternative to prescribed levels of domestic equity, authorities may impose a more general requirement for foreign investors to offer unspecified amounts of equity to local residents at the commencement of a project. Another way in which national authorities impose ownership restrictions is by specifying a 'fade out' requirement for foreign

investors to divest all or a share of their equity to local residents over a certain period. These requirements may apply to all FDI, in some sectors or even to specific projects, and will often form part of the entry requirement. Typically such fade out requirements apply over a long period such as ten or more years.

Aside from ownership restrictions, foreign investment codes may prescribe various performance and operational requirements. Like ownership restrictions these provisions are designed to enhance domestic control and may apply to all or selected sectors. Performance requirements often relate to minimum levels of employment, or to the generation of foreign currency earnings or minimum export volumes. Operational requirements may include local content requirements, where final products must comprise a minimum level or value of locally produced intermediate inputs. A commitment to share technology, or employ or train a certain number of local workers is also sometimes specified. In addition, foreign investment codes may articulate restrictions on access to local finance, including borrowing from local banks and a prohibition against listing on local stock exchanges.

Finally, incentives to attract foreign investors, as well as special dispute resolution mechanisms, are spelled out in foreign investment codes. Incentives usually include some combination of tax concessions and subsidies, access to special economic zones such as industrial parks or export processing zones, guarantees to limit market competition and commitments to provide new infrastructure. Often these will only apply for investments in particular industries or with certain characteristics that are deemed by authorities to be particularly attractive such as capital intensive, high technology or export oriented production. Furthermore, incentives may be linked to a particular geographic region as part of regional development objectives. Special provisions for dispute resolution and guarantees regarding property rights are designed to alleviate fears that foreign investors might hold regarding the expropriation of their assets, particularly in countries where expropriation has occurred in the past.

4.2.2 Existing FDI policy datasets

Existing cross-country indicators of FDI related policies are sparse. Furthermore, of the data that are currently available, these are less than ideal for long run analysis due to limited coverage or because they poorly target some of the most important aspects of FDI policies. Three datasets have been developed which use qualitative information to

assign numerical values to indicators of national FDI policies for a sizeable number of countries.[36]

First, the *Index of Economic Freedom* is produced by the US based think tank the Heritage Foundation. In this dataset, a score between one and five is assigned to different aspects of FDI policy to indicate the strength of any restrictions that may apply. Areas covered include differential legal treatment of foreign investors, administrative procedures for undertaking FDI, the range of sectors closed to foreign investment and restrictions on FDI related capital transfers. A second dataset, by Shatz (2000), provides similar information, again drawing on qualitative information. Finally, the United Nations Conference on Trade and Development (UNCTAD) produces the *Investment Compass* database using information gleaned from surveys issued to national authorities. While all of these datasets provide numerical indicators of different aspects of the FDI regime for a sizeable sample of countries, the period for which data are available is limited to around one decade, which is arguably insufficient for long run analysis.

Aside from these broad indicators of FDI policies, a number of datasets provide information on official or *de jure* capital controls. In representing one particular form of restriction on the freedoms of foreign investors, capital controls on the movement of FDI related capital form one element of the overall FDI regime. However, notwithstanding the limitation that capital control indicators lack information on broader aspects of the FDI regime, the available indicators of capital controls are of limited use in assessing controls on FDI in a long run context. This is because they either do not target the pertinent aspects of capital controls that apply to foreign direct investors, or like the datasets discussed above, suffer from limited coverage. For example, the International Monetary Fund (IMF) produces a binary indicator of broad capital account restrictions for a large sample of countries from the 1960s onwards. However, since many countries adopt heterogeneous approaches towards controlling different types of capital this broad indicator is unlikely to accurately reflect restrictions applying specifically to direct investors (Eichengreen and Mussa 1998).

[36] A data source containing information on FDI policies faced by US MNE foreign affiliates is provided by the US Bureau of Economic Analysis. See section 5.2.1 of chapter 5 for further details.

Some researchers have made use of text descriptions of capital account related policies presented in the IMF *Annual Report on Exchange Arrangements and Exchange Restrictions* (AREAER) to compile indicators for specific types of capital control. For example, Miniane (2004) presents a dataset containing indicators of different capital controls starting in 1983, but for only 34 countries. A far more comprehensive dataset is by Brune et al. (2001) who compile different capital control indicators for 173 countries over the period 1973 to 1999. This dataset provides information on restrictions on both inflows and outflows for a number of different transactions including a category relating to direct investment. However, the category on FDI related transfers groups together restrictions on the liquidation of investments by non-residents in the recipient country as well as the liquidation of investments made by residents abroad. Since some countries adopt different policies with respect to inward and outward FDI, it is not possible to use this particular indicator to accurately gauge restrictions imposed on inward FDI.

A further limitation of the dataset by Brune et al. (2001) is that while it contains information on restrictions relating to payments for invisible transactions, including payments relating to income earned on foreign capital, no distinction is made between the types of payment falling under this category. This limits the suitability of this dataset to measure specific FDI related restrictions. A similar limitation applies to the *Freedom of the World Index* compiled by the Canadian based think tank the Fraser Institute which provides data starting in 1970. The variable concerned with FDI flows in this dataset is an aggregate indicator which may reflect restrictions on either or both the inflow and outflow of FDI related capital.

4.3 New FDI policy indicators

4.3.1 Definitions and methodology

In light of the limitations of existing FDI policy indicators, a new dataset has been compiled which provides improved coverage suitable for longer run analysis of the type presented in this thesis. The dataset has been compiled using a wide range of qualitative information and for almost all of the 89 countries included in the dataset annual observations for three different policy indicators are available from 1970 to 2000. This period was selected on the basis that it represents a period when official attitudes

towards foreign investment ranged widely and because data on FDI flows and other variables of interest are widely available for these years.

In order to devise a dataset that provides an indication of the prevalence of FDI policy restrictions while also ensuring the task of compiling the data remained feasible, indicators relating to three aspects of FDI policies have been compiled. Given the importance of ownership restrictions in shaping the operating environment for foreign investors, the first indicator (*Ownership restrictions*) reflects whether countries prohibit outright the establishment and operation of wholly foreign owned enterprises. Put another way, this variable indicates whether countries impose a joint venture requirement on all FDI. A further two indicators reflect restrictions on capital flows specifically affecting foreign direct investors. These are restrictions on the rights of foreign investors to remit earnings on capital, including profits (*Profit restrictions*), and restrictions on the liquidation and repatriation of foreign owned capital (*Liquidation restrictions*).

These three policy indicators target some pertinent aspects of the overall FDI regime and are suitable for analysing the role of FDI policies in affecting the nature of MNE production and conditioning the growth effects of FDI. First, as noted in chapter 3, export platform FDI, more than other forms of direct investment, is expected to be discouraged by the presence of all three types of policy restrictions. This is because this type of investment is more footloose and investors undertaking this type of investment will be attracted to countries offering a superior operating environment. This will include a regulatory environment that does not prevent investors from establishing wholly foreign owned affiliated or hinder the free movement of capital between the affiliate and the parent company. Second, the presence of ownership limits will reduce the incentive for technology transfer to MNE affiliates. This may be due to concerns over the loss of propriety knowledge to rivals and or because shared ownership may reduce the financial return on costly technology transfer.

Ideally, other policies outlined in section 4.2, such as performance requirements, would also be covered by the dataset, as these are also expected to impact on the nature of MNE production. However, good information relating to these policies is particularly difficult to assemble for a large sample of countries as precise details are often not prescribed in foreign investment codes. For example, a code may outline general

principals regarding performance requirements but provide authorities with the discretion to make decisions on a case by case basis.

Moreover, it is argued that not every aspect of the FDI regime need be included in order for a numerical policy indicator to be suitable for the applications described above. A comprehensive FDI policy indicator might incorporate details on sectors closed to foreign investors or detail regulations that apply to particular areas of activity. However, such special provisions are most likely to apply to politically sensitive areas. These may be of little interest to direct investors, especially those seeking to establish export platforms which are of central interest in the empirical analysis presented in this thesis.

For example, with the exception of natural resources, regulated sectors often relate to the production of non-tradeable goods and production that does not reflect the comparative advantage of the host country. Many types of services including health and utilities fall in to this category, as do media, entertainment and defence. For this reason a more detailed FDI regime dataset may well be redundant for assessing many FDI related issues, including those of interest in this thesis.

Each of the three indicators included in the dataset are binary variables, signalling the presence or otherwise of each type of policy restriction. A scale system that accurately reflects the severity of restrictions offers the advantage of providing a richer source of information. However, compiling this type of data is a more resource intensive endeavour requiring detailed descriptions of prevailing policies. In addition, a scale approach inevitably requires the exercise of a good deal more judgement when converting qualitative information in to quantitative information. In this way a scale variable may suffer from greater measurement error.

The criterion used to code the *Ownership restrictions* indicator was whether full foreign ownership of an enterprise was prohibited in every sector. This included a requirement for new investments to be joint ventures from the outset or an obligation for an initially fully foreign owned venture to incorporate local equity within a specified time frame. That is, whether any requirement for a dilution of ownership, such as a fade out provision, existed. Applying this strict standard enables, in principle, the inference that

all FDI flowing to countries with this type of restriction either represents equity in a joint venture or in an enterprise that is destined to become a joint venture.[37]

An alternative approach to coding the *Ownership restrictions* indicator would be to define some criterion to capture the existence of ownership restrictions in some, rather than all, sectors. However, this may not provide any useful indication of the proportion of direct investment that is subject to ownership restrictions. As noted above, many countries, including some industrialised, have historically imposed foreign equity limits in sensitive sectors that may be of little interest to foreign investors. Therefore, countries that selectively impose limits on foreign ownership may actually impose ownership restrictions on a very small proportion of total FDI.

A considerable challenge in coding the *Ownership restrictions* indicator is that some countries have historically adopted foreign investment codes which on the surface appear liberal but subject investment proposals to a screening process that may unofficially favour joint ventures. To address this problem, *Ownership restrictions* were also coded where there was clear evidence of a *de facto* requirement for local participation. This inevitably requires exercising judgement to distinguish between authorities holding a preference for joint ventures but adopting a pragmatic approach on the one hand, and on the other, taking a hostile and dogmatic view of foreign investment and insisting on joint ventures.

To ensure consistency with the stringent criterion outlined above, *de facto* ownership restrictions were assumed to exist where governments adopted an overtly hostile attitude to foreign investment. The signal used to identify such a stance was the rise to power of a socialist regime, as defined by Kornai (1992), or clear evidence of widespread actions by a government to nationalise foreign enterprises. Often such episodes occurred in conjunction with declarations of nationalist intentions by regimes swept to power through revolutionary means.[38] Where ownership restrictions were coded on the basis of this information, it was assumed that such restrictions existed until

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[37] In a small number of instances countries have assigned special status to other countries, allowing some foreign investors to bypass ownership restrictions. For example, members of the Andean Community imposed ownership limits for much of the 1970s and 1980s but exempted investors from other Community countries. Similar provisions existed in some Arab countries. Since these provisions typically apply to only a very select group of countries, ownership restrictions were assumed to apply in these circumstances.

[38] This occurred in some African, Middle Eastern and Latin American countries, especially during the 1970s and 1980s.

there was a clear indication of a change in official attitudes. Invariably this was assumed to occur when authorities introduced a new foreign investment code that did not stipulate blanket ownership restrictions, as described above.

For the two capital control related indicators, the decision to code restrictions was based on the presence of controls that impinge on the rights of investors to transfer FDI related capital. This includes overt restrictions as well as the existence of ceilings on the amounts that could be transferred in any one period, requirements to phase capital transfers over some period or special taxes that applied to transfers. Restrictions were also coded where a requirement to seek prior authorisation or approval existed.

However, exceptions were made where there was clear evidence that as a matter of practice, approval was invariably given automatically. One concern in the context of the *Liquidation restriction* indicator is that waiting period requirements might not actually represent any meaningful impediment for direct investors given that FDI is associated with long term commitments. Nevertheless, to ensure consistency, restrictions were coded for this indicator wherever any waiting period applied.

Following the approach adopted by others who have compiled data on *de jure* capital controls including Miniane (2004) and Brune et al. (2001), the first step in compiling the new dataset was to review capital account policy descriptions contained in the IMF AREAER series, for each country from 1970 to 2000. The AREAER contains text descriptions of trade and exchange related policies prevailing in most IMF member countries and has been produced annually since 1950 as part of a requirement set out in the IMF's Articles of Agreement.

In general, the descriptions provided in the AREAER include details on matters such as exchange rate arrangements, payments for imports of goods and invisible items as well as proceeds from exports and restrictions on capital flows, both inward and outward. The coverage of policy descriptions has largely remained unchanged since the inception of the series, although the presentation format changed in 1996 to provide some additional detail. The description of policies contained in each report are based on information provided by national authorities, media reports and other sources and the final version is agreed to by both IMF staff and authorities in member countries as reflecting an accurate account of policies prevailing at any point in time.

Text descriptions in the AREAER under the heading of 'capital' cover any special arrangements or limitations attached to the inflow or outflow of capital. These descriptions were the primary source of information used to code each of the three FDI policy indicators. Guidelines provided in each edition of the AREAER report that regulations governing the transfer of income derived from foreign capital (including dividends and profits), are also usually described under this sub-heading.

However, in many instances regulations relating to the transfer of income derived on foreign capital are detailed under the heading of 'payments for invisibles'. Therefore information provided under both of these sub-headings was used. If details for any country entry under these sub-headings contained a reference consistent with the above criteria for each policy indicator then a value of 'one' was recorded to indicate the presence of a particular restriction, otherwise 'zero' was recorded.

A limitation of the AREAER series is that the level of detail provided on FDI policies (and indeed other trade and exchange related policies) varies considerably from country to country. While descriptions for some countries are comprehensive, for others they are sketchy or absent altogether. This is especially true for information relating to *de jure* ownership restrictions. Moreover, the *AREAR* series provides no information on *de facto* ownership restrictions, as defined above.

Hence, while the AREAER provided a good starting point, and also complete coverage of relevant FDI policies for some countries included in the dataset, there was a need to use a variety of supplementary sources. Unfortunately, no other single source contains consolidated information on FDI policies, necessitating the need to drawn upon a wide variety of sources. These included various published volumes, reports by the World Bank, UN and Economist Intelligence Unit, commercial country guides by the US Government and a range of other material.

4.3.2 Assessing FDI policy indicators

Legislative frameworks in many countries provide authorities with considerable discretion for applying restrictions on FDI flows and associated MNE activities. As a consequence, the true application of FDI policies may differ from the policy position identified in relevant statutes. By using information on how policies are applied in practice, in addition to information on *de jure* policy settings, the chances that each of

the indicators reflects the true application of policies is enhanced. Nevertheless, where judgments are made to assign values to the indicator variables there is an inevitable possibility that errors will be made.

This possibility of error prompts the need to assess the accuracy of the three FDI indicator variables. However, this task is made difficult by the lack of a benchmark with which to make comparisons. Further, as noted above, existing data sources on FDI policies are much more limited in their coverage. Indeed, the time coverage of the most comparable datasets is around one third of the coverage in this dataset.

An indirect method of assessing the FDI policy indicators is to examine whether they are correlated with observed FDI flows. As argued in chapter 3, FDI associated with export oriented production is expected to be particularly sensitive to FDI policies as prospective investors seek out the best operating environment. Nevertheless, it is likely that, *ceteris paribus*, other forms of investment will also be influenced by FDI policies. Therefore, liberal FDI policies are expected to have a positive influence on all forms of FDI.

Table 4.1 below, reports the results from regressing inward FDI flows, expressed as a proportion of GDP, on the new FDI policy indicators. All results are derived using annual data and fixed effects which allows for the control of time invariant country characteristics. Similar results were obtained using five year averages rather than annual observations.

The first three regressions report the results from regressing FDI flows on each of the three policy indicators separately. In regression four all three policy variables are included while in regressions five and six composite variables comprising combinations of the three indicators are used. The first, *Capital restrictions*, indicates the presence of either *Profit restrictions* or *Liquidation restrictions*. The second, *Regime*, is an average of all three policy indicator variables.

Table 4.1: FDI policy indicators and FDI flows, 1970 to 2000

	1	2	3	4	5	6
Ownership restrictions	-0.019*** (0.002)			-0.015*** (0.002)	-0.015*** (0.002)	
Profit restrictions		-0.016*** (0.002)		-0.002 (0.002)		
Liquidation restrictions			-0.016*** (0.002)	-0.01*** (0.002)		
Capital restrictions					-0.012*** (0.002)	
Regime						-0.026*** (0.002)
Obs.	2677	2677	2677	2677	2677	2677
R-squared	0.04	0.02	0.02	0.05	0.05	0.04

Source: UNCTAD online FDI database and author's calculations. Robust standard errors are reported in parentheses while ***, ** and * denote statistical significance at the 1, 5 and 10 per cent level respectively.
Notes: dependent variable is annual net FDI inflows as a proportion of GDP, all data measured in nominal US dollars. Results derived using fixed effects estimation technique with annual data.

Overall, the results provide some assurance that the three indicator variables reflect useful information about the status of prevailing FDI policies. When entered individually, the coefficients on each of the three policy indicators feature the expected negative sign and are highly significant. This indicates that the existence of all three policy restrictions reduces aggregate FDI flows.

When all three indicators are included together, in regression four, the coefficient on *Profit restrictions* is insignificant while the other two remain highly significant. A likely explanation for the insignificant coefficient is the high degree of correlation between the *Profit restrictions* and *Liquidation restrictions* indicator variables causing multicollinearity. Combining the different indicator variables does not appear to result in any significant changes. The coefficient on *Capital restrictions* is significant and negative when entered alongside *Ownership restrictions*, while the coefficient on *Regime* is also negative and highly significant when used independently.

4.3.2 Overview of FDI policy indicators

The sample of countries included in the dataset was determined by two factors. The first was the availability of data on FDI flows and other variables of interest in the analyses presented in this thesis. The second was sufficient qualitative information on prevailing FDI policies to enable the coding of the three FDI policy indicators. A total of 89 diverse countries passed both of these criteria and were included in the dataset.

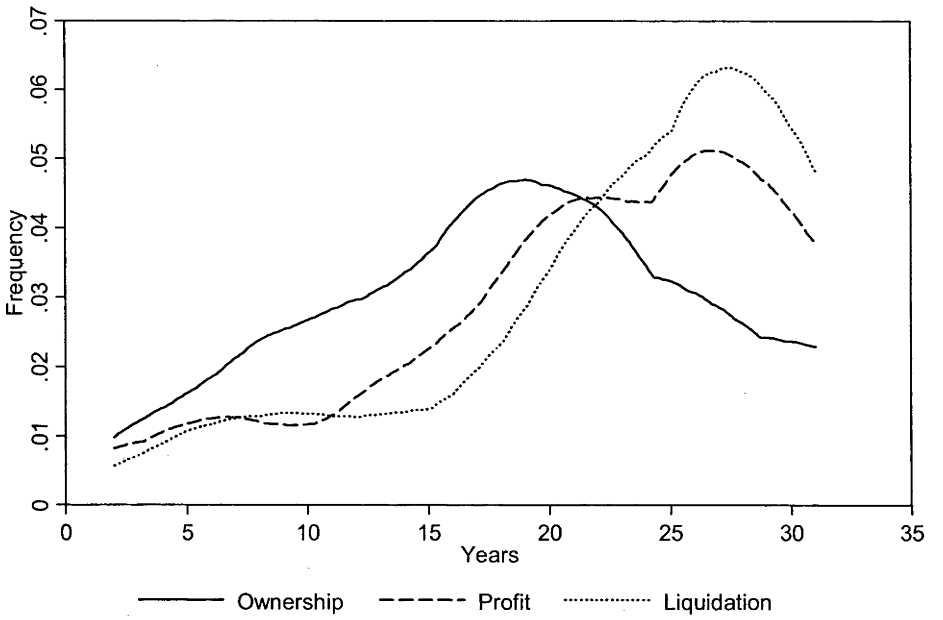
The sample comprises a broad geographic and economic representation with 20 countries classified as industrialised, 13 located in the Middle East or North Africa, 21 in sub-Sahara Africa, 20 in Latin American or the Caribbean region and 15 from Asia and the Pacific.[39]

There are four dominant features in the data, the first of which is the persistence of prevailing policies. In most countries the three FDI policy restrictions have either never been adopted or imposed for an extended period. In this way, FDI policies appear to mirror trade policies which, at a general level at least, are also highly persistent (see for example Sachs and Warner (1995)). Out of the full sample, 23 countries have never imposed any of the three policy restrictions. While this group is dominated by industrialised countries it also includes a small number of developing countries.

Figure 4.1 below highlights the persistence of policy restrictions using kernel density estimates which are a smoothed representation of a standard histogram (Pagan and Ullah 1999). For each policy indicator, the frequency of episodes where restrictions have been continuously imposed is plotted according to the duration of the episode. The clear pattern that emerges from this illustration is that where FDI policy restrictions have been imposed they have generally remained in place for at least a decade and often more than two decades. This is especially true for the *Profit restrictions* and *Liquidation restrictions* indicators where episodes of restrictions have most often lasted over 25 years. This reflects the fact that in many countries where these types of restrictions were imposed were invariably in place in 1970 and were not liberalised until the late 1990s.

[39] Industrialised countries are defined by membership of the Organisation for Economic Cooperation and Development (OECD) prior to its expansion in the 1990s when Mexico and several former Soviet block countries were admitted.

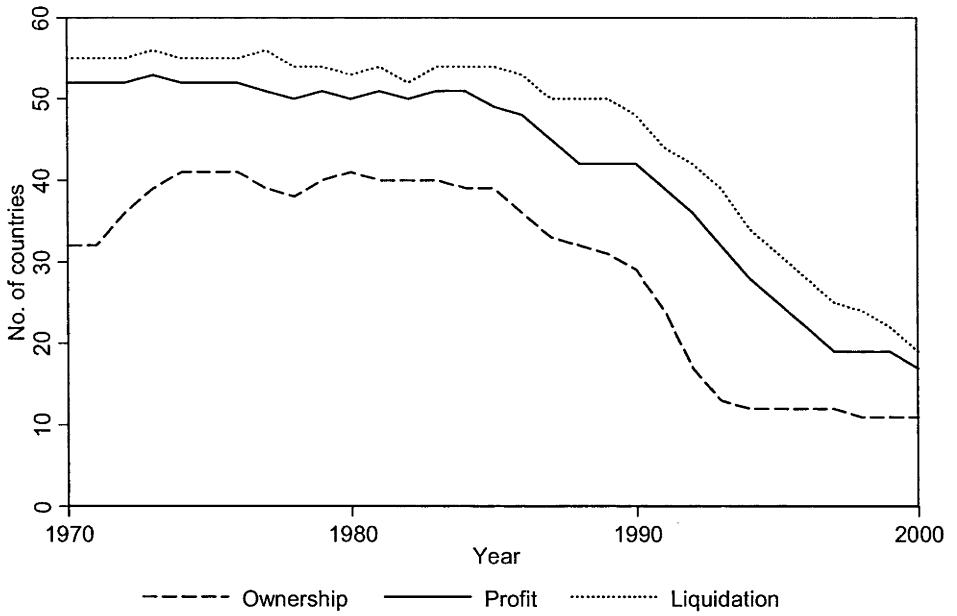
Figure 4.1: Duration of episodes featuring FDI policy restrictions, 1970 to 2000



Source: author's calculations.

There is clear evidence that the incidence of all forms of FDI policy restrictions fell markedly between 1970 and 2000, consistent with other evidence. As with the general move towards international trade liberalisation, the dominant global trend regarding these particular FDI policies since the 1970s has been for countries to adopt a more liberal stance. Furthermore, once liberalisation has occurred, instances of policy reversal have been rare, thereby reinforcing the persistence of policy settings. The general trend towards liberalisation is highlighted in figure 4.2 below, which plots the evolution of the three policy variables across time for the full sample. In general the incidence of restrictions was quite stable during the 1970s and early 1980s before widespread liberalisation occurred during the late 1980s and early 1990s.

Figure 4.2: Incidence of FDI policy restrictions, 1970 to 2000



Source: author's calculations.

Regarding the pattern of liberalisation within individual countries, some countries introduced restrictions after 1970. However, in general instances of liberalisation followed by the reimposition of restrictions are rare. Indeed no country has a record of reinstating ownership restrictions following liberalisation. For the two capital control indicators there are a few instances where countries liberalise and then temporarily reintroduce *Profit restrictions* or *Liquidation restrictions* during periods that coincide with capital account crises (for example Turkey), but these are rare. As with *Ownership restrictions*, the dominant trend is to liberalise and retain a liberal policy stance.

Another dominant feature of the dataset is the greater incidence of capital control related restrictions compared with *Ownership restrictions* (figure 4.2). A total of 45 countries, none of which are classified as industrialised, have imposed ownership restrictions at some point. In comparison, a total of 55 countries have at some point imposed *Profit restrictions* and 61 imposed *Liquidation restrictions*.

In many cases countries adopted multiple FDI related capital controls, particularly during the 1970s and early 1980s. As a result, there is a clear positive global correlation between the *Profit restrictions* and *Liquidation restrictions* indicator variables. Furthermore, in general countries which have adopted *Ownership restrictions* have also imposed one or both type of capital control restriction. However, the reverse is not true

with many countries adopting some form of capital control restriction without imposing *Ownership restrictions*.

The incidence of all types of FDI policy restrictions varies across major country groupings.[40] The incidence of all types of restrictions is generally highest in African and Middle Eastern countries and, not surprisingly, the lowest in industrialised countries. There are no *Ownership restrictions* coded for the 20 industrialised countries included in the sample and only 3 have ever imposed *Profit restrictions* or *Liquidation restrictions*. The incidence of restrictions across Asian and Latin American and Caribbean countries falls somewhere in between. Hence, liberal FDI policies are somewhat correlated with levels of development.

The timing of liberalisation is similar within major country groups. This regional concentration of controls to some extent reflects formal regional economic associations of some form. For example, former French colonies in Africa, which have adopted common exchange arrangements in conjunction with the CFA Franc, tended to adopt the same approach to regulating the movement of FDI related capital. Likewise, South American countries which formed part of the Andean Community, adopted similar policies regarding *Ownership restrictions* and *Profit restrictions* through the 1970s and 1980s.

4.4 Conclusion

This chapter introduces a new cross-country dataset on FDI related policies to be used in various empirical analyses in this thesis. Although the dataset does not include information on the full range of relevant FDI policies it summarises policy settings on some important aspects of the FDI regime relevant to the analyses presented in this thesis. The dataset comprises three variables which indicate the presence of particular FDI related policy restrictions. The first relates to restrictions on the foreign ownership of enterprises while a further two relate to restrictions on the transfer of FDI related capital. An attempt was made to compile indicators that reflect the true application of policies and to validate them by examining correlations with FDI flows.

The compiled indicators show a number of distinctive characteristics including a high degree of time persistence. The dataset also points to a global trend towards the

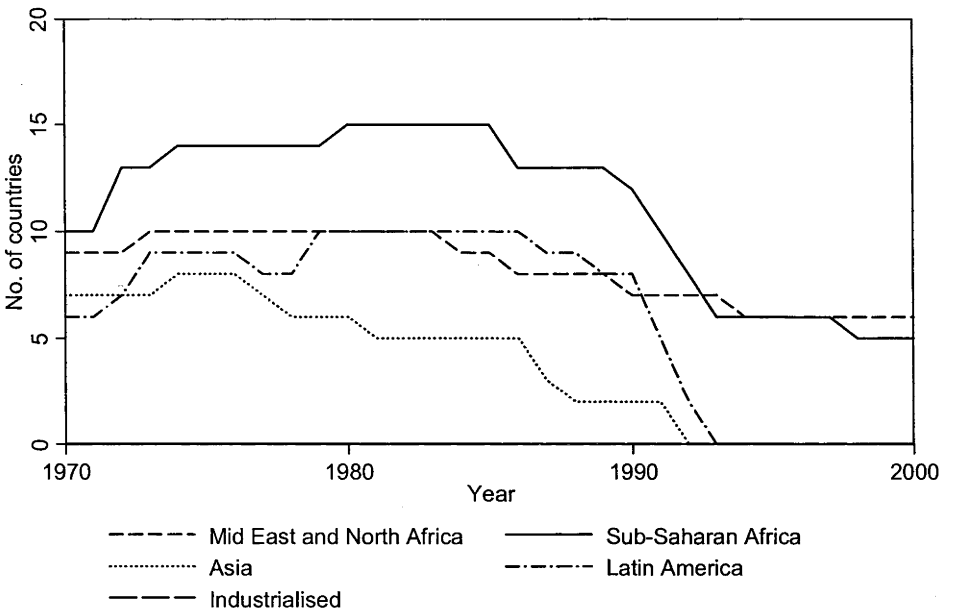
[40] See figures A4.1, A4.2 and A4.3 in appendix 4.1 for graphical representations of the incidence of restrictions by country group.

adoption of more liberal FDI policies, particularly since the late 1980s. Perhaps unsurprisingly, restrictive FDI policies are concentrated in developing countries, especially in the Middle East and parts of Africa. Restrictions on the transfer of FDI related capital are also far more predominant than *Ownership restrictions*.

In the following three chapters the newly compiled data are applied to three empirical analyses. The next chapter focuses on determinants of MNE export orientation followed by the determinants of technology transfer to MNE foreign affiliates. This leads to an analysis of the growth effects of FDI in chapter 7.

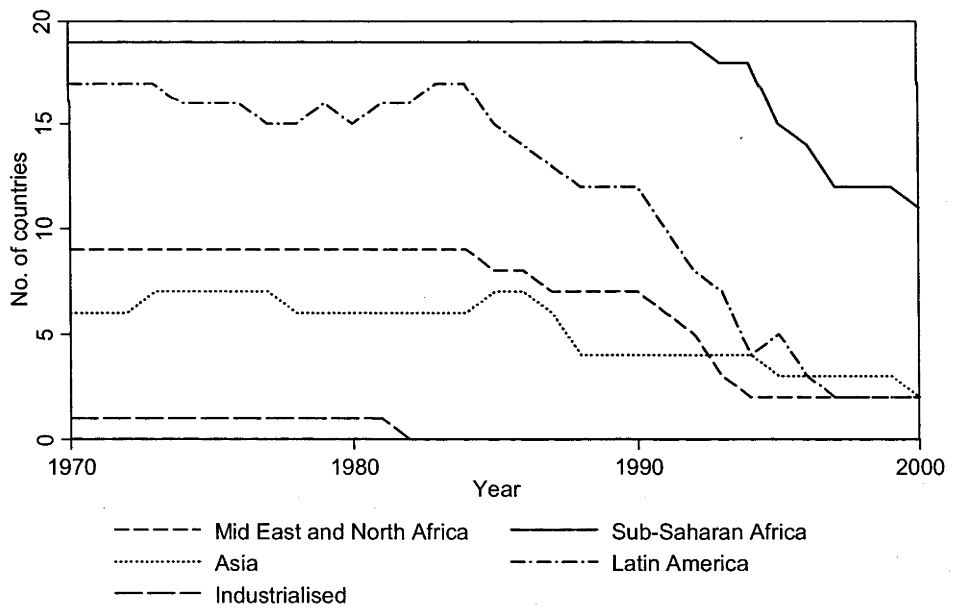
Appendix 4.1 Descriptive statistics

Figure A4.1: Incidence of ownership restrictions by country group, 1970 to 2000



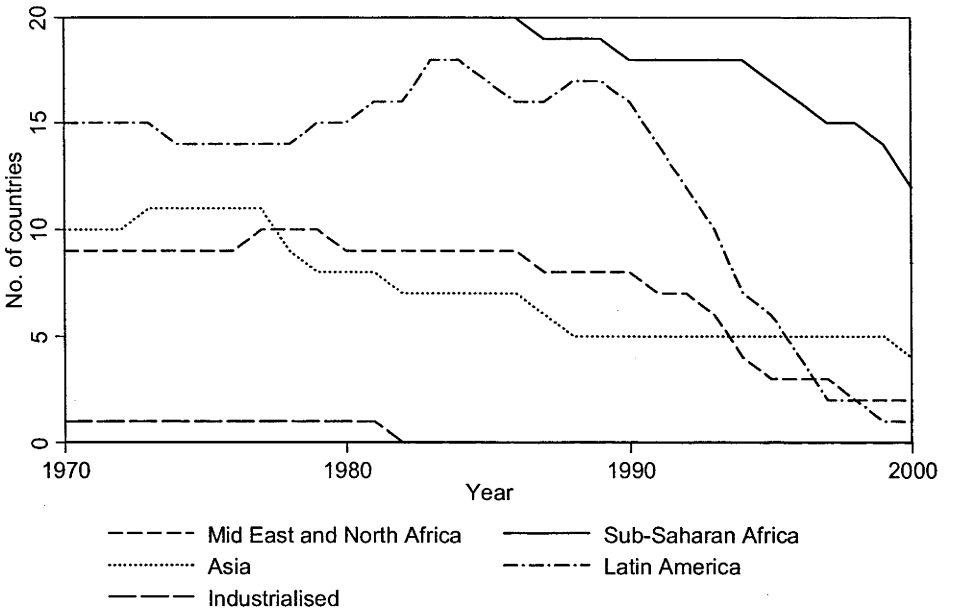
Source: author's calculations.

