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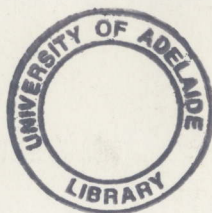
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East Asia

*How successful is China's trade reform:
an empirical assessment*

Zhang Xiaoguang

94/4

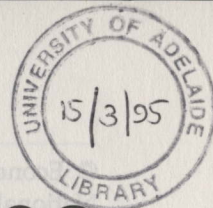
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Zhang Xiaoguang is currently a lecturer with the Department of Economics, University of Melbourne. He completed his doctoral dissertation 'China trade patterns and international comparative advantage' at the National Centre for Development Studies.

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*a*bstract

During the past decade and a half, China's foreign trade has expanded at an unprecedented annual rate of 16 per cent in nominal terms. Exports now account for nearly 20 per cent of GDP (State Statistical Bureau of China 1993). Such rapid growth of trade is widely attributed to China's success in reforming its centrally planned economic system and in particular its trade regime (Lardy 1992). Is this growth associated with improvement in resource allocation efficiency so that commodity patterns of Chinese exports and imports reflect a more efficient utilisation of resources in the economy during the post-reform period than before?

For a planned or partially planned economy, the assessment of efficiency in trade is often hindered by various distortions in goods and factor prices. The conventional practice, which relies on recorded financial indicators of trade, is unlikely to provide clues about the real economic gains or losses to the society as a whole. The export of some goods may be financially profitable simply because key inputs into its production are subsidised. In an extreme case, a commodity can be exported despite the fact that its value-added, measured at international prices, is negative. Domestic distortions in a planned or partially planned economy complicate efficiency measurement, and call for more sophisticated methods to reveal the underlying economic values of various productive activities.

It is generally agreed in economic theory that, to maximise gains from trade, a country's pattern of trade and production should be in line with its comparative advantage. The principle of comparative advantage has thus been seen as a guide for optimal resource allocation.

To be useful in applied economic analysis, comparative advantage must be transferred from an abstract concept to a workable index which can be related to empirical measurement. In this study, the measure of domestic resource cost (DRC) as a proxy of comparative advantage has been adopted. China's commodity patterns of trade are compared with the estimated underlying comparative advantage to detect the convergence between these two patterns. A comparison is made for two separate years, 1978 and 1987, representing the pre-reform and post-reform era, respectively. The study covers 61 tradable commodity groups. It is intended to reveal the impacts of economic reforms on resource allocation efficiency in the Chinese economy.

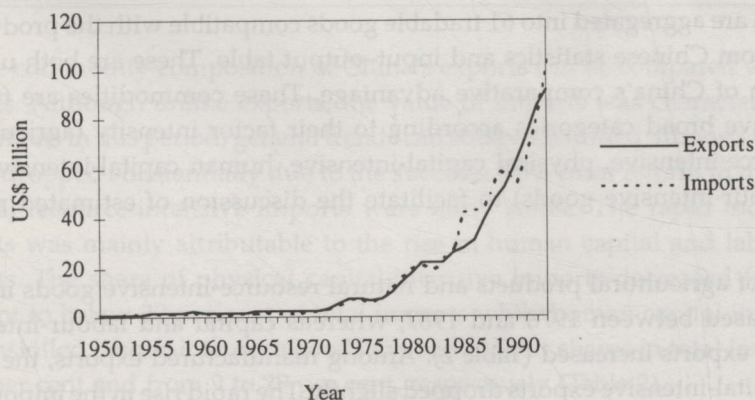
The study confirms that in the pre-reform years, China's exports and imports were not based on considerations of economic efficiency. The most important finding is that after ten years of economic reform, China's trade patterns had clearly moved closer towards the underlying comparative advantage. This result is consistent with trade theory predictions about what would happen in a market-oriented economy. It implies that economic reform has improved resource allocation efficiency in the Chinese economy.

How successful is China's trade reform: an empirical assessment

China's trade patterns

Between 1978 and 1993, the total value of China's trade rose from US\$20.6 to US\$195.8 billion (State Statistical Bureau of China 1993). This growth performance was in sharp contrast with the previous period (Figure 1).

Figure 1 China's export and import values, 1950–93 (US\$ billion)



Source: State Statistical Bureau of China, 1993. *Statistical Yearbook of China 1993*, China Statistical Publishing House, Beijing; State Statistical Bureau of China, March 1 1994. 'A statistical communique of 1993 national economic and social development', *Renmin ribao* (People's Daily), Beijing.

The rapid growth of exports has also been associated with considerable structural change in the commodity composition of trade, particularly exports. Between 1978 and 1992, the share of primary goods shrank while the share of manufactures expanded (Table 1). In 1978, primary goods comprised just over half of Chinese exports, whereas in 1987, they accounted for one third of exports. In 1992, primary goods represented only one fifth of total Chinese exports. In one and a half decades, China had changed from being an exporter of primary products to a major exporter of industrially manufactured products.

Table 1 Commodity composition of China's exports and imports, 1978-92 (per cent)

	Exports			Imports		
	1980	1987	1992	1978	1987	1992
Primary products	50.3	33.5	20.1	34.8	16.0	16.4
Manufactured products	49.7	66.5	79.9	65.2	84.0	83.6

Source: State Statistical Bureau of China 1993. *Statistical Yearbook of China 1993*, China Statistical Publishing House, Beijing.

To analyse trade patterns at the commodity level, China's trade data from its trading partners (compiled by the United Nations Statistical Office) have been used. All 5-digit commodities under the SITC (United Nations' Standard International Trade Classification) are aggregated into 61 tradable goods compatible with the production data drawn from Chinese statistics and input-output table. These are both used in the estimation of China's comparative advantage. These commodities are further clustered in five broad categories according to their factor intensity (agricultural, natural resource-intensive, physical capital-intensive, human capital-intensive and unskilled labour-intensive goods) to facilitate the discussion of estimated results (Appendix 1).

The share of agricultural products and natural resource-intensive goods in total exports decreased between 1978 and 1987, whereas capital and labour-intensive manufactured exports increased (Table 2). Among manufactured exports, the share of physical capital-intensive exports dropped slightly. The rapid rise in the importance of manufactured exports was largely due to an increase in the export of human capital intensive-goods and unskilled labour-intensive goods: from 9.5 per cent to 13 per cent and 43.3 per cent to 51.9 per cent respectively (Table 2).¹

The increase in manufactured exports, and unskilled labour-intensive exports in particular, was facilitated by a number of reform measures adopted by the government in the first half of the 1980s. They included

- the establishment of Special Economic Zones
- the opening up of coastal cities to foreign investment
- the provision of incentives for foreign firms
- adoption of the foreign exchange retention scheme for exporters.

Enterprises and local authorities gained more autonomy in export decision making and were eager to export for their own interests.

Table 2 Commodity composition of China's exports and imports, 1978 and 1987 (per cent)

	Exports		Imports	
	1978	1987	1978	1987
Agricultural products	21.4	12.8	21.4	6.8
Natural resources-intensive products	13.0	10.0	2.2	2.2
Physical capital-intensive products	12.8	12.2	50.1	27.1
Human capital-intensive products	9.5	13.0	17.2	43.7
Unskilled labour-intensive products	43.3	51.9	9.0	20.3

Source: International Economic Databank, The Australian National University, Canberra.

The commodity composition of China's exports can be compared with that of its imports. Although unlike exports, the value of imports was characterised by some fluctuations in this period, general trends can still be identified. Imports of agricultural goods dropped substantially due to the success of the rural reform in the early 1980s. Natural resource-intensive imports were fairly stable. The rapid increase in total imports was mainly attributable to the rise in human capital and labour-intensive imports. The share of physical capital-intensive imports decreased from above 50 per cent to below 30 per cent of total imports while human capital-intensive goods and unskilled labour-intensive goods expanded their shares in total imports from 17 to 43 per cent and from 9 to 20 per cent, respectively (Table 2).

The decline in the shares of agricultural products, natural resource-intensive and physical capital-intensive goods in total imports reflected an improvement in the domestic supply of these products as a result of economic reforms. Economic reform began in 1978, but its impact on imports was not felt until 1982 when the economic

adjustment program was accomplished. Several changes in the structure of imports during the period of reform between 1978 and 1989 are worth noting.

First, one of the most important achievements of economic reform was the improvement in agricultural productivity following the implementation of the agricultural household responsibility system. With a substantial increase in agricultural production, the economy was able to reduce its agricultural imports. The value of agricultural imports, which mainly consisted of wheat and maize, dropped by more than 65 per cent from a peak of US\$4.16 billion in 1980 to less than US\$1.45 billion in 1985, lowering the share of agricultural products in total imports from 25 per cent in 1980 to a mere 4 per cent in 1985. Although agricultural production in the following years was not as successful, agricultural imports and their share in total imports did not again reach their level of the early 1980s.

Second, as the central government relaxed its control over small-scale investment and allowed large enterprises and local governments to participate in decision-making on imports, investment booms occurred. These significantly increased imports of physical capital-intensive goods such as iron and steel and human capital-intensive goods such as machinery and transport equipment. The introduction in 1984 of a two-tier price system for producer goods encouraged domestic production of some goods in short supply, especially iron and steel products, thus reducing imports of these goods and lowering the share of physical capital-intensive goods in total imports. Consequently, the share of human capital-intensive goods expanded (Table 2).

Third, the rapid growth of textile exports under the export promotion scheme gave rise to a strong increase in the demand for imports of textile yarn and fibres. This increased the share of unskilled labour-intensive goods in total imports. Furthermore, in association with the introduction of the foreign exchange retention scheme, there was a considerable relaxation of restrictions on consumer good imports which consisted of both human capital-intensive goods like electronic products and the unskilled labour-intensive goods. As a result, the share of these two groups of commodities in total imports increased substantially (Table 2).

To provide a complete picture of the overall trade performance, we must not only compare China's trade pattern with its own pre-reform structure, but also with the rest of the world. This requires development of an index which can capture the essence of China's trade patterns.

The index used in this study to measure China's overall trade performance is the net export performance ratio (*NEPR*). It is a synthesis of two indices: the export performance ratio (*EPR*), and the net export ratio (*NER*).

The export performance ratio, first used by Liesner (1958) and then by Balassa (1965) as an index for 'revealed comparative advantage', is a country's share in world exports of a given commodity category relative to that country's overall share of world exports,

$$EPR_{ij} = \frac{X_{ij}/X_{wj}}{X_{it}/X_{wt}} \quad (1)$$

where the subscripts i and j refer to country and commodity, respectively, w refers to all countries and t , all commodities.

The *EPR* limits investigation of a country's trade patterns to data on gross exports. Imports are excluded, because observed import patterns are said to be more likely to be influenced by the system of protection in the importing country. In fact, the exclusion of imports cannot be justified on the grounds of protection distortions because exports are also subject to various direct protection policies and, furthermore, are affected indirectly by the structure of import protection. In attempting to demonstrate a country's actual trade performance, there seems no reason to exclude imports from consideration.

Recognition of the potential bias involved in using export data alone led to the development of indices based on net exports such as the *NER* (UNIDO 1982 and 1986; Belassa 1986; Belassa and Bauwens 1988). This measure expresses net exports of commodity j as a percentage of total trade flows in commodity j for a country.

$$NER_j = \frac{X_j - M_j}{X_j + M_j} \quad (2)$$

The problem with this index is that if exports and imports are not substitutes, the measure is irrelevant. If they are perfect substitutes, either gross exports or gross imports would be zero and the net export ratio would be either -1 or 1, respectively. It is not clear what values of the index between these two extremes indicate an industry's trade performance. This ratio also does not indicate the relative position of a country's trade in a given good in the world markets.

Given the limitations of the above indices, the net export performance ratio is devised as follows.

$$NEPR_{ij} = \frac{(X_{ij} - M_{ij})/X_{wj}}{X_{it}/X_{wt}} = \frac{(X_{ij} - M_{ij})/X_{it}}{X_{wj}/X_{wt}} \quad (3)$$

The *NEPR* combines features of the *EPR* and *NER*. It differs from the *EPR* in its inclusion of competing imports and it differs from the *NER* in its comparison of a country's trade with the rest of the world. It is helpful to interpret the *NEPR* index as being

approximately equal to the difference between the export performance ratio (*EPR*) and the analogous import performance ratio, given by

$$D_{ij} = \frac{X_{ij} / X_{wj}}{X_{it} / X_{wt}} - \frac{M_{ij} / M_{wj}}{M_{it} / M_{wt}} \quad (4)$$

In principle, the value of world imports of good *j* is equal to the value of world exports of *j* ($M_{wj} = X_{wj}$) and the value of total world imports is equal to the value of total world exports ($M_{wt} = X_{wt}$). If a country's trade is balanced ($M_{it} = X_{it}$), then D_{ij} is equal to the $NEPR_{ij}$.

The advantage of this index is that it can be easily adapted to measure either net export or net import. When the import of a good is greater than its export, the denominator can be seen as the import share of that good in the total world imports. The fact that the world export is by definition, the world import, allows the denominator of the index to switch between exports and imports to measure not only net exporters but also net importers.

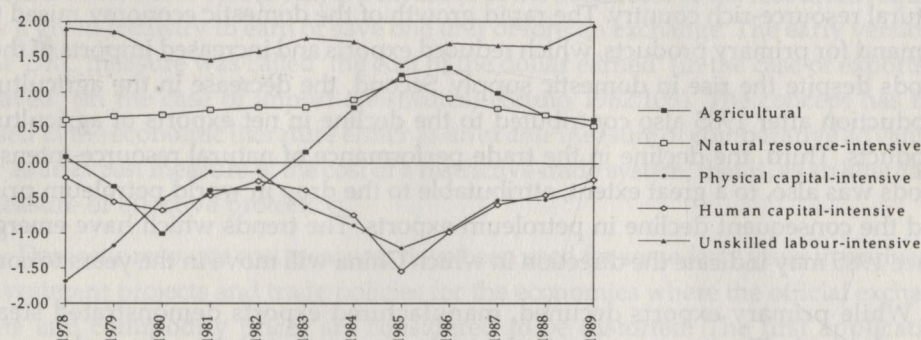
The *NEPR* is a better indicator of China's overall trade performance because it removes the limitations and combines the advantages of the *EPR* and *NER*. It takes account not only of exports and imports but also of China's trade position in the world market. A high value of this index for a commodity implies that China's share of world exports of that commodity is higher than its share of world imports. This reflects China's concentration on exporting that commodity. The *NEPR* reveals China's actual trade pattern. Whether this pattern corresponds to its pattern of comparative advantage will be examined in the next section.

General trends in China's trade performance during the period between 1978 and 1989 can be seen in the *NEPR* measures in Figure 2.² Three sub-periods can be identified in terms of changes in the measures of *NEPR*.

From 1978 to 1982. The *NEPR* measures for agricultural products dropped to a low point in 1980 and then began to rise concomitantly with increased agricultural output. The *NEPR* for natural resource-intensive goods increased marginally. Among manufactured goods, the *NEPR* for unskilled labour-intensive goods declined while that for capital-intensive goods, particularly physical capital-intensive goods, increased sharply.