Figure A4.2: Incidence of profit restrictions by country group, 1970 to 2000



Source: author's calculations.

Figure A4.3: Incidence of liquidation restrictions by country group, 1970 to 2000



Source: author's calculations.

Appendix 4.2 FDI policy descriptions, coding details and sources

This appendix provides a brief description of FDI policies between 1970 and 2000 for each country included in the dataset. In addition, the years, if any, in which restrictions were coded for each of the three policy indicators *Ownership restrictions*, *Profit restrictions* and *Liquidation restrictions* are noted. The appendix also details the references used to compile the dataset, for each country, in addition to the IMF AREAER series. As noted above, for each country in the dataset, each addition of the AREAER from 1970 to 2000 was reviewed as the first step in compiling the dataset for all countries.[41]

In providing the following descriptions of prevailing FDI policies an attempt was made to use uniform terminology. In describing ownership related restrictions, the term 'blanket ownership restriction' refers to a prohibition on the establishment or acquisition of an enterprise that solely comprises foreign capital in all sectors. Equivalently, this term describes a policy mandating joint ventures in all sectors. The term 'fade out requirement' is used to describe a policy that requires divestment by foreign investors within a particular timeframe across all sectors. In contrast the term 'liberal policy regarding ownership' refers to a situation where neither a fade out requirement or blanket ownership restriction exists across all sectors. It should be noted that this terminology does not imply an absence of ownership restrictions; in almost all countries such restrictions have applied in at least some sectors at some point in time.

In describing restrictions on the transfer of FDI related capital, the term 'authorisation requirement' refers to a general requirement for all or most transfers to be approved by a prescribed authority before the transfer can proceed. The term 'restrictions' signals a policy of disallowing capital transfers under most circumstances. The term 'special taxes' refers to the existence of taxes that apply specifically to capital transfers. The terms 'ceilings' and 'waiting periods' respectively refer to a policy of allowing capital transfers only in limited amounts or over specified periods. In contrast, the term 'liberal policy regarding capital transfers' signals a policy of generally allowing the transfer of FDI related capital at the discretion of the investor.

[41] The exception is Taiwan which is the only country in the dataset that is not a member of the IMF and is therefore not covered by the AREAER series.

1. Algeria

The 1986 foreign investment code is described as considerably less restrictive than earlier regulations but maintained blanket ownership restrictions (UNCIT 1988, p.267). A new code in 1993 removed this requirement (US Department of State 1998a; UNCTAD 2003a). Restrictions, including ceilings, applied to capital transfers.
Ownership restrictions: 1970-1993
Profit restrictions: 1970-1993
Liquidation restrictions: 1970-1993

2. Argentina

Generally liberal policy regarding foreign ownership (UNCTC 1978b, p.219; Grosse 1989, pp.74-77). Restrictions, including special taxes and waiting periods, applied to capital transfers.
Ownership restrictions: none
Profit restrictions: 1970-1986
Liquidation restrictions: 1970-1993

3. Australia

Generally liberal policy regarding foreign ownership (Hammer et al. 1983, pp.5-12). Authorisation requirement for capital transfers existed in 1970s and early 1980s but approval normally given.
Ownership restrictions: none
Profit restrictions: none
Liquidation restrictions: none

4. Austria

Generally liberal policy regarding foreign ownership (Hammer et al. 1983, pp.13-14). Liberal policy regarding capital transfers.
Ownership restrictions: none
Profit restrictions: none
Liquidation restrictions: none

5. Bangladesh[42]

Blanket ownership restrictions applied until the introduction of a new foreign investment code in 1980 allowed full foreign ownership in some circumstances, including for export oriented production. Authorisation requirement applied to capital transfers.
Ownership restrictions: 1970-1980
Profit restrictions: 1973-1994
Liquidation restrictions: 1973-2000

6. Belgium

Liberal policy regarding foreign ownership and capital transfers (Hammer et al. 1983, pp.21-26).
Ownership restrictions: none
Profit restrictions: none
Liquidation restrictions: none

[42] Coded as for Pakistan prior to 1973.

7. Benin

Foreign investment code of 1972 includes provisions entitling the state to a minimum 20 per cent stake in projects receiving any incentives (UNCTC 1978b, p.76). Regime also classified as socialist from 1972 by Kornai (1992, pp.6-7). Process of structural adjustment including privatisation began in late 1980s (World Bank 1994, pp.6-7). No general limits on ownership in 1990 code (US Department of State 2001a). Authorisation requirement applied to capital transfers.
Ownership restrictions: 1972-1990
Profit restrictions: 1970-1999
Liquidation restrictions: 1970-1999

8. Bolivia

Andean Pact regulations which stipulated blanket ownership restrictions and fade out requirements applied from 1970 until 1987. In addition, fade out provisions appear to have been maintained for a short period after this (UNCTC 1986, pp.123-125; Pfeffermann 1988; Grosse 1989, pp.74-77 and pp.113-115). A new code introduced in 1990 does not stipulate any blanket ownership restrictions or fade out requirements (IADB 1997). Authorisation requirement and restrictions, including special taxes, applied to capital transfers.
Ownership restrictions: 1970-1990
Profit restrictions: 1970-2000
Liquidation restrictions: 1983-1996

9. Botswana

Liberal policy regarding foreign ownership (UNCTC 1986, pp.4-6; Harvey and Lewis 1990, pp.159-185; Ailola 2000). Authorisation requirement applied to capital transfers.
Ownership restrictions: none
Profit restrictions: 1970-1992
Liquidation restrictions: 1970-1999

10. Brazil

No blanket ownership restrictions prescribed in early foreign investment codes (UNCTC 1978b, p.219). Historically, authorities have preferred joint ventures but insufficient evidence to presume *de facto* ownership restrictions existed (Hammer et al. 1983, pp.29-32; Grosse 1989, pp.74-77). Restrictions, including special taxes applied to profit remittances. Authorisation requirement applied to capital repatriation but no requests disallowed since 1990 (UNCTAD 2005a).
Ownership restrictions: none
Profit restrictions: 1970-1990
Liquidation restrictions: 1970-1990

11. Burkina Faso	Blanket ownership restrictions stipulated in investment regulations dating from 1970s (UNCTC 1988, p.6). Authorisation requirement applied to capital transfers. *Ownership restrictions*: 1970-2000 *Profit restrictions*: 1970-2000 *Liquidation restrictions*: 1970-2000
12. Cameroon	No evidence of blanket ownership restrictions in investment regulations dating from 1965 or 1990 (UNCTC 1978b, p.79; Ndongko 1986; Worldmark Encyclopaedia of the Nations 2006a). Authorisation requirement applied to capital transfers. *Ownership restrictions*: none *Profit restrictions*: 1970-2000 *Liquidation restrictions*: 1970-2000
13. Canada	Liberal policy regarding foreign ownership and capital transfers (Hammer et al. 1983, pp.33-36; UNCTC 1983b, pp.300-303). *Ownership restrictions*: none *Profit restrictions*: none *Liquidation restrictions*: none
14. Central African Republic	Regulations dating from 1960s which appear to have applied through the 1990s stipulate ownership restrictions. This requirement could be waived but only for a specified period (UNCTC 1988, pp.19-25). Authorisation requirement applied to capital transfers. *Ownership restrictions*: 1970-2000 *Profit restrictions*: 1970-2000 *Liquidation restrictions*: 1970-2000
15. Chile	Andean Pact regulations which applied from 1973 stipulated blanket ownership restrictions and fade out requirements. This policy was abandoned in 1976 (UNCTC 1978b, pp.219-220; Grosse 1989, pp.74-77 and pp.113-115). Waiting periods applied to capital transfers. *Ownership restrictions*: 1970-1976 *Profit restrictions*: 1970-1976 *Liquidation restrictions*: 1970-2000
16. China	Effectively closed to foreign investment until early 1970s and first foreign investment code introduced in 1979 stipulated blanket ownership restrictions. Partial liberalisation allowing full foreign ownership in some circumstances occurred in 1986 (Zhang 1999, pp.13-19). Authorisation requirement and taxes applied to capital transfers. *Ownership restrictions*: 1970-1986 *Profit restrictions*: 1970-2000 *Liquidation restrictions*: 1970-2000

17. Colombia

Andean Pact regulations which stipulated blanket ownership restrictions and fade out requirements applied from 1970 until 1987. However, fade out provisions appear to have been maintained for a short period after this (Pfeffermann 1988; Grosse 1989, pp.74-77 and pp.113-115). A new code introduced in 1991 does not stipulate blanket ownership restrictions or fade out requirements (IADB 1997). Restrictions including waiting periods and authorisation requirement applied to capital transfers.
Ownership restrictions: 1970-1991
Profit restrictions: 1970-1993
Liquidation restrictions: 1970-1998

18. Congo, People's Republic

Classified as socialist from early 1960s by Kornai (1992, pp.6-7). Liberalisation commenced in late 1980s and continued through 1990s, accompanied by wide ranging constitutional reform (World Bank 1994, pp.43-44). A new foreign investment code was established in 1992 which does not appear to contain any blanket ownership restrictions (Worldmark Encyclopaedia of the Nations 2006b). The late 1990s marked renewed civil unrest but no evidence of reversal of liberalisation effort (EIU 1992; 1998). Authorisation requirement applied to capital transfers.
Ownership restrictions: 1970-1992
Profit restrictions: 1970-2000
Liquidation restrictions: 1970-2000

19. Congo, Democratic Republic (Zaire)

During 1970s government adopted hostile attitude to foreign investment resulting in widespread nationalisation of foreign assets (Marsden and Belot 1989). In 1979 a new foreign investment code was introduced which did not stipulate blanket restrictions on ownership. However, under the new code authorities had the right to equity participation and the official attitude to foreign capital remained antagonistic through the 1980s and 1990s (UNCTC 1983b, pp.37-38; US Department of State 2001b). Authorisation requirement applied to capital transfers which were also subject to delays.
Ownership restrictions: 1970-2000
Profit restrictions: 1970-2000
Liquidation restrictions: 1970-2000

20. Costa Rica

Liberal policy regarding foreign ownership (Willmore 1976; Hammer et al. 1983, pp.53-55; UNCTC 1983b, pp.145-146). Authorisation requirement and special taxes applied to capital transfers.
Ownership restrictions: none
Profit restrictions: 1970-2000
Liquidation restrictions: 1970-1992

21. Denmark

Liberal policy regarding foreign ownership and capital transfers (Hammer et al. 1983, pp.59-61).
Ownership restrictions: none
Profit restrictions: none
Liquidation restrictions: none

22. Dominican Republic

Liberal policy regarding foreign ownership (EIU 1972; Hammer et al. 1983, pp.63-67; UNCTC 1988, pp.257-259). Authorisation requirement and ceilings applied to capital transfers.
Ownership restrictions: none
Profit restrictions: 1970-1995
Liquidation restrictions: 1970-1995

23. Ecuador

Andean Pact regulations which stipulated blanket ownership restrictions and fade out requirements applied from 1970 until 1987. However, fade out provisions appear to have been maintained for a short period after this (Pfeffermann 1988; Grosse 1989, pp.74-77 and pp.113-115). A new code introduced in 1991 does not stipulate any blanket ownership restrictions or fade out requirements (IADB 1997). Restrictions, including waiting periods, applied to capital transfers.
Ownership restrictions: 1970-1991
Profit restrictions: 1970-1991
Liquidation restrictions: 1970-1991

24. Egypt

Blanket ownership restrictions applied through 1960s and early 1970s. A new foreign investment code introduced in 1974 included a requirement for a specified amount of local equity unless an exemption was provided by a majority vote of the prescribed authority. Evidence suggests authorities maintained a strong preference for joint ventures through the 1970s and 1980s. In 1989 an amendment formally lifted this ownership requirement (UNCTC 1978b, p.167; Esfahani 1993; Springborg 1993; UNCTAD 1999). Ceilings and waiting periods applied to capital transfers.
Ownership restrictions: 1970-1989
Profit restrictions: 1970-1987
Liquidation restrictions: 1970-1997

25. El Salvador

Legislation introduced in 1969 disallowed foreign ownership of small enterprises but no evidence of blanket ownership restrictions (EIU 1969). Junta government that seized power in 1979 embarked on program of widespread nationalisation (EIU 1980). In 1988 a new, more liberal, foreign investment code that does not stipulate blanket ownership restrictions was introduced (World Bank 1996). Ceilings and authorisation requirement applied to capital transfers.
Ownership restrictions: 1979-1988
Profit restrictions: 1970-1992
Liquidation restrictions: 1970-1992

26. Ethiopia

Classified as socialist by Kornai (1992, pp.6-7) from 1974 and extensive state intervention and nationalisation throughout the 1970s (Marsela and Belot 1987). Blanket ownership restrictions later enshrined in regulations. Restrictions and authorisation requirement applied to capital transfers.
Ownership restrictions: 1974-2000
Profit restrictions: 1970-2000
Liquidation restrictions: 1970-2000

27. Fiji

Liberal policy regarding foreign ownership (Hammer et al. 1983, pp.79-81). Restrictions, including ceilings, and authorisation requirement applied to capital transfers.
Ownership restrictions: none
Profit restrictions: 1970-1999
Liquidation restrictions: 1970-1999

28. Finland

Liberal policy regarding foreign ownership. For a period capital transfers required approval but evidence suggests this was freely given (Hammer et al. 1983, pp.83-85).
Ownership restrictions: none
Profit restrictions: none
Liquidation restrictions: none

29. France

Liberal policy regarding foreign ownership. For a period capital transfers required approval but evidence suggests this was freely given (Hammer et al. 1983, pp.87-89; UNCTC 1983b, p.319).
Ownership restrictions: none
Profit restrictions: none
Liquidation restrictions: none

30. Gabon

Blanket ownership restrictions in major industrial projects prescribed in various foreign investment codes in 1960s and 1970s and an indigenisation decree introduced in 1975 (UNCTC 1978b, p.76). A foreign investment code introduced in 1989 requires foreign companies investing in Gabon to offer shares to locals. Authorisation requirement applied to capital transfers.
Ownership restrictions: 1970-2000
Profit restrictions: 1970-2000
Liquidation restrictions: 1970-2000

31. Germany

Liberal policy regarding ownership and capital transfers (Hammer et al. 1983, pp.91-93).
Ownership restrictions: none
Profit restrictions: none
Liquidation restrictions: none

32.Ghana

From early 1970s government adopted hostile attitude towards foreign investment resulting in blanket ownership restrictions being enshrined in legislation. A new foreign investment code introduced in 1985 allowed full foreign ownership for enterprises generating foreign exchange (Marsela and Belot 1987; UNCIT 1988, p.266; UNCTAD 2003b). Restrictions and authorisation requirement applied to capital transfers.
Ownership restrictions: 1972-1985
Profit restrictions: 1970-1995
Liquidation restrictions: 1970-1995

33. Greece

Liberal policy regarding foreign ownership (Hammer et al. 1983, pp.95-98). Waiting periods and ceilings applied to the transfer of capital.
Ownership restrictions: none
Profit restrictions: 1970-1990
Liquidation restrictions: 1970-1990

34. Guatemala

Liberal policy regarding foreign ownership (Willmore 1976; Hammer et al. 1983, pp.99-101; US Department of State 1998b). Restrictions and taxes applied to capital controls.
Ownership restrictions: none
Profit restrictions: 1970-1973 and 1981-1984
Liquidation restrictions: 1970-1973 and 1981-1984

35. Guinea

From independence authorities adopted a hostile attitude towards foreign investment. Major liberalisation effort commenced in mid 1980s. This included widespread privatisation and introduction of a new foreign investment code in 1985 that allowed full foreign ownership of large projects (Marsela and Belot 1987; World Bank 1994, pp.82-83). Authorisation requirement applied to capital transfers.
Ownership restrictions: 1970-1985
Profit restrictions: 1970-2000
Liquidation restrictions: 1970-2000

36. Guyana

Socialist style policies which included widespread nationalisation of foreign assets adopted from around 1970. During early 1970s government stated foreign investment only allowed in projects which were majority owned by the government. Foreign investment code dating from late 1970s stipulates a joint venture requirement (UNCTC 1983b, pp.163-165; Thomas 1984; Pantin 1990; Gafar 1996). Abandonment of socialist policies and major liberalization effort commenced in 1988. Evidence suggests that from the early 1990s blanket ownership restrictions were lifted (McFeeters 1992). Authorisation requirement applied to capital transfers.
Ownership restrictions: 1970-1990
Profit restrictions: 1970-1990
Liquidation restrictions: 1970-1990

37. Honduras

Liberal policy regarding foreign ownership (Willmore 1976; Hammer et al. 1983, pp.103-105; IADB 1997). Authorisation requirement applied to capital transfers.
Ownership restrictions: none
Profit restrictions: 1970-1993
Liquidation restrictions: 1970-1994

38. Hong Kong, China

Liberal policy regarding ownership and capital transfers (Hammer et al. 1983, pp.107-108).
Ownership restrictions: none
Profit restrictions: none
Liquidation restrictions: none

39. India

Various blanket ownership restrictions enshrined in foreign investment codes from early 1970s until 1991. These included prescribed limits on foreign participation and dilution requirements where an expansion of a foreign enterprise required local participation (UNCTC 1978b, pp.128-129; Hammer et al. 1983, pp.109-116). Authorisation requirement and restrictions including ceilings applied to capital transfers.
Ownership restrictions: 1970-1991
Profit restrictions: 1970-2000
Liquidation restrictions: 1970-2000

40. Indonesia

Presidential decree in 1974 resulted in widespread ownership restrictions and instituted a fade out requirement. However, while the announcement appears to have had some effect through the late 1970s, there are doubts as to how strongly the measures were enforced after this. The indigenisation decree remained official policy through the 1980s and 1990s but the timeframe under which firms were forced to indigenise were lengthened in 1986 and 1994 (Hill 1989, pp.28-33; Sastromihardo 1990, pp.80-89; Pangestu and Azis 1994). Some capital transfers subject to ceilings.
Ownership restrictions: 1974-1986
Profit restrictions: none
Liquidation restrictions: 1970-1977

41. Iran

Blanket ownership restrictions appear to have applied before and after 1976 revolution (CBI 1972; UNCTC 1978b, p.167). Restrictions applied to capital transfers.
Ownership restrictions: 1970-2000
Profit restrictions: 1970-2000
Liquidation restrictions: 1970-2000

42. Ireland

Liberal policy regarding ownership (Hammer et al. 1983, pp.121-124). Authorisation requirement applied to capital transfers until early 1990s but were freely given throughout the 1980s.
Ownership restrictions: none
Profit restrictions: 1970-1981
Liquidation restrictions: 1970-1981

43. Israel

Liberal policy regarding ownership (UNCTC 1983a, p.138; OECD 2002). Restrictions applied to some capital transfers.
Ownership restrictions: none
Profit restrictions: none
Liquidation restrictions: 1970-1979

44. Italy

Liberal policy regarding ownership and capital transfers (Hammer et al. 1983, pp.125-134; UNCTC 1986, pp.57-58).
Ownership restrictions: none
Profit restrictions: none
Liquidation restrictions: none

45. Japan

Ownership restrictions applied to a number of sectors until reforms implemented during 1980s (Hammer et al. 1983, pp.145-147). Liberal policy regarding capital transfers.
Ownership restrictions: none
Profit restrictions: none
Liquidation restrictions: none

46. Jordan

Program of liberalisation, including widespread privatisations began during 1970s. However, full foreign ownership prohibited until 1985 (Joffe 1993). Restrictions applied to capital transfers.
Ownership restrictions: 1970-1985
Profit restrictions: 1970-1992
Liquidation restrictions: 1970-1994

47. Kenya

No blanket ownership restrictions enshrined in foreign investment code. Historically, authorities have preferred joint ventures, particularly during the 1970s, but insufficient evidence to presume *de facto* ownership restrictions existed (UNCTC 1978b, pp.77-78; Rweyemanu 1987; UNCTAD 2005b). Authorisation requirement applied to capital transfers.
Ownership restrictions: none
Profit restrictions: 1970-1994
Liquidation restrictions: 1970-1989

48. Korea

Joint ventures were required in a number, but not all, sectors during the 1970s. Full foreign ownership allowed for export oriented production. Over time the trend has been gradual liberalisation (UNCTC 1978b, pp.130-131; UNCTC 1986, p.200). Restrictions, including ceilings applied to some capital transfers.
Ownership restrictions: none
Profit restrictions: none
Liquidation restrictions: 1970-1981

49. Kuwait

Liberal policy regarding capital transfers but blanket ownership restrictions applied (UNCTC 1978b, p.168; Joffe 1993).
Ownership restrictions: 1970-2000
Profit restrictions: none
Liquidation restrictions: none

50. Madagascar

Socialist revolution in the early 1970s resulted in adoption of state-led development policies and widespread nationalisation (Schraeder 1995). Constitutional reform commenced during mid 1980s and included a new foreign investment code in 1985. Details of this code are unclear and indications are that official attitudes towards foreign investment remained ambivalent around this period (Pryor 1990, pp.314-315). In 1990 a new foreign investment code was introduced, seeking to attract export oriented investment in particular. Evidence suggests this code did not stipulate blanket ownership restrictions (World Bank 1994, pp.103-104; 1995). Restrictions applied to capital transfers.
Ownership restrictions: 1972-1990
Profit restrictions: 1970-1996
Liquidation restrictions: 1970-2000

51. Malaysia

Some ownership restrictions applied but policy allowed for full foreign ownership in export oriented enterprises and under other circumstances (Robinson 1976, pp.38-43; UNCTC 1978b, p.129). Authorisation required for large capital transfers but freely given.
Ownership restrictions: none
Profit restrictions: none
Liquidation restrictions: none

52. Mauritius

Regulations dating from 1970s allow full foreign ownership in export oriented industries (US Department of State 1998c). Authorisation required for some capital transfers but normally given.
Ownership restrictions: none
Profit restrictions: none
Liquidation restrictions: none

53. Mexico

Foreign investment code from early 1970s stipulated blanket ownership restrictions. This policy was abandoned in 1986 when new guidelines allowing full foreign ownership under various conditions was allowed (UNCTC 1978b, pp.221-222; Grosse 1989, pp.74-77; Nunez 1990, pp.39-45). Restrictions applied to capital transfers.
Ownership restrictions: 1973-1986
Profit restrictions: 1983-1985
Liquidation restrictions: 1983-1985

54. Morocco

Indigenisation degree introduced in 1973 resulted in blanket ownership restrictions until partial removal for some sectors including manufacturing in 1983 (Haddad and Harrison 1993). Authorisation requirement and waiting periods applied to capital transfers.
Ownership restrictions: 1973-1983
Profit restrictions: 1970-1992
Liquidation restrictions: 1970-1992

55. Nepal

Effectively closed to foreign investment during the 1970s and early 1980s. Industrial regulations introduced in 1987 marked a move towards a more open attitude to foreign investment and allowed for full foreign ownership in large exported oriented projects (Chitraker 1994, pp.34-39; Dabadi 1999; UNCTAD 2003c). Authorisation requirement and ceilings applied to capital transfers.
Ownership restrictions: 1970-1987
Profit restrictions: 1970-1987
Liquidation restrictions: 1970-2000

56. Netherlands

Liberal policy regarding ownership and capital transfers (Hammer et al. 1983, pp.195-199).
Ownership restrictions: none
Profit restrictions: none
Liquidation restrictions: none

57. New Zealand

Liberal policy regarding ownership (Hammer et al. 1983, pp.205-208). Authorisation requirement applied to some capital transfers, which was normally given.
Ownership restrictions: none
Profit restrictions: none
Liquidation restrictions: none

58. Nicaragua

Historically authorities have adopted liberal policy regarding foreign ownership (EIU 1955; Willmore 1976). However, classified as socialist from 1979 by Kornai (1992, pp.6-7). Reformist government undertook major reforms from 1991 and introduced new investment related legislation allowing full foreign ownership in most sectors (IADB 1997; US Department of State 1998d). Restrictions and authorisation requirement applied to capital transfers.
Ownership restrictions: 1979-1991
Profit restrictions: 1979-1995
Liquidation restrictions: 1979-1995

59. Nigeria

Indigenisation decrees mandating local participation in foreign projects declared throughout the 1970s (UNCTC 1978b, pp.78-79). Full foreign ownership not allowed until introduction of a new foreign investment code in 1989 (Riddell and Cockcroft 1991). Authorisation requirement applied to capital transfers.
Ownership restrictions: 1970-1989
Profit restrictions: 1970-2000
Liquidation restrictions: 1970-2000

60. Norway

Liberal policy regarding foreign ownership and capital transfers (Hammer et al. 1983, pp.217-219).
Ownership restrictions: none
Profit restrictions: none
Liquidation restrictions: none

61. Oman

Liberal policy regarding capital transfers but blanket ownership restrictions applied (Joffe 1993; US Department of State 1999).
Ownership restrictions: 1970-2000
Profit restrictions: none
Liquidation restrictions: none

62. Pakistan

Widespread nationalisation in industrial sector occurred during 1970s but sharp policy reversal occurred shortly after. A new foreign investment code introduced in 1976 did not stipulate blanket ownership restrictions (UNCTC 1978b, p.130; Hammer et al. 1983, pp.221-224; UNCTC 1983b, p.92). Authorisation requirement applied to some capital transfers.
Ownership restrictions: 1970-1976
Profit restrictions: 1985-1987
Liquidation restrictions: none

63. Panama

Ownership restrictions have applied in a limited number of sectors. Generally liberal policy regarding capital transfers (Hammer et al. 1983, pp.225-227; UNCTC 1983b, pp.175-176).
Ownership restrictions: none
Profit restrictions: none
Liquidation restrictions: none

64. Paraguay

Foreign investment regulations dating from 1960s do not appear to limit foreign equity participation in all sectors (Pincus 1968, pp.247-254; Hammer et al. 1983, pp.235-237). Restrictions, including waiting periods and taxes, as well as an authorisation requirement applied to capital transfers.
Ownership restrictions: none
Profit restrictions: 1970-1987 and 1995-1996
Liquidation restrictions: 1970-1996

65. Peru

Andean Pact regulations which stipulated blanket ownership restrictions and fade out requirements applied from 1970 until 1987 (Grosse 1989, pp.74-77 and pp.113-115). Regulations during the late 1980s unclear but a suite of new legislation governing foreign investment introduced in the early 1990s does not stipulate any blanket ownership restrictions or fade out requirements (IADB 1997; US Department of State 1997a). Authorisation requirement and ceilings applied to capital transfers.
Ownership restrictions: 1970-1992
Profit restrictions: 1970-1991
Liquidation restrictions: 1970-1991

66. Philippines

Foreign investment code of 1967 specified a general joint venture requirement. Projects granted 'pioneer' status were allowed to be fully foreign owned initially but were subject to a fade out requirement (Robinson 1976, pp.118-168; UNCTC 1983a, pp.97-98). A new code introduced in 1991 lifted local participation requirements (Estanislao 1997). Authorisation requirement and ceilings applied to capital transfers.
Ownership restrictions: 1970-1991
Profit restrictions: 1970-1986
Liquidation restrictions: 1970-1986

67. Portugal

Liberal policy regarding foreign ownership (Hammer et al. 1983, pp.243-244; UNCTC 1986, pp.75-76). Authorisation requirement, ceilings and waiting periods applied to capital transfers.
Ownership restrictions: none
Profit restrictions: 1970-1986
Liquidation restrictions: 1977-1986

68. Saudi Arabia

Liberal policy regarding capital transfers but blanket ownership restrictions applied until introduction of new foreign investment code in 2000 (Joffe 1993; US Department of Commerce 2003).
Ownership restrictions: 1970-2000
Profit restrictions: none
Liquidation restrictions: none

69. Senegal

Foreign investment code dating from early 1970s does not stipulate blanket ownership restrictions and evidence suggests a new code introduced in 1987 was more liberal (UNCTC 1978a, p.79; Siggel 1994). Authorisation requirement applied to capital transfers.
Ownership restrictions: none
Profit restrictions: 1970-2000
Liquidation restrictions: 1970-2000

70. Singapore

Liberal policy regarding foreign ownership (UNCTC 1978b, p.131; Hammer et al. 1983, pp.255-265). Authorisation requirement applied to capital transfers which was freely given to only some types of transfers during the 1970s.
Ownership restrictions: none
Profit restrictions: none
Liquidation restrictions: 1970-1978

71. South Africa

Liberal policy regarding foreign ownership (Ailola 2000). Authorisation requirement applied to some capital transfers.
Ownership restrictions: none
Profit restrictions: none
Liquidation restrictions: 1970-1986

72. Spain

Liberal policy regarding foreign ownership and capital transfers (Hammer et al. 1983, pp.275-277).
Ownership restrictions: none
Profit restrictions: none
Liquidation restrictions: none

73. Sri Lanka

Blanket ownership restrictions lifted in 1977 (Athukorala and Rajapatirana 2000, pp.52-55). Restrictions applied to capital transfers.
Ownership restrictions: 1970-1977
Profit restrictions: 1970-1977
Liquidation restrictions: 1970-1977

74. Sweden

Liberal policy regarding foreign ownership (Hammer et al. 1983, pp.279-282). Historically, authorisation requirement applied to some capital transfers, which were freely given.
Ownership restrictions: none
Profit restrictions: none
Liquidation restrictions: none

75. Syria

Socialist style policies and nationalisation prominent in 1960s. New government in 1970 placed greater emphasis on private sector development but attitudes to foreign investment remained hostile. Foreign investment code of 1991 opened up various sectors to domestic and foreign private investment but foreign participation only allowed in partnership with public sector (Perthes 1995, pp.23-79; Efrat 1999). Authorisation requirement applied to capital transfers.
Ownership restrictions: 1970-2000
Profit restrictions: 1970-2000
Liquidation restrictions: 1970-2000

76. Taiwan

Liberal policy regarding foreign ownership (OECD 1995). Waiting periods applied to some capital transfers.
Ownership restrictions: none
Profit restrictions: none
Liquidation restrictions: 1970-1987

77. Tanzania

Socialist style policies and widespread nationalisation of foreign assets from late 1960s. Process of liberalisation commenced in mid 1980s and first market oriented code was established in 1990. However, this maintained blanket foreign ownership restrictions which were not removed until a revised code was introduced in the late 1990s (UNIDO 1986; World Bank 1994, pp.169-170; UNCTAD 2002). Restrictions and authorisation requirement applied to capital transfers.
Ownership restrictions: 1970-1997
Profit restrictions: 1970-1996
Liquidation restrictions: 1970-1996

78. Thailand

Some ownership restrictions existed in the early 1970s but exemptions were allowed, including for export oriented production (Robinson 1976, pp.68-76). Liberal policy regarding capital transfers.
Ownership restrictions: none
Profit restrictions: none
Liquidation restrictions: none

79. Trinidad and Tobago

Liberal attitude towards foreign investment up until 1972 when government embarked on program of widespread public investment and nationalisation of foreign assets. Blanket ownership restrictions enshrined in foreign investment code dating from late 1970s. A new foreign investment code that does not stipulate blanket ownership restrictions introduced in 1990 (Hammer et al. 1983, pp.289-291; UNCTC 1983b, pp.192-193; Coyne 1995, p.74; US Department of State 1997b). Authorisation for profit remittances and capital repatriation required until 1993.
Ownership restrictions: 1972-1990
Profit restrictions: 1970-1993
Liquidation restrictions: 1970-1993

80. Tunisia

Instances of nationalisation during 1960s but gradual move towards liberalisation began in early 1970s. Foreign investment code of 1972 includes provision to allow full foreign ownership in some circumstances (UNCTC 1978b, p.170; Hopkins 1989; Grissa 1991). Authorisation requirement and ceilings applied to capital transfers.
Ownership restrictions: 1970-1972
Profit restrictions: 1970-1984 and 1988-1991
Liquidation restrictions: 1970-1993

81. Turkey

Some ownership restrictions existed during 1970s but no evidence of blanket restrictions and move towards more liberal policy commenced in early 1980s (OECD 1983; UNCTC 1983b, pp.246-248). Authorisation requirement applied to some capital transfers.
Ownership restrictions: none
Profit restrictions: none
Liquidation restrictions: 1985-1990

82. Uganda	Widespread nationalisation of foreign assets through 1970s (World Bank 1982). A new foreign investment code introduced in 1991 does not stipulate blanket restrictions on foreign ownership (UNCTAD 2000). Restrictions including ceilings as well as authorisation requirement applied to capital transfers. *Ownership restrictions*: 1970-1991 *Profit restrictions*: 1970-1994 *Liquidation restrictions*: 1970-1998
83. United Arab Emirates[43]	Liberal policy regarding capital transfers but blanket ownership restrictions (Joffe 1993). *Ownership restrictions*: 1973-2000 *Profit restrictions*: none *Liquidation restrictions*: none
84. United Kingdom	Liberal policy regarding ownership and capital transfers (Hammer et al. 1983, pp.293-299). *Ownership restrictions*: none *Profit restrictions*: none *Liquidation restrictions*: none
85. United States	Liberal policy regarding ownership and capital transfers (Hammer et al. 1983, pp.301-307). *Ownership restrictions*: none *Profit restrictions*: none *Liquidation restrictions*: none
86. Uruguay	Liberal policy regarding foreign ownership (EIU 1971; 1974; Hammer et al. 1983, pp.309-311). Authorisation requirement, taxes and ceilings applied to capital transfers. *Ownership restrictions*: none *Profit restrictions*: 1970-1979 *Liquidation restrictions*: 1970-1993
87. Venezuela	Andean Pact regulations which stipulated blanket ownership restrictions and fade out requirements applied from 1973 until 1987. However, fade out provisions appear to have been maintained for a short period after this (Pfeffermann 1988; Grosse 1989, pp.74-77 and pp.113-115). Presidential decree in 1992 lifted blanket ownership restrictions and fade out requirements (IADB 1997). Restrictions applied to capital transfers. *Ownership restrictions*: 1973-1992 *Profit restrictions*: 1970-1984 *Liquidation restrictions*: 1988-1989

[43] FDI policy indicators coded from 1973 onwards.