The *NEPR* measures for manufactured goods exhibited unusual trends for which two causal factors can be singled out. First, an economic readjustment program was implemented in this sub-period with the intention of eliminating the adverse impact of the ambitious Four Modernisations program introduced in 1977, and restoring balance in the economy. Under the program, investment was shifted from heavy industries to light industries and imports of producer goods were restricted in an

Figure 2 China's net export performance ratio, 1978–89



Source: International Economic Databank, The Australian National University, Canberra.

attempt to reduce the trade deficit. Due to these factors, enterprises in heavy industries were forced to export their capital-intensive products.

Second, despite the announcement of economic reforms in 1978, foreign trade remained dominated by the centrally-planned system in which all financial losses were subsidised by the central government. As a result, capital-intensive producer goods were exported and unskilled labour-intensive goods, especially consumer goods, were not exported due to high domestic demand. To re-shape the heavy industry-biased economic structure, the government encouraged production of consumer goods by increasing imports of inputs that could be used in their production such as textile raw materials. This also increased the share of unskilled labour-intensive goods in total imports.

From 1982 to 1985. Trade reform began taking shape during this sub-period. It focused to a large extent on decentralisation of foreign trade management. As domestic price reforms lagged behind, the decentralisation of foreign trade resulted in a surge of imports of raw materials and capital goods because their world market prices were lower than their domestic prices. The NEPR for all manufactured goods declined, indicating some competition from world markets (Figure 2). Exports of petroleum and coal continued to rise. The most remarkable improvement in trade performance during this sub-period occurred in agricultural products, in which China moved from being a net importer to a net exporter.

From 1985 to 1989. During this sub-period, a new trend emerged in China's foreign trade performance. The NEPR measures for primary products, agricultural products and natural resource-intensive goods declined, and measures for manufactured goods increased (Figure 2).

The decline in the *NEPR* for primary goods seems to have resulted from a combination of several factors. First, China in terms of per capita endowments is not a natural resource-rich country. The rapid growth of the domestic economy raised the demand for primary products, which reduced exports and increased imports of these goods despite the rise in domestic supply. Second, the decrease in the agricultural production after 1985 also contributed to the decline in net exports of agricultural products. Third, the decline in the trade performance of natural resource-intensive goods was also, to a great extent, attributable to the drop in world petroleum prices and the consequent decline in petroleum exports. The trends which have emerged since 1985 may indicate the direction in which China will move in the years to come.

While primary exports declined, manufactured exports demonstrated steady growth trends. The improvement in the trade of manufactured goods can be seen as a result of economic reforms and the open-door policy. In particular, the introduction of foreign technologies increased the productivity and competitiveness of manufacturing sectors and enabled them to improve their performance in world markets.

The economic reforms introduced during the 1980s led to an unprecedented surge of exports and imports from a low base and, consequently, an increase in the importance of foreign trade to the economy as a whole. Foreign trade ceased to be a residual of central economic plans and its growth is no longer limited by shortages and surpluses inherent in the economic plans (Hsu 1989). This change has been most obviously reflected in the changes in the commodity patterns of trade.

The rapid growth of trade, and the shift in commodity patterns of trade are clearly a result of economic reforms and the open-door policy. The partial removal of the centrally-controlled trade system, combined with other reform measures, has created an environment in which enterprises are able to respond to market signals and various incentive schemes. Export and import decisions are now made at lower levels and profitability has become a more important consideration.

This does not mean to suggest, however, that China had an efficient system of foreign trade by the end of 1980s. The foreign trade system was still only partially reformed. Foreign trade reforms, to a large extent, depend upon macroeconomic and microeconomic reforms of the economy as a whole. The mismatch of the domestic price structure with that in the international market makes it very difficult, if not impossible without significant government intervention, for independent enterprises to operate across the boundaries of the two systems without causing large disturbances to the structure of the domestic economy.

Domestic resource productivity methodology and data issues

Domestic resource cost (DRC) is a measure of the social cost of the resources required by a given industry to earn or save one unit of foreign exchange. The early version of the DRC measure was called 'the cost of the dollar earned' (in the case of exports) or 'saved' (in the case of import substitutes) (Bruno 1962:106). The concept has been used in the economic literature either as an *ex ante* measure of comparative advantage or as an *ex post* measure of the cost of a restrictive trade system, that is, as an alternative measure of effective protection.

Domestic resource cost measures have been used for some forty years in evaluating investment projects and trade policies for the economies where the official exchange rate and commodity prices are considered to be distorted. The first applications appeared in Israel in the 1950s (Baharal 1956; Barkai 1956; Toren 1957). A systematic analytical treatment was provided in the 1960s by Bruno (1962 and 1965). Since then, the DRC has been adopted widely in many country studies, among others, Turkey (Krueger 1966), Ghana (Leith 1976), Chile (Behrman 1977), Morocco (Balassa et al. 1984), Madagascar (Greenaway and Milner 1990) and Indonesia (Warr 1991).

Domestic resource cost measures have their origin in the classical concept of comparative advantage. In a multi-commodity Ricardian model, the home country will have a comparative advantage in good j if

$$\frac{a_j}{a_j^*} < 1 \quad (5)$$

where a_j and a_j^* denote the unit labour costs in producing good j in the home country and in the rest of the world respectively. More realistically, using intermediate inputs and non-labour factors of production, the comparative advantage of good j can be expressed as

$$\frac{\sum_{s=1}^n f_{sj} p_s}{p_j^* - \sum_{i=1}^l b_{ij} p_i^*} < 1 \quad (6)$$

where p_j^* is the world price of good j , p_s is the domestic price of primary factor s , and f_{sj} and b_{ij} are the coefficients of factor s and intermediate input i in the production of good j , respectively.

In empirical studies, the concept of comparative advantage has to be modified so that it can be measured using available information. This leads to the following formulation of DRC.

$$DRC_j = \frac{\sum_{s=1}^n f_{sj}^d p_s^d}{p_j^w - \sum_{i=1}^t b_{ij}^d p_i^w} \quad (7)$$

Two differences are worth noting. First, the prices in the *DRC* formula are not unobservable autarky prices. The factor prices, p_s^d , are domestic market prices of factors, or shadow prices should domestic factor markets be distorted. The world prices, p_j^w , are border prices of traded goods instead of the autarky prices in the rest of the world. The underlying assumption is that the world prices are given and will not be changed by the home country's trade activities.

Second, the coefficients of intermediate inputs should, ideally, be derived from world data compatible with the domestic factor costs measured on domestic data. Such a compatible world input-output table is, however, rarely available. As an alternative, the domestic coefficients are adopted in the estimation of *DRC*.

This modification requires a cautious interpretation of *DRC* estimates. The denominator in the formula shows the value-added generated by domestic, instead of the world, industries under the world prices. Given technological divergences, such derived value-added could well be zero or even negative for some industries where domestic productivity is substantially lower or the domestic intermediate input usage is considerably higher than the rest of the world. This could magnify the real difference between the home country and the rest of the world, but this is unlikely to change the ranking order of *DRC* measures, more important in this analysis than the actual levels.

To avoid undefined *DRC* measures when encountering a zero denominator, the inverse of *DRC* has been adopted and can be redefined as domestic resource productivity (*DRP*). This modification also facilitates the comparison between China's trade patterns and the estimated comparative advantage in the following section.

Third, as some goods produced in a country are non-tradable, the *DRP* measure must be confined to tradable goods. Thus the *DRP* formula should be written as

$$DRP_j = \frac{p_j^w - \sum_{i=1}^t (b_{ij}^d + b_{ij}^{d'}) p_i^w}{\sum_{s=1}^n (f_{sj}^d + f_{sj}^{d'}) p_s^d} \quad (8)$$

where $f_{sj}^{d'}$ and $b_{ij}^{d'}$ are the input coefficients of factor s and intermediate good i used in the production of non-tradable good j , respectively.

From the above equation, it can be seen that three sets of data are required in estimating China's *DRPs* for 1978 and 1987: input-output tables, ratios of border to domestic prices for tradable goods and the shadow price conversion factors of primary factors.

China's input-output tables. The compilation of China's 1987 input-output table is based on a 117-sector input-output table for that year (State Statistical Bureau of China 1991). It is the most recent and disaggregated table ever published in China. This table is modified to suit this analysis. The 6 agricultural sectors used in the table are further broken down into 13 commodity groups. Of the other 104 sectors, 81 sectors are aggregated into 48 groups of tradables, and 23 sectors are aggregated into 8 groups of non-tradables. The result is a 69-sector input-output table.³

The 1978 input-output table is derived by using the *RAS* approach (for procedures and properties see Stone 1961; Stone and Brown 1962; Cambridge University Department of Applied Economics 1963; Bacharach 1970; MacGill 1977). Three pieces of information for 1978 are gathered from Chinese statistics: the total gross output of each sector; total intermediate inputs sales of each sector; and total intermediate input purchases of each sector. Using this information and the direct coefficient table of the base year of 1987, the input-output coefficients for 1978 are derived from a series of iterations of bi-proportional adjustments.

Tradable goods price ratios. The ratios of border to domestic prices of 61 tradable goods are adopted from an estimation of China's nominal rates of protection (*NRP*) by Zhang (1993). As nominal tariff rates were unlikely to reflect China's true protection structure due to remaining price controls and various non-tariff barriers, the estimation of *NRP* was conducted on the basis of direct price comparison for each of the tradable goods specified. The price ratio for tradable good category *j* is the output weighted average of the price ratios of all the goods included in this category

$$\frac{ep_j^w}{p_j^d} = \sum_{k=1}^n w_{kj} \frac{ep_{kj}^w}{p_{kj}^d} \quad (9)$$

where *e* is the exchange rate and w_{kj} is the share of good *k* in the total output of tradable goods in the category *j*. The estimated price ratios are presented in Appendix Table 3.

Shadow price conversion factors for primary factors. China lacks well-functioning factor markets. The observed returns to factors are determined by a complex of non-market mechanisms and are unlikely to reveal the social opportunity costs of the factors involved. Such circumstances warrant an estimation of shadow prices.

Two primary factors of production, capital and labour, are included in China's input-output table. This division is based on an implicit assumption of homogeneous

labour. In China, however, labour must be regarded as heterogeneous, composed of at least two distinct categories. The majority of the labour force in China is unskilled and over-supplied, whereas skilled and highly trained workers remain a scarce resource and always in short supply. This heterogeneous nature of Chinese labour calls for separate estimation of shadow prices for two different types of labour.

Shadow price conversion factors for three factors: capital, skilled and unskilled labour, are estimated by Zhang (1993). The shadow price conversion factor for a given factor of production is the ratio of its estimated shadow price to its prevailing price.

The estimation of shadow prices was based on the marginal products of the factors concerned. The marginal products were estimated separately from the cross-section data of five major sectors of the economy: agriculture, industry, construction, transportation and commerce. Since the data were measured in terms of distorted domestic prices, the estimated marginal products must be converted to border prices by the ratios of border to domestic good prices. The shadow price conversion factor can then be expressed as

$$\frac{p^*}{p^d} = \sum_{i=1}^s l_i \frac{p_i^*}{p_i^d} \quad (10)$$

where p_i^* is the shadow price of a factor in sector i , p_i^d is the sectoral average return to the factor concerned and l_i is its sectoral weight. The shadow price of labour is the border price equivalent of its marginal product. For the shadow price of capital, the border price equivalent of its marginal product must be divided by a social discount rate (for derivation see Squire and van der Tak 1975:68–9). Estimates are presented in Table 3.

Table 3 Shadow price conversion factors for primary factors, China, 1978 and 1987

	1978	1987
Capital	1.28	2.01
Skilled labour	4.63	2.58
Unskilled labour	0.33	0.87

Sources: Zhang Xiaoguang, 1993. China's Trade Patterns and International Comparative Advantage, PhD dissertation, The Australian National University, Canberra.

The input-output tables for China have six value-added items

- basic depreciation
- capital repair depreciation
- labour income
- the welfare fund
- profits and taxes
- others.

The two items of depreciation can be aggregated into one. The welfare fund is payable to individual workers and can therefore be incorporated into labour income. The resulting sum is broken down into skilled and unskilled labour income.

Profits and taxes are presented as one item in the Chinese input-output tables because in a planned economy dominated by state-owned enterprises, profits, like taxes, are a part of government revenue, but they differ in their relationship to capital. Profits can essentially be regarded as capital gains or payments for capital services while taxes are usually not directly related to capital. Tax revenue comes from various sources, however the predominant component of tax revenue in China had long been the so-called 'uniform industrial and commercial tax' (*gongshang tongyi shui*). Which was dependent on the gross value of turnover or output but not the net income or profits of enterprises. In recent years, the traditional taxation system has been substantially reformed, but the above situation did not change in the period concerned. For this reason, an attempt has been made to separate profits from taxes. The last item, 'others', contains unspecified transfer payments and therefore is included in taxes.

It should be noted that the concept of profit in a planned economy is more complicated than in a market economy. Its level may be determined by capital market distortions such as depressed interest rates and depreciation rates. Depreciation and profits are both treated as payments for capital services and hence shadow priced. Similarly, skilled and unskilled labour income should also be assigned to shadow wage conversion factors. Tax revenue and other transfer payments are government revenue and therefore their relevant conversion factors are set to unity because government revenue is the numeraire used in shadow pricing.

DRP estimates of China's comparative advantage

The *DRP* estimates of China's comparative advantage for 61 tradable goods for 1978 and 1987 are presented in Figures 3 and 4. The tradables are divided into two broad groups: advantage and disadvantage, by a benchmark of unity. The commodities are grouped into five categories according to their factor intensity: agricultural, natural resource, physical capital, human capital and labour-intensive.