88. Zambia

Move towards socialism in late 1960s. Constitutional amendment in 1969 allowed for compulsory acquisitions of private enterprise for public purposes and widespread nationalisation ensued during the 1970s. A new foreign investment code introduced in 1986 was vague, containing few details on important criteria. Structural adjustment program began in 1990 and a more detailed, liberal foreign investment code that does not stipulate blanket ownership restrictions was introduced in 1991 (World Bank 1994, pp.190-191; Ailola 2000). Authorisation requirement and ceilings applied to capital transfers.
Ownership restrictions: 1970-1991
Profit restrictions: 1970-1994
Liquidation restrictions: 1970-1994

89. Zimbabwe

No indications of ownership restrictions in pre-independence era but regulations dating from early 1980s stipulated blanket ownership restrictions. Also, classified as socialist by Kornai (1992, pp.6-7) from 1980. In 1992 a new foreign investment code allowing for full foreign ownership in some circumstances was introduced. Restrictions including ceilings and authorisation requirement applied to capital transfers before and after independence (Chimombe 1986; UNCTC 1988, pp.101-103; Skalnes 1995, pp.143-145; Ailola 2000).
Ownership restrictions: 1980-1992
Profit restrictions: 1970-2000
Liquidation restrictions: 1970-2000

Chapter 5

Determinants of multinational export orientation: the case of US multinational affiliates

5.1 Introduction

As discussed in chapter 3, differences in the nature of MNE affiliate production are hypothesised to affect the growth impact of FDI. In turn, it was argued that the nature of MNE affiliate production is influenced by a range of host country factors, thereby providing a link between certain host country factors and gains from FDI. In particular, it was argued that a strong human capital base, combined with open trade and liberal FDI policies creates an environment conducive to attracting the most productive and dynamic forms of MNE production.

As a prelude to analysing the growth effects of FDI, this and the following chapter first examine the determinants of two different aspects of MNE affiliate production which are hypothesised to influence the growth effects of FDI. This chapter presents an analysis of the determinants of MNE affiliate export orientation while the following chapter examines the determinants of technology transfer to MNE affiliates. By examining these issues, the analysis in these chapters aims to provide some direct empirical evidence on the underlying hypotheses concerning the heterogeneous growth effects of FDI discussed in chapter 3 and explored subsequently in chapter 7.

To briefly recap from chapter 3, MNE export production is hypothesized to bring about larger increases in host country productivity than MNE local market production for at least three reasons. First, export production is likely to be technologically superior, and therefore give rise to greater knowledge spillovers. Second, the nature of the linkages that export affiliates establish with local firms are also likely to maximise opportunities for knowledge spillovers. Third, export MNE affiliates generally involve larger scale operations which may improve opportunities for local suppliers to achieve productivity gains through economies of scale.

By definition, the export orientation of MNE production in a given country depends on the relative magnitude of export platform and local market MNE production. Therefore, host country factors influence the overall level of MNE export orientation by affecting

the underlying mix of MNE production. Since local market production is primarily motivated by market access, larger countries are likely to attract relatively more of this type of production and hence have a lower level of overall MNE export orientation. In contrast, because export production is generally footloose and primarily motivated by access to low cost inputs and a sound operating environment, countries with a superior operating environment and lower costs are expected to have higher levels of MNE export orientation. Finally, lower trade costs will also increase export orientation by increasing the quantity of export platform production and deterring local market production.

The analysis employs data on the activities of overseas US manufacturing MNE affiliates operating in a diverse sample of countries between 1982 and 1997. Using sales data for MNE affiliates a measure of export orientation is derived and employed as the dependent variable in a range of empirical specifications. The impact of a wide range of host country factors on export orientation is considered. However, following the central theme in this thesis, of particular interest is the influence of trade and FDI policies, as well as host country human capital.

As discussed in chapter 3, the export activities of MNE affiliates has been examined in existing empirical studies. However, this analysis contains a number of original contributions. First and foremost, the use of the FDI policy indicators introduced in the previous chapter provides a new assessment of the impact of FDI policies, including a unique examination of the role of different types of FDI policy restrictions. The analysis also incorporates a greater range of other explanatory variables and a longer sample than existing studies, and makes use of alternative samples and estimation techniques to ensure robust results.

The following section discusses the US dataset used in this analysis and model specification. This is followed by an overview of the data sample in section 5.3. In section 5.4 the results are presented and discussed while the chapter concludes in section 5.5. The appendices provide summary statistics, details of data definitions and sources as well as supplementary results.

5.2 Measuring export orientation and model specification

5.2.1 Measuring export orientation and the US Bureau of Economic Analysis dataset

As highlighted in chapter 1, international flows of FDI have grown rapidly over recent decades, outstripping growth in global output and trade. However, these figures mask some significant changes in the nature of international investment and MNE production which can only be revealed using detailed production data for multinational firms (Lipsey 2003). A rich data source which provides such data for US MNE affiliates operating around the world is compiled by the Bureau of Economic Analysis, US Department of Commerce (BEA).[44] This dataset is used extensively in both this and the following chapter, to shed light on the country factors that influence the nature of MNE affiliate production.

Since 1982 the BEA has collected on an annual basis a variety of investment and production data on US MNE affiliates by way of surveys issued directly to the affiliates.[45] In most years a standard survey is issued which covers many aspects of affiliate production including assets, sales and employment. In addition, 'benchmark' surveys are issued at irregular intervals which request more detailed operational information. Most, but not all, data are available by broad industrial categories. These categories have varied over time but in all years data for at least twelve industries, including seven manufacturing industries are available. The published data are, however, incomplete due to confidentiality considerations leading to the suppression of a number of observations (Mataloni 1995).

Of particular interest for the analysis in this chapter are data on sales by US MNE affiliates, which are reported for each host country and major industrial classification. This data distinguishes between sales by affiliates to the local market and sales abroad (exports). By combining the sales data it is possible to construct a measure of export orientation of affiliate production.

[44] The BEA defines an affiliate as an enterprise in which a single US investor owns an equity stake of at least 10 per cent.

[45] Data are available prior to 1982 on an irregular basis.

The dependent variable employed in this analysis, *Export orientation*, is constructed by dividing the total value of US affiliate exports by the total value of affiliate sales, for each industry and host country combination, as follows:

$$Export\ orientation_{ijt} = \frac{Exports_{ijt}}{Exports_{ijt} + Localsales_{ijt}} \qquad (5.1)$$

In equation 5.1 *Exports* represents the total value of US MNE affiliate exports to all destinations, *Localsales* the value of US MNE affiliate sales within the host country, while subscripts i, j and t denote industry, country and period respectively. Therefore, the sample used in this analysis comprises a panel which spans host countries, industries and time. Using industry, rather than country, level data avoids the potential pitfall of aggregation bias that may arise from intra-industry heterogeneity. It also provides a potentially richer source of information.

The BEA data used to construct the dependent variables in the analyses presented in this and the following chapter are only available for majority owned US affiliates. This has the advantage that the data will primarily reflect the decisions of the parent company, rather than the influences of other investors which may vary across the sample. A downside, however, is that the sample may be correlated with the ownership variable included in the analysis, giving rise to possible sample selection bias. Since comparable data on non-majority owned affiliates are unavailable it is impossible to investigate this issue.

A further restriction on the sample is that it only includes affiliates engaged predominantly in manufacturing activities. As noted above data for other industries are available, including for petroleum and service industries. However, it is unclear whether standard theories of FDI, which motivate the empirical specification, readily apply to industries outside of manufacturing.[46]

Using a sample comprising only US MNE affiliates is not ideal but reflects a practical limitation of data availability. On the upside US MNE interests span the globe, as reflected in the BEA dataset, and the US has been a major source of FDI over a long period. Moreover, a significant advantage of the BEA dataset is that it is measured and

[46] Investment in the petroleum industry, for example, will clearly be motivated by proximity to oil reserves.

collected on a consistent basis for all countries, ensuring direct international comparability. Another problem avoided is that of varying international institutional capacity to collect data. It is well known that in many small developing countries, in particular, the capacity for authorities to collect high quality data is limited.

5.2.2 Explanatory variables

The objective of this analysis is to examine the impact of a wide range of host country factors on the export orientation of MNE affiliates, with particular emphasis on the role of host country policies and human capital. Reflecting this, a relatively diverse set of explanatory variables are incorporated in the empirical model, motivated by theories of FDI and international production discussed in chapters 2 and 3. Each of the core explanatory variables used in the analysis relates to one of three sets of host country factors that are hypothesised to determine export orientation. As noted in chapter 3, these are trade costs, including trade policies, aspects of the operating environment and market size and factor costs.

The primary measure of host country trade policies used is the ratio of total trade to GDP (*Openness*). This is a commonly used proxy which is justified on the basis that more open trade policies will be revealed through greater observed trade flows. The major advantage of this measure is that it provides a broad indicator of trade policies at the national level and is widely available.

However, the use of this proxy has limitations. First, a high trade ratio may reflect country specific factors rather than underlying trade policies. Countries with large endowments of natural resources will tend to have higher trade to GDP ratios on account of these resource endowments. Also, less populous and less diversified economies will naturally trade more than larger countries. A second problem is that since MNE exports form part of total national exports, by construction the ratio of trade to GDP will be correlated with MNE export orientation. Hence, any observed correlation between the dependent variable and *Openness* may reflect a statistical artefact, rather than the impact of trade policies on export orientation.

To minimise these problems, two alternatives to *Openness* are employed. The first is the ratio of imports to GDP (*Openness imports*). Applying this variable addresses the problem of the trade to GDP ratio being inflated by exports of natural resources and

goes someway to correcting the problem of MNE exports being correlated with the trade to GDP ratio. If export oriented firms use imported inputs more intensively then this measure will clearly be imperfect. Nevertheless, to the extent that it is less correlated with the dependent variable than the trade to GDP ratio it represents an improvement. Second, a population adjusted measure of the trade to GDP ratio is constructed (*Openness adjusted*) which represents *Openness* net of the impact of population. This measure is derived as the residual from regressing *Openness* on population, which by definition represents the predicted trade to GDP ratio after adjusting for population.

An additional dimension of trade policy that may be important in the context of explaining patterns of MNE export orientation that may not be adequately captured by a general measure of trade openness are preferential or free trade agreements (FTA). As with reductions in other trade barriers, membership of an FTA may enhance opportunities for export platform production by providing improved access to foreign markets. At the same time, by reducing barriers for foreign producers, FTAs should also deter local market MNE production (Blomstrom and Kokko 1997). On this basis FTA membership is expected to increase export orientation.

A caveat, however, is that many FTAs incorporate rules of origin which may prevent improved market access for exporters. In the presence of such rules, market access is dependent on firms not exceeding prescribed limits on the use of inputs produced outside the FTA area (Rodriguez 2001). This may present a binding constraint in the case of MNE affiliates which form part of a complex vertical supply chain and use foreign produced inputs intensively. In this case such regulations will be incompatible with the preferred organisation of MNE production. Therefore, FTA membership will not provide an added incentive for export platform production.

To assess the impact of FTAs, dummy variables are included for membership of a number of agreements that involve countries included in the sample. In recent years there has been a sharp rise in the number of preferential trade agreements but many of these were developed after the end of the sample used in this analysis. Dummy variables are included for membership of the European Union (*EU*), Mercosur (*Mercosur*), the Central American Common Market (*CACM*) or the North American

Free Trade Agreement (*NAFTA*). As with the trade openness variable, the coefficients on each of these dummy variables are expected to be positive.

In addition to trade policies, transport costs will also have an important bearing on trade costs. Incorporating transport costs in this type of analysis poses a considerable challenge due to the lack of internationally comparable data. As an alternative to using data on actual trade costs, a widely available geography based proxy is used instead. Transport costs are likely to increase in proportion to the distance a good must travel between the point of manufacture and sale. On this basis the variable *Air distance* is included as a proxy for transport costs. This variable represents the great-circle distance between a country and the nearest potential major export market which, on the basis of market size, is assumed to be either Europe, Japan or the US. Like lower trade policy barriers, lower transport costs are presumed to encourage export production and discourage local market production. Therefore the coefficient on *Air distance* is expected to be negative.

An alternative proxy for transport costs experimented with in the analysis is the indicator of coastal access proposed by Gallup et al. (1999). This variable, termed *Pop100*, is the proportion of a country's population located within 100 kilometres of the open sea. The use of this proxy is based on the observation that international transport costs are often heavily influenced by proximity to the open sea, especially for remote, developing countries. This reflects the superiority of sea transport for the movement of many internationally traded goods, especially bulk items over long distances. The variable *Pop100* is, in effect, a superior alternative to using a simple landlocked dummy which may provide a misleading indicator of whether economic activity is proximate to the coast for countries that are not landlocked. A higher value of *Pop100* is expected to be associated with lower transport costs and on this basis is expected to be positively correlated with *Export orientation*.

The other main policy variable of interest examined is FDI policies. The role of FDI policies is assessed using the three policy indicator variables introduced in the previous chapter, namely *Ownership restrictions*, *Profit restrictions* and *Liquidation restrictions*. As FDI policies form an important element of the operating environment for multinational production, the presence of these policy restrictions is expected to deter

export production in particular. Therefore, the prior expectation is that the coefficient on each of these variables will be negative.

An additional aspect of the operating environment that has a direct bearing on costs is the tax burden. To control for the effect of different tax rates across countries, a proxy variable is constructed using data on actual taxes paid by US MNE affiliates, reported in the BEA dataset. This approach is likely produce a superior proxy than one based on published tax rates. Many countries offer tax holidays to investors on a discretionary basis in which case reported tax rates may differ significantly from the actual tax burden faced by investors.

In constructing a tax proxy from reported tax payments data one would ideally divide tax payments by gross income, in order to derive a measure of the revealed corporate income tax rate. Unfortunately, however, gross income figures are generally only reported in the BEA dataset on an aggregated, national, basis. Given that tax rates may vary significantly across major industry groups, petroleum production, for example, is likely to be different, it is not possible to use gross income data. Instead, the tax proxy *Corporate tax* is calculated by dividing reported tax payments for all manufacturing affiliates by the value of total manufacturing sales, for each country. By raising production costs at the margin, a higher tax burden is expected to reduce export orientation. The coefficient on *Corporate tax* is therefore expected to be negative.

The level of macroeconomic stability may also form an important element of the general operating environment. To control for this factor, the variable *Inflation*, which is the annual change in the GDP price deflator, is included. Like higher taxes, and restrictive FDI policies, macroeconomic instability is expected to be particular detrimental to export production and on this basis a negative relationship between *Inflation* and *Export orientation* is expected.

To assess the role of international differences in labour costs, a simple measure of manufacturing wages is constructed for each country, using data on employee compensation available in the BEA dataset. This is derived by dividing the total wage bill for all manufacturing affiliates in a particular country by the number of workers employed by all manufacturing affiliates in the same country. This series is then deflated using the US GDP deflator to yield a constant US dollar measure of remuneration. Therefore, the variable *Wage* is simply the real average wage per worker

employed by US MNE manufacturing affiliates. Deriving separate wage measures for each manufacturing industry was considered but deemed impractical due to missing observations.

Higher wages not only reflect higher costs but are also likely to in part reflect higher labour productivity. Therefore, it is necessary to supplement the *Wages* variable with a measure of labour quality. In practice this is difficult as many aspects of worker quality are unobservable. Given this constraint, worker quality is proxied using a national level measure of the average years of schooling amongst the adult population. The variable *Years of schooling* draws on data from Barro and Lee (2001). Theories of vertical FDI predict that MNE export affiliates will be attracted to countries with lower cost workers. On this basis a negative coefficient on *Wage* and a positive coefficient on *Years of schooling* are anticipated.

While differences in factor costs provide the fundamental motive for MNE export platform production, market access is the principal driver of local market production. To control for the impact of market size the proxy *GDP*, a measure of real GDP, is included in all specifications. With larger markets expected to attract more local market MNE production the coefficient on this variable is expected to be negative.

Finally, as the analysis focuses on the operations of firms affiliated with US MNEs, rather than a universal sample of countries, it is important to control for any US specific factors that might affect the results. One possibility is that US MNEs view countries located within the Americas differently. First, the countries of this region are located within the US sphere of influence, which may give rise to greater economic, political and social linkages that influence investment patterns. Second, these countries are located within a similar longitudinal range to the US and therefore within a similar time zone which may again influence MNE activity.[47] To control for the possibility that *Export orientation* is influenced by either of these factors a dummy variable for location within the Americas, *Western hemisphere*, is included in the analysis.

[47] See Stein and Daude (2007) for evidence that longitude affects aggregate FDI flows.

5.3 Sample and descriptive statistics

5.3.1 Sample

The countries included in the BEA dataset have changed since the first annual publication in 1982. Some countries, including Libya, have been omitted while others, such as China and a number of former Soviet block countries have been added. Since 1982, data on MNE operations in up to 63 countries have been published but data for only 48 countries are available for every year. The sample used in this analysis includes up to 50 countries, 31 one of which are classified as developing. Countries that are excluded due to a lack of available data for key explanatory variables tend to be small and or available for a very limited period. Collectively countries in the sample account for around 99 per cent of all US MNE manufacturing affiliate sales for the period analysed.[48]

The data used in the analysis spans the period 1982 to 1997, with the start and end dates dictated by the availability of comparable annual data. While the BEA has published data since 1997, the industry classification scheme changed in the late 1990s from the *Standard Industrial Classification* to the *North American Industry Classification System*. As a result the more recent data are not fully comparable to the earlier data (US Bureau of Economic Analysis 2004). As noted above, the sample is restricted to manufacturing industries covered by the BEA dataset over the period of interest. These include: food, chemicals, metals, machinery, electronics, transport and miscellaneous manufacturing.

Given the high costs of relocating production facilities, the broad pattern of international production is unlikely to vary significantly from year to year. Indeed, year to year changes in *Export orientation* may well reflect more noise than useful information about the underlying drivers of export orientation. For this reason annual data are averaged over multiple years to ensure that longer run relationships are more readily identifiable.

The number of years over which the data are averaged represents a trade off between ensuring long run patterns are identifiable and the dynamic aspects of the data are fully exploited. Just as using annual data are unlikely to be optimal, averaging over the

[48] Table A5.5 of the appendix details the countries included in the analysis, including those classified as developing countries.

16 years for which data are available is likely to result in the loss of useful information. In the absence of clear guidance on what is optimal, data are averaged over four non-overlapping years. By applying this approach a sample comprising four periods, each spanning fours years, is derived.[49]

5.3.2 Descriptive statistics

Key aggregates in the BEA dataset highlight the increasing importance of export platform production for US MNEs since the early 1980s. Between 1982 and 2003 the value of exports produced by US MNE affiliates rose from around US$92 billion to over US$560 billion. While local sales by affiliates also rose sharply during this period, the increase in the value of exports was larger. As a result, the average proportion of US manufacturing affiliate output that was exported increased from around 34 per cent in 1982 to over 40 per cent by the late 1990s. These figures, together with the observation that aggregate FDI flows have been increasing rapidly, suggest a growing importance of MNE production in the world economy and a greater vertical specialisation amongst MNE affiliates.

At the same time, the average level of export orientation amongst US manufacturing affiliates varies enormously across countries. Table 5.1 lists the ten countries with the highest average level of export orientation for US manufacturing affiliates between 1982 and 1997, as well as the ten countries with the lowest average export orientation. In less than ten countries more than half of all sales are exported with the top three, Ireland, Singapore and Malaysia, exporting more than three quarters. At the other end of the distribution, in six countries affiliates exported on average 5 per cent or less of all sales. Countries with the lowest levels of export orientation are diverse and include small industrialised countries as well as large developing countries.

[49] Using data from 1982 to 1997 the four periods in the panel correspond to the periods 1982 to 1985, 1986 to 1989, 1990 to 1993 and 1994 to 1997.

Table 5.1: Highest and lowest average export orientation, 1982 to 1997

Country	Export orientation
Ten highest average export orientation	
Ireland	0.86
Singapore	0.84
Malaysia	0.76
Dominican Republic	0.70
Belgium	0.68
Netherlands	0.65
Thailand	0.63
Hong Kong	0.60
Israel	0.52
Denmark	0.48
Ten lowest average export orientation	
New Zealand	0.09
Colombia	0.07
Honduras	0.07
India	0.06
South Africa	0.05
Egypt	0.05
Venezuela	0.05
Peru	0.05
Saudi Arabia	0.04
Nigeria	0.00

Notes: average proportion of total sales exported by all US MNE manufacturing affiliates between 1982 and 1997. See appendix 5.2 for definitions and sources.

Table A5.1 in appendix 5.1 provides summary statistics for the sample used in the empirical analysis. As noted above, in all cases these figures represent averages over four year periods. Beginning with the dependent variable, *Export orientation*, the mean observation is around 0.29, indicating that on average just under 30 per cent of all affiliate output in a particular industry and country pair was exported in a given four year period. Relative to the mean, the standard deviation is a high 0.28, suggesting a high degree of variability in the level of *Export orientation*. Indeed, in a large number of countries US MNE activities appear to be focussed on serving the local market while a small number of countries attract US MNE activity that is almost entirely engaged in exporting activities.

In the full sample, the countries with the highest level of *Export orientation* tend to be developing countries and or have small populations. As noted above, this is expected on the basis that larger countries will attract relatively more local market production. For just three observations *Export orientation* has the value of one (that is all MNE

output is exported). This includes the machinery sector in Ecuador, during the late 1990s, the food sector in Israel for the early 1980s and the metals sector in the Philippines, during the early 1990s.

Aside from these three observations, many of the highest figures for *Export orientation* are for Ireland, particularly in electronics. Amongst developing countries Malaysia, Singapore and Thailand also feature a number of observations above 0.9. Aside from all being relatively small, these countries share no other common characteristics, suggesting that overall export orientation is influenced by a number of factors.

As with the dependent variable, there is considerable statistical variability in data for each of the explanatory variables. Beginning with the three FDI policy indicators *Ownership restrictions*, *Profit restrictions* and *Liquidation restrictions*, observed values range from zero to one. These values reflect a consistently restrictive or liberal approach to FDI policies over a particular four year period. Out of the three FDI policy indicators, the mean value of *Ownership restrictions* is lowest, followed by *Profit restrictions* and *Liquidation restrictions*. This is consistent with the general pattern observed for the full FDI policy dataset discussed in the previous chapter.

The proxy for trade policies, *Openness*, which is the trade to GDP ratio, ranges from a low of just over 0.1, recorded for India during the late 1980s, to a high of around 3.0 for Singapore, again recorded during the late 1980s. Singapore also scores the highest value for an alternative openness proxy, *Openness imports*, at around 1.6 during the 1980s. At the other end of the spectrum the lowest values are recorded for Brazil and Argentina, both around 0.05 during the 1980s and early 1990s. Observations for the measure of macroeconomic stability, *Inflation*, accord with prior expectations. The highest inflation figures are all for developing countries, especially those located in South America, while low inflation observations are generally dominated by industrialised countries.

The average value for *Wage*, the measure of labour costs, is 0.026. As values for this variable are expressed in millions of constant US dollars per year this equates to annual remuneration of US$26,000. Observations range from a high of 0.082, for Japan during the late 1990s, down to 0.003 for China during the early 1990s. As expected, values for other countries also correlate strongly with levels of development. The highest figures are dominated by Japan and Western European countries including Belgium, France and

Germany. Countries at the other end of the spectrum include the Dominican Republic, India and the Philippines. The measure of human capital, *Years of schooling*, also correlates broadly with levels of development. Guatemala and India record the lowest levels of average educational attainment, with the former recording figures as low as 2.5 years. The highest figure is recorded for New Zealand, at 11.8 years.

Reported values for *Air distance*, used to proxy transport costs, reflect geographic isolation from major economic hubs. Countries that record high figures include Japan, reflecting distance from Europe and the US, and New Zealand and South Africa, which are particularly distant from all three major centres of Europe, the US and Japan. Conversely, figures for European countries and Canada are low, reflecting close proximity to the major markets of other European countries and the US respectively.

The average figure for *Corporate tax*, which is the value of income tax paid as a percentage of total sales, is around 2.7 per cent. This variable displays considerable variation across the sample and there is no obvious correlation with country characteristics such as levels of development or economic performance. The lowest figure of 0.2 per cent is recorded for Chile during the late 1980s and the highest for Brazil at 9.2 per cent, also during the late 1980s. Alongside Chile at the low end of the distribution are the Dominican Republic, Ireland, Singapore and Sweden which all record figures less than 1 per cent for at least one period in the sample. At the other end are Japan, Peru and Turkey.

Bivariate correlations between the variables included in the analysis are presented in table A5.2 of appendix 5.1. In general the bivariate correlations between *Export orientation* and each of the explanatory variables are consistent with prior expectations as outlined above. This provides some assurance that the model is well specified and the proxies used are valid.

All three FDI policy indicators, *Air distance*, *Corporate tax*, *GDP* and *Inflation* are negatively correlated with *Export orientation*, as expected. In contrast, measures of trade policies, including *Openness* and most of the FTA dummy variables, and *Years of schooling* are positively correlated with *Export orientation*. The correlation is particularly strong in the case of *Openness*. The one outlier amongst these bivariate correlations is *Wage*, which is positively correlated with the dependent variable. One possible explanation for this is that as noted above, higher wages reflect higher quality

workers that are particularly attractive for export production. This highlights the need to control for worker quality, in addition to labour costs, as proposed in this analysis. Consistent with the analysis and discussion in chapter 4, there is a high correlation between the three FDI policy indicators, particularly *Profit restrictions* and *Liquidation restrictions*.

5.4 Estimation strategy, results and discussion

5.4.1 Estimation strategy

Two particular issues arise when considering the appropriate estimation technique for this analysis. The first concerns the possibility that the results may suffer from endogeneity bias caused by unobservable heterogeneity. As the analysis draws on industry level cross-country data, unobservable heterogeneity may arise from either time invariant industry or country specific characteristics. The second methodological issue relates to two unusual features of the distribution of the dependent variable, *Export orientation* which is illustrated in a histogram in figure A5.1 of appendix 5.1.

The first unusual feature of *Export orientation* is that it is bounded between zero and one, since it is not possible for affiliates within a particular industry and country pair to have either negative sales or an export to total sales ratio greater than one. Second, approximately 10 per cent of the observations have a value of zero. That is, in a number of periods in the sample, affiliates in particular industry and country pairs produced entirely for the local market. In summary, the distribution of *Export orientation* is censored at zero and one, with a number of observations taking a value of zero.

In general, using ordinary least squares (OLS) to estimate a model where the dependent variable features this type of skewed, censored distribution will lead to inconsistent coefficient estimates (Wooldridge 2002, pp.524-525). The severity of this inconsistency will depend on the nature of the distribution, with a more skewed distribution leading to more inconsistent estimates using OLS. To overcome this problem it is necessary to use the Tobit estimator, the limited dependent variable estimator designed for censored distributions where the dependent variable is continuous over a certain range.

The standard solution for bias caused by time invariant unobservable effects with panel data is to use a fixed effects estimator which removes the time invariant effect through a

de-meaning or difference transformation. Unfortunately, it is not possible to combine the Tobit procedure with a fixed effects method, as the Tobit fixed effects estimator is undefined (Greene 2004). Therefore, a trade off exists between alternative approaches. Possible unobservable heterogeneity bias caused by industry or country specific effects can be addressed by applying fixed effects. Alternatively, the inconsistency caused by applying a least squares estimator to a censored distribution can be overcome by using Tobit.

However, it is important to note that the problem of unobservable heterogeneity is merely hypothetical. It could be that industry or country specific effects are not correlated with the explanatory variables in the model. In this case there would be no need to consider the use of a fixed effects estimation technique and the standard Tobit procedure would be ideal. This issue can be resolved using a Hausman test which compares the coefficients derived using random effects with those from a fixed effects procedure. If unobservable heterogeneity causes bias then the results from the two procedures will be systematically different.

In applying the Hausman test industry dummy variables are included in the specification. Hence, any unobservable heterogeneity arising from industry effects are controlled for, leaving country effects as the only possible source of unobservable heterogeneity. The test is undertaken in this fashion because industry dummy variables would be included in any subsequent specification, irrespective of the estimation technique applied.

The results from the Hausman test show that there is no systematic difference between the estimates derived using random and fixed effects. The reported p-value for the null hypothesis of no difference between the estimates is around 0.4, indicating that the null cannot be rejected at conventional levels of significance. Therefore, unobservable heterogeneity from country effects does not appear to pose a problem in this particular application.

As a consequence there is no need to consider trade-offs between alternative estimation techniques. The Tobit estimator, which is theoretically superior, is used to generate all of the results reported in sections 5.4.2 and 5.4.3 below. For comparative purposes results derived using random effects are reported in table A5.3 of appendix 5.1. Since

the proportion of dependent variable observations that is zero is relatively small it is unsurprising that the Tobit and random effects results do not differ greatly.

Given the empirical specification is not explicitly derived from theory it is useful to experiment with alternative specifications. An overly parsimonious specification may give rise to biased results if important explanatory variables are omitted. Equally, the inclusion of extraneous variables may cause multicollinearity. As noted above, alternative proxies for trade openness and transport costs are employed in the analysis. In addition, the binary indicators of FDI policies are entered separately, and also as a composite variable. This experimentation helps to illuminate identification problems in the analysis. Changes in results caused by the addition of new explanatory variables or the use of alternative proxies may signal fragility while stable coefficients are more likely to reflect robust relationships.

5.4.2 Full sample results

Table 5.2 presents the results from applying a variety of specifications to the full sample. All specifications include industry dummy variables to control for possible industry heterogeneity and robust standard errors are used to infer statistical significance. A chi-square test of model significance, which tests whether the predicted value of the dependent variable differs between the full model and a model comprising a constant term only, indicates that all specifications are highly significant. The pseudo R-squared, derived as the correlation between the predicted and actual values of the dependent variable indicates that the estimated models explains just under half of the variation in the dependent variable.

The first regression includes all three FDI policy indicators, *Openness* and all FTA dummy variables, the controls for labour costs and quality, *Wage* and *Years of schooling*, *Air distance*, *GDP* and the *Western hemisphere* dummy. Most of the results from this specification conform to expectations. Starting with trade policies, the coefficient on *Openness* is positive and significant. All four FTA dummy variable coefficients are also positive, although only *European Union* and *Mercosur* are significant at conventional levels of significance. These results highlight the importance of trade policies in influencing export orientation, especially in terms of general trade openness. The results for the three FDI policy indicators are not uniform. While the

coefficient on *Ownership restrictions* features the expected negative sign and is highly significant, neither *Liquidation restrictions* nor *Profit restrictions* are significant.

The coefficient on both *Wage* and *Years of schooling* are not statistically significant, possibly owing to multicollinearity. As noted in table A5.2 in appendix 5.1, the bivariate correlation between these variables in the full sample is over 0.6. However, the coefficients on *GDP* and *Air distance* are both significant with the expected (negative) sign. The coefficient on *GDP* supports the hypothesis that countries with larger domestic markets will, overall, tend to host less export orientated MNE production. The negative coefficient on *Air distance* supports the hypothesis that higher trade costs reduce export orientation by both increasing local market country production and discouraging export production. When *Pop100* was included as an alternative proxy for trade costs (not reported) it was found to be insignificant. Finally, the *Western hemisphere* dummy variable is positive but insignificant.

Table 5.2: Determinants of MNE export orientation, full sample

	1	2	3	4	5	6	7	8
Ownership restrictions	-0.112*** (0.031)	-0.106*** (0.031)	-0.104*** (0.028)			-0.101*** (0.028)	-0.098*** (0.028)	-0.093*** (0.028)
Profit restrictions	0.035 (0.031)	0.036 (0.032)		-0.036 (0.022)				
Liquidation restrictions	-0.049 (0.03)	-0.054* (0.03)			-0.048** (0.022)			
Capital restrictions						-0.021 (0.019)	-0.044** (0.019)	-0.024 (0.019)
Openness	0.222*** (0.013)	0.221*** (0.014)	0.226*** (0.014)	0.228*** (0.014)	0.224*** (0.014)	0.223*** (0.014)		
Openness adjusted							0.223*** (0.015)	
Openness imports								0.425*** (0.026)
EU	0.111*** (0.026)	0.108*** (0.026)	0.107*** (0.026)	0.114*** (0.026)	0.115*** (0.026)	0.108*** (0.026)	0.117*** (0.026)	0.113*** (0.026)
NAFTA	0.052 (0.048)	0.055 (0.048)	0.062 (0.049)	0.079 (0.048)	0.075 (0.048)	0.057 (0.048)	0.048 (0.048)	0.06 (0.048)
Mercosur	0.078** (0.035)	0.068* (0.036)	0.082** (0.035)	0.095*** (0.035)	0.085** (0.035)	0.073** (0.036)	0.046 (0.036)	0.067* (0.036)
CACM	0.076 (0.049)	0.078 (0.051)	0.099** (0.049)	0.144*** (0.047)	0.125*** (0.047)	0.101** (0.05)	0.115** (0.05)	0.093* (0.049)
Air distance	-0.014*** (0.003)	-0.014*** (0.003)	-0.015*** (0.003)	-0.014*** (0.003)	-0.013*** (0.003)	-0.015*** (0.003)	-0.012*** (0.003)	-0.014*** (0.003)
Wage	0.123 (0.766)	0.334 (0.786)	0.297 (0.778)	0.401 (0.789)	0.459 (0.78)	0.251 (0.783)	0.739 (0.793)	0.44 (0.782)
Years of schooling	0.004 (0.004)	0.004 (0.005)	0.005 (0.005)	0.006 (0.005)	0.005 (0.005)	0.005 (0.005)	0.006 (0.005)	0.006 (0.005)
GDP	-0.017* (0.01)	-0.015 (0.011)	-0.013 (0.011)	-0.01 (0.01)	-0.012 (0.01)	-0.013 (0.011)	-0.026** (0.011)	-0.015 (0.011)
Western hemisphere	0.02 (0.021)	0.014 (0.024)	0.009 (0.023)	-0.005 (0.022)	0 (0.022)	0.012 (0.024)	0.027 (0.024)	0.015 (0.023)
Corporate tax		-0.005 (0.006)	-0.003 (0.006)	-0.007 (0.006)	-0.008 (0.006)	-0.004 (0.006)	-0.004 (0.006)	-0.004 (0.006)
Inflation		0.007 (0.008)	0.006 (0.008)	0.009 (0.008)	0.01 (0.008)	0.007 (0.008)	0.009 (0.008)	0.007 (0.008)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Chi-square statistic	1010***	1017***	1013***	977***	974***	1010***	989***	1016***
Pseudo R-squared	0.48	0.48	0.48	0.48	0.48	0.48	0.47	0.48
Obs.	893	893	893	893	893	893	893	893

Notes: the dependent variable *Export orientation* is the proportion of US MNE manufacturing affiliate output exported, by industry and country. All results derived using the Tobit estimation technique. All specifications include a constant term and industry dummy variables that are not reported for brevity. Reported coefficients are marginal effects derived from the unconditional expected value of the model. Robust standard errors are reported in parentheses while ***, ** and * denote statistical significance at the 1, 5 and 10 per cent level respectively. The pseudo R-squared is calculated as the correlation between the fitted and actual values of the dependent variable while the chi-square statistic is a joint test of model significance. See appendix 5.2 for definitions and sources.

All of the industry dummy variables, omitted from the table for brevity, are significant at the 10 per cent level or better, highlighting the benefits of using industry level data that allows for the control of industry heterogeneity. Relative to the base group of miscellaneous manufacturing, the industry dummies for food, chemicals and metals are all negative. In contrast, the coefficients for machinery, electronics and transport equipment are all positive, consistent with the idea that production in these industries is internationally fragmented.

In regressions two to eight of table 5.2 additional control variables are added and alternative proxies introduced. In regression two, *Corporate tax* and *Inflation* are added but neither are found to be significant. The addition of these variables makes a small difference to the estimates for some variables. Most notably, the FDI policy indicator *Liquidation restrictions* become significant with a negative coefficient while *GDP* becomes marginally insignificant.

In regressions three, four and five, each of the FDI policy indicators are entered individually, alongside the full set of control variables. As noted above, the correlation between each of these variables is high, especially for the two capital transfer related policy indicators, which may pose a problem to inference. When *Ownership restrictions* and *Liquidation restrictions* are entered individually both feature the expected negative sign and are significant at the 1 and 5 per cent level respectively. The third FDI policy indicator, *Profit restrictions* is also negative and is borderline significant with a t-statistic of 1.63. These results suggest that multicollinearity may indeed plague results for the two capital transfer indicators.

To further explore this problem, in regressions six, seven and eight, a composite indicator of controls on the transfer of FDI related capital is created by combining observations for *Profit restrictions* and *Liquidation restrictions*. The binary variable *Capital restrictions* takes the value of one if the value of either *Profit restrictions* or *Liquidation restrictions* is one. Hence, the composite variable indicates the presence or otherwise of any type of restriction on FDI related capital transfers. This variable is negative, as expected, but significant in only one regression.

A second experiment is to use the alternative indicators of trade policies, *Openness adjusted* and *Openness imports*. Both of these variables are found to be positive and highly significant, while the results on the FTA dummy variables are largely unchanged.

Hence, the use of these alternative proxies does not make any difference to the conclusion that greater trade openness exerts a strong positive impact on *Export orientation*.

The magnitude of the estimated coefficients suggest that changes in FDI and trade policies are likely to lead to significant changes in the export orientation of MNE affiliate production. The abolition of joint venture requirements, as defined by the FDI policy indicator variable *Ownership restrictions*, is predicted to increase export orientation by around 10 per cent. The results for the other FDI policy indicators are more fragile but the magnitude of the coefficients suggest that a further 3 to 5 per cent increase in export orientation would be achieved by relaxing restrictions on the transfer of FDI related capital.

The adoption of more liberal trade policies, as reflected in an increase in the trade to GDP ratio of 10 per cent, is predicted to increase export orientation by around 2 to 3 per cent. This result is consistent with other studies of MNE export orientation which report a statistically and economically significant impact from trade openness, including Kumur (1998) and Hanson et al. (2001). The results from the FTA variables are mixed, consistent with the findings of Shatz (2004). On the whole the results provide some support to the hypothesis that FTA membership can exert a positive influence on MNE export orientation. Of the FTAs examined, membership of the European Union appears to cause the largest rise in export orientation, around 11 per cent.

Some of the results reported in table 5.2 differ from those reported in existing studies discussed in chapter 3. For example, Kumar (1994; 1998) and Shatz (2004) find a statistically significant negative relationship between wage costs and export orientation. The insignificant result on the tax variable *Corporate tax* also contrasts with the findings of Hanson et al. (2001) and Shatz (2004) who find robust evidence that higher taxes deter export orientation.

5.4.3 Developing and industrialised country sub-sample results

The results presented in table 5.2 are derived using the full sample of countries. In estimating a model using the full sample it is implicitly assumed that the model coefficients are constant across the sample. In other words, it is assumed that the relationship between the dependent variable *Export orientation* and each of the control

variables is constant for all countries. It is possible, however, that each of the variables considered in this analysis affects MNE export orientation differently for industrialized and developing economies. This will be especially true if the nature of export production differs systematically across these two groups. For example, if labour intensive production is centred in developing countries, differences in wage costs may be more important in explaining the determinants of export platform production in developing countries.

To examine whether it is appropriate to pool industrialised and developing countries together in this analysis a Chow test is undertaken. This test involves estimating a model of export orientation using the full sample and adding to the baseline model interaction terms between each of the explanatory variables and an industrialised country dummy variable. The coefficients on the interaction terms indicate whether the slope coefficients differ between industrialised and developing countries. If there is a difference, the interaction terms will be significantly different from zero. An F-test of joint significance is then applied to the coefficients of the interaction terms, to make an overall assessment of differences between the two groups of countries as a whole.

The results from the Chow test are reported in table A5.4 of appendix 5.1. The null hypothesis that all the interaction terms are insignificant is rejected at the 1 per cent level. On this basis it is concluded that the slope coefficients differ between the industrialised and developing countries. To address this heterogeneity, separate estimates are derived using sub-samples comprising only developing or industrialised countries. The results from this analysis are reported below, in tables 5.3 and 5.4.

Since no developing country is a member of the European Union, the *EU* dummy variable is dropped from the analysis of developing countries. Otherwise, the same specifications reported using the full sample in table 5.2 are applied to the developing country sub-sample in table 5.3. As with the full sample, a chi-square test indicates that all specifications are highly significant. However, the pseudo R-squared is considerably lower, suggesting that model fit is not as good for developing countries. Most of the industry dummy variables are again significant.

The results for the FDI policy indicators and variables capturing trade openness are similar to those derived using the full sample. Again the existence of FDI policy restrictions appears to reduce export orientation, especially policy restrictions captured

by *Ownership restrictions*. A more open trade policy stance, as reflected by *Openness* also exerts a positive impact on export orientation. The coefficients on the FTA dummy variables are similar for the developing country sub-sample, providing support to the hypothesis that FTA membership can boost MNE export orientation in developing countries.

Table 5.3: Determinants of MNE export orientation, developing countries

	1	2	3	4	5	6	7	8
Ownership restrictions	-0.112*** (0.036)	-0.109*** (0.035)	-0.104*** (0.03)			-0.098*** (0.03)	-0.105*** (0.03)	-0.086*** (0.03)
Profit restrictions	0.049 (0.035)	0.051 (0.035)		-0.04* (0.024)				
Liquidation restrictions	-0.063** (0.03)	-0.07** (0.03)			-0.061*** (0.023)			
Capital restrictions						-0.027 (0.02)	-0.042** (0.02)	-0.032 (0.02)
Openness	0.174*** (0.015)	0.175*** (0.016)	0.185*** (0.016)	0.189*** (0.016)	0.181*** (0.016)	0.18*** (0.016)		
Openness adjusted							0.18*** (0.016)	
Openness imports								0.357*** (0.029)
NAFTA	0.094 (0.071)	0.102 (0.072)	0.114 (0.07)	0.102 (0.073)	0.09 (0.072)	0.097 (0.07)	0.123* (0.071)	0.089 (0.07)
Mercosur	0.088* (0.047)	0.086* (0.05)	0.107** (0.047)	0.079 (0.048)	0.058 (0.049)	0.088* (0.049)	0.093* (0.049)	0.073 (0.049)
CACM	0.063 (0.054)	0.061 (0.055)	0.088* (0.05)	0.15*** (0.045)	0.13*** (0.044)	0.094* (0.051)	0.091* (0.051)	0.095* (0.051)
Air distance	-0.005 (0.005)	-0.006 (0.005)	-0.009* (0.005)	-0.004 (0.005)	-0.001 (0.005)	-0.007 (0.005)	-0.007 (0.005)	-0.004 (0.005)
Wage	-3.502* (2.058)	-3.353 (2.129)	-3.498* (2.09)	-3.21 (2.135)	-3.112 (2.08)	-3.627* (2.109)	-2.999 (2.087)	-3.776* (2.097)
Years of schooling	0.012** (0.006)	0.011* (0.007)	0.013* (0.007)	0.014** (0.007)	0.013* (0.007)	0.012* (0.007)	0.014** (0.007)	0.013** (0.007)
GDP	-0.047 (0.071)	-0.071 (0.072)	-0.06 (0.062)	0.04 (0.059)	0.036 (0.056)	-0.044 (0.062)	-0.15** (0.06)	-0.01 (0.062)
Western hemisphere	0.024 (0.023)	0.009 (0.026)	0.005 (0.026)	-0.001 (0.026)	0.003 (0.026)	0.01 (0.026)	0.019 (0.026)	0.014 (0.026)
Corporate tax		-0.007 (0.007)	-0.004 (0.006)	-0.008 (0.007)	-0.011 (0.007)	-0.005 (0.006)	-0.004 (0.006)	-0.005 (0.006)
Inflation		0.015* (0.009)	0.014 (0.009)	0.014 (0.009)	0.015* (0.009)	0.014* (0.009)	0.019** (0.009)	0.016* (0.009)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Chi-square statistic	487***	485***	477***	454***	459***	476***	465***	509***
Pseudo R-squared	0.28	0.25	0.26	0.29	0.28	0.27	0.20	0.26
Obs.	464	464	464	464	464	464	464	464

Notes: results derived using developing country sub-sample. Other notes as for table 5.2

The most noticeable difference in the results for the developing country sub-sample concerns the labour market variables. Whereas for the full sample the coefficient for *Wage* is positive but insignificant, for developing countries it is consistently negative and marginally significant. This result is consistent with the hypothesis that most MNE export production in developing countries is engaged in labour intensive production that is more sensitive to labour costs.

However, the results for *Years of schooling* suggest that it is not just labour costs alone that matter for developing countries. The coefficient on this variable is consistently positive and significant, suggesting that higher quality labour also enhances export orientation. The magnitude of the coefficient suggests that an increase in the average level of educational attainment by one year would increase export orientation by a little over 1 per cent.

Table 5.4 presents results for the industrialised country sub-sample. The specifications used to analyse the determinants of MNE export orientation in the industrialised country sub-sample features three minor differences from the specification applied to the full sample. First, since the FDI policy restrictions reflected in the policy indicator variable *Ownership restrictions* have not applied in any industrialised countries, this variable was dropped. Second, although FDI policy restrictions reflected in the policy indicators *Profit restrictions* and *Liquidation restrictions* do apply in some industrialised countries, they occur together in every instance. Therefore, it is not possible to separately identify the impact of each of these variables for this sub-sample. To address this latter problem the composite variable *Capital restrictions* discussed above is used. Finally, the *Mercosur* and *CACM* FTA dummy variables are omitted since these groupings comprise developing countries only.

Diagnostic tests for the industrialised country sub-sample produce similar results reported for the full sample. The pseudo R-squared indicates that the models explain around 40 per cent of the variation in *Export orientation*, only marginally lower than for the full sample. Once again the chi-square test statistic indicates the specifications are highly significant while around half of the industry dummy variables are found to be significant.

The coefficients on each of the alternative proxies for general trade policies are positive, highly significant and do not appear to be sensitive to model specification. Hence, as

with the results for the full sample and developing country sub-sample, there is strong evidence to suggest that more open trade policies increase export orientation. Indeed, the magnitude of the coefficient on *Openness* suggests that trade policies have a stronger impact on export orientation in industrialised countries.

The trade cost proxy, *Air distance*, also remains negative and significant, indicating that high trade costs also reduce export orientation in industrialised countries. However, the coefficients on the two FTA dummy variables that apply to the industrialised country sub-sample, *NAFTA* and *EU*, are both insignificant. The insignificance of the *EU* dummy is a notable difference from the full sample, where the coefficient for this variable is found to be large, positive and highly significant. One possible explanation is that this variable was picking up other industrialised country factors in the full sample.

A second difference with the industrialised country sub-sample is that the proxy for macroeconomic stability, *Inflation*, is negative and statistically significant, in contrast to the full sample where it is insignificant. This suggests that to the extent macroeconomic stability influences the operating environment, it is only relevant in the case of MNE production locating within industrialised countries.

Table 5.4: Determinants of MNE export orientation, industrialised countries

	1	2	3	4
Capital restrictions	-0.089*	-0.051	-0.048	-0.073
	(0.05)	(0.053)	(0.053)	(0.053)
Openness	0.472***	0.444***		
	(0.037)	(0.038)		
Openness adjusted			0.447***	
			(0.039)	
Openness imports				0.885***
				(0.08)
EU	0.031	0.026	0.024	0.031
	(0.034)	(0.034)	(0.034)	(0.034)
NAFTA	0.011	-0.009	-0.01	-0.015
	(0.052)	(0.053)	(0.053)	(0.052)
Air distance	-0.02***	-0.021***	-0.02***	-0.023***
	(0.005)	(0.006)	(0.006)	(0.006)
Wage	-0.463	-2.016*	-1.958*	-2.011*
	(0.904)	(1.049)	(1.053)	(1.075)
Years of schooling	0	-0.006	-0.006	0.001
	(0.008)	(0.009)	(0.009)	(0.009)
GDP	0.015	0.015	0.006	0.016
	(0.012)	(0.014)	(0.014)	(0.015)
Western hemisphere	-0.056	-0.056	-0.057	-0.062
	(0.045)	(0.044)	(0.044)	(0.044)
Corporate tax		-0.006	-0.006	-0.003
		(0.01)	(0.01)	(0.01)
Inflation		-0.065**	-0.066**	-0.077***
		(0.026)	(0.026)	(0.026)
Industry dummies	Yes	Yes	Yes	Yes
Chi-square statistic	562***	624***	621***	590***
Pseudo R-squared	0.41	0.39	0.37	0.38
Obs.	429	429	429	429

Notes: results derived using industrialised country sub-sample. Other notes as for table 5.2

A third difference for the industrialised country sub-sample relates to the two labour market related variables. In the expanded specifications in regressions two to four, the labour cost proxy *Wage*, is negative and significant while the measure of human capital, *Years of schooling*, is insignificant. This result suggests that industrialised countries might compete for export FDI on the basis of labour cost but not quality.

The fact that the coefficient on the labour cost variable is negative and statistically significant for each of the sub-samples but not statistically significant for the full sample indicates that important differences in the impact of labour costs are obscured in the full sample. The estimated coefficient on *Wage* is around 50 per cent higher in the developing country sub-sample, suggesting that MNE export production is far more

sensitive to labour costs in these countries. Again, this result is consistent with MNE production in developing countries being more labour intensive than in industrialised countries.

However, it is surprising that worker quality, as reflected by levels of human capital, affects export orientation only in developing countries. MNE export platform affiliates based in industrialised countries are more likely to specialise in skill intensive production. On this basis, one would expect industrialised countries to compete on the quality of labour and for the human capital variable to be significant. One possible explanation is that the variation in levels of educational attainment amongst industrialised countries is very low, making the identification of this effect difficult. A second possibility is multicollinearity, caused by the high correlation between levels of education and labour costs.

The relatively low degree of variation in levels of human capital amongst industrialised countries might also help to explain the more significant results for *Inflation* and *Openness* reported for this sub-sample. If levels of human capital are very similar then it is to be expected that small variations in other relevant factors such as macroeconomic stability and trade policies would become more important.

5.5 Conclusion

This chapter examines the determinants of the export orientation of MNE affiliates using sales data for US MNEs operating in a diverse sample of countries. The analysis aims to provide some direct empirical evidence on how host country factors influence a dimension of MNE production that is hypothesised to influence the growth effects of FDI. Of particular interest is the impact of host country FDI and trade policies, as well as human capital.

Theories of FDI predict that three sets of host country factors impact on MNE export orientation. Therefore, a variety of explanatory variables are incorporated in the analysis. In addition to proxies for trade and FDI policies, controls are included for market size, labour costs and quality, transport costs, tax rates and other aspects of the operating environment. Many, though not all, of these variables are found to be statistically significant with the theoretically predicted sign.

Amongst the FDI policy indicators, evidence is found to suggest that restrictions on the ownership structure of affiliates exerts a strong negative influence on export orientation. The evidence for FDI policy restrictions relating to the transfer of FDI capital is weaker but indicates that these policies may also have an adverse impact on export orientation. As expected, the results also highlight an important role for trade policies. A variety of general trade policy proxies are found to exert a positive impact on export orientation. However, the evidence on the effects of FTA membership is more mixed, suggesting that the specific design of the FTA may be important.

It is also found that the impact of some explanatory variables differs between industrialised and developing countries. Although higher wages are found to exert a negative influence on export orientation in all countries, the magnitude of this impact is much greater in developing countries. In addition, levels of human capital are found to be important in explaining inter-country variation in the degree of export orientation only for developing countries, presumably due to relative uniformity in the levels of human capital amongst industrialised countries.

Having provided some new empirical evidence that host country trade and FDI policies, as well as human capital, influences MNE export orientation, the next chapter investigates whether these and other factors also influence technology transfer to MNE affiliates.

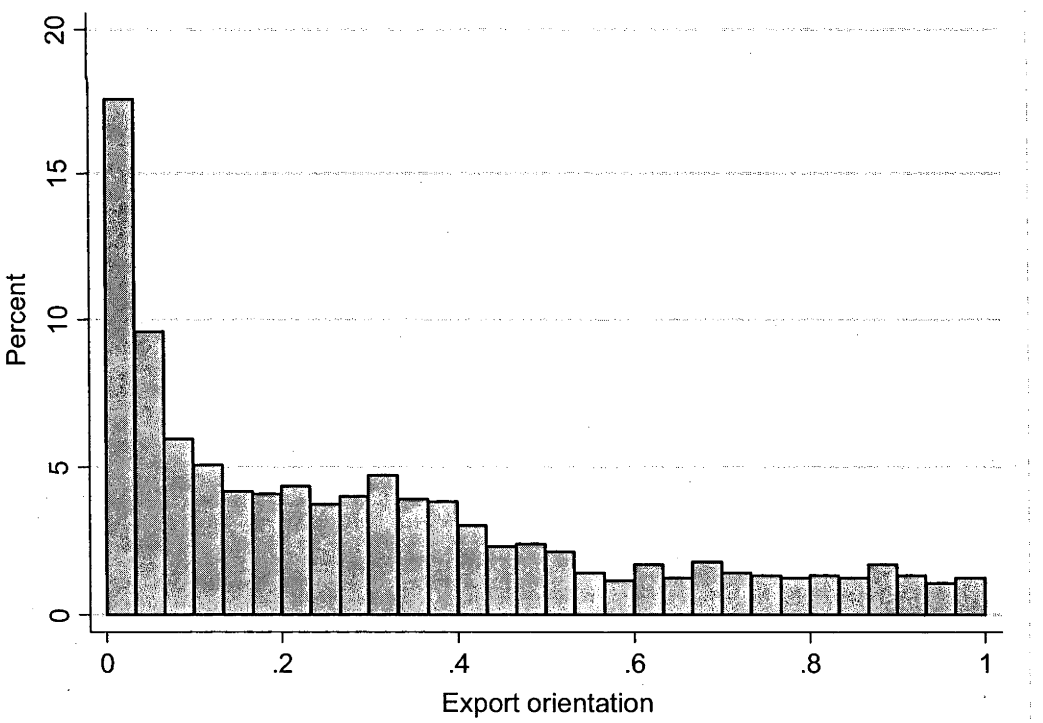
Appendix 5.1 Descriptive statistics and supplementary results

Table A5.1: Summary of statistics

	Mean	Standard deviation	Minimum	Maximum
Export orientation	0.292	0.277	0	1
Ownership restrictions	0.105	0.290	0	1
Profit restrictions	0.158	0.349	0	1
Liquidation restrictions	0.215	0.393	0	1
Openness	0.575	0.531	0.111	3.031
Wage	0.026	0.017	0.003	0.082
Years of schooling	7.125	2.263	2.517	11.775
GDP	0.390	0.688	0.004	4.531
Air distance	3.505	2.922	0.140	9.387
Corporate tax	2.677	1.455	0.206	9.194
Inflation	2.218	1.214	0.339	7.084

Notes: see appendix 5.2 for definitions and sources.

Figure A5.1: Distribution of export orientation



Notes: histogram of *Export orientation*, based on BEA data for the years 1982 to 1997. See appendix 5.2 for definition and source.

Table A5.2: Correlation matrix

	Export orientation	Ownership restrictions	Profit restrictions	Liquidation restrictions	Openness	EU	NAFTA	Mercosur	CACM	Air distance	Wage	Years of schooling	GDP	Western hemisphere	Corporate tax
Ownership restrictions	-0.257														
Profit restrictions	-0.242	0.518													
Liquidation restrictions	-0.317	0.415	0.763												
Openness	0.522	-0.169	-0.214	-0.264											
EU	0.337	-0.240	-0.247	-0.314	0.038										
NAFTA	0.034	-0.046	-0.057	-0.069	-0.004	-0.083									
Mercosur	-0.078	-0.064	-0.052	0.013	-0.142	-0.115	-0.022								
CACM	0.011	-0.061	0.181	0.041	-0.008	-0.111	-0.021	-0.029							
Air distance	-0.362	0.085	0.131	0.292	-0.125	-0.616	-0.067	0.276	-0.007						
Wage	0.160	-0.322	-0.406	-0.444	-0.090	0.554	0.016	0.003	-0.175	-0.315					
Years of schooling	0.190	-0.335	-0.433	-0.472	0.080	0.255	0.093	-0.087	-0.210	-0.201	0.662				
GDP	-0.092	-0.156	-0.135	-0.180	-0.213	0.170	0.026	-0.002	-0.093	0.084	0.569	0.227			
Western hemisphere	-0.258	0.303	0.371	0.410	-0.264	-0.423	0.197	0.273	0.262	0.248	-0.320	-0.317	-0.184		
Corporate tax	-0.320	0.286	0.256	0.187	-0.365	-0.181	-0.029	0.000	-0.029	0.303	-0.025	-0.234	0.246	0.157	
Inflation	-0.294	0.313	0.468	0.524	-0.300	-0.348	-0.024	0.233	0.096	0.327	-0.522	-0.544	-0.261	0.550	0.302

Notes: see appendix 5.2 for definitions and sources.

Table A5.3: Determinants of MNE affiliate export orientation, random effects

	1	2	3	4	5	6	7	8
Ownership restrictions	-0.087***	-0.086***	-0.093***			-0.09***	-0.087***	-0.085***
	(0.023)	(0.023)	(0.02)			(0.02)	(0.02)	(0.02)
Profit restrictions	0.004	0.005	0.228***	-0.056**				
	(0.024)	(0.024)	(0.024)	(0.022)				
Liquidation restrictions	-0.03	-0.031	0.059**		-0.053**			
	(0.022)	(0.022)	(0.027)		(0.023)			
Capital restrictions						-0.015	-0.025	-0.014
						(0.02)	(0.02)	(0.02)
Openness	0.226***	0.225***	0.054**	0.228***	0.227***	0.227***		
	(0.024)	(0.025)	(0.026)	(0.025)	(0.025)	(0.025)		
Openness adjusted							0.22***	
							(0.025)	
Openness imports								0.427***
								(0.046)
EU	0.059**	0.06**	0.019	0.061**	0.063**	0.059**	0.062**	0.063**
	(0.027)	(0.028)	(0.022)	(0.028)	(0.028)	(0.027)	(0.028)	(0.028)
NAFTA	0.054**	0.054**	0.083**	0.063**	0.065**	0.055**	0.055**	0.056**
	(0.026)	(0.026)	(0.041)	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)
Mercosur	0.004	0.002	-0.02***	-0.018	-0.015	0.008	-0.007	0.001
	(0.029)	(0.031)	(0.004)	(0.029)	(0.03)	(0.028)	(0.028)	(0.028)
CACM	0.073*	0.072*	0.726	0.094**	0.076*	0.082**	0.086**	0.074*
	(0.042)	(0.043)	(0.746)	(0.043)	(0.042)	(0.041)	(0.042)	(0.042)
Air distance	-0.019***	-0.019***	-0.013	-0.019***	-0.018***	-0.019***	-0.019***	-0.019***
	(0.004)	(0.004)	(0.014)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Wage	0.722	0.702	-0.003	0.467	0.485	0.701	1.001	0.834
	(0.713)	(0.752)	(0.031)	(0.746)	(0.746)	(0.751)	(0.761)	(0.745)
Years of schooling	-0.004	-0.004	-0.002	-0.001	-0.002	-0.003	-0.002	-0.002
	(0.006)	(0.006)	(0.007)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
GDP	-0.014	-0.013	-0.003	-0.006	-0.008	-0.013	-0.025*	-0.015
	(0.014)	(0.014)	(0.006)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Western hemisphere	0.001	0.002	-0.001	-0.002	-0.002	0	0.01	0.001
	(0.03)	(0.031)	(0.004)	(0.031)	(0.031)	(0.031)	(0.032)	(0.031)
Corporate tax		-0.001	-0.088**	-0.002	-0.004	-0.001	-0.001	0
		(0.004)	(0.039)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Inflation		0	-0.046	-0.001	0.001	-0.001	0	-0.001
		(0.007)	(0.036)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Chi-square statistic	343***	347***	343***	321***	320***	345***	333***	341***
Pseudo R-squared	0.47	0.47	0.47	0.46	0.46	0.47	0.46	0.46
Obs.	893	893	893	893	893	893	893	893

Notes: results derived using random effects estimation technique. Other notes as for table 5.2

Table A5.4: Chow test for structural break

Ownership restrictions	-0.084***
	(0.023)
Capital restrictions	-0.04*
	(0.022)
Openness	0.195***
	(0.025)
EU	0.022
	(0.026)
NAFTA	0.073
	(0.054)
Mercosur	0.053
	(0.05)
CACM	0.088*
	(0.051)
Air distance	-0.006
	(0.008)
Wage	-5.032**
	(2.089)
Years of schooling	0.012
	(0.009)
GDP	-0.071
	(0.083)
Western hemisphere	0.019
	(0.036)
Corporate tax	0.001
	(0.006)
Inflation	0.002
	(0.009)
Industrialised dummy	0.213
	(0.148)
Capital restrictions x Industrialised dummy	0.126**
	(0.058)
Openness x Industrialised dummy	0.21***
	(0.067)
NAFTA x Industrialised dummy	-0.07
	(0.077)
Air distance x Industrialised dummy	-0.014
	(0.011)
Wage x Industrialised dummy	4.971**
	(2.371)
Years of schooling x Industrialised dummy	-0.025*
	(0.014)
GDP x Industrialised dummy	0.073
	(0.086)
Western hemisphere x Industrialised dummy	-0.063
	(0.087)
Corporate tax x Industrialised dummy	-0.005
	(0.01)
Inflation x Industrialised dummy	-0.055**
	(0.023)
Industry dummies	Yes
Chi-square statistic	373***
Obs.	893

Notes: results derived using random effects estimation. *Industrialised dummy* equal to one for industrialised countries. Other notes as for table 5.2.

Appendix 5.2 Data definitions and sources

Export orientation: total US MNE manufacturing affiliate exports divided by total sales, by industry and host country. All data measured in nominal US dollars.
Source: Bureau of Economic Analysis, US Department of Commerce.

Ownership restrictions: binary variable equal to one if country imposes mandatory joint venture requirement, as described in chapter 4.