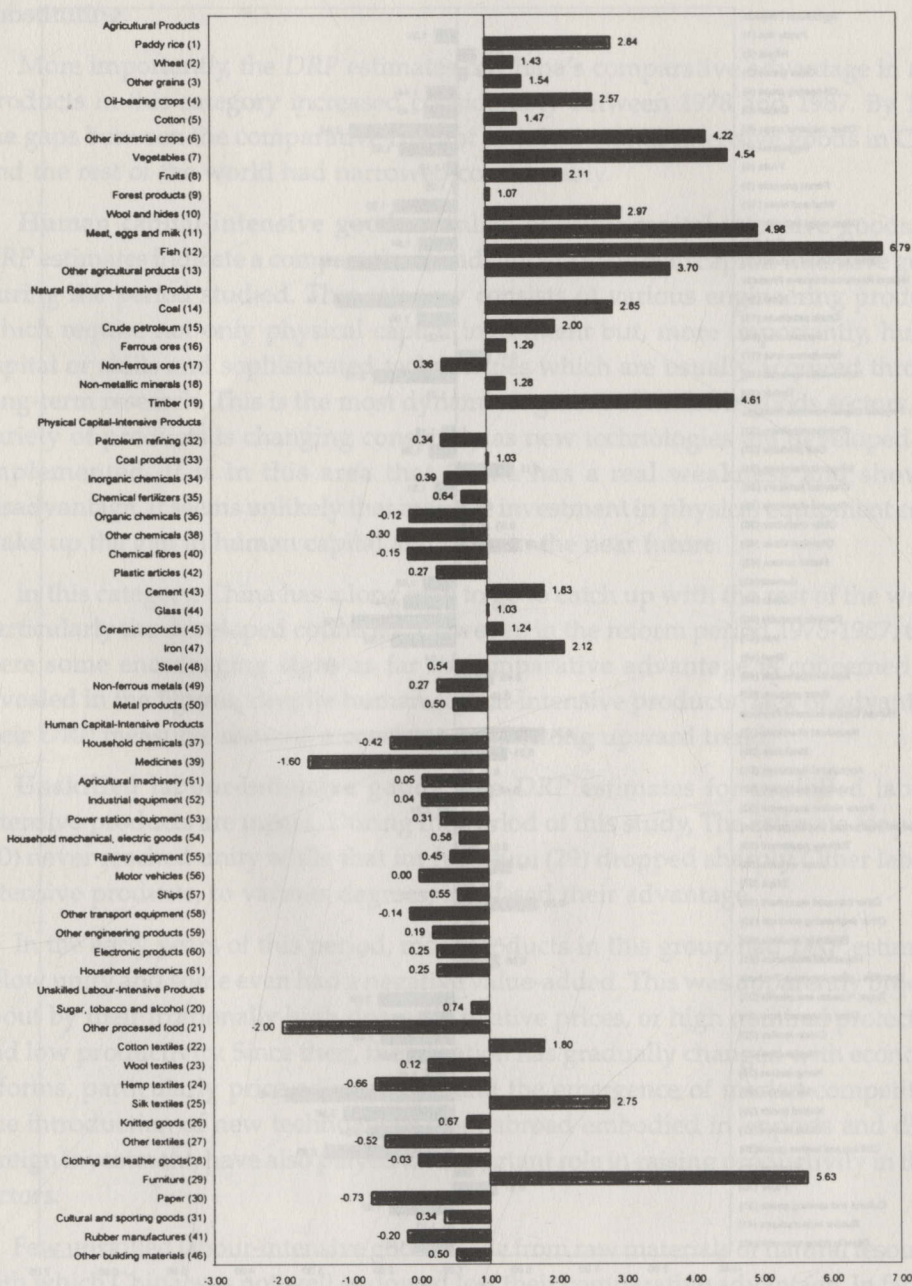
Agricultural products. With the exception of cotton (5) and forest products (9) which have relatively stable *DRP* estimates, almost every agricultural commodity group shows a decline in *DRP* estimates, which indicates rising comparative costs of production. For instance, in 1978, one yuan worth of domestic factor costs in paddy rice production could generate 2.84 yuan worth of US dollars while in 1987 the same input could only produce 1.31 yuan worth of US dollars. In 1978, all agricultural commodities had *DRP* measures above unity, whereas in 1987 their comparative advantage over the rest of the world was lower and in some cases such as wheat (2) and other grains (3), they had become uncompetitive.

Natural resource-intensive goods. China had a comparative advantage in these goods during 1978–87, with the exception of non-ferrous ores (17). The *DRP* measures for coal (14) and crude petroleum (15) were quite high whilst the former exhibited very mild variations. Ferrous ores (16) seemed to be losing, and non-metallic minerals (18) to be increasing, their respective comparative advantages. The biggest decline in comparative advantage in this category occurred in timber (19), from 4.61 in 1978 to 1.03 in 1987.

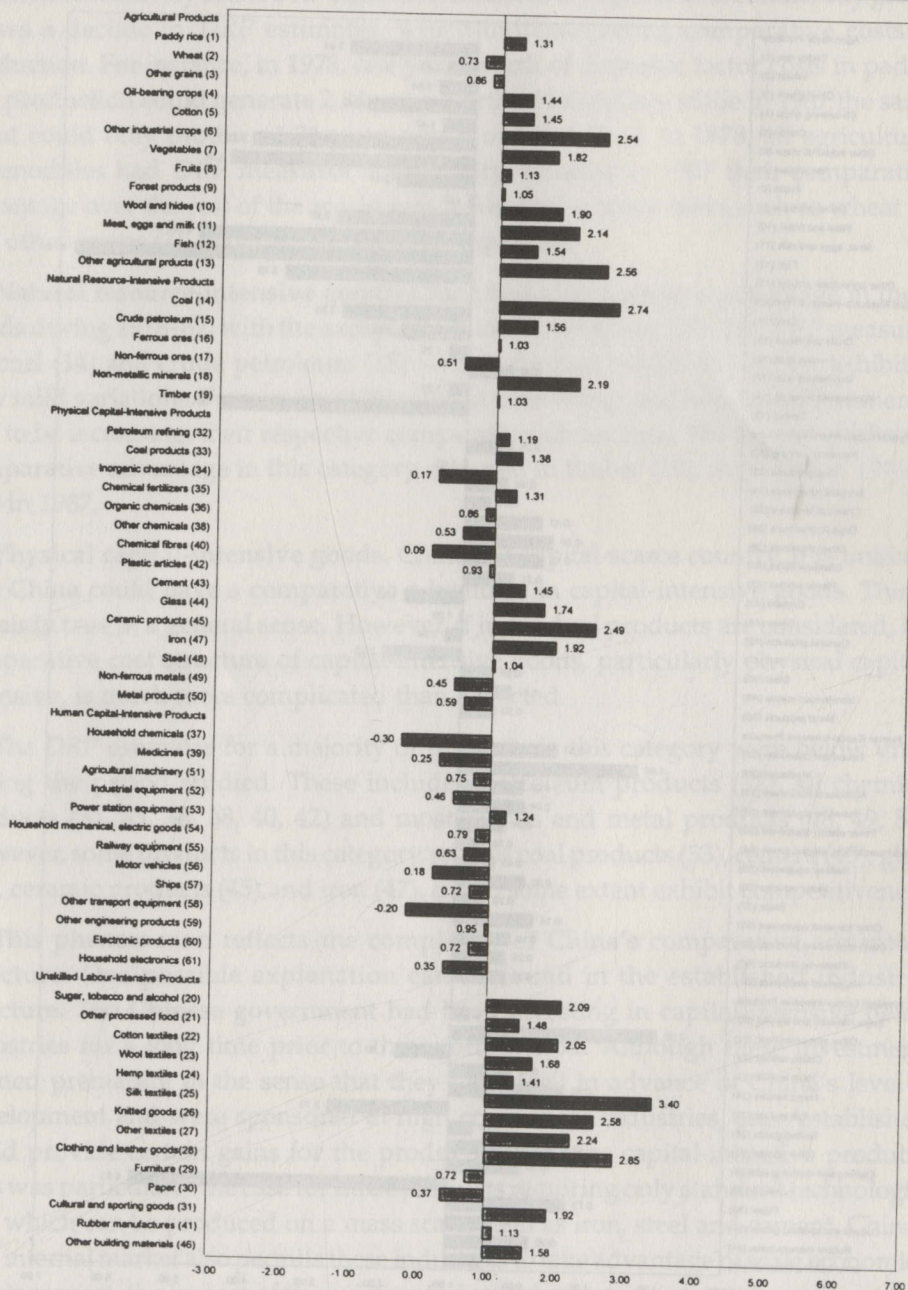
Physical capital-intensive goods. China is a capital-scarce country. It is unlikely that China could have a comparative advantage in capital-intensive goods. This is certainly true in a general sense. However, if individual products are considered, the comparative cost structure of capital-intensive goods, particularly physical capital-intensive, is much more complicated than expected.

The *DRP* estimates for a majority of products in this category were below unity during the period studied. These included petroleum products (32), all chemical products (34, 35, 36, 38, 40, 42) and most metals and metal products (48, 49, 50). However, some products in this category, such as coal products (33), cement (43), glass (44), ceramic products (45) and iron (47), did to some extent exhibit competitiveness.

This phenomenon reflects the complexity of China's comparative advantage structure. One possible explanation can be found in the established industrial structure. The Chinese government had been investing in capital-intensive heavy industries for a long time prior to the reform period. Although these investments seemed premature in the sense that they were well in advance of China's level of development and were sponsored at high costs, these industries, once established, could provide certain gains for the production of some capital-intensive products. This was particularly the case for those products requiring only standard technologies and which can be produced on a mass scale, such as iron, steel and cement. China's vast internal market also permits these industries to take advantage of scale economies. In this respect, the impact of the existing industrial structure, or past investments, on

Figure 3 *DRP* measures of China's comparative advantage, 1978

Source: Zhang Xiaoguang, 1993. China's Trade Patterns and International Comparative Advantage, PhD dissertation, The Australian National University, Canberra, Table 9.1.

Figure 4 *DRP measures of China's comparative advantage, 1987*

Source: Zhang Xiaoguang, 1993. China's Trade Patterns and International Comparative Advantage, PhD dissertation, The Australian National University, Canberra, Table 9.2.

China's current comparative advantage should not be overlooked because it may help to determine in which industries China has a potential for import competing or substituting.

More importantly, the *DRP* estimates of China's comparative advantage in most products in this category increased considerably between 1978 and 1987. By 1987, the gaps between the comparative costs of physical capital-intensive goods in China and the rest of the world had narrowed considerably.

Human capital-intensive goods. Unlike physical capital-intensive goods, the *DRP* estimates indicate a comparative disadvantage in human capital-intensive goods during the period studied. This category consists of various engineering products, which require not only physical capital investment but, more importantly, human capital or skills and sophisticated technologies which are usually acquired through long-term research. This is the most dynamic segment of tradable goods sectors. The variety of products is changing constantly as new technologies are developed and implemented. It is in this area that China has a real weakness and shows a disadvantage. It seems unlikely that massive investment in physical equipment could make up the gap in human capital and skills in the near future.

In this category, China has a long way to go to catch up with the rest of the world, particularly the developed countries. However, in the reform period 1978-1987, there were some encouraging signs as far as comparative advantage is concerned. As revealed in the figures, despite human capital-intensive products' lack of advantage, their *DRP* measures showed a consistent and strong upward trend.

Unskilled labour-intensive goods. The *DRP* estimates for unskilled labour-intensive products are mixed. During the period of this study, The estimate for paper (30) never reached unity while that for furniture (29) dropped sharply. Other labour-intensive products, to various degrees, increased their advantage.

In the early years of this period, most products in this group had *DRP* estimates below unity and some even had a negative value-added. This was apparently brought about by their irrationally high domestic relative prices, or high nominal protection, and low productivity. Since then, the situation has gradually changed with economic reforms, particularly price adjustments, and the emergence of market competition. The introduction of new technologies from abroad embodied in imports and direct foreign investment, have also played an important role in raising productivity in these sectors.

Few unskilled labour-intensive goods made from raw materials or natural resources with which China was not well endowed lost their comparative advantage. In fact, as comparative advantage in agricultural and natural resource-intensive goods declined

as shown above, the pace of increase in comparative advantage in those labour-intensive goods which relied heavily upon primary products as their intermediate inputs diminished after the mid-1980s, or at least did not increase as rapidly as in previous years. The comparative advantage associated with some products even fell, as seen, for instance, in the *DRP* estimates for sugar, tobacco and alcohol (20), wool textiles (23), hemp textiles (24) and other textiles (27). This is a cause for some concern over prospects for development in unskilled labour-intensive manufacturing.

In 1978, China's comparative advantage was almost exclusively confined to agricultural and natural resource-intensive goods. Even the handful of physical capital and unskilled labour-intensive products that displayed some comparative advantage such as cement (43), ceramic products (45), cotton textiles (22), silk textiles (25) and furniture (29) were all, to some extent, related to agricultural products and other natural resources.

By 1987, this structure had changed dramatically (Figure 4). The comparative advantage previously shown in primary products had fallen sharply and that in manufactured products had increased considerably despite the fact that many products, especially capital-intensive manufactures, were still uncompetitive internationally. Most notably, the majority of unskilled labour-intensive products were found to have a comparative advantage. From these figures, four general trends can be identified.

(1) There was a general increase in *DRP* measures of China's comparative advantage in the period studied, implying that the Chinese economy experienced a considerable increase in its international competitiveness. The *DRP* ranking of tradable commodities indicates that in 1978 only 24 of 31 tradable product groups had a *DRP* estimate above unity. This number increased to 37 by 1987. In 1978, the commodities with a comparative advantage accounted for only 45 per cent of the total value of gross output of Chinese tradables. By 1987, however, this group amounted to more than 64 per cent of total tradable output value.

(2) There was a significant shift in comparative advantage away from primary products, particularly agricultural commodities, towards manufactures, especially labour intensive goods. As shown in Table 4, the *DRP* estimates for agricultural and natural resource-intensive goods declined while that of other manufactured goods increased. By 1987, *DRP* estimates for unskilled labour-intensive goods as a group surpassed primary products and became the most competitive commodity group relative to other tradables.

Table 4 *DRP measures of China's comparative advantage in five groups of tradable goods, 1978 and 1987*

	1978	1987
Agricultural products	2.99	1.57
Natural resources-intensive products	2.11	1.50
Physical capital-intensive products	0.65	1.09
Human capital-intensive products	0.08	0.51
Unskilled labour-intensive products	0.80	1.78

In 1978, China's comparative advantage was confined mainly to primary commodities, namely agricultural products, minerals and timber. Of 24 commodity groups with *DRP* measures above unity, 13 were from the agricultural sector. Along with 5 natural resource-intensive goods, primary products together accounted for 67 per cent of the output value of these commodities. In 1987, although 11 agricultural products and 5 natural resource-intensive goods remained in the group of 37 commodities with a comparative advantage, their aggregated share in the output value of this group dropped to 38 per cent (Table 5).

Over the same period, manufactured products, particularly unskilled labour-intensive manufactures, replaced primary products and dominated this group. In 1978, most labour-intensive manufactures had no comparative advantage. By 1987, however, 12 out of 14 unskilled labour-intensive manufactured products had shown a comparative advantage. Labour-intensive goods alone contributed more than 42 per cent of the value of all commodities with a comparative advantage in 1987.

Physical and human capital-intensive manufactured goods dominated the group which displayed a comparative disadvantage during the period studied. The combined share in total output value of this group expanded from 60 to 71 per cent as the share of unskilled labour-intensive manufactures shrank sharply. It can also be seen in Table 5 that the share of primary products in the group estimated to have a comparative disadvantage rose dramatically as more agricultural and natural resource-intensive products lost their advantage.

Changes in the commodity composition of China's comparative advantage are further illustrated in Table 6 where the commodities are arranged in descending order in accordance with their *DRP* ranking and equally divided into three groups. The top 20 commodities have the highest values of *DRP* estimates implying the highest level of comparative advantage.