Profit restrictions: binary variable equal to one if country imposes restrictions on the repatriation of FDI related income, as described in chapter 4.

Liquidation restrictions: binary variable equal to one if country imposes restrictions on the repatriation of the proceeds from the liquidation of FDI related assets, as described in chapter 4.

Openness: ratio of exports plus imports to GDP. All data measured in nominal US dollars.
Source: IMF International Financial Statistics online database, World Bank World Development Indicators online database and World Bank Growth Resources Database (Easterly 2001).

Openness adjusted: population adjusted measure of *Openness* estimated by regressing *Openness* on total population.
Source: trade data as for *Openness*, population data from World Bank World Development Indicators online database and for Taiwan only, Penn World Table (Heston et al. 2002).

The regression applied is as follows (standard error in parentheses):

Openness = 0.6369 - 0.0005*Population
(0.00004)

Openness imports: ratio of imports to GDP. All data measured in nominal US dollars.
Source: International Financial Statistics, World Development Indicators and World Bank Growth Resources Database (Easterly 2001).

EU: dummy variable indicating membership of European Union.

NAFTA: dummy variable indicating membership of North American Free Trade Association.

Mercosur: dummy variable indicating membership of Mercosur or the Southern Common Market.

CACM: dummy variable indicating membership of the Central American Common Market.

GDP: real GDP, purchasing power parity basis.
Source: Penn World Table (Heston et al. 2002).

Wage: total employee compensation paid by US MNE manufacturing affiliates divided by total employment, by industry and host country. Series converted to constant US dollar basis using US GDP deflator.
Source: Bureau of Economic Analysis, US Department of Commerce, and World Development Indicators.

Years of schooling: total years of schooling of workers 25 years and older.
Source: Barro and Lee (2001).

Western hemisphere: dummy variable equal to one for countries located within North, Central or South America.

Pop100: proportion of country population located within 100km of coastal fringe.
Source: Gallup et al. (1999).

Air distance: great-circle air distance to one of the three major economic hubs of Europe, Japan or the United States, specifically Rotterdam, Tokyo or New York, measured in thousands of kilometres. For Japan, distance to Rotterdam applies.
Source: Gallup et al. (1999).

Corporate tax: income taxes paid by US MNE manufacturing affiliates divided by total sales, by industry and host country. All data measured in nominal US dollars.
Source: Bureau of Economic Analysis, US Department of Commerce.

Inflation: annual change in GDP price deflator.
Source: World Development Indicators.

Table A5.5: Country sample

Argentina	Italy*
Australia*	Japan*
Austria*	Malaysia
Belgium*	Mexico
Brazil	Netherlands*
Canada*	New Zealand*
Chile	Nigeria
China	Norway*
Colombia	Panama
Costa Rica	Peru
Denmark*	Philippines
Dominican Republic	Portugal*
Ecuador	Saudi Arabia
Egypt	Singapore
Finland*	South Africa
France*	South Korea
Germany*	Spain*
Greece*	Sweden*
Guatemala	Taiwan
Honduras	Thailand
Hong Kong	Trinidad-Tobago
India	Turkey
Indonesia	United Arab Emirates
Ireland*	United Kingdom*
Israel	Venezuela

Notes: * denotes industrialised country.

Chapter 6

Determinants of multinational technology transfer: the case of US multinational affiliates

6.1 Introduction

This chapter examines the determinants of technology transfer to MNE affiliates. As with the analysis of export orientation presented in the previous chapter, it aims to highlight the host country factors that influence an aspect of multinational production which is hypothesised to influence the growth effects of FDI. The technological capability of MNE affiliates not only influences the productivity of the affiliate itself, but also opportunities for knowledge spillovers to domestic firms.

To recap from chapter 3, a number of theoretical and analytical contributions have highlighted a variety of host country factors that are likely to influence technology transfer to MNE affiliates. One factor is FDI policies, particularly those policies which seek to limit foreign control over MNE affiliates. Moran (1998; 2001) argues that foreign investors may be reluctant to transfer propriety knowledge to an affiliate that is not wholly owned for fear of rival firms gaining access to proprietary knowledge. This risk is likely to be particularly acute where intellectual property rights (IPR) are weak. Ramachandran (1993) also argues there will be an immediate financial disincentive to technology transfer under a joint venture if the parent company is not fully compensated for undertaking costly technology transfer.

The theory of FDI spillovers devised by Wang and Blomstrom (1992), highlight two additional factors influencing technology transfer to MNE affiliates. One of these is the degree of market competition faced by affiliates. In more competitive markets there is a need for additional technological resources in order to compete with rival firms. Therefore, policies that increase market competition, including more open trade policies, are expected to encourage higher technology transfers to MNE affiliates.

A second factor highlighted by Wang and Blomstrom (1992) is host country absorptive capacity. Consistent with general theories of absorptive capacity discussed in chapter 2, the model assumes that technology transfer will be less costly in countries with stronger absorptive capacity, including a better educated workforce. Therefore, affiliates

located in countries with higher levels of human capital and other technical resources, will also tend to be the beneficiaries of greater technology transfer.

The aim of this chapter is to test the hypothesis that liberal FDI policies with respect to foreign ownership, open trade policies and higher levels of host country human capital all encourage technology transfer to MNE affiliates. The analysis employs data on technology payments made by US manufacturing MNE affiliates from the same BEA dataset used to analyse export orientation in chapter 5. This dataset enables a cross-country analysis of the determinants of technology transfer using industry level data between 1982 and 1994. The impact of FDI policies is assessed using one of the FDI policy indicators introduced in chapter 4 while alternative measures of educational attainment and trade openness are used to test the role of human capital and trade policies.

As noted in chapter 3, no existing empirical study has examined the direct impact of FDI ownership policies on technology transfer. Nevertheless, a number of studies, including Mansfield and Romero (1980), Ramachandran (1993), Urata and Kawai (2000) and Desai et al. (2004) provide some indirect evidence. Rather than investigating the impact of policy restrictions, these studies examine the effect of the ownership structure of foreign affiliates on technology transfer. Each of these studies report at least some evidence that technology transfer to MNE affiliates is lower or takes place at a slower pace for joint ventures, compared with wholly foreign owned affiliates. The aim of the current analysis is to build on these findings by examining the direct impact of FDI ownership policies.

The following section discusses model specification, including details on the construction of the dependent variable. In section 6.3, data are discussed, including an overview of patterns of technology transfer amongst US affiliates, as well as descriptive statistics for the sample used in the analysis. Section 6.4 begins with a discussion of the estimation strategy, before moving on to a presentation of the results. Section 6.5 concludes while sample statistics, country coverage, supplementary results and data sources are presented in the appendices.

6.2 Measuring technology transfer and model specification

6.2.1 Measuring technology transfer

To analyse the determinants of technology transfer to MNE affiliates, a proxy for technology transfer is constructed using data on technology related payments by US MNE affiliates. This measure is then regressed on a number of explanatory variables, including measures of FDI and trade policies, human capital and other controls. The data for the dependent variable are sourced from the same BEA dataset used in the analysis of export orientation in chapter 5 and again relate to majority US owned manufacturing affiliates.

The dependent variable for this analysis, *Technology transfer*, is constructed by dividing the total value of US MNE affiliate technology payments by the total value of affiliate sales, for each industry and host country combination, as follows:

$$Technology\ transfer_{ijt} = \frac{Technology\ payments_{ijt}}{Sales_{ijt}} \qquad (6.1)$$

In equation 6.1 *Technology payments* represents the total value of US MNE affiliate payments, *Sales* the total value of US MNE affiliate sales and subscripts i, j and t denote industry, country and period respectively. Therefore, as in chapter 5, the sample used in this analysis comprises a panel spaning host countries, industries and time. Once again, the use of industry, rather than country, level data avoids possible aggregation bias arising from intra-industry heterogeneity and provides a potentially richer source of information.

Data on technology payments reflect payments for technology licensing and franchise fees for industrial products and processes. While this data are arguably of a high standard, and unique in its coverage, the use of data on technology related payments as a proxy for technology transfer is imperfect. Such data are likely to provide a good indicator of transfers of knowledge embodied in tangible blueprints and designs. However, like other forms of data associated with technology exchange, may not provide an accurate account of less formal exchanges of knowledge. For example, the routine movement of staff between the parent company and affiliate is unlikely to be captured. The same is also likely to be true for many informal exchanges of information. Where any such interactions fall outside the domain of contracted

services, technology payments data will understate the true magnitude of technology transfer.

Another potential problem with the data is that firms may use technology related payments as a guise for transferring capital from the affiliate in order to reduce tax liabilities or circumvent capital controls which exempt technology payments.[50] However, this is unlikely to be a major problem with BEA data. This is because US and other jurisdiction legislation reduces the discretion of firms to manipulate how technology payments are reported in the BEA surveys (Branstetter et al. 2006).

First, there is a general legal requirement to price technology transfers within the company in the same manner that would apply to an arms length exchange. Therefore, there are clear legal sanctions against US firms engaging in the manipulation of prices. Second, technology transfers from parent companies to foreign affiliates are typically centrally managed by the parent company. As a result, discrepancies in technology related prices are relatively easy to detect by enforcement authorities.

6.2.2 Explanatory variables

The primary focus in analysing the determinants of technology transfer is to examine the impact of host country FDI and trade policies, as well as human capital. As argued in chapter 3, FDI policies which require foreign investors to form joint ventures with local investors are expected to represent a significant deterrent to technology transfer. However, despite the relevance of this policy variable, no existing study of technology transfer to MNE affiliates has examined its impact. This issue is examined here using the *Ownership restrictions* indicator compiled in chapter 4, which indicates the presence of joint venture requirements. Since this variable takes the value of one where countries impose ownership restrictions, a negative coefficient on this variable is expected.

The theoretical model of technology transfer by Blomstrom and Wang (1992) highlights the importance of market competition in affecting technology transfers. There are many factors that are likely to influence the degree of market competition, including trade policies. Trade policies are likely to be particularly important in tradeable goods sectors, including the manufacturing industries examined in this analysis. On this basis,

[50] This is related to transfer pricing whereby firms intentionally misrepresent internal trading prices to ease the movement of capital within the firm.

it is anticipated that more open trade policies increase technology transfer to MNE affiliates by increasing the degree of market competition in the host country. Other factors, including competition policies, are also likely to be important. However, it is difficult to control for these policies in this analysis given the lack of comparable cross-country data.

Two measures of trade openness are used in the analysis, labelled *Openness* and *Openness adjusted.* As in chapter 5, the first of these variables represents the ratio of total trade to GDP. As noted in the previous chapter, a shortcoming of this proxy is that more populous countries will naturally trade less. Therefore, values for this variable not only reflect openness to international trade but also country size. To correct this, the indicator *Openness adjusted* is derived as it is in the previous chapter, as a population adjusted measure of *Openness*. Both of these measures are expected to be positively correlated with *Technology transfer*.

Proxies for human capital are included to capture the role of absorptive capacity in aiding technology transfer. As discussed in chapters 2 and 3, the availability of adequate human capital is likely to have a bearing on the costs of technology transfer, an idea grounded in broader theories of the complementarity between the embodied knowledge of workers and disembodied knowledge. In this analysis, the impact of human capital is assessed using two alternative measures of educational attainment from the Barro and Lee (2001) dataset. The main variable used, *Years of schooling*, reflects the average years of schooling amongst the adult population. An alternative variable, *Years of secondary schooling*, reflects years of secondary schooling.

Another factor that is likely to impact on technology transfer is IPR. Like joint venture requirements, weak IPR may pose risks to the ownership and control of proprietary assets (Branstetter et al. 2006). Even where a parent company has full control over a foreign affiliate, opportunities for rivals to appropriate priority knowledge through such mechanisms as demonstration effects and labour turnover will abound. Without strong IPR there will be no recourse to legal sanctions if technology is misappropriated.

In this analysis, the strength of IPR is proxied using the measure of property rights protection proposed by Clague et al. (1999). Termed *Contract intensive money*, this measure is constructed as the proportion of broad money held in forms other than

currency. It is premised on the idea that the level of confidence economic agents have in contract enforcement and property rights will be reflected by their willingness to hold wealth in forms that depend on contract enforcement, including financial instruments other than currency. The primary attraction of this variable over alternative measures of institutional quality is that it is objective, in that it reflects the actions of independent economic agents, and is widely available.

Strictly speaking this variable is designed to reflect the strength of private property rights, rather than IPR as such. However, since strong private property rights and IPR are both underpinned by the same legal principals it is likely that the two are strongly correlated. Furthermore, there is a dearth of alternative data, as highlighted by the Branstetter et al. (2006) study which relies on an IPR indicator compiled specifically for that study.[51] Finally, Clague et al. (1999) report that the monetary based proxy is strongly correlated with subjective measures of property rights, providing some assurance that the variable is well founded.

As noted above, it is possible that firms use intra firm technology related payments to reduce tax liabilities and or circumvent capital controls. If this were the case then the presence of capital restrictions or high corporate taxes would be associated with higher levels of technology payments as firms seek to exploit this 'loophole'. As discussed there are doubts as to how effectively US MNEs can manipulate technology payments. Nevertheless, to ensure that the misreporting of payments does not affect the interpretation of the results, two additional control variables are included.

As discussed in section 5.2.2 of chapter 5, this variable offers the advantage of providing a very good indicator of the actual tax burden faced by firms. However, a draw back is the possibility that it may be endogenous in the sense that firms may aim to manipulate technology payments to minimise tax liabilities. In the absence of instrumental variables or alternative proxy variables that cover the sample of interest, examining the precise nature of this issue is difficult.

The first is the FDI policy indicator introduced in chapter 4 which details restrictions on the transfer of income earned on FDI, *Profit restrictions*. The second is a proxy for the tax liabilities faced by MNE affiliates. The variable used is the same tax proxy

[51] The IPR indicator compiled by Branstetter et al. (2006) was not considered for this analysis as it is only available for a small number of countries.

employed in the previous chapter, *Corporate tax*, which is based on actual taxes paid by US MNE manufacturing affiliates. If MNEs seek to manipulate technology payments it is expected that the coefficient on one or both of these variables will be positive.

Finally, as with the analysis of the determinants of export orientation presented in chapter 5, industry dummy variables are included to capture industry specific effects. As in chapter 5, the dummy variable *Western hemisphere* is also included which takes a value of one for countries located within the Americas. This variable is included on account of the data covering only US MNEs which may view the countries of the Americas differently owing to geographic or political factors not adequately controlled for by the other explanatory variables.

6.3 Sample and descriptive statistics

6.3.1 Sample

Data on technology payments has not been collected by the BEA on an annual basis. Rather, this data was collected as part of the 'benchmark surveys' that are undertaken to collect more detailed operational data on an irregular basis. Benchmark surveys that contain information on technology payments that are used in this analysis pertain to the years 1982, 1989 and 1994.

As with the regular annual BEA publications, each of the benchmark surveys provide data on the activities of US MNE manufacturing affiliates by major industrial classification across a large sample of countries. However, as noted in section 5.2.1 of chapter 5, some BEA data are suppressed from publication due to confidentiality requirements. In addition, a small number of countries are dropped from the sample due to a lack of data for some explanatory variables. The final sample used in the analysis includes up to 43 countries, 24 of which are classified as developing.[52] The sample also includes data for the same 7 manufacturing industries covered in the analysis in the previous chapter. These are: food, chemicals, metals, machinery, electronics, transport and miscellaneous manufacturing.

[52] Table A6.5 of the appendix details the countries included in the analysis, including those classified as developing countries.

6.3.2 Descriptive statistics

The BEA data show a sharp increase in technology payments by US manufacturing MNE affiliates between 1982 and 1994. During this period the value of total royalties and license payments rose from around US$3 billion to well over US$13 billion. Significantly, these payments rose faster than total sales, resulting in the ratio of payments to total sales almost doubling. This suggests a strong upward trend in how intensively technology is used by US MNE manufacturing affiliates. This pattern is consistent with a process of increasing international vertical specialisation, where MNEs consolidate resources devoted to each part of a global supply chain, including technology, in a particular location.

There is a large degree of variation in the average value of transfers across host countries. Table 6.1 provides a snapshot of these differences by listing the ten countries where US MNE manufacturing affiliates recorded the highest and lowest average levels of technology payments over the years 1982, 1989 and 1994. Since payments for technology are small relative to sales, the value of payments is scaled by 100. Therefore, values of *Technology transfer* are expressed as the number of cents spent on technology payments per US dollar of sales.

US manufacturing affiliates in Japan and Ireland are by far the largest recipients of technology, with payments in excess of 4 cents per dollar of sales. Also featuring high on the list are a number of European countries with high technology manufacturing industries, including the Netherlands and Sweden. Only one developing country, China, ranks in the top ten. Countries receiving the lowest levels of technology are all classified as developing. The list includes countries with a history of adopting restrictive FDI policies, including India, Nigeria and Venezuela. However, Malaysia, which, as noted in the previous chapter, has a history of hosting export oriented MNE production, also features.

Table 6.1: Highest and lowest average levels of technology transfer, 1982 to 1994

Country	Technology transfer
Ten highest recipients of technology	
Japan	4.94
Ireland	4.04
Netherlands	2.76
Sweden	2.54
Italy	2.45
France	2.27
Egypt	2.22
Finland	2.21
China	2.04
Germany	1.89
Ten lowest recipients of technology	
Nigeria	0.44
Venezuela	0.44
Israel	0.44
Malaysia	0.39
Colombia	0.34
India	0.34
Brazil	0.14
Dominican Republic	0.12
Honduras	0
Trinidad and Tobago	0

Notes: ratio of total technology payments to sales for all US MNE manufacturing affiliates averaged over the years 1982, 1989 and 1994. See appendix 6.2 for definitions and sources.

Table A6.1 in appendix 6.1 provides summary statistics for *Technology transfer* and explanatory variables for the sample used for the empirical analysis. The mean value of *Technology transfer* across all countries, industries and years is 1.2 cents per dollar of sales. The average for industrialised countries, 1.4 cents per dollar, is notably higher than for developing countries, 1 cent per dollar. There are also large differences across industries, with average payments ranging from a high of 2 cents per dollar for chemicals down to 0.4 cents for transport.

The high standard deviation of *Technology transfer* is likely to partly reflect many zero observations in the sample. In contrast, the highest observation in the sample is 12.2 cents per dollar of sales for the chemicals industry in Ireland in 1994. Although developing countries have lower payments on average, it is not the case that industrialised countries account for all of the highest observations in the sample. Countries as diverse as China, Ecuador and Thailand feature in the highest twenty

observations for *Technology transfer* in particular periods and industries, along with the likes of Japan, the Netherlands and the UK.

There is also a high degree of sample variation for the explanatory variables. Beginning with *Openness*, a number of countries in the sample record trade to GDP ratios of less than 0.2, including Argentina, Brazil and India. In contrast, very open economies including Belgium, Hong Kong, Malaysia and Singapore have trade to GDP ratios greater than one. For *Years of schooling*, the worst performers are Guatemala and India, both recording figures of less than 3 years of schooling amongst the adult population in 1982. The highest average levels of education are for Canada, New Zealand and Norway, all in excess of 11 years of schooling.

As expected, the measure of property rights security, *Contract intensive money*, broadly correlates with average levels of development. Countries with the lowest observations include the Dominican Republic, Honduras and Indonesia while Finland, New Zealand and the UK all score highly. Nevertheless, there are some observations that appear to be at odds with prior expectations. For example, Argentina scores poorly while the figure for Brazil is comparable to many industrialised countries. As in the sample used to analyse export orientation in the previous chapter, there are many observations for *Corporate tax* that suggest MNE affiliates benefited from special tax breaks. For example, the lowest observation of 0.21 per cent, which applied to Chile in 1989, indicates that taxes paid by affiliates amounts to less than half of one per cent of total sales. In contrast, the highest observation is 7.2 per cent, recorded for Japan in 1989.

Bivariate correlations between the main explanatory variables are presented in table A6.2 of appendix 6.1. Overall, the direction of correlation generally conforms to prior expectation although the strength of correlation in most cases appears weak. As expected, *Technology transfer* is negatively correlated with *Ownership restrictions* and positively correlated with *Openness*, *Years of schooling* and *Contract intensive money*. A negative bivariate correlation is observed between *Technology transfer* and both *Profit restrictions* and *Corporate tax*. This provides some assurance that the technology payments data have not been manipulated by MNEs to avoid capital controls or minimise tax liabilities.

6.4 Estimation strategy, results and discussion

6.4.1 Estimation strategy

Analysing the determinants of technology transfer presents similar methodological challenges to those faced in the analysis of export orientation in chapter 5. Once again, the analysis draws on industry level cross-country data, raising the possibility of unobservable heterogeneity bias arising from either time invariant industry or country specific effects. Second, the distribution of the dependent variable, *Technology transfer*, illustrated in figure A6.1 of appendix 6.1, shares two of the unusual characteristics of the dependent variable used in the analysis of export orientation.

First, *Technology transfer* has a lower bound of zero since it is not possible for affiliates within a particular industry and country pair to have negative technology payments. Second, approximately 15 per cent of the observations have a value of zero. This means that for a number of country and industry combinations in the sample, affiliates made no technology related payments. In summary, *Technology transfer* features a distribution that is censored at zero and has a relatively high frequency of observations equal to zero.

As noted in section 5.4.1 of chapter 5, the limited dependent variable estimator Tobit is ideal for estimation where the dependent variable features this type of censored distribution. The other potential problem, unobservable heterogeneity, is usually addressed by using a fixed effects estimator which removes the time invariant effect through a de-meaning or difference transformation. However, since the fixed effects Tobit estimator is undefined, it is not possible to implement a technique which combines the virtues of Tobit and the fixed effects estimator (Greene 2004). Hence, as with the analysis in chapter 5, there exists a potential trade off between using a fixed effects estimator and not properly addressing the issue of the censored distribution, or using a Tobit estimator and leaving potential unobservable heterogeneity unchecked.

As in chapter 5, the approach taken here is to first examine whether unobservable heterogeneity is indeed a problem by way of a Hausman specification test. To briefly reiterate, this test compares the coefficients from a model of technology transfer derived using the random effects estimator which does not control for unobservable heterogeneity, to those from a fixed effects estimator. If unobservable heterogeneity causes the estimates to be biased then the results from applying the two estimation

techniques will differ. As in chapter 5, industry dummy variables are included in the specifications used in the test. The inclusion of these dummies controls for industry effects, leaving country effects as the only possible source of unobservable heterogeneity. The test is undertaken in this manner as industry dummy variables would be included in any subsequent estimation, irrespective of the estimation technique chosen to undertake the final analysis.

As in chapter 5, the results from the Hausman test show there is no systematic difference between the estimates derived using random and fixed effects. The reported p-value for the null hypothesis of no difference between the models is around 0.3, indicating that the null cannot be rejected at conventional levels of significance. This suggests that unobservable heterogeneity from country effects does not pose a problem to this analysis. Therefore, the theoretically superior Tobit estimator is used to generate all of the results reported in sections 6.4.2 and 6.4.3 below. As in chapter 5, comparative results derived using random effects are reported in appendix 6.1 and again do not differ significantly from the Tobit results.

6.4.2 Full sample results

Table 6.2 presents results on the determinants of technology transfer, based on the full sample. All specifications include industry dummy variables to control for possible industry heterogeneity. In all cases robust standard errors are reported and used to infer statistical significance. The pseudo R-squared, which is the correlation between the predicted and actual values of the dependent variable indicates the models explain approximately 20 per cent of the variation in the dependent variable. Despite this relatively low figure a chi-square test of model significance indicates that all specifications are statistically significant.

The coefficients on all of the industry dummy variables, omitted from the table for brevity, are significant except for electronics. The significance of the industry dummy variables highlights the benefits of using industry level data that allows for the control of industry heterogeneity. Relative to the base group of miscellaneous manufacturing, the industry dummy for chemicals is positive while the industry dummies for food, metals, industrial machinery and transport equipment are all negative.

Beginning with regression one, the coefficient on *Ownership restrictions* is negative and statistically significant at the 5 per cent level. Consistent with the results reported in other studies on technology transfer which control for human capital, the coefficient on *Years of schooling* is positive at the 1 per cent level. The other three explanatory variables, *Openness*, *Contract intensive money* and *Western Hemisphere* are all insignificant, although the first two of these feature the expected positive sign.

In regressions two and three the additional control variables *Corporate tax* and *Profit restrictions* are added to the base specification. The coefficients on both of these variables are negative but neither is significant. The results for the existing variables are largely unchanged. This suggests that technology payments are not influenced in any systematic manner by restrictions on the repatriation of FDI related income, or the level of host country corporate tax.

Alternative measures of human capital and trade openness are introduced in regressions four and five. First, the population adjusted measure of trade openness, *Openness adjusted* is used in lieu of *Openness* and then *Years of secondary schooling* is used as a substitute for *Years of schooling*. The modified openness variable appears to make little difference to the results. Like *Openness*, *Openness adjusted* features the expected positive sign but is insignificant at the 10 per cent level. However, the alternative human capital proxy, based on years of secondary schooling, is insignificant. This suggests some fragility may exist in the relationship between *Technology transfer* and levels of educational attainment.

The magnitude of the coefficient on *Ownership restrictions* implies that a change in policy to allow the establishment of at least some wholly owned foreign affiliates would lead to an increase in technology payments of approximately 0.35 cents per dollar of sales. This represents a significant increase relative to the average level of payments across the full sample. In comparison, the coefficient on *Years of schooling* implies that technology payments would rise by around 0.07 cents per dollar in response to a one year increase in the average level of educational attainment.

Table 6.2: Determinants of MNE technology transfer, full sample

	1	2	3	4	5
Ownership restrictions	-0.346**	-0.356**	-0.34**	-0.331**	-0.357**
	(0.165)	(0.166)	(0.165)	(0.165)	(0.164)
Openness	0.139	0.102	0.082		0.061
	(0.145)	(0.157)	(0.154)		(0.153)
Openness adjusted				0.116	
				(0.153)	
Years of schooling	0.079***	0.073***	0.064**	0.066**	
	(0.026)	(0.028)	(0.027)	(0.027)	
Years of secondary schooling					0.075
					(0.047)
Contract intensive money	0.971	0.773	0.35	0.421	0.823
	(1.164)	(1.157)	(1.154)	(1.141)	(1.149)
Western hemisphere	-0.194	-0.186	-0.168	-0.153	-0.172
	(0.118)	(0.117)	(0.122)	(0.122)	(0.122)
Corporate tax		-0.04	-0.035	-0.031	-0.044
		(0.042)	(0.043)	(0.042)	(0.043)
Profit restrictions			-0.26	-0.265	-0.294
			(0.188)	(0.191)	(0.187)
Industry dummies	Yes	Yes	Yes	Yes	Yes
Chi-square statistic	88***	88***	93***	93***	93***
Pseudo R-squared	0.18	0.18	0.19	0.19	0.18
Obs.	427	422	422	422	422

Notes: the dependent variable *Technology transfer* is the ratio of payments of royalties and licence fees to total sales for US MNE manufacturing affiliates, by industry and country. All results derived using Tobit estimation technique. All specifications include a constant term and industry dummy variables that are not reported for brevity. Reported coefficients are marginal effects derived from the unconditional expected value of the model. Robust standard errors reported in parentheses while ***, ** and * demote statistical significance at the 1, 5 and 10 per cent level respectively. The pseudo R-squared is calculated as the correlation between the fitted and actual values of the dependent variable while the chi-square statistic is a joint test of model significance. See appendix 6.2 for definitions and sources.

The lack of statistical support for the hypothesis that property rights or trade openness influences technology transfer is somewhat surprising but may reflect the quality of the proxy variables used. While greater openness to trade is expected to enhance competition by exposing domestic firms to foreign rivals there are likely to be many other factors, notably government regulations, which also influence competition. The proxy for IPR, *Contract intensive money*, also has limitations. In particular, as noted above, this variable is designed to reflect the strength of private property rights at large, rather than IPR specifically. Alternatively, these results may indicate differences in the relevance of these variables for different groups of countries, an issue which is examined in the next section.

6.4.3 Developing and industrialised country sub-sample results

The results reported in table 6.2 are based on the full sample of countries. Pooling countries in this manner assumes that the model coefficients are constant across all countries. However, it may be more reasonable to assume that at least some of the control variables affect technology transfer to MNE affiliates in industrialized and developing economies differently. This is especially so if production processes and technology usage differs between these groups of countries. As noted above, affiliates which are the recipients of the highest levels of technology transfer tend to be located in industrialised countries. This suggests that higher technology production is concentrated in industrialised countries, possibly owing to complementarities between human capital and disembodied technology. In this case it is likely that the strength of intellectual property rights, for example, will matter more in industrialised countries.

To examine whether the model coefficients differ between developing and industrialised countries a Chow test is undertaken. As in chapter 5, this test involves estimating a model of technology transfer using the full sample and adding to the baseline model interaction terms between each of the explanatory variables and an industrialised country dummy variable. Inferences about whether the slope coefficients differ between the industrialised and developing countries are made by examining the coefficients on the interaction terms. An overall assessment of differences between the two groups of countries can then be made by applying an F-test of joint significance to the coefficients of the interaction terms.

The null hypothesis that all of the interaction terms are insignificant is rejected at the 1 per cent level. Therefore, the test indicates that the slope coefficients do indeed differ between industrialised and developing countries. On this basis, models are separately estimated using sub-samples for each of these groups. The results for developing countries are reported in table 6.3 and in table 6.4 for industrialised countries.

For the developing country sub-sample, the same specifications used to generate the results reported in table 6.2 are again used. For this sub-sample the pseudo R-squared is fractionally lower while the chi-square test statistic indicates the specifications are again highly significant. The coefficient on *Ownership restrictions* is again negative and significant, albeit at the 10 per cent level. The magnitude of the coefficient is once

again large, suggesting that the removal of this policy restriction would increase technology transfer to MNE affiliates markedly.

As with the results based on the full sample, the coefficients on *Contract intensive money* and alternative measures of openness are again insignificant. A notable difference, however, is that the coefficients on the human capital variables are insignificant in a majority of specifications. This is perhaps surprising given prior expectations regarding the importance of human capital.

Table 6.3: Determinants of MNE technology transfer, developing countries

	1	2	3	4	5
Ownership restrictions	-0.299*	-0.294*	-0.282*	-0.275*	-0.291*
	(0.166)	(0.166)	(0.164)	(0.165)	(0.164)
Openness	0.071	0.014	-0.008		-0.028
	(0.157)	(0.172)	(0.167)		(0.173)
Openness adjusted				0.028	
				(0.169)	
Years of schooling	0.099*	0.063	0.057	0.059	
	(0.051)	(0.057)	(0.056)	(0.056)	
Years of secondary schooling					0.082
					(0.149)
Contract intensive money	-0.213	-0.19	-0.768	-0.762	-0.626
	(1.373)	(1.395)	(1.383)	(1.373)	(1.39)
Western hemisphere	-0.151	-0.129	-0.121	-0.098	-0.122
	(0.18)	(0.178)	(0.18)	(0.182)	(0.178)
Corporate tax		-0.088*	-0.076	-0.071	-0.087*
		(0.049)	(0.053)	(0.052)	(0.05)
Profit restrictions			-0.286	-0.283	-0.294
			(0.181)	(0.188)	(0.182)
Industry dummies	Yes	Yes	Yes	Yes	Yes
Chi-square statistic	34***	38***	48***	48***	52***
Pseudo R-squared	0.17	0.17	0.17	0.17	0.16
Obs.	193	190	190	190	190

Notes: results derived using developing country sub-sample. Other notes as for table 6.2.

The same empirical specifications estimated with the full sample are applied to the industrial country sub-sample with one exception. The FDI policy indicator *Ownership restrictions* is not included as this type of policy restriction does not apply in any industrialised country. For this sub-sample the pseudo R-squared falls to around 0.1 but the chi-square test statistic of model significance indicates the specifications are highly significant.

The results for the industrialised country sub-sample differ considerably from those reported using both the full sample and the developing country sub-sample. First, the proxy for property rights protection, *Contract intensive money*, is positive and highly significant, indicating that stronger IPR encourages greater technology transfer to affiliates located in industrialised countries. Second, alternative trade based proxies for market competition, *Openness* and *Openness adjusted*, are also positive and significant. This result supports the hypothesis that greater market competition, brought about by trade openness, encourages technology transfer to affiliates. It is also consistent with the findings of Blomstrom et al. (1994a) and Kokko and Blomstrom (1995), who find that technology transfer is positively correlated with alternative proxies for market competition.

Table 6.4: Determinants of MNE technology transfer, industrialised countries

	1	2	3	4	5
Openness	0.827**	1.048**	1.057***		1.049***
	(0.398)	(0.405)	(0.404)		(0.402)
Openness adjusted				1.134***	
				(0.414)	
Years of schooling	-0.001	-0.012	-0.007	-0.006	
	(0.044)	(0.044)	(0.039)	(0.039)	
Years of secondary schooling					-0.025
					(0.054)
Contract intensive money	5.503***	5.916***	6.051***	6.258***	6.042***
	(1.991)	(2.015)	(2.113)	(2.127)	(2.052)
Western hemisphere	-0.088	0.028	0.019	0.02	0.032
	(0.192)	(0.202)	(0.2)	(0.199)	(0.188)
Corporate tax		0.118*	0.118*	0.118*	0.118*
		(0.07)	(0.07)	(0.069)	(0.069)
Profit restrictions			0.161	0.191	0.143
			(0.56)	(0.561)	(0.567)
Industry dummies	Yes	Yes	Yes	Yes	Yes
Chi-square statistic	96***	99***	98***	98***	98***
Pseudo R-squared	0.11	0.09	0.08	0.08	0.08
Obs.	234	232	232	232	232

Notes: results derived using industrialised country sub-sample. Other notes as for table 6.2.

Neither of the human capital proxies are significant which is again surprising given the hypothesised importance of absorptive capacity to the successful transfer and utilisation of technology. Collectively, the three reported sets of results suggest that human capital may be somewhat important as a general determinant of technology across all countries. Indeed differences in human capital may offer a partial explanation as to why MNE affiliates in developing countries receive on average considerably less technology than

affiliates located in industrialised countries. At the same time the results suggest that amongst countries of similar levels of development, differences in human capital do not markedly affect levels of technology transfer. Nevertheless, given the low degree of variation in the human capital variable, particularly amongst industrialised countries, some caution must be exercised in interpreting this result.

A final difference in the results for the industrialised country sub-sample is that the coefficient on the *Corporate tax* variable is positive and statistically significant. It is possible that this result reflects MNEs manipulating payments in order to minimise tax liabilities. However, as noted in section 6.2.1, legal sanctions on misreporting imposed by the US and other governments make this doubtful. An alternative explanation for this finding is that the tax variable is picking up higher technology payments to industrialised countries specialising in advanced manufacturing which also happen to impose relatively high tax rates. Many of the industrialised countries where affiliates attracted the highest levels of transfer were concentrated in northern Europe, where tax burdens are generally above industrialised country averages.

6.5 Conclusion

This chapter presents an analysis of the determinants of technology transfer to MNE affiliates using industry level data on technology payments by US MNE manufacturing affiliates. As with the previous chapter it aims to provide some direct empirical evidence of the policies and other host country characteristics that influence an underlying determinant of the productivity of FDI. Consistent with the theme in this thesis, of particular interest in the analysis are the role of FDI policies, particularly restrictions on foreign ownership, trade openness and host country human capital. The results indicate that all three factors play some role in affecting technology transfer to MNE affiliates.

The first set of results draw on a general sample comprising both developing and industrialised countries. Additional separate results are also estimated for each of these groups. The FDI ownership policy indicator presented in chapter 4 is used in the analysis to test the role of FDI policies. Robust evidence is found that this variable exerts a negative impact on technology payments, both in the general sample and the developing country sub-sample. Moreover, the magnitude of the coefficient on this variable suggests that liberalising FDI policies to allow the establishment of some fully

foreign owned MNE affiliates would increase aggregate technology transfer considerably.

Consistent with theories of absorptive capacity, some evidence is found of a positive relationship between technology transfer and levels of human capital. However, this result is sensitive to the choice of sample. The results on trade openness and private property rights protection is also sensitive to the sample, with a positive link between these variables and technology transfer identified for industrialised countries only. One possible explanation for this latter finding is that the latest innovations tend to be the preserve of affiliates located in industrialised countries, owing to greater absorptive capacity requirements. In this case, differences in property rights between industrialised countries will matter more than differences across all countries.

Having provided some direct empirical evidence that FDI and trade policies, as well as human capital, influence technology transfer to multinational affiliates, the next chapter examines whether these variables impact on the growth effects of FDI.

Appendix 6.1 Descriptive statistics and supplementary results

Table A6.1: Summary of statistics

	Mean	Standard deviation	Minimum	Maximum
Technology transfer	1.202	1.382	0	12.204
Ownership restrictions	0.082	0.275	0	1.000
Openness	0.568	0.561	0.128	3.207
Years of schooling	7.185	2.282	2.564	11.624
Contract intensive money	0.891	0.054	0.721	0.985
Profit restrictions	0.138	0.345	0	1
Corporate tax	2.760	1.556	0.206	9.194

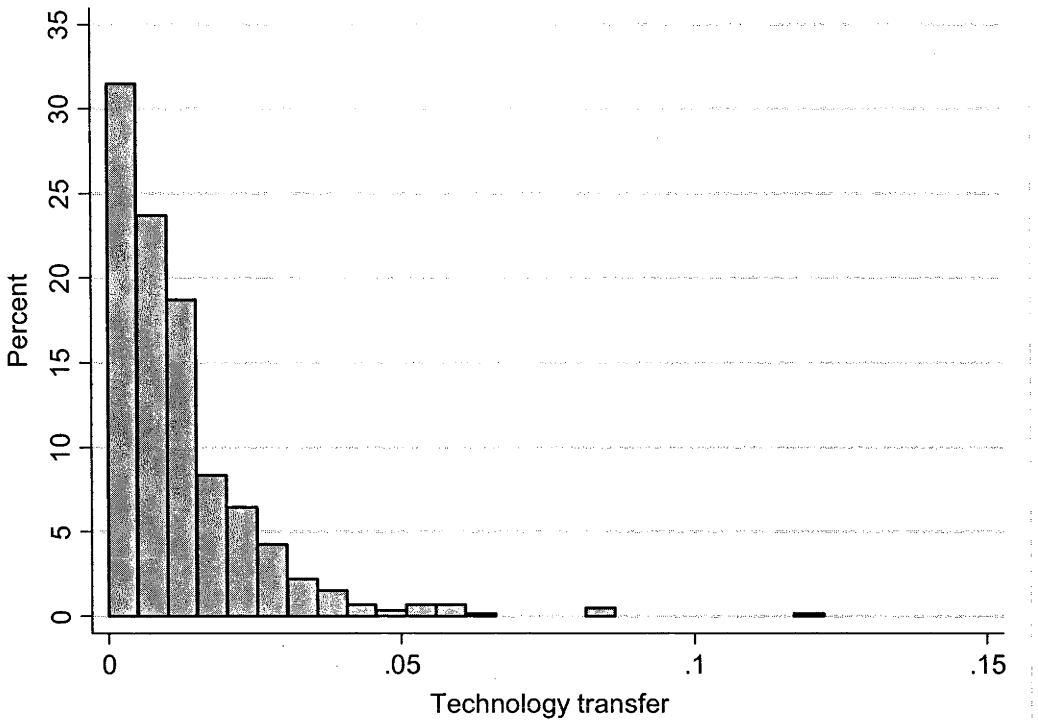
Notes: see appendix 6.2 for definitions and sources.

Table A6.2: Correlation matrix

	Technology transfer	Ownership restrictions	Openness	Years of schooling	Contract intensive money	Profit restrictions
Ownership restrictions	-0.132					
Openness	0.094	-0.123				
Years of schooling	0.147	-0.305	-0.025			
Contract intensive money	0.092	-0.397	-0.011	0.510		
Profit restrictions	-0.119	0.286	-0.173	-0.388	-0.418	
Corporate tax	-0.101	0.153	-0.327	-0.174	-0.025	0.191

Notes: see appendix 6.2 for definitions and sources.

Figure A6.1: Distribution of technology transfer



Notes: histogram of *Technology transfer*, based on BEA data for the years 1982, 1989 and 1994. See appendix 6.2 for definition and source.

Table A6.3: Determinants of technology transfer, random effects

	1	2	3	4	5
Ownership restrictions	-0.445***	-0.451***	-0.433**	-0.417**	-0.456***
	(0.166)	(0.166)	(0.171)	(0.17)	(0.17)
Openness	0.215	0.204	0.194		0.174
	(0.192)	(0.203)	(0.2)		(0.2)
Openness adjusted				0.229	
				(0.2)	
Years of schooling	0.089**	0.086**	0.082**	0.084**	
	(0.035)	(0.036)	(0.035)	(0.035)	
Years of secondary schooling					0.108*
					(0.061)
Contract intensive money	0.034	-0.145	-0.354	-0.269	0.137
	(1.267)	(1.274)	(1.27)	(1.254)	(1.258)
Western hemisphere	-0.176	-0.159	-0.147	-0.124	-0.15
	(0.151)	(0.149)	(0.157)	(0.156)	(0.157)
Corporate tax		-0.014	-0.011	-0.008	-0.02
		(0.044)	(0.045)	(0.045)	(0.045)
Profit restrictions			-0.134	-0.151	-0.16
			(0.222)	(0.226)	(0.223)
Industry dummies	Yes	Yes	Yes	Yes	Yes
Chi-square statistic	83***	83***	87***	87***	86***
R-square	0.19	0.19	0.19	0.19	0.19
Obs.	427	422	422	422	422

Notes: results derived using random effects estimation technique. Other notes as for table 6.2

Table A6.4: Chow test for structural break

Ownership restrictions	-0.452*
	(0.247)
Openness	0.073
	(0.154)
Years of schooling	0.062
	(0.063)
Contract intensive money	-2.128
	(1.809)
Western hemisphere	-0.145
	(0.233)
Corporate tax	-0.07
	(0.056)
Profit restrictions	-0.292
	(0.234)
Industrialised dummy	-9.259***
	(3.18)
Openness x Industrialised dummy	1.18***
	(0.411)
Years of schooling x Industrialised dummy	-0.023
	(0.088)
Contract intensive money x Industrialised dummy	9.283***
	(3.502)
Western hemisphere x Industrialised dummy	0.062
	(0.463)
Corporate tax x Industrialised dummy	0.217**
	(0.091)
Profit restrictions x Industrialised dummy	0.888*
	(0.515)
Industry dummies	Yes
Chi-square statistic	104***
Obs.	422

Notes: results derived using random effects estimation technique. *Industrialised dummy* equal to one for industrialised countries. Other notes as for table 6.2.

Appendix 6.2 Data definitions and sources

Technology transfer: ratio of total US MNE affiliate payments of royalties and licence fees to total sales, by manufacturing industry and host country. All data measured in nominal US dollars. Value of payments is scaled by 100 so that ratio represents US cents per US dollar of sales.
Source: Bureau of Economic Analysis, US Department of Commerce

Ownership restrictions: binary variable equal to one if country imposes mandatory joint venture requirement, as described in chapter 4.

Profit restrictions: binary variable equal to one if country imposes restrictions on the repatriation of FDI related income, as described in chapter 4.

Openness: ratio of exports plus imports to GDP. All data measured in nominal US dollars.
Source: IMF International Financial Statistics, World Bank World Development Indicators and World Bank Growth Resources Database (Easterly 2001).

Openness adjusted: population adjusted measure of *Openness* estimated by regressing *Openness* on total population.
Source: trade data as for *Openness*, population data from World Bank World Development Indicators online database and for Taiwan only, Penn World Table (Heston et al. 2002).

The regression applied is as follows (standard error in parentheses):

Openness = 0.6369 - 0.0005*Population
(0.00004)

Years of schooling: total years of schooling of workers 25 years and older.
Source: Barro and Lee (2001).

Years of secondary schooling: total years of secondary schooling of workers 25 years and older.
Source: Barro and Lee (2001).

Corporate tax: income taxes paid by US MNE manufacturing affiliates divided by total sales, by industry and host country. All data measured in nominal US dollars.
Source: Bureau of Economic Analysis, US Department of Commerce.

Contract intensive money: proportion of broad money (M2) held in forms other than currency. All data measured in nominal local currency units.
Source: IMF International Financial Statistics online database and International Financial Yearbook, various editions.

Western hemisphere: dummy variable equal to one for countries located within North, Central or South America.

Table A6.5: Country sample

Argentina	Ireland*
Australia*	Israel
Austria*	Italy*
Belgium*	Japan*
Brazil	Korea
Canada*	Malaysia
Chile	Mexico
China	Netherlands*
Hong Kong	New Zealand*
Colombia	Norway*
Costa Rica	Peru
Denmark*	Philippines
Dominican Republic	Portugal*
Ecuador	Singapore
Egypt	South Africa
Finland*	Spain*
France*	Sweden*
Germany*	Thailand
Greece*	Turkey
Guatemala	United Kingdom*
India	Venezuela
Indonesia	

Notes: * denotes industrialised country.

Chapter 7

Heterogeneous growth effects of FDI: evidence from cross-country data

7.1 Introduction

This chapter takes the final step in testing the core hypothesis examined in this thesis that host country factors influence the growth effects of FDI. As discussed in chapter 3, host country factors are hypothesized to alter the nature of multinational production a country will tend to attract and as a consequence, the growth effect of the associated FDI. The empirical analyses presented in chapters 5 and 6 provide new evidence supporting the first part of this hypothesis. Results indicate that liberal trade and FDI policies, as well as investment in human capital, increase MNE affiliate export orientation and or the level of technology transfer to affiliates. On this basis, it is expected that these policies should also influence the growth effects of FDI.

The chapter builds on a number of existing studies discussed in chapter 3 which incorporate host country factors in a general empirical model of long run growth that includes FDI as an explanatory variable. These studies provide some support in favour of the hypothesis that host country factors, including trade policies and human capital, affect the growth effects of FDI. However, there is little analysis of the impact of FDI policies, or whether host country factors have any complementary effects. The aim of this chapter is to address this gap.

The impact of FDI policies is examined using the FDI policy dataset presented in chapter 4. As these indicators are available for a large number of countries over a lengthy period they present one of the few available options for investigating the relevance of FDI policies in a long run framework. The impact of FDI policies are examined in isolation and in conjunction with measures of trade openness and human capital. This enables a broad assessment of the role of liberalisation and absorptive capacity in conditioning the growth effects of FDI.

The analysis draws on cross-country data for a diverse sample of countries, spanning the period 1971 to 2000. In response to criticisms levelled at these types of studies careful attention is paid to the estimation methodology employed. Efforts are made to address

endogeneity bias by applying instrumental variable techniques, model uncertainty through the inclusion of a diverse set of explanatory variables, and heterogeneity through experimentation with different samples and interaction terms.

The next section provides a concise review of the cross-country growth empirics literature. This is used to motivate the methodology and model specification, which is discussed in section 7.3. The results of the analysis are presented and discussed in section 7.4 while section 7.5 concludes. Supplementary results, data sources and additional details on the empirical techniques are presented in the appendices.

7.2 A concise survey of the growth empirics literature

The past two decades have seen an outpouring of empirical research that aims to identify the sources of long run economic growth. This work shares the common approach of analysing partial correlations between some measure of output growth and a range of explanatory variables, using data for a wide sample of countries. There is, however, diversity in terms of the specific methodology employed.

While some studies are firmly grounded in theory others take a more informal approach to model specification. Early analyses tended to employ cross-section data but more recent contributions have used panel data that exploit within country variation and allow the application of more advanced methods designed to address a range of long standing technical problems including endogeneity bias. Motivated in part by advances in growth theory and the availability of new data, there has also been a trend towards examining the relevance of a range of new variables and incorporating these and existing variables using innovative approaches such as with interaction terms and in non-linear specifications.

One of the weaknesses of this literature is that, as most studies solely examine partial correlations between different variables and growth outcomes, the precise channels through which factors influence growth are often left unidentified. Nevertheless, it remains a useful approach for identifying common empirical regularities. Further, it remains one of the only options for examining empirically many country specific factors that are either time invariant or slow to change.

No attempt is made here to provide a comprehensive review of the vast empirical growth literature. However, in order to motivate the different empirical specifications

considered in this analysis, a brief overview of some of the key results is presented in the following section.[53] This discussion is arranged around three categories of explanatory variables that either theory suggest are important or have been found to be robustly correlated with some measure of growth in a number of empirical studies. These include measures of factor accumulation and initial conditions (which capture the process of conditional convergence), government and policy related variables and other relevant factors.

7.2.1 Factor accumulation and initial conditions

One of the key predictions of the Solow-Swan growth model is that changes in the capital labour ratio cannot drive a perpetual expansion in labour productivity. However, with changes in the capital labour ratio adjusting slowly in response to changes in the savings and investment rate, a higher rate of investment will result in faster growth to the new steady-state equilibrium. In an alternative theoretical framework, with an augmented production function that incorporates an additional factor of production such as human capital, diminishing returns to physical capital may be avoided and increases in the investment rate can drive faster perpetual growth.

Based on either of these postulates, one would expect a positive relationship between the rate of capital accumulation and output growth. This is a common empirical observation, indeed different proxies for the rate of physical capital accumulation are one of the most robust explanatory variables in growth regressions (Levine and Renelt 1992; Sala-i-Martin 1997; Hoover and Perez 2004). However, some have argued that the observed strong correlation between investment rates and growth is due to reverse causation, a criticism found to have some empirical support. For example, in applying Granger causation analysis Blomstrom et al. (1996) find that past investment rates are not correlated with current growth rates whereas past growth rates are correlated with current investment rates. There is also some evidence that certain types of physical investment have a stronger impact on growth. For example, De Long and Summers (1991; 1993) find that the rate of return on investment in machinery and equipment is higher than for investments in dwellings and structures.

As discussed in chapter 2, theory highlights two mechanisms by which human capital affects economic growth. First, if human capital represents a direct factor of production

[53] This discussion draws heavily from Hill and Hill (2005).

higher rates of investment in human capital will drive faster growth (Rebelo 1991). Second, as postulated in many endogenous growth theories such as Romer (1990a), human capital may be important for creating knowledge or aiding knowledge diffusion from a more technologically advanced country. In this case higher levels of human capital would be expected to drive higher growth. However, the results on the impact of human capital in empirical growth studies are mixed, with a sizeable number of studies failing to detect any robust correlation. This is not only surprising in light of the predictions of growth theory but also contrast with many microeconomic based empirical studies that find significant, positive rates of return from education (Krueger and Lindahl 2001).

A number of early studies using cross-sectional data report a robust correlation between the level of human capital and growth outcomes but differ in their interpretation. For example, Barro (1991) and Barro and Lee (1994) include measures of the initial stock of human capital, proxied by enrolment or educational attainment data. The authors interpret this finding as evidence that higher levels of human capital are associated with higher rates of transitionary growth to the steady-state. Benhabib and Spiegel (1994) separately test for whether growth rates are contemporaneously correlated with levels or growth rates of human capital and find a significant correlation in the levels specification only. They interpret this as support for the hypothesis that higher levels of human capital facilitate knowledge diffusion. However, Temple (1999) argues that the weak results Benhabib and Spiegel report for growth in human capital stocks might be due to influential outliers.

More recent studies which make use of panel data and more sophisticated econometric techniques to control for estimation problems, including country specific effects, also report mixed results. Islam (1995) and Caselli et al. (1996) fail to find any robust relationship. In contrast Bassanini and Scarpetta (2002), who apply a pooled mean-group estimator that allows for both short and long run dynamics to a sample of industrialised countries find evidence that higher rates of human capital accumulation are associated with faster growth.

One possible explanation for the weak results relating to human capital is measurement error. For a sample of industrialised countries, de la Fuente and Domenech (2001) build on a dataset devised by Barro and Lee (1996) using other international and national

sources to generate what they claim are more precise indicators of educational attainment. Using this particular measure they find that the rate of growth in the stock of human capital, proxied by changes in educational attainment, is robustly correlated with output growth. Similarly, Cohen and Soto (2007) also devise a new dataset on educational attainment and report a robust link between the growth of the human capital stock and output growth. Finally, other studies using data on internationally comparable test scores also report stronger evidence on the role of human capital accumulation (Hanushek and Kimko 2000; Barro 2001).

Aside from the inclusion of basic factors of production, almost all cross-country growth studies include the initial (lagged) level of some measure of productivity as an explanatory variable. The coefficient on this variable is often found to be negative and statistically significant, supporting the β-convergence hypothesis that, *ceteris paribus,* poorer countries tend to grow faster than rich countries. This finding has been reported for studies using both cross-section and panel data, in conjunction with more sophisticated techniques.[54]

One interpretation of this result, consistent with the findings of a range of historical country and industry level studies, as well as theoretical models of technological diffusion, is that technological backwardness provides an opportunity for growth through a process of catch-up.[55] An alternative interpretation, based on the dynamics of the Solow-Swan model and often referred to as classical convergence, is that lagged labour productivity reflects the distance between actual output and the steady-state level of output (Mankiw et al. 1992). In this case the finding of a negative coefficient on this term is interpreted as supporting evidence of convergence occurring through a process of capital deepening. This latter interpretation is, however, problematic where the empirical analysis uses capital stock data rather than a proxy for the savings or investment rate (Rogers 2003).[56]

[54] For studies using cross-section data see for example Baumol (1986), Dowrick and Nguyen (1989) and Barro (1991), and using panel data Islam (1995), Caselli et al. (1996), Lee et al. (1997) and Dowrick and Rogers (2002).
[55] For example Barro and Sala-i-Martin (1997).
[56] Other empirical studies, which suggest that a large proportion of the international variation in output levels is due to factors other than factor accumulation, also lend support to the technological convergence hypothesis (see for example Hall and Jones (1999) and Easterly and Levine (2001)).

7.2.2 *Government and policy*

A range of policy variables are likely to influence technical and allocative efficiency, thereby impacting on growth outcomes directly, or by altering the incentives and opportunities for factor accumulation, impacting on growth indirectly. Amongst the most common types of direct policy variables assessed in empirical growth studies are policies relating to international trade openness, macroeconomic stability and the size and nature of government expenditures.

Beginning with openness to international trade, it has been hypothesized that this policy variable affects long run economic performance through a multitude of channels (Berg and Krueger 2003). Openness may reduce inefficiencies by spurring market competition and lessen opportunities for rent seeking and encourage specialization that in turn may facilitate greater economies of scale. Finally, openness increases opportunities for trade in capital equipment that embodies new technology, thereby facilitating knowledge diffusion from abroad.[57]

A large body of empirical evidence, using different measures of both trade regimes and measures of revealed openness to trade have found this variable to be robustly correlated with growth (see for example Dollar (1992), Sachs and Warner (1997) and Edwards (1998)). Many of these studies have been the subject of a wide ranging criticism relating to measurement error and especially endogeneity bias (Rodriguez and Rodrik 2000).[58] Nevertheless, using refined measures of trade openness and instrumental variable techniques Dollar and Kraay (2004) report results consistent with greater trade openness promoting higher growth.

The orthodox view of economic management and growth, espoused by Fischer (1993) amongst others, contends that a relatively stable macroeconomic environment is a prerequisite for sustained growth. However, as with the link between growth and some other policy variables, the precise theoretical linkages are not always clear (Temple

[57] It is worth noting that many of the hypothesised beneficial affects of greater openness to trade may be static, suggesting that openness and the dynamic process of growth may be unrelated. However, it is possible that many of these static effects play out over long time horizons. Moreover, as noted in chapter 3, endogenous growth theory highlights a role for openness in facilitating technology diffusion which is a dynamic determinant of growth (see for example Rivera-Batiz and Romer (1991)).

[58] In a separate critique, Vamvakidis (2002) examines the growth-openness nexus since 1870 and argues that the finding of a robust, positive correlation is sensitive to the period examined. In particular, he reports that the strongest correlation between openness and growth appears to exist for the period since 1970, which corresponds to the period most cross-country studies cover, and that for earlier periods there is a general lack of evidence of a positive correlation.

2000). In addition, defining exactly what constitutes macroeconomic stability and assessing whether it has ongoing or temporary effects on growth is problematic and this is born out in some empirical studies. Bruno and Easterly (1998) argue that the general cross-country correlation between inflation and growth tends to break down as the sample period expands, consistent with the hypothesis of money neutrality. Also, significant findings for macroeconomic stability are sometimes sensitive to the inclusion of crisis-afflicted countries that experience sustained high inflation.

Governments may also influence growth through their decisions to produce and consume. Government activity can crowd out and distort private investments, particularly where access to credit is limited. Equally, government expenditure on projects with strong public good characteristics may generate high social returns with positive spillovers to the private sector.

The weight of empirical evidence appears to suggest a negative relationship between the size of government and growth performance. Specifically, a number of cross-country studies show that the ratio of government consumption to output is negatively correlated with growth (Barro and Lee 1994; Barro 2001; Folster and Henrekson 2001). However, using cross-country data Easterly and Rebelo (1993) report a positive correlation between certain types of public investment and growth. This suggests that the composition of government expenditures is important.

7.2.3 Other factors

The enforcement of contracts and the safeguarding of private property rights are a fundamental requisite for most forms of economic activity, including production and exchange. Many empirical studies of growth have attempted to examine the impact of property rights security and in general the results from these conform to expectations. However, accessing data that accurately gauges property rights security remains a major challenge.

Many studies employ indicators of investment risk and contract enforcement, constructed by private ratings agencies, either directly or in conjunction with an instrumental variable based on geographic or historical factors (see for example Knack and Keefer (1995), Hall and Jones (1999) and Acemoglu et al. (2001)). A limitation of using these subjective measures of property rights is that they may be affected by

economic performance if those formulating the data are subtly influenced by good or bad economic news for a particular country. This weakness has led to the development of alternative measures of property rights protection including the measure proposed by Clague et al. (1999) used in chapter 6.

Although not a policy lever, in the sense of the variables discussed above, like various policy variables, financial sector development may support growth directly, by facilitating the efficient allocation of resources and indirectly, by encouraging savings and capital formation. Using cross-country data King and Levine (1993) test for correlations between a number of different measures of financial development, and growth rates and other indicators of economic performance. Their results provide support for the hypothesis that financial development aids growth with strong contemporaneous correlations between the variables of interest reported. In a more recent study, Benhabib and Spiegel (2000) conduct a similar exercise that makes use of panel data. They generate similar results, although these are sensitive to the inclusion of country specific effects.

Like macroeconomic stability, political stability may represent a necessary though not sufficient condition for growth. Sudden adverse changes in the political environment are likely to damage confidence in the security of property rights and weaken incentives to participate in exchange and engage in factor accumulation. However, political stability is multifaceted and it is likely that some aspects of political instability will be a greater hindrance to economic activity than others. Frequent changes in the executive, for example, may not be adverse for growth where a commitment to sound and predictable policy settings is maintained. In this respect the quality and independence of the bureaucracy can play an important role. Accounting for these subtle nuances in an aggregate measure of policy stability is, however, difficult.

An additional political factor considered in some empirical growth studies is the type of political regime. This is often done to test a prior expectation that a more open and competitive political system is more consistent with an environment conducive to productive economic activity. A number of studies have included some indicator of the type of political regime, often a dummy variable for whether a country is deemed to be democratic (see for example Barro and Lee (1994)). However, there is no doubt that, as the East Asian experience clearly demonstrates, authoritarian regimes can bring about a

sound economic environment that is conducive to growth, particularly in the early phases of development. By the same token, democratic regimes might not always be able to achieve this goal (Barro 1997).

Aside from political variables, the importance of other so-called 'soft factors' have also been highlighted. These include factors that have traditionally been seen by some as beyond the realms of mainstream economics. For example, empirical studies have examined the importance of social cohesiveness which may play an important role in helping to facilitate a range of economic activities where explicit contracts are difficult to monitor and enforce.

This issue is explored by Knack and Keefer (1997), who argue that 'social capital', is important for both encouraging factor accumulation and innovation. In addition, they suggest that greater social capital may have a range of indirect effects on growth owing to, for example, superior public policy outcomes as a result of greater political participation. The study reports a strong statistical association between growth outcomes and two measures of social capital derived from the *World Values Survey*. In a similar study, Temple and Johnson (1998) report that a composite index of social capability is a good predictor of subsequent long run growth performance.

Some have argued a key factor in explaining poor growth performance in Africa, in particular, is ethnic fractionalisation. Like other forms of social disharmony, this may represent a fundamental constraint on economic activity, as well as contributing to an environment of polarization and poor policy outcomes. Supporting this view, Easterly and Levine (1997) report a strong negative association between the degree of ethnic fractionalisation, measured using a range of proxies, and both growth outcomes and sound policies.

Finally, different geographic and environmental factors are argued by some to be very influential in shaping long run economic performance (Bloom et al. 1998). A tropical climate may increase the prevalence of disease, thereby retarding productivity as well as reducing the incentive for investments in human capital. This type of climate is also associated with lower yields for certain types of staple crops. It is also possible that a tropical climate may limit opportunities for technology diffusion where innovations are

most suited to the temperate climates of innovative countries. This is likely to be especially so for innovations associated with agriculture.

7.3 Methodology and data

7.3.1 Assessing the role of host country factors

The three FDI policy indicators introduced in chapter 4, along with measures of trade policies and human capital are used to test the hypothesis that more liberal policies and higher investments in human capital enhance the growth effects of FDI. The impact of FDI policies is assessed by estimating a series of general growth equations using different samples based on prevailing FDI policies and examining differences in the estimated FDI coefficient. Any evidence that FDI is more productive or robustly correlated with growth in the sample comprising countries with liberal policies is interpreted as supporting the relevance of these policies in conditioning gains from FDI.

An alternative method for examining the relevance of FDI policies would be to interact each policy indicator with the FDI variable. However, since the policy indicators are binary and highly time invariant such an approach leads to multicollinearity problems. To illustrate, for a country that applies a particular FDI policy restriction, the policy indicator variable will take a value of one and the interaction term will take the same value as the FDI variable. Alternatively, where a particular policy restriction does not apply, both the policy indicator and the interaction term will take the value of zero.

The impact of trade policies and human capital are examined both individually and in conjunction with FDI policies. Since the proxies of trade policies and human capital used in the analysis are both continuous and time varying, the multicollinearity problem associated with interacting the FDI policy indicators noted above may be less severe. Therefore, two approaches are used to examine the impact of trade policies and human capital.

The first involves the same approach used to examine the impact of FDI policies. The general sample is divided in to sub-samples comprising countries that rank relatively high or low on measures of trade openness and human capital. Regressions are then estimated using each sub-sample and inferences made about the impact of trade policies and human capital by comparing results from the two sub-samples. The second approach uses the full sample to estimate a specification that incorporates an interaction

variable between FDI and either a measure of trade policies or human capital. In this approach inferences regarding the relevance of trade policies and human capital are made by direct inspection of the coefficient on the interaction term.

The possibility of two way interactions between FDI policies and either trade policies or human capital are also examined. The approach taken to examine this issue is to include interactions between the FDI variable and either proxies for trade policies or human capital separately for sub-samples comprising countries with and without FDI policy restrictions. This makes it possible to control for FDI policies while also examining the impact of trade policies or human capital.

7.3.2 Model specification

The core empirical specification is based on an aggregate production function where per capita output is assumed to be a function of physical capital and factors that influence total factor productivity. Given the focus of the analysis, physical capital is disaggregated in to FDI and domestically sourced investment. This approach to model specification ensures that all forms of physical capital, which represent an important determinant of labour productivity, are controlled for, while also allowing for an assessment of the heterogeneous growth effects of FDI. The empirical model used in this analysis can be represented by the following equation:

$$\Delta ln\, y_{it} = \beta ln\, y_{i(t-\tau)} + \phi x_{it} + \delta k_{it} + \alpha f_{it} + \lambda_i + \varepsilon_{it} \qquad (7.1)$$

Where y represents per capita output, k and f growth in the stocks of domestic and foreign capital respectively, x a vector of other control variables, λ time invariant unobservable country heterogeneity and ε the stochastic error term.

In order to remove the effects of short run fluctuations, following the approach adopted in a number of other growth studies, five year averages of the data are used rather than annual observations. Therefore, the dependent variable is the annualised growth rate of per capita output over a five year period. Lagged per capita output (*Initial per capita output*) is included to capture the effects of conditional convergence. This variable is the log level of per capita output at the beginning of each five year block in the panel. Like the dependent variable, all other explanatory variables represent averages over five year periods. With data for many of the variables of

interest available from 1970 to 2000, taking five year averages yields a maximum of six observations per country. However, missing data for some countries reduces this number in some specifications.