Table 5 Composition of commodity groups with and without comparative advantage, China, 1978 and 1987 (per cent)

	1978		1987	
Group with comparative advantage ($DRP > 1$)				
Agricultural products	56.4	(13)	31.8	(11)
Natural resource-intensive products	10.7	(5)	6.6	(5)
Physical capital-intensive products	4.7	(3)	17.6	(8)
Human capital-intensive products	-	(-)	1.9	(1)
Unskilled labour-intensive products	28.2	(3)	42.2	(12)
Group without comparative advantage ($DRP < 1$)				
Agricultural products	-	(-)	19.0	(2)
Natural resource-intensive products	0.1	(1)	1.2	(1)
Physical capital-intensive products	33.6	(12)	31.8	(7)
Human capital-intensive products	26.0	(13)	39.0	(12)
Unskilled labour-intensive products	39.2	(11)	9.1	(2)

Note: Figures in parentheses are numbers of commodities in the group.

Table 6 Commodity composition of *DRP* ranking, China, 1978 and 1987

	1978	1987
Top 20		
Agricultural products	12	5
Natural resource-intensive products	3	3
Physical capital-intensive products	2	3
Human capital-intensive products	-	-
Unskilled labour-intensive products	3	9
Middle 20		
Agricultural products	1	6
Natural resource-intensive products	3	2
Physical capital-intensive products	8	7
Human capital-intensive products	4	2
Unskilled labour-intensive products	4	3
Bottom 21		
Agricultural products	-	2
Natural resource-intensive products	-	1
Physical capital-intensive products	5	5
Human capital-intensive products	9	11
Unskilled labour-intensive products	7	2

The relative positions of natural resource and capital-intensive goods were fairly stable during this period (Table 6). Major shifts occurred between agricultural and labour-intensive goods: the number of agricultural commodities in the top 20 group dropped from 12 to 5 while 6 labour-intensive goods moved from the bottom or the middle group to the top group replacing the agricultural products which moved out of the top 20 group.

(3) The international competitiveness of capital-intensive manufactured goods improved over the period concerned, though their relative positions in *DRP* rankings remained almost unchanged. This was reflected in a general rise in the magnitudes of their *DRP* estimates. Although most of these goods still had a *DRP* estimate below unity, the degree to which they were uncompetitive fell. This is an important aspect of the overall improvement in China's comparative advantage.

Comparative advantage and trade patterns

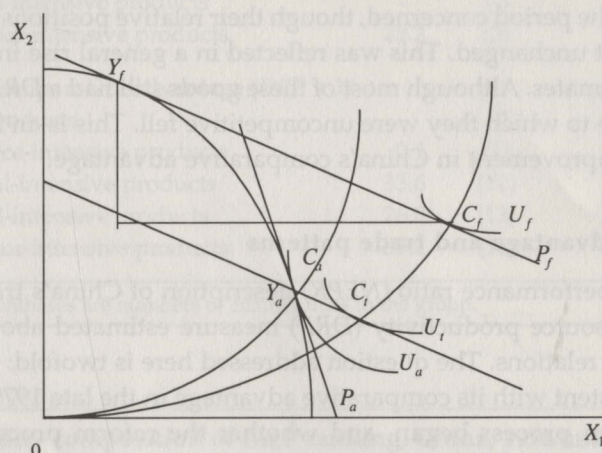
The net export performance ratio (*NEPR*) description of China's trade patterns and the domestic resource productivity (*DRP*) measure estimated above allow further analysis of their relations. The question addressed here is twofold: whether China's trade was consistent with its comparative advantage in the late 1970s just before the economic reform process began, and whether the reform process had led to a convergence or divergence of China's trade from its pattern of comparative advantage ten years later.

Trade theory suggests that if a country employs neutral trade policies its trade will follow its comparative advantage. In so doing, the country maximises the gains from trade. This also implies that domestic resources will be allocated according to the country's comparative advantage. The relationship between a country's comparative advantage, trade pattern and production structure can be illustrated using a simple two sector Heckscher-Ohlin model (Figure 5).

In isolation, the economy produces and consumes two goods X_1 and X_2 at Y_a on the domestic relative price line P_a . Suppose that the international relative price line P_f is flatter than P_a implying that X_2 is more expensive and/or X_1 is relatively cheaper in the world than domestic markets. The country, therefore, has a comparative advantage in X_2 and a disadvantage in X_1 . If the economy begins to trade according to its comparative advantage, that is, exports X_2 and imports X_1 , and resources are immobile between sectors it can increase its welfare by consuming at C_i , and moving from the indifference curve U_a to a higher curve U_i . This gain is limited and obtained only when resources are immobile between sectors and hence production remains at Y_a .

Assuming all prices are competitive, comparative advantage in this model is determined by the difference in relative commodity prices between the home country in its pre-trade equilibrium and the rest of the world. It is this difference that shapes the optimum pattern of trade.

Figure 5 Relationship between comparative advantage, trade patterns and the structure of production



Although the home country can gain from trade whilst keeping its production structure intact, to maximise the gains from trade, domestic resources must be re-allocated in accordance with comparative advantage so that pattern of trade will change. Without adjustment in the pattern of domestic production, a country's capacity to expand trade is limited. This is illustrated in Figure 5. As export of X_2 in exchange for X_1 is beneficial for the country, the production structure should be rearranged so that X_2 production is increased. This is shown in the movement of the production point from Y_a along the production frontier toward Y_f . The change in the structure of production enables the home country to export more X_2 , import more X_1 and further increase welfare. As trade expands and domestic resources are continuously reallocated between sectors in the way described above, the country's welfare improves. The maximum gain is achieved when the country produces at the point Y_f and consumes at C_f on the international relative price line P_f .

The maximisation of gains from trade is associated with efficient resource allocation among sectors. Resource allocation efficiency in production can therefore be detected by changes in trade patterns, particularly their relationships with comparative advantage.

When an economy moves from isolation to open trade or from a system of central planning to free markets, trade patterns are expected to move toward comparative advantage. In the process of the policy shift, a growing correlation between patterns of trade and comparative advantage can be seen as a sign of positive gains from trade. Changes in production structure follow, and as these changes are induced by trade, they are reflected in variations in trade patterns. A comparison of trade patterns and comparative advantage indicates the impact of policy shift.

In this study, the *NEPR* is descriptive of actual trade patterns and *DRP* is a proxy for comparative advantage. It is expected that the *NEPR* will be correlated with *DRP* if domestic resources are allocated efficiently. Other things being constant, *NEPR* can be expressed as a function of *DRP*.

$$NEPR = f(DRP) \quad (11)$$

This relationship between *DRP* and the *NEPR* is valid for an environment characterised by various distortions. In a free trade situation domestic production is conducted at international prices and by definition *DRP* estimates will equal unity for all tradable goods. In such circumstances *DRP* are not related to the country's trade flows.

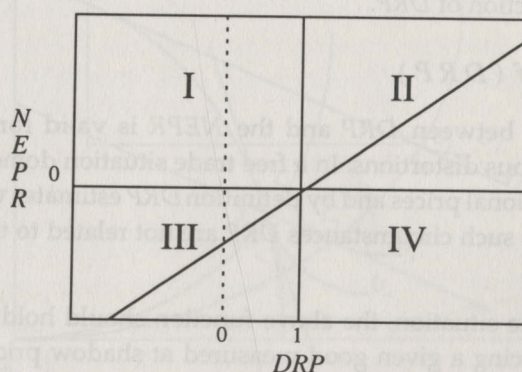
In a non-free trade situation, the above function should hold because domestic factor costs of producing a given good measured at shadow prices are usually not identical to its value-added measured at international prices. A *DRP* estimate below (above) unity indicates a low (high) productivity of domestic factors, or a high (low) cost of domestic production, in comparison with the corresponding international level. Therefore the good ought to be imported (exported) should domestic resources be allocated efficiently. The degree of correlation between *DRP* and the *NEPR* can thus be viewed as an indication of resource allocation efficiency in tradable goods industries.

The relationship between *DRP* and the *NEPR* is illustrated in Figure 6.⁴ The horizontal axis refers to *DRP* and the vertical axis refers to *NEPR*. The figure is divided into four quadrants. Commodities with a *DRP* measure above unity have an international comparative advantage and are expected to be net exports, that is, positive *NEPR* measures. These commodities should be located in Quadrant II. Commodities with a *DRP* measure below unity have a comparative disadvantage and are net imports. Their *NEPR* measures are negative and lie in Quadrant III.

In general, a high *DRP* estimate should be associated with a high value of *NEPR*, and a low *DRP* with a low *NEPR* if domestic resources are allocated efficiently across tradable goods producing industries. The case of inefficient allocation can be illustrated using two commodities. If commodity *A* has a higher *DRP* estimate and a lower *NEPR* estimate than *B*, the economy could benefit from shifting domestic resources from

production of *B* to production of *A* and expanding exports of *A* because exporting *A* is more profitable in terms of international value-added. As a result, the higher *DRP* estimate for *A* will eventually lead to a higher *NEPR*. In the case of efficient resource allocation, the measures of *DRP* and *NEPR* for tradable goods should lie close to the upward sloped curve in Figure 6.

Figure 6 Relationship between *DRP* and *NEPR*



In the real world, various distortions prevent countries from trading with each other according to their comparative advantage. As a result, trade patterns may not follow comparative advantage as indicated by the convergence curve in Figure 6. The deviation of trade patterns from comparative advantage can be used to examine resource allocation inefficiency in industries producing tradable goods.

In a highly distorted economy, domestic and international prices for tradable goods diverge so greatly that the *DRP* estimates for some goods may be a long way from unity. In extreme cases, value-added for certain tradables may be negative. This results in negative *DRP* estimates. Due to these distorted market signals, domestic firms are unlikely to make correct decisions about their foreign trade transactions. In addition, trade flows may be even more distorted and divergent from comparative advantage if government intervenes in enterprises' trade decisions or seeks direct control over foreign trade business, as was often seen in centrally-planned economies. In such situations, commodities could be either over-traded (excessively exported or imported) or under-traded (heavily protected domestic production). *DRP* and *NEPR* are unlikely to be closely correlated. On the other hand, if a country reduces distortions by moving

to a market-oriented system and liberalises its trade with the outside world, domestic and international prices gradually converge and trade decisions are increasingly based on international prices. As a result, *DRP* and *NEPR* are more likely to be closely correlated.

In the presence of distortions, *DRP* estimates for tradable goods may vary widely and the convergence curve may be quite flat (Figure 6). As a country moves towards free trade, *DRP* estimates move closer to unity and the convergence curve will rotate towards the vertical line through the horizontal axis at 1 (Figure 6). The angle between the curve and the vertical line can also be used as an indicator of resource allocation efficiency. It indicates how close the economy is to free trade equilibrium. A higher degree of slope implies a high level of domestic distortion. As the economy moves towards free trade, the degree of the angle declines. A zero degrees indicates that the economy reaches the free trade equilibrium. This triangle formed by the convergence curve and the vertical line is referred to in the following as the 'distortion triangle'.

The movement of *DRP* estimates towards unity over time as an economy moves toward free trade is also accompanied by an increase in the correlation between *DRP* and *NEPR* estimates. It can be seen that as *DRP* move closer to unity *NEPR* estimates converge towards them. In other words, the degree of correlation between the two estimates will rise as the economy opens up. This occurs because domestic prices are gradually linked to world prices so that foreign trade decisions are made more in accordance with comparative advantage. When *DRP* estimates finally equal unity *NEPR* estimates for tradable goods will all lie on the vertical line and their correlation coefficients will all be one.

In the following, the above analysis is applied to China. Correlations between estimates of China's *DRP* and *NEPR* over the periods 1978–87 are examined to reveal whether, after ten years of economic reforms, resource allocation efficiency was improved in the tradable good producing sectors. The hypothesis is that if efficiency of resource allocation in China's trade sector improved through the process of economic reforms, two changes in *DRP* and *NEPR* estimates should be visible over time.

- *NEPR* estimates should have become more closely correlated with *DRP* estimates as firms increasingly based their trade decisions on market signals instead of central plans
- *DRP* estimates should have moved closer to unity as the economy opened up to free trade and relative price differentials fell. The observed curve should have rotated counter-clockwise.

The first change can be analysed by plotting measures of *DRP* and *NEPR* of 61 tradable commodities for 1978 (Figure 7). Tradable commodities are spread so widely that little correlation could be found between the two measurements. China exported

19 groups of goods with *DRP* estimates less than unity and imported 6 groups of goods with *DRP* estimates above unity.⁵ They are seen in Quadrants I and IV (Figure 7). As a *DRP* measure of unity delineates comparative advantage and disadvantage, these 25 groups of commodities were traded against China's comparative advantage. In 1978, the 19 exports accounted for 43 per cent of China's total exports while the 6 imports accounted for 22 per cent of total imports.

These results are not surprising because, at that time, China's traditional trade system was still in place. Production and trade decisions were almost exclusively made through plans and, as a result, resource flows among industries were normally not guided by international market signals and profitability.

After the early 1980s, the centrally-planned trade system was reformed in many ways and a decentralised system began to take shape. Foreign trade corporations were granted more freedom in decision making. Foreign investment in export producing industries increased rapidly and inserted a substantial impact on the economy, particularly in the southeast coastal region. It could be expected that China's international comparative advantage and its trade patterns changed accordingly over this period.

To investigate the impact of the reforms, China's trade pattern is compared with its comparative advantage for 1987 in the same manner as the above analysis for 1978. The *DRP* measures of comparative advantage and *NEPR* measures of trade patterns for 1987 are plotted in Figure 8. The difference between this figure and the figure for 1978 is impressive. The spread of tradable goods narrowed substantially and most goods moved closer to the regression line and a clear correlation between the estimates of *DRP* and *NEPR* emerged.

The figure indicates that the number of goods or groups of goods traded against comparative advantage fell from 25 to 19. The number of exported goods with *DRP* estimates lower than unity declined from 18 to 8⁶ while the number of the imported goods with *DRP* estimates higher than unity rose from 6 to 11.⁷ This suggests that efficiency improvement was much greater in the export sector than in the import sector. Despite the increase in imports traded against advantage, however, the share of these goods in total imports fell to 8.4 per cent while the proportion of goods exported against comparative advantage in total exports declined to 13.5 per cent.

The improvement in resource allocation in the trade sector can be further verified by examining changes in the correlation coefficients between *DRP* and *NEPR* measures during this period. It should be noted that the extent to which the two measures are correlated depends, to some extent, on the classification of industries. If an industry in which these two measures are closely correlated is further divided into a number of sub-industries, the increase in the number of correlated observations could arbitrarily

increase the correlation coefficient. As the industries in this study are not divided evenly by size, a simple ordinary least squares (OLS) regression may bias the actual correlations between *DRP* and the *NEPR*. To tackle this problem, a weighted least square (WLS) estimation is used with sectoral gross or net output values as weights. Correlation coefficients are derived from the equation

$$NEPR_j = a + b(DRP_j) + e_j \quad (12)$$

where e_j is the error term. Estimated results from the OLS and WLS regressions