Growth in the stock of domestically sourced investment (*Domestic investment*) is calculated as growth in the stock of total investment less growth in the stock of foreign investment (*FDI*). From a methodological point of view it makes no difference whether *FDI* is included alongside a measure of total investment or *Domestic investment*. The decision to include domestic, rather than total, investment is made purely on presentational grounds, to allow an easy direct comparison of the total impact of *FDI* across different specifications. Given the limited availability of capital stock data for FDI and other forms of investment, ratios of investment spending to GDP are used to proxy growth in the stocks of domestic capital and FDI.

Output data are measured on a purchasing power parity (PPP) basis and taken from the Penn World Table (PWT) by Heston et al. (2002). In a cross-country context using data expressed in international prices provides a more meaningful comparison than data based on local currency measures (Dowrick 2005). Furthermore, in some instances, the availability of data is greater in the PWT. Data for total investment expenditures are also available on a PPP basis in the PWT. However, data on FDI, which are sourced from UNCTAD, are measured in nominal US dollars. Therefore, raw FDI data are first converted to international prices using the PPP investment deflator available in the PWT.[59] This ensures that all investment data used in the analysis are measured on the same internationally comparable basis.

A challenge in modelling the determinants of growth is adequately controlling for the determinants of total factor productivity, as reflected in the vector x in equation 7.1. Naturally the selection of explanatory variables should be informed by growth theory. However, there are limits as to how far this approach can be taken as different theories tend to highlight the importance of a single variable whereas the results of numerous empirical studies point to a wide range of factors as being important. A number of studies have sort to shed light on this issue by using different statistical methods to identify the variables most robustly correlated with growth. However, the results from

[59] See appendix 7.2 for details.

these studies appear to be sensitive to the technique employed and there remains no consensus on precisely which explanatory variables are the most important.[60]

As with any form of model uncertainty, this problem may lead to misleading inferences about the importance of particular explanatory variables. Observed partial correlations may simply result from a spurious correlation underpinned by a missing correlated explanatory variable (Rogers 2003). This problem is particularly severe in situations where the number of relevant explanatory variables is high and these are strongly correlated, both of which apply in the context of growth empirics.

To ameliorate the risk of using an overly parsimonious specification, the approach adopted in this analysis is to include a relatively diverse set of explanatory variables. Following other growth studies, variables are selected on the basis of theory and the results from existing empirical studies. In particular, variables which have been reported to be robustly correlated with growth in a large number of existing studies are included in this analysis.

Amongst the additional explanatory variables included, the stock of human capital (*Years of schooling*) is based on educational attainment data by Barro and Lee (2001). As in chapters 5 and 6, the main measure used is the total years of schooling amongst the working age population while a measure based on years of secondary schooling (*Years of secondary schooling*) is used as an alternative in some specifications. This variable is entered in level form by itself to capture the role of human capital in driving innovation and faster technology diffusion. It is also interacted with *FDI* to examine the absorptive capacity hypothesis.

As in chapters 5 and 6, trade policies are proxied using the ratio of total trade to GDP (*Openness*). Like *Years of schooling* this variable is entered by itself, to capture the direct impact of trade openness on growth and also as an interaction with *FDI*, to assess the impact of trade openness on the productivity of FDI. As noted in chapters 5 and 6, the ratio of trade to GDP is a crude proxy for trade openness and an attempt is made to improve on this by adopting the same modification applied in earlier chapters. The variable *Openness adjusted* is a population adjusted measure of *Openness* which

[60] See appendix 7.3 for details.

represents the trade to GDP ratio net of the effect of differences in country populations. It is derived by regressing *Openness* on population.

Additional explanatory variables are incorporated to control for other factors that are expected to impact on total factor productivity, drawing on the existing growth empirics literature outlined above in section 7.2. First, the size of government (*Government consumption*) is measured as the ratio of government consumption expenditure to GDP. Second, a measure of macroeconomic stability (*Inflation*) which is the annual change in the GDP price deflator. Third, the proxy for property rights protection based on monetary aggregates (*Contract intensive money*) proposed by Clague et al. (1999) and used in chapter 6. Finally, the level of financial development (*Financial depth*) is proxied using the ratio of M2 to GDP. Details on all variables are included in appendix 7.2.

7.3.3 Estimation strategy and data

Estimating a growth equation of the form of equation 7.1 presents a number of technical challenges. In particular, it is likely that most, if not all, of the explanatory variables are subject to some form of endogeneity bias. One source of endogeneity arises from two way causation between growth and many of the explanatory variables. It is not difficult to conceive of a situation where a shock to growth will also influence an explanatory variable such as investment. Indeed some studies provide formal statistical evidence supporting this conjecture, for both total and foreign investment (Blomstrom et al. 1996; Choe 2003; Li and Liu 2005).

A second source of endogeneity bias stems from omitted variables. As discussed above in section 7.2, theory and empirical evidence highlight a diverse set of factors that impact on growth, many of which are difficult to measure and control for satisfactorily. In addition, it is likely that at least some of these factors will be correlated with the explanatory variables, giving rise to biased estimates. To illustrate, controlling for all aspects of geography is likely to be difficult and at least some aspects of geography are likely to influence trade related variables.

The presence of unobservable country heterogeneity gives rise to an additional source of endogeneity bias in dynamic specifications such as equation 7.1. In this type of equation, time invariant unobservable factors will, by construction, be correlated with

the lag of the dependent variable, which features on the right hand side of the equation as the explanatory variable *Initial per capita output*. Therefore, the presence of unobservable country effects will necessarily lead to biased results when estimated with OLS.

The standard procedure for addressing omitted variable bias is to use a fixed effects estimation procedure. However, applying a fixed effects transformation to a dynamic equation such as the specification used here creates additional problems. In particular, the fixed effects transformation will induce a new type of endogeneity bias resulting from the lagged dependent variable being correlated with the transformed error term (Caselli et al. 1996).[61]

A variety of estimation techniques have been developed to addresses the problem of estimating dynamic panel models that feature unobservable heterogeneity. These build on Anderson and Hsiao (1981) who showed that the problem of the lagged dependent term being endogenous in the transformed model could be addressed by using lagged observations of this variable as an instrument for itself. This approach will be valid so long as there is no second order serial correlation.

Later, Arellano and Bond (1991) built on this idea by developing a Generalised Method of Moments (GMM) estimator that increased the efficiency of the Anderson and Hsiao (1981) approach by using additional lagged observations to expand the set of available instruments. This technique, often referred to as difference GMM, not only enables the lagged dependent term to be estimated using instrumental variables but also other explanatory variables that may suffer from simultaneity bias. Lagged observations of other explanatory variables are again used to form the set of instruments. This makes it an ideal method for estimating a specification of the form of equation 7.1 which is likely to suffer from simultaneity bias. A variation on this estimator, termed system GMM, is proposed by Arellano and Bover (1995) and Arellano and Bond (1998). This technique takes a slightly different approach to specifying the instrument set. Rather than just using the lagged levels of the endogenous variables as instruments, lagged differences are also employed.

[61] See appendix 7.4 for details.

These GMM estimators have been used in a large number of cross-country growth studies, beginning with Caselli et al. (1996) and including the study focussing on FDI by Carkovic and Levine (2005). On the basis of the problems posed by the estimation of dynamic specifications outlined above, and to ensure that the reported results are comparable with recent evidence, this analysis makes use of both difference and system GMM estimators.

To ensure these methods are valid, in each regression the results from two diagnostic tests are presented, in addition to a measure of the goodness of fit and a chi-square test of model significance. The first is a Sargan test of over identifying restrictions, which assesses the contemporaneous correlation between the full set of instruments and the residual in each period. This test provides an indicator of whether the lags of all the explanatory variables are satisfactory instruments. The second test reported is a test of second order serial correlation. As noted above, the validity of these estimators, in particular the use of lagged observations as instruments, depends on there being no second order (or higher) serial correlation.

The sample used in the analysis is determined by whether a country is included in the FDI regime dataset presented in chapter 4, as well as availability of data for other variables. A total of 85 countries are included in the sample, a small number of which are excluded from some specifications due to insufficient data for certain explanatory variables. Table A7.1 of appendix 7.1 provides a summary of each of the variables for the period 1971 to 2000, based on the five year averages in the sample. As one would expect there is considerable diversity in the sample.

Average annual per capita growth rates vary from a high of around 11 per cent for Botswana down to -11.4 per cent recorded in the Democratic Republic of Congo during the first half of the 1990s. Other countries to experience prolonged episodes of high average growth include Jordan during the late 1970s and China during the 1990s. The range of reported investment rates for both *Domestic investment* and *FDI* also varies considerably. The highest value for *FDI* is recorded for Belgium at over 23 per cent during the late 1990s. This figure represents a considerable outlier and presumably partly reflects merger and acquisition activity associated with European integration. Hong Kong and Singapore also recorded very high figures for *FDI*. At the other end of

the spectrum Botswana, Gabon and Panama all recorded periods of negative net outflows of *FDI*.

As detailed in table A7.2 of appendix 7.1, bivariate correlations between the dependent and explanatory variables included in the analysis conform to expectations. Per capita output growth is positively correlated with the three factor accumulation variables *Domestic investment*, *FDI* and *Years of schooling*, although the correlation coefficient is noticeably higher for *Domestic investment*. Other variables positively correlated with growth include *Openness*, *Financial depth* and *Contractive intensive money*. As expected both *Inflation* and *Government consumption* are negatively correlated with growth.

Bivariate correlations between *FDI* and the other explanatory variables also accords with prior expectations. FDI is positively correlated with all explanatory variables except *Inflation* and *Government consumption*. This includes *Domestic investment*, indicating an (albeit weak) complementarity between domestic and foreign sourced investment.

7.4 Results and discussion

Four main sets of results are presented below in tables 7.1 to 7.4. The first set of results, in table 7.1, provide a baseline for the analysis. The impact of *FDI* is examined in a range of different specifications using the full sample without controlling for the conditioning effects of host country factors. A parsimonious specification is first estimated and then additional control variables are added to examine whether results are sensitive to model specification. These provide evidence on the average effect of FDI on growth in a diverse sample of countries.

In table 7.2 results from applying the same specification to sub-samples based on prevailing FDI policies provides evidence on the conditioning impact of FDI policies. Tables 7.3 and 7.4 report results on the role of trade policies and human capital. In each table results are also presented controlling for FDI policies, with the aim of providing inferences on possible interactions between these factors and FDI policies.

7.4.1 Full sample results

The results presented in table 7.1 indicate that across the full sample FDI has a strong, positive impact on growth that is insensitive to the inclusion of other explanatory variables. Beginning with regression one, the most parsimonious specification, *Initial per capita output* has the expected negative sign, indicating support for the conditional convergence hypothesis, while *Domestic investment* and *FDI* feature the expected positive sign. All three variables are significant at conventional levels of significance in this and every other specification reported with this set of results.

The first variable added to this parsimonious specification, in regression two, is *Years of schooling*, which is again positive and significant in this and the majority of other specifications reported in table 7.1. In regression three, *Openness* features the expected positive coefficient but is marginally insignificant. However, in the expanded specifications (regressions four to seven) the coefficient for this variable becomes significant. From here the remaining explanatory variables are added, beginning with *Government consumption* which is positive and insignificant in all regressions. Next, *Inflation* features the expected negative coefficient and is highly significant. Finally, the proxy for property rights protection, *Contract intensive money*, and financial development, *Financial depth*, are added but are both insignificant.

The output elasticity of both *Domestic investment* and *FDI* varies somewhat across specifications but estimates are generally plausible. For *Domestic investment* the coefficient varies from a low of 0.16 to a high of 0.21 while *FDI* ranges from a low of 0.19 up to 0.4. Hence, the average output elasticity across domestic and foreign sourced investment appears to be similar to output elasticities for total investment derived in studies that adopt a similar methodology.[62] It is interesting to note that while the highest reported elasticity for *FDI* exceeds the highest elasticity for *Domestic investment*, in the most complete specification the coefficients are of a similar magnitude.

[62] For example, Dowrick and Rogers (2002) estimate output elasticities for total investment of between 0.19 and 0.23 using the same estimation technique and a similar data setup.

Table 7.1: Growth regressions, full sample

	1	2	3	4	5	6	7
Initial per capita output	-0.119*	-0.224**	-0.241***	-0.258***	-0.264***	-0.271***	-0.241***
	(0.062)	(0.09)	(0.073)	(0.073)	(0.07)	(0.066)	(0.057)
FDI	0.395***	0.331***	0.218**	0.204**	0.191**	0.245**	0.214*
	(0.144)	(0.096)	(0.098)	(0.103)	(0.096)	(0.109)	(0.122)
Domestic investment	0.162**	0.199***	0.213***	0.212***	0.198***	0.183***	0.203***
	(0.079)	(0.075)	(0.055)	(0.059)	(0.058)	(0.066)	(0.055)
Years of schooling		0.007*	0.007*	0.008**	0.006*	0.005	0.005*
		(0.004)	(0.004)	(0.004)	(0.003)	(0.004)	(0.003)
Openness			0.037	0.051**	0.056**	0.048***	0.049***
			(0.023)	(0.025)	(0.022)	(0.017)	(0.016)
Government consumption				0.025	0.066	0.06	0.023
				(0.049)	(0.048)	(0.053)	(0.046)
Inflation					-0.005***	-0.007***	-0.006**
					(0.002)	(0.002)	(0.002)
Contract intensive money						0.01	0.031
						(0.043)	(0.045)
Financial depth							-0.017
							(0.018)
Obs.	424	384	384	384	376	364	360
Pseudo R-squared	0.21	0.30	0.36	0.36	0.39	0.41	0.40
Chi-square	43***	74***	81***	87***	122***	104***	123***
Sargan test	0.06	0.26	0.47	0.81	0.99	1.00	1.00
Serial correlation	0.60	0.91	0.81	0.86	0.70	0.60	0.71

Notes: the dependent variable is annual growth in per capita output measured on a PPP basis averaged over a five year period. All explanatory variables except *Initial per capita output* represent averages over non-overlapping five year periods. *Initial per capita output* is the log level of output at the beginning of each five year period. Results derived using the difference GMM dynamic panel (twostep) estimator by Arellano and Bond (1991) using the xtabond2 Stata procedure by Roodman (2006). Heteroskedastic robust standard errors based on Windmeijer (2005) are reported in parentheses with ***, ** and * denoting significance at the 1, 5 and 10 per cent level respectively. The pseudo R-squared is calculated as the correlation between the fitted and actual values of the dependent variable while the chi-square statistic is a joint test of model significance. The Sargan test is a test of over identifying restrictions while the serial correlation test indicates the presence of second order serial correlation. See appendix 7.2 for definitions and sources.

A chi-square test of model significance, which tests whether the predicted value of the dependent variable differs between the full model and a model comprising a constant term only, indicates that all specifications are highly significant. The pseudo R-squared, derived as the correlation between the predicted and actual values of the dependent variable indicates that the expanded specifications explain around 40 per cent of the observed variation in growth outcomes across the sample. This is consistent with results from similar studies.

All of the results presented in table 7.1 are derived using the difference GMM estimator by Arellano and Bond (1991). As noted above, dynamic panel estimators of this type

require that there is no second order or higher serial correlation that would negate the use of lagged levels of output as instruments. The p-value of a test for the existence of such serial correlation is reported for each regression, where the null hypothesis is of no second order serial correlation. In all of the specifications reported in table 7.1 the null hypothesis cannot be rejected at conventional levels of significance, suggesting that serial correlation is not a problem.

The results for the Sargan test of over identifying restrictions for the use of lags of all explanatory variables as instruments is also presented in table 7.1. With this test, the null hypothesis is that the correlation between the instrument set and the residual term is zero. In all but the most parsimonious regression the null cannot be rejected, supporting the validity of using lags as instruments in each regression. Similar results for both the serial correlation and Sargan tests are reported for other results discussed below.

As noted in section 7.3.3, system GMM provides an alternative to the difference GMM technique used to generate the results in table 7.1. To examine whether these results are robust to the choice of estimation technique, all regressions are re-estimated using system GMM. The results, presented in table A7.3 of appendix 7.1, are noticeably different. In particular, many of the variables reported to be significant in table 7.1 are found to be insignificant. This includes *FDI* as well as proxies for trade policies and human capital, which are insignificant in every regression. Indeed *Domestic investment* and *Inflation* are the only variables consistently significant.

These results are troubling. They contrast sharply not only with the results derived using the difference GMM estimator but also the predictions of theory and the results reported in many existing empirical studies. This is especially so in the case of the trade openness variable which is invariably found to be positive and statistically significant in cross-country growth regressions. Further experimentation with the system GMM estimator for other regressions presented in this chapter (not reported) were also found to be problematic.[63] Indeed, these results mirror the unstable results reported by Carkovic and Levine (2005), who also use a system GMM method.

[63] For example, in the analysis incorporating an interaction term between *FDI* and *Openness* the results implied that more FDI and greater trade openness exerted a statistically significant negative impact on growth.

As noted above, the motivation for using dynamic panel GMM estimators in this analysis is to deal with the bias caused by the inclusion of the lagged dependent variable as an explanatory variable and the presence of unobservable country heterogeneity. Both the difference and system GMM estimators address these problems but apply a slightly different approach to the construction of the instrumental variable set. Given that both techniques are theoretically sound but only difference GMM yields results consistent with theory and the bulk of existing empirical evidence, the remainder of the analysis focuses on results derived using the difference GMM estimator. It should be noted, however, that these results are sensitive to the estimation technique employed.

7.4.2 The role of FDI policies

Having established the baseline results the analysis now examines the role of FDI policies. Each of the three FDI policy variables included in the dataset presented in chapter 4, including *Ownership restrictions*, *Profit restrictions* and *Liquidation restrictions*, are employed for this purpose. Table 7.2 presents the results from applying the same empirical specification to different sub-samples determined by the value of these three policy variables. The full set of explanatory variables reported in table 7.1 are included on the basis that the Sargan test for over-identifying restrictions does not suggest any problems in incorporating all of these variables. Indeed, the selection of a relatively wide range of explanatory variables should improve the robustness of the results.

Regression one in table 7.2 is based on a sub-sample where there are no *Ownership restrictions* while regression two is based on a sub-sample where such restrictions do prevail. Likewise, regressions three and four report results from sub-samples without and with *Profit restrictions* and regressions five and six the results from sub-samples without and with *Liquidation restrictions*. As panel data are used, each sub-sample is determined by prevailing policies in each country at each five year interval, rather than for the full thirty year period covered in the analysis. Taking this approach controls for FDI policy changes that occur within countries over time.

Table 7.2: Growth regressions, the role of FDI policies

	1 No Own	2 Own.	3 No Profit	4 Profit	5 No Liquid	6 Liquid
Initial per capita output	-0.350*** (0.065)	-0.459*** (0.132)	-0.328*** (0.066)	-0.355*** (0.113)	-0.326*** (0.07)	-0.407*** (0.113)
FDI	0.184** (0.089)	-0.633 (1.259)	0.122 (0.077)	-0.083 (0.262)	0.075 (0.075)	-0.053 (0.256)
Domestic investment	0.203*** (0.063)	0.193** (0.092)	0.157*** (0.049)	0.326*** (0.104)	0.131** (0.054)	0.354*** (0.065)
Years of schooling	0.014*** (0.004)	0.007 (0.013)	0.011** (0.004)	0.004 (0.004)	0.009** (0.003)	0.010* (0.005)
Openness	0.031*** (0.011)	0.058* (0.032)	0.025** (0.012)	0.082*** (0.025)	0.021 (0.015)	0.086*** (0.019)
Government consumption	-0.073 (0.052)	0.093 (0.141)	-0.055 (0.061)	0.073 (0.063)	-0.07 (0.059)	0.067 (0.059)
Inflation	-0.004 (0.003)	-0.012 (0.011)	-0.004 (0.003)	-0.005 (0.005)	-0.004 (0.003)	-0.010** (0.005)
Contract intensive money	-0.007 (0.042)	0.113 (0.104)	0.093** (0.04)	0.045 (0.07)	0.055 (0.066)	-0.008 (0.059)
Financial depth	-0.003 (0.016)	-0.027 (0.07)	-0.016 (0.015)	-0.003 (0.03)	0.011 (0.019)	0.032 (0.033)
Obs.	261	76	190	134	172	152
Pseudo R-squared	0.41	0.28	0.42	0.41	0.44	0.40
Chi-square	138***	179***	90***	100***	65***	173***
Sargan test	1.00	1.00	1.00	1.00	1.00	1.00
Serial correlation	0.74	0.72	0.78	0.56	0.37	0.60

Notes: "No Own." and "Own." denote results derived using sub-sample comprising countries without and with *Ownership restrictions* respectively. The same convention applies to "No Profit" and "Profit" for the *Profit restrictions* indicator and "No Liquid" and "Liquid" for the *Liquidation restrictions* indicator. Other notes as for table 7.1.

In regression one the coefficients on *Domestic investment* and *FDI* are positive, significant at the 5 per cent level or better and are of a similar magnitude to the estimates derived using the full sample reported in table 7.1. However, when the same specification is estimated using a sub-sample where *Ownership restrictions* are imposed, regression two, the *FDI* coefficient becomes negative and insignificant. In contrast the coefficient on *Domestic investment* remains positive and significant while results for other variables are mixed.

The results for regressions three and four, which are based on sub-samples with and without *Profit restrictions*, produce similar, though weaker results. The coefficient on *FDI* is positive in the sub-sample without restrictions and on the borderline of conventional levels of significance. In contrast the coefficient is negative where restrictions apply. In the final two regressions, where sub-samples are determined by the existence of *Liquidation restrictions*, the *FDI* coefficient is again positive where

restrictions are not applied and negative where restrictions do prevail. However, in both cases the coefficient is insignificant.

A problem in interpreting these results is that the FDI policy indicators may reflect factors other than FDI policies. As noted in chapter 4, restrictive FDI policies are more prevalent in developing countries. Therefore, different estimated coefficients for *FDI* across different sub-samples determined by each of the policy indicators may actually reflect broader differences between developed and developing countries that reduce the productivity all investment. The results reported for *Domestic investment* in Table 7.2, however, suggest that this is not the case. In particular, there is no indication that locally sourced investment is any less productive where FDI policy restrictions apply. Indeed, if anything the opposite appears to be case.

Overall, therefore, the results provide some evidence that restrictive FDI policies reduce the growth effects of FDI. The impact of FDI on growth in countries which adopt FDI policy restrictions is much weaker, or indeed non-existent, compared with countries which do not impose these restrictions. This result appears to be particularly strong in the case of policy restrictions captured by the *Ownership restrictions* variable.

7.4.3 The role of trade policies

Having examined the impact of FDI policies, the next set of results adds trade policies to the analysis. Table 7.3 presents results examining whether trade policies enhance the growth effects of FDI alone, and in conjunction with FDI policies, using two different approaches. First, in regressions one to four interactions between FDI and alternative measures of trade policies are added to the same baseline specification used in table 7.2 above.

As noted above, a potential problem arising from the inclusion of the interaction term between FDI and measures of trade policies is that these variables are highly correlated. Indeed in the sample used here, the bivariate correlation between measures of trade policies and the interaction term is over 0.8. Therefore, it seems reasonably likely that results for interaction terms are plagued by multicollinearity.

To address this problem, the second approach taken is to estimate equations using sub-samples based on prevailing levels of trade openness, rather than including interaction terms. This approach is analogous to the method employed in section 7.4.2

above to test the role of FDI policies. In regressions five to eight, the full sample is divided in to sub-samples determined by whether a given observation is above or below the median values of the trade policy proxies *Openness* or *Openness adjusted.*[64] This enables the sample to be divided into observations that are relatively more or less open to trade following the approach taken by Balasubramanyam et al. (1996) and Greenaway et al. (2007).

Beginning with regression one, the full sample is used to estimate an augmented specification that includes the interaction term between *FDI* and *Openness*. This interaction term is found to be insignificant, providing no support to the hypothesis that more open trade policies enhance the growth effects of FDI. To assess whether this result is sensitive to the measure of trade openness used, in regression two the population adjusted measure of openness, *Openness adjusted*, is used in the interaction term, rather than *Openness*. The results are largely unchanged with the interaction term again insignificant.

It is possible that these insignificant results reflect policy complementarities where open trade policies only infer benefits where liberal FDI policies are also adopted. To examine this possibility, regressions one and two are re-estimated using sub-samples comprising countries with more liberal FDI policies. Specifically, the sub-samples comprise observations without *Ownership restrictions*, the FDI policy variable that was found to have the strongest impact in table 7.2. The results presented in regressions three and four indicate that controlling for FDI policies makes little difference, with the interaction terms between *FDI* and alternative measures of openness again found to be insignificant.

The consistently insignificant coefficient on the FDI-trade policy interaction variables suggest that multicollinearity may indeed present a problem. In this case, the alternative method of splitting samples in to observations that are relatively open or closed to trade may be more suitable. In regressions five and six, the results are estimated using sub-samples determined by values of *Openness*, with the first of these regressions comprising observations that are above the median value for the sample. In regressions

[64] Dividing the sample to the basis of observations being above or below the sample mean, rather than median, produced similar results.

seven and eight the same approach is taken except that the sub-samples are determined by values of the alternative trade policy proxy, *Openness adjusted.*

Table 7.3: Growth regressions, the role of trade policies

	1 Full sample	2 Full sample	3 No Own.	4 No Own.	5 High Open	6 Low Open	7 High Open adj.	8 Low Open adj.
Initial per capita output	-0.238*** (0.051)	-0.239*** (0.049)	-0.332*** (0.062)	-0.333*** (0.066)	-0.243*** (0.069)	-0.386*** (0.086)	-0.221*** (0.074)	-0.404*** (0.072)
FDI	0.212 (0.158)	0.245* (0.137)	0.157 (0.1)	0.153* (0.087)	0.185* (0.113)	0.121 (0.368)	0.183** (0.079)	-0.011 (0.32)
FDI x Openness	-0.015 (0.092)		-0.012 (0.082)					
FDI x Openness adjusted		-0.032 (0.093)		-0.022 (0.091)				
Domestic investment	0.204*** (0.066)	0.192*** (0.063)	0.203*** (0.055)	0.201*** (0.066)	0.171* (0.095)	0.257*** (0.091)	0.194*** (0.053)	0.237** (0.104)
Years of schooling	0.005* (0.003)	0.005* (0.003)	0.013*** (0.003)	0.013*** (0.004)	0.006* (0.003)	0.013*** (0.005)	0.007 (0.004)	0.013*** (0.004)
Openness	0.040** (0.016)		0.032** (0.013)		0.034* (0.018)	0.102*** (0.029)		
Openness adjusted		0.038*** (0.014)		0.033** (0.014)			0.041** (0.016)	0.086*** (0.033)
Government consumption	0.01 (0.053)	0.025 (0.046)	-0.068 (0.042)	-0.082* (0.049)	0.058 (0.087)	0.014 (0.082)	0.055 (0.049)	0.027 (0.071)
Inflation	-0.006*** (0.002)	-0.006** (0.002)	-0.005* (0.002)	-0.004 (0.003)	-0.014*** (0.004)	-0.004 (0.003)	-0.012** (0.005)	-0.006** (0.002)
Contract intensive money	0.028 (0.045)	0.031 (0.047)	-0.006 (0.043)	-0.013 (0.046)	-0.07 (0.072)	-0.005 (0.05)	-0.108 (0.115)	0.003 (0.053)
Financial depth	-0.019 (0.022)	-0.019 (0.02)	-0.001 (0.017)	0.001 (0.019)	-0.02 (0.022)	0.02 (0.026)	-0.003 (0.024)	-0.006 (0.03)
Obs.	360	360	261	261	180	180	180	180
Pseudo R-squared	0.41	0.41	0.41	0.41	0.31	0.39	0.32	0.43
Chi-square	109***	109***	184***	183***	104***	85***	78***	130***
Sargan test	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Serial correlation	0.83	0.77	0.68	0.71	0.62	1.00	0.89	0.55

Notes: "Full sample" and "No Own." denote results derived using the full sample or a sub-sample without *Ownership restrictions* respectively. "High open" and "Low open" denote results derived using observations with values of *Openness* above or below the full sample median respectively. "High open adj." and "Low open adj." denote results derived using observations with values of *Openness adjusted* above or below the full sample median respectively. Other notes as for table 7.1.

The results in regressions five to eight support the hypothesis that trade openness enhances the growth effects of FDI. In regression five, a relatively open sub-sample, as determined by values of *Openness*, the coefficient on *FDI* is positive and significant, whereas in regression six, a relatively closed sub-sample, it is insignificant. In regressions seven and eight, a similar pattern is observed using sub-samples determined by values of *Openness adjusted.* Again, the coefficient on *FDI* is positive and

significant only in the relatively open sub-sample. As with the results reported in table 7.2, the coefficient on *Domestic investment* remains positive and statistically significant in all specifications. This provides some assurance that the results for FDI do not reflect broader factors that may be correlated with trade policies. The result that FDI only exerts a positive influence on growth in relatively open countries is consistent with the findings of Balasubramanyam et al. (1996) and Greenaway et al. (2007).

7.4.4 The role of human capital

The final set of results, focussing on the role of human capital, are reported in table 7.4. These are derived using the same process as the one described above for measures of trade policies but with measures of human capital used instead. Interaction terms are again added to a baseline specification. In addition, given the likely problem of multicollinearity, results are presented from using sub-samples based on relatively high and low levels of human capital.

Beginning with regression one, the interaction of *FDI* and *Years of schooling* is incorporated with the baseline specification and estimated using the full sample. The interaction term is found to be insignificant, as is the coefficient on *FDI*. To examine whether this result is sensitive to the human capital proxy used, the same specification is applied in regression two except that *Years of secondary schooling* is used in place of *Years of schooling*. Again the interaction with FDI is found to be insignificant. Therefore, using the full sample no evidence is found supporting the hypothesis that higher levels of human capital enhance the growth effects of FDI.

Table 7.4: Growth regressions, the role of human capital

	1 Full sample	2 Full sample	3 No Own.	4 No Own.	5 High edu.	6 Low edu.	7 High sec. edu.	8 Low sec. edu.
Initial per capita output	-0.262*** (0.055)	-0.241*** (0.063)	-0.358*** (0.062)	-0.342*** (0.049)	-0.364*** (0.063)	-0.301*** (0.079)	-0.288*** (0.064)	-0.329*** (0.07)
FDI	0.092 (0.142)	0.132 (0.12)	0.188 (0.125)	0.230* (0.139)	0.105 (0.079)	-0.143 (0.342)	0.165 (0.131)	0.072 (0.308)
FDI x Years of schooling	0.006 (0.01)		0 (0.008)					
FDI x Years of secondary schooling		0.006 (0.02)		-0.013 (0.016)				
Domestic investment	0.205*** (0.06)	0.208*** (0.051)	0.176*** (0.051)	0.195*** (0.049)	0.157*** (0.053)	0.222* (0.118)	0.271*** (0.067)	0.130** (0.062)
Years of schooling	0.006** (0.003)		0.013*** (0.003)		0.008** (0.004)	0.004 (0.005)		
Years of secondary schooling		0.010* (0.005)		0.024*** (0.006)			0.015** (0.006)	0.004 (0.01)
Openness	0.044*** (0.015)	0.044*** (0.016)	0.027*** (0.01)	0.028** (0.011)	0.065** (0.028)	0.042** (0.02)	0.028 (0.021)	0.044** (0.021)
Government consumption	0.037 (0.059)	0.01 (0.047)	-0.077* (0.044)	-0.076 (0.056)	-0.086 (0.057)	0.036 (0.074)	-0.07 (0.056)	0.088 (0.059)
Inflation	-0.007*** (0.002)	-0.005*** (0.002)	-0.004 (0.003)	-0.004 (0.003)	-0.009*** (0.003)	-0.006* (0.003)	-0.009*** (0.003)	-0.005 (0.004)
Contract intensive money	0.022 (0.044)	0.037 (0.036)	-0.022 (0.042)	-0.007 (0.032)	-0.077 (0.054)	0.082* (0.05)	0.03 (0.057)	0.066 (0.046)
Financial depth	-0.016 (0.022)	-0.012 (0.019)	0.002 (0.017)	0.004 (0.012)	0.015 (0.018)	-0.03 (0.029)	-0.012 (0.016)	-0.027 (0.028)
Obs.	355	355	258	258	180	180	180	180
Pseudo R-squared	0.44	0.43	0.43	0.42	0.41	0.41	0.38	0.44
Chi-square	108***	115***	211***	157***	137***	43***	98***	53***
Sargan test	1	1	1	1	1	1	1	1
Serial correlation	0.64	0.58	0.67	0.36	0.37	0.96	0.9	0.78

Notes: "Full sample" and "No Own." denote results derived using the full sample or a sub-sample without *Ownership restrictions* respectively. "High edu." and "Low edu." denote results derived using observations with values of *Years of schooling* above or below the full sample median respectively. "High sec. edu." and "Low sec. edu." denote results derived using observations with values of *Years of secondary schooling* above or below the full sample median respectively. Other notes as for table 7.1.

In regressions three and four the possibility that human capital increases the growth effects of FDI only where liberal FDI policies are adopted is assessed. The same specification used in regressions one and two are estimated using a sub-sample restricted to observations where *Ownership restrictions* do not prevail. In both regression three and four the interaction between *FDI* and alternative measures of human capital are again found to be insignificant. Therefore, these results suggest that FDI policies make no different to the impact of human capital on the growth effects of FDI.

As in section 7.4.3 it is possible that the insignificant results for the interaction variables reflect multicollinearity. Therefore, in regressions five to eight, the alternative method of investigating FDI-human capital complementarities by splitting the full sample on the basis of prevailing levels of human capital is applied. In regressions five and six, the results are estimated using sub-samples determined by values of *Years of schooling*. Regression five employs a sub-sample where observations for *Years of schooling* are above the median value for the full sample, while regression six uses a sub-sample with below median values. The same process is repeated in regressions seven and eight except that *Years of secondary schooling* is used to determine the sub-samples.

In each regression the coefficient on FDI is found to be insignificant at conventional levels of significance. However, the coefficients are larger and or positive, and t-ratios higher in the sub-samples with higher levels of human capital. Therefore, the results from regressions five to eight may be considered to provide weak evidence that higher levels of human capital enhance the growth effects of FDI.

The insignificant coefficient on *FDI* in these regressions contrasts with the results presented in table 7.1, which indicate that on average FDI exerts a strong positive impact on growth. The results in table 7.4 suggest that other conditions may need to be met, even amongst countries with relatively high levels of human capital before FDI can be expected to have a consistently positive impact on the growth of the host country. This raises the question of the role of FDI and trade policies. Unfortunately, however, methodological limitations discussed above make an assessment of this issue difficult.

The results on the role of human capital contrast with the findings of Borensztein et al. (1998) but are consistent with those of Blonigen and Wang (2005). The general weakness of human capital in this analysis also mirrors the relatively weak results reported in chapters five and six. To recap, while some evidence was reported that human capital enhanced technology transfer to MNE affiliates in chapter six, this result was sensitive to the choice of sample. In addition, in chapter five, human capital was not found to influence MNE export orientation in either the full sample or in the case of industrialised countries.

7.5 Conclusion

This chapter seeks to build on the literature which examines how various host country factors affect the link between FDI and growth using cross-country data. The primary novelty of the analysis is that it examines the role of FDI policies, both alone and in conjunction with trade policies and human capital. In light of criticisms levelled at many existing empirical studies of FDI and growth, a technique which controls for both unobservable country heterogeneity and uses an instrumental variable approach to address endogeneity bias is used.

The results lend support to the hypothesis that some FDI policies affect the relationship between FDI and growth, although these are sensitive to the choice of estimation technique. While FDI is found to exert a robust positive impact on growth in a general sample and in countries that adopt liberal FDI policies, this result does not always hold where restrictive FDI policies are adopted. Out of the three FDI policies considered in the analysis, the strongest evidence is found for policies relating to foreign ownership restrictions, consistent with the evidence reported in chapters 5 and 6. Importantly, the results indicate that FDI policies impact primarily on foreign, rather than domestically sourced investment. This suggests that restrictive FDI policies do not merely reflect other factors that may impact on the productivity of all forms of investment.

There is also evidence to suggest that open trade policies enhance the growth effects of FDI. However, no evidence could be found that liberal FDI policies have any bearing on this impact. The impact of human capital is much less clear, mirroring the findings presented in chapters 5 and 6. In particular, only weak evidence was found to suggest that higher levels of human capital enhance the growth effects of FDI and again, FDI policy settings appear to have no bearing on this result.

Appendix 7.1 Descriptive statistics and supplementary results

Table A7.1: Summary of statistics

	Mean	Standard deviation	Minimum	Maximum
Per capita GDP growth	0.02	0.03	-0.11	0.11
FDI	0.01	0.02	-0.03	0.23
Domestic investment	0.17	0.08	0.01	0.56
Years of schooling	5.73	2.73	0.61	12.25
Openness	0.53	0.41	0.08	3.10
Government consumption	0.18	0.09	0.03	0.62
Inflation	2.38	1.06	0.47	7.95
Contract intensive money	0.81	0.13	0.21	0.98
Financial depth	0.45	0.26	0.00	1.99

Notes: see appendix 7.2 for details.

Table A7.2: Correlation matrix

	Per capita GDP growth	FDI	Domestic investment	Years of schooling	Openness	Government consumption	Inflation	Contract intensive money
FDI	0.22							
Domestic investment	0.40	0.36						
Years of schooling	0.14	0.31	0.55					
Openness	0.24	0.64	0.39	0.14				
Government consumption	-0.20	-0.21	-0.36	-0.34	-0.03			
Inflation	-0.34	-0.28	-0.28	-0.31	-0.23	0.29		
Contract intensive money	0.24	0.27	0.49	0.64	0.16	-0.45	-0.24	
Financial depth	0.23	0.35	0.50	0.45	0.36	-0.15	-0.39	0.41

Notes: see appendix 7.2 for details.

Table A7.3: Growth regressions, system GMM estimation

	1	2	3	4	5	6	7
Initial per capita output	-0.018 (0.022)	-0.043 (0.042)	-0.042 (0.045)	-0.064* (0.037)	-0.061* (0.036)	-0.099*** (0.028)	-0.078*** (0.028)
FDI	0.041 (0.082)	0.029 (0.096)	0.048 (0.097)	0.034 (0.098)	-0.013 (0.083)	0.097 (0.08)	0.098 (0.083)
Domestic investment	0.246*** (0.043)	0.248*** (0.038)	0.230*** (0.033)	0.214*** (0.035)	0.198*** (0.033)	0.215*** (0.029)	0.191*** (0.033)
Years of schooling		0.002 (0.003)	0.002 (0.002)	0.003 (0.002)	0.002 (0.002)	0.001 (0.002)	0 (0.002)
Openness			0.001 (0.009)	0.005 (0.009)	0.003 (0.008)	-0.006 (0.006)	-0.001 (0.007)
Government consumption				-0.058 (0.042)	-0.042 (0.035)	-0.025 (0.031)	-0.043 (0.034)
Inflation					-0.007*** (0.002)	-0.007*** (0.002)	-0.005** (0.002)
Contract intensive money						0.042 (0.027)	0.048* (0.029)
Financial depth							-0.005 (0.011)
Obs.	509	461	461	461	452	439	435
Pseudo R-squared	0.2	0.2	0.21	0.23	0.27	0.28	0.27
Chi-square	39***	47***	51***	58***	67***	99***	94***
Sargan test	0.13	0.48	0.94	1	1	1	1
Serial correlation	0.44	0.89	0.94	0.9	0.67	0.68	0.75

Notes: results derived using the system GMM dynamic panel (twostep) estimator by Arellano and Bover (1995) and Arellano and Bond (1998). Other notes as for table 7.1.

Appendix 7.2 Data definitions and sources

Per capita GDP growth: the dependent variable in all regressions is the annual rate of per capita output growth, purchasing power parity basis. It is derived as the difference between the log level of per capita output over a five year period, divided by five. With the sample comprising data from 1970 to 2000, observations for per capita output in 1970 and every fifth year up to 2000 are used. For example, for the most recent block in the panel the value of the dependent variable is the difference between the log of per capita output in 2000 and 1995, divided by five.

In a small number of cases, where output data are missing for one of the years used to derive growth rates but available for nearby years a linear trend was used to estimate observations for the required years. The trend was derived within each five year block in the panel. For example, if data were available for the years 1996 to 1999 but missing for 2000, the observation for 2000 was extrapolated on the basis of the data for 1996 to 1999.
Source: Penn World Table (Heston et al. 2002).

FDI: net inflows of FDI as a share of GDP, purchasing power parity basis.
FDI series converted from nominal US dollars to purchasing power parity basis by dividing nominal series by purchasing power parity investment deflator from Penn World Table (Heston et al. 2002). This purchasing power parity adjusted series was then divided by GDP, measured on a purchasing power parity basis.
Source: UNCTAD online FDI database and Penn World Table (Heston et al. 2002).

Domestic investment: investment share of GDP purchasing power parity basis, less *FDI*.
Source: Penn World Table (Heston et al. 2002).

Ownership restrictions: binary variable equal to one if country imposes mandatory joint venture requirement, as described in chapter 4.

Profit restrictions: binary variable equal to one if country imposes restrictions on the repatriation of FDI related income, as described in chapter 4.

Liquidation restrictions: binary variable equal to one if country imposes restrictions on the repatriation of the proceeds from the liquidation of FDI related assets, as described in chapter 4.

Openness: ratio of exports plus imports to GDP. All data measured in nominal US dollars.
Source: IMF International Financial Statistics online database, World Bank World Development Indicators online database and World Bank Growth Resources Database (Easterly 2001).

Openness adjusted: population adjusted measure of *Openness* estimated by regressing *Openness* on total population.
Source: trade data as for *Openness*, population data from World Bank World Development Indicators online database and for Taiwan only, Penn World Table (Heston et al. 2002).

The regression applied is as follows (standard error in parentheses):

Openness = 0.5453- 0.0005*Population
(0.00005)

Years of schooling: total years of schooling of workers 25 years and older.
Source: Barro and Lee (2001).

Years of secondary schooling: total years of secondary schooling of workers 25 years and older.
Source: Barro and Lee (2001).

Government consumption: government expenditure share of GDP, purchasing power parity basis.
Source: Penn World Table (Heston et al. 2002).

Inflation: annual change in GDP price deflator.
Source: Penn World Table (Heston et al. 2002).

Contract intensive money: proportion of broad money (M2) held in forms other than currency. All data measured in nominal local currency units.
Source: IMF International Financial Statistics online database and International Financial Yearbook, various editions.

Financial depth: ratio of broad money (M2) to nominal GDP. All data measured in nominal local currency units.
Source: IMF International Financial Statistics online database and International Financial Yearbook, various editions and World Bank World Development Indicators online database.

Table A7.4: Country sample

Algeria	Italy*
Argentina	Japan*
Australia*	Jordan
Austria*	Kenya
Bangladesh	Korea
Belgium*	Madagascar
Benin	Malaysia
Bolivia	Mauritius
Botswana	Mexico
Brazil	Morocco
Burkina Faso	Nepal
Cameroon	Netherlands*
Canada*	New Zealand*
Central African Republic	Nicaragua
Chile	Nigeria
China	Norway*
Colombia	Pakistan
Democratic Republic Congo	Panama
Republic of Congo	Paraguay
Costa Rica	Peru
Denmark*	Philippines
Dominican Republic	Portugal*
Ecuador	Senegal
Egypt	Singapore
El Salvador	South Africa
Ethiopia	Spain*
Fiji	Sri Lanka
Finland*	Sweden*
France*	Syria
Gabon	Taiwan
Germany*	Tanzania
Ghana	Thailand
Greece*	Trinidad and Tobago
Guatemala	Tunisia
Guinea	Turkey
Guyana	Uganda
Honduras	United Kingdom*
Hong Kong	United States
India	Uruguay
Indonesia	Venezuela
Iran	Zambia
Ireland*	Zimbabwe
Israel	

Notes: * denotes industrialised country.

Appendix 7.3 Model uncertainty in growth empirics

One of the key challenges in analysing empirically the determinants of growth is model uncertainty. This relates both to the choice of explanatory variables and their functional form. A number of studies have sought to address this issue using statistical techniques to identify which variables, out of the many highlighted by theory as being potentially important, have the strongest statistical correlation with observed growth rates. An influential example of this is by Levine and Renelt (1992) who apply extreme bounds analysis based on Leamer (1983). This technique assesses the robustness of explanatory variables by examining how sensitive they are to changes in the choice of other explanatory variables.

To illustrate, suppose there is a set x which contains all possible explanatory variables. Within this set there is a subset of variables v which are strongly believed to influence growth and a second subset w for which prior expectations are weaker. Extreme bounds analysis involves examining the estimated coefficients for a single variable z from the subset w after controlling for variables included in v and some variables from w.

An assessment of whether or not the variable z is robustly correlated with growth is made by identifying the upper and lower values of the estimated coefficient for this variable when changes are made to the set of conditioning variables from w. If the highest estimated value for the coefficient (the upper bound) is statistically significant and positive and the lowest estimated value for the coefficient statistically significant and negative (the lower bound) then the variable is deemed to be fragile. The process is then repeated for a wide range of variables to build up a view of which variables are statistically important and which are not. A similar study is undertaken by Sala-i-Martin (1997), using a more flexible methodology. Rather than considering the extreme bounds only, the distribution of the estimated coefficients for each variable of interest are examined and used to infer robustness.

More recently, Hendry and Krolzig (2004) and Hoover and Perez (2004) have applied the general to specific methodology to help identify robust explanatory variables in growth regressions. This approach involves starting with a general specification that encompasses all possible explanatory variables and then searching over alternative models to narrow the model to a more parsimonious specification. The decision to

include or exclude a particular explanatory variables is based on an assessment of the statistical significance of the variable and diagnostic tests of the overall performance of different specifications.

Unfortunately, the results from these types of studies do not provide any definitive list of robust explanatory variables. While some variables, notably proxies for capital accumulation, do seem to be robust in different tests, a large number of other variables are found to be robust in some tests but fragile in others. Overall, therefore, these studies underline the importance of experimenting with different specifications in each specific application.

Appendix 7.4 Dynamic panel data estimation

The estimation of dynamic panel data models such as the one used in this chapter requires a careful consideration of the appropriate estimation technique. A dynamic specification is one in which a lagged value of the dependent variables is included as an explanatory variable. Specifications used to study the determinants of economic growth often include the lag of per capita output as a control for the influence of conditional convergence and therefore represent a dynamic model.

To illustrate the problems associated with the estimation of dynamic panel models using OLS consider a generic dynamic specification:

$$y_{it} = \beta y_{i(t-1)} + \alpha x_{it} + \lambda_i + \varepsilon_{it} \qquad \text{(A7.1)}$$

where x represents a vector of explanatory variables and λ unobservable heterogeneity. The presence of the lag of y as an explanatory variable in this type of specification induces a particular type of endogeneity bias that requires the application of a dynamic panel estimator.

The problem can be decomposed into two parts. First, by construction, the lag of the dependent term y will be correlated with the unobservable heterogeneity term λ. This is illustrated by taking the lag of equation A7.1 and applying an expectations operator to examine the correlation between y and λ as follows:

$$E(\lambda_i y_{i(t-1)}) = E(\lambda_i(\beta y_{i(t-2)} + \alpha x_{i(t-1)} + \lambda_i + \varepsilon_{i(t-1)})) \qquad \text{(A7.2)}$$

$$E(\lambda_i y_{i(t-1)}) = E(\lambda_i \lambda_i) \neq 0 \qquad \text{(A7.3)}$$

As noted in A7.3, by construction the lagged value of y will be correlated with λ, implying the coefficient on this variable will be biased when estimated with OLS. The usual approach to addressing the problem of bias arising from unobservable heterogeneity is to apply a fixed effects transformation to eliminate λ. However, with a dynamic model this transformation creates a new form of bias. To illustrate, consider the first difference of equation A7.1:

$$y_{it} - y_{i(t-1)} = \beta(y_{i(t-1)} - y_{i(t-2)}) + \alpha(x_{it} - x_{i(t-1)}) + (\varepsilon_{it} - \varepsilon_{i(t-1)}) \qquad \text{(A7.4)}$$

In this equation the time invariant unobservable heterogeneity has been eliminated. Therefore, the problem of the lagged dependent variable being correlated with λ has been rectified.

However, in equation A7.1 the dependent term y is contemporaneously correlated with the error term ε. This implies that lagged values of the dependent term will also be correlated with lagged values of the error term. This is problematic in the case of the transformed equation A7.4 since the transformed lagged dependent term $(y_{i(t-1)} - y_{i(t-2)})$ is now correlated with the transformed error term $(\varepsilon_{it} - \varepsilon_{i(t-1)})$, which will again give rise to biased estimates with OLS. Hence, action taken to remove unobservable heterogeneity has created an alternative source of endogeneity bias. This necessitates the need to instrument the differenced lagged dependent term.

Chapter 8

Conclusion

8.1 Introduction

FDI plays an increasingly important role in the global economy, linking investors, firms and workers across national boundaries. Unlike other international capital flows FDI enables foreign control of factors of production thereby facilitating growth in the host country through a number of mechanisms, including the transfer of new technology. However, the empirical relationship between FDI inflows and growth performance is weak. A number of growth studies report an insignificant impact from FDI and some even find evidence of a negative effect. This is perhaps unsurprising given existing hypotheses which illustrate how a variety of host country factors can alter the nature of MNE production and, ultimately, the growth effects of FDI. Motivated by these observations, this thesis provides new evidence on the impact of host country factors on the growth effects of FDI.

Existing hypotheses contend that MNE production that is more export orientated and associated with higher inflows of technology will bring about larger productivity gains in the host country. Therefore, in order to provide a more comprehensive analysis, the thesis presents new evidence on how host factors influence these aspects of MNE production, in addition to examining the direct growth effects of FDI. Mindful of the possibility that a number of different factors influence gains from FDI, the analysis focuses on the impact of three host country factors. These are FDI and trade policies and investments in human capital.

The thesis makes a number of contributions to the literature. The first is to present a new cross-country dataset on FDI policies which aims to fill a significant gap in currently available data. A second contribution is to apply this new dataset to examine the impact of FDI policies on the nature of MNE production and the growth effects of FDI. Third, updated evidence is also presented on the impact of trade policies and human capital. Fourth, by examining the impact of these host country factors on both the nature of MNE production and the growth effects of FDI the study presents an integrated analysis of the role of different host country factors. In addition,

complementarities between host country factors increasing the growth effects of FDI are analysed.

The next section provides an overview of the main findings. Section 8.3 discusses policy implications and section 8.4, areas for further research.

8.2 Findings

The newly compiled FDI policy indicator dataset presented in chapter 4 provides annual information on policy settings for 89 countries between 1970 and 2000. One policy indicator in the dataset details the existence of a joint venture requirement that applies across all sectors. A further two indicators reflect controls on the movement of FDI related capital, including FDI related income and the proceeds from the liquidation of FDI projects. This data are compiled using qualitative information gleaned from a number of sources and efforts were made to construct policy indicators that reflected how policies have been implemented in practice.

All three FDI policy indicators show a marked increase in the adoption of more liberal policies since 1970, with reform efforts particularly widespread during the late 1980s and early 1990s. This is true of both joint venture requirements and policies restricting the movement of FDI related capital. This finding is consistent with anecdotal evidence, qualitative assessments of changes in policies within individual countries and trends evident in other cross-country datasets cataloguing FDI policies. Also consistent with existing evidence is the finding that the most restrictive FDI policies have tended to be adopted by authorities in Africa, the Middle East and Latin America. In contrast, industrialised countries have the longest tradition of adopting the most liberal FDI policies.

Owing to the broad coverage of the policy indicator dataset and the specific nature of each of the variables, it is not possible to undertake a detailed comparison of the new indicators against existing datasets. However, the distribution of restrictive policy settings, particularly the concentration in developing countries, as well as the clear trend towards the adoption of more liberal policies over time are both consistent with other assessments of FDI policies. In addition, a simple partial correlation analysis indicates that more liberal FDI policy settings are associated with higher flows of FDI. Given

that more liberal FDI policies are likely to attract higher aggregate flows of FDI this finding provides some additional assurance of the validity of the compiled data.

The empirical evidence presented supports the hypothesis that host country factors influence both the nature of MNE production and the growth effects of FDI. Beginning with the analysis of MNE export orientation in chapter 5, consistent evidence is found that joint venture requirements reduce export orientation. Moreover, the magnitude of this effect is large, with the removal of joint venture requirements, as reflected by the policy variable, predicted to increase export orientation by around 10 per cent. However, the evidence for the two policy indicators relating to restrictions on capital transfers is much weaker, with the significance of these variables sensitive to model specification. These findings provide new evidence on how FDI policies impact on MNE export orientation and are consistent with theoretical predictions that export production will gravitate towards superior operating environments.

There is strong evidence that greater trade openness enhances the export orientation of MNE affiliate production. Again, this is consistent with the predictions of FDI theory and the findings of other studies. However, the evidence on the impact of FTAs is less robust. This finding may reflect FTAs providing limited increases in market access, or conditional access that is incompatible with vertically integrated production networks. For example, rules of origin in FTAs often stipulate binding limits on domestic content which prevent the free movement of goods across borders. This will deter vertically integrated MNE export production that makes extensive use of inputs produced by affiliates located in other countries located outside the FTA's boundaries.

Finally, evidence is found to suggest that after controlling for labour costs, higher levels of human capital increase export orientation, but only in developing countries. Higher labour costs are found to reduce export orientation, especially in developing countries. These results are again consistent with the predictions of FDI theory which suggest that when establishing export facilities MNEs will be attracted to countries where the most productive workers are located.

The analysis of the determinants of technology transfer to MNE affiliates in chapter 6 provides new evidence on the impact of FDI policies and produced other results consistent with existing studies. Robust evidence is reported that joint venture

requirements reduce technology transfer. This finding supports the hypothesis that parent companies transfer less technology to joint ventures owing to fears concerning the loss of control over proprietary knowledge or being inadequately compensated for outlays associated with the technology transfer process. As in the case of export orientation, the magnitude of the impact of joint venture requirements is large.

Theories of technology transfer and spillovers emphasise the importance of absorptive capacity, determined by the availability of human capital and other supply side factors. In particular, a stronger human capital base is expected to reduce the non trivial costs associated with learning and implementing new technology. Consistent with these ideas, higher levels of human capital are found to increase technology transfer to MNE affiliates. However, this result is sensitive to the choice of sample. Whereas a statistically and economically significant impact is reported for the full sample, alternative measures of human capital are generally insignificant for developing and industrialised country sub-samples.

The analysis of technology transfer also incorporates a measure of trade policies, to control for the effects of market competition. Trade openness is found to increase technology transfer, but only amongst industrialised countries. This effect is economically significant and is consistent with the predictions of the spillover model by Wang and Blomstrom (1992). The result is also consistent with empirical studies that examine the impact of market competition on technology transfer.

In chapter 7, two approaches are used to analyse the interaction between host country factors and the growth effects of FDI. First, to examine the impact of FDI policies, the FDI indicator variables introduced in chapter 4 are used to split a universal sample of countries in to sub-samples comprising countries with and without policy restrictions. Second, to analyse the impact of trade openness and human capital, proxies for each of these variables are interacted with FDI flows and used to split the full sample in to sub-samples.

The first result to emerge from this analysis is that in a diverse sample, comprising countries with different policies and other characteristics, FDI exerts a positive impact on growth. The magnitude of this effect is comparable to domestically sourced investment and is insensitive to model specification. Moreover, since an instrumental

variable estimator is used, this result does not appear to be driven by simultaneity bias. However, this and other results presented in the chapter do not hold when an alternative instrumental variable technique is applied. This finding mirrors results presented by Carkovic and Levine (2005) who report no robust evidence of FDI exerting a positive influence on growth.

The analysis of the impact of FDI policies suggest that FDI has a stronger influence on host country growth where liberal policies are adopted, with the strongest evidence found in the case of the policy variable reflecting joint venture requirements. Using different specifications and sub-samples, the coefficient on FDI is positive and significant for sub-samples comprising countries that did not impose this type of policy restriction. In contrast, in countries where this restriction was imposed, FDI was found to have no statistically significant effect on growth. Importantly, domestic investment was found to exert a statistically significant effect on growth irrespective of the prevailing FDI policy. This provides some assurance that the results do not reflect other factors that may be correlated with FDI policies. Similar, though slightly less robust results are reported for the FDI policy variable relating to restrictions on the transfer of FDI related income while the results for the third policy indicator, reflecting other types of capital restrictions, are weaker still.

Using alternative proxies for trade policies, some evidence is found to suggest that FDI exerts a stronger impact on growth in more open countries. The results, however, provide no indication that liberal FDI policies enhance this impact. One possibility is that methodological limitations, particularly multicollinearity, prevent the identification of this effect.

The results from analysing the impact of human capital on the growth effects of FDI are less conclusive. Using both interaction terms and different sub-samples comprising countries with relatively high and low levels of human capital, very little evidence could be found to suggest countries with higher levels of human capital benefit more from FDI. In addition, as with the investigation of the impact of trade policies, no evidence could be found that liberal FDI policies have any bearing on this result.

In summary, evidence is found that host country factors affect the export orientation of MNE production as well as the level of technology transferred to MNE affiliates.

Consistent with this finding, some evidence is also found that host country factors influence the growth effects of FDI, although these findings are sensitive to the choice of estimation technique. Out of the three host country factors assessed in each analysis, the strongest evidence is reported for FDI policies relating to joint ventures. The variable reflecting this policy restriction exerts a strong influence on both MNE affiliate export orientation and technology transfer, as well as the growth effects of FDI. The evidence for the other two FDI policy variables is consistently weaker.

Trade policies are found to exert a particularly strong impact on MNE export orientation and on the growth effects of FDI. There is also some evidence that the level of human capital influences both the export orientation of MNE production and technology transfer, although this effect was sensitive to model specification and especially sample selection. Consistent with this finding, the evidence on whether human capital enhances the growth effects of FDI is also weaker.

8.3 Policy implications

Overall, the evidence presented suggests that host country trade and FDI policies and human capital can influence both the nature of MNE production and the growth effects of FDI. The results imply that gains from FDI are maximised by the adoption of liberal FDI policies, open trade regimes and to a lesser extent investing in human capital. This conclusion is broadly consistent with others who argue that a less prescriptive approach to regulating FDI and MNE activity is likely to maximise the potential benefits of FDI, including Kokko and Blomstrom (1995) and Moran et al. (2005).

In terms of specific policies, the strong evidence reported on the adverse impact of joint venture requirements suggest countries would benefit from the removal of this type of policy restriction. However, due to the manner in which the FDI policy indicator used to draw this conclusion was constructed, it is difficult to make an assessment of whether the impact of joint venture requirements will vary according to the manner in which they are applied. In particular, whether the selective application of joint venture requirements, the approach taken in many countries, would necessarily cause the same adverse effects as imposing joint venture requirements universally.

It is likely that joint venture requirements, as well as other prescriptive FDI policies, are most detrimental when applied to sectors in which a country possesses a comparative

advantage. These are the sectors where countries are most likely to attract export platform MNE production and, owing to the quantity of inward market seeking FDI being constrained by the size of the local economy, the largest quantities of inward FDI. Imposing policy restrictions including joint venture requirements in these sectors is therefore likely to bring about a twofold negative impact. First, significantly reducing the quantity of inward FDI and second, reducing the export orientation of MNE production.

The evidence on the impact of FDI related capital controls is considerably weaker. In the case of restrictions on the liquidation of FDI related projects this result is perhaps unsurprising. As noted in chapter 4, direct investors tend to take a long term view with their investments and as such may not be particularly deterred by the presence of these types of restrictions when undertaking new investments, including in export facilities. Nevertheless, the analysis does provide limited evidence that these capital control related restrictions reduce MNE export orientation and, perhaps, the growth effects of FDI. On this basis both types of restrictions are deemed undesirable.

There is some support for the hypothesis that more open trade policies and higher investments in human capital encourage more desirable forms of MNE production and increase the growth of FDI. Therefore, investing in human capital and adopting more open trade policies are deemed to help maximise the potential benefits of FDI. An interesting nuance in the case of trade policy is the impact of FTAs compared with unilateral or multilateral reductions in trade barriers. As noted above, the evidence presented suggests FTAs may not always have the desired effect of increasing MNE export orientation. It is likely, therefore, that the impact of FTAs depends on the specific nature of the agreement, and in particular whether it is compatible with vertically integrated international production networks.

In assessing policy implications one needs to be mindful of the general equilibrium effects of policy changes. In the context of the three host country factors examined in this thesis, changes which lead to larger gains from FDI are likely to have either broader beneficial effects on growth and welfare, or a neutral impact. Specifically, greater trade openness and investments in human capital are likely to yield benefits on the host economy over and above their impact on the productivity of FDI, while FDI policies are

unlikely to have any broader effects. On this basis, one may be more confident in articulating these policy recommendations.

A detailed analysis of the determinants of aggregate FDI flows is beyond the scope of this thesis. However, it is likely that the adoption of policies to maximise the gains from FDI also promote larger inward flows. As argued in chapters 3 and 5, although improvements in the operating environment are anticipated to have a disproportionately positive impact on export platform investment, other types of FDI are also expected to be attracted by these changes. The same is likely to be true of investments in human capital. Finally, although greater openness to trade may deter market seeking FDI, it is likely that increases in export platform investment can more than offset this reduction given that this form of investment is not constrained by the size of the local market.

A more controversial issue is whether governments should provide special incentives, including fiscal incentives, to attract FDI, particularly investments associated with export or technology intensive production. The existence of FDI spillovers, which represent a form of positive externality provides a possible theoretical justification for such incentives. However, it is difficult to judge both the effectiveness of such incentives and the optimal level of any subsidy. While these issues are beyond the scope of this study one particular result from the analysis helps inform one aspect of this issue. The analysis in chapter 5 indicates that levels of corporate taxation do not impact on the export orientation of MNE affiliates. This suggests that tax incentives may not represent an effective instrument for altering the nature of MNE production.

8.4 Areas for further research

There exist many additional avenues for further research on the broad issues canvassed in this thesis. One of the contributions of this study is to provide new evidence on the impact of host country FDI policies. However, as discussed in chapter 4, there are many dimensions of FDI policies which are not captured by the policy indicator variables introduced in this study. This includes both restrictive measures such as local content and performance requirements, as well as the many incentives governments offer to MNEs. Therefore, many avenues exist to build on existing datasets of FDI policies to provide more detailed, comparable information on policy settings across time and countries.

More generally, by demonstrating that the underlying patterns of MNE production are influenced by a suite of host country factors, analyses of the type presented in chapters 5 and 6 suggest many other factors are likely to impact on the growth effects of FDI. Amongst the factors identified in this study as being important include geography, the macroeconomic environment, different aspects of market competition and intellectual property rights. A key challenge in considering these broader factors is to devise an appropriate methodology to test the relative importance of each factor. This task is particularly difficult given that many of these are likely to be highly correlated at the country level making identification difficult.

Of the three host country factors focussed on in this thesis, the results presented on the role of human capital are perhaps the most unsatisfactory. They provide some evidence that human capital affects the nature of MNE production and the growth effects of FDI but are unstable and hence inconclusive. In this sense the results presented here parallel the collective results reported in existing empirical studies which examine the impact of human capital. Given the strong theoretical linkages between human capital and technology diffusion additional research focussing on this issue is merited. New data sources on human capital continue to be developed and represent one avenue for further work.

As discussed in chapter 3, results from recent empirical studies indicate that spillovers may be stronger between, rather than within sectors. This suggests that collaboration between MNE affiliates and local firms along different parts of the supply chain present good opportunities for spillovers. Nevertheless, more evidence on the workings of different spillover mechanisms, including the role played by worker mobility, is needed to fully understand the impact of FDI on host country production.

Little is also know about whether the sectoral composition of FDI has any consequences for host country growth. The manner in which service sector MNE affiliates integrate in the host country may differ from manufacturing affiliates, which may have implications for the benefits that accrue to local firms. The importance of understanding this issue is underscored by the increasing importance of services FDI, which as noted in chapter 1, is now the dominant form of direct investment in many countries.

Finally, there are a number of areas where methodological improvements could be made. Using firm level data to examine the nature of MNE production enables the control of firm level characteristics, including time invariant unobservable characteristics where panel data are available, which may produce more reliable results. Firm level data may also ease the problem of measurement error which is likely to be particularly problematic in the case of aggregate FDI data. Addressing the various sources of endogeneity bias also continues to pose a major challenge to empirical research on the determinants of growth. This presents a need for continued experimentation with new estimation techniques including the use of creative instrumental variables.

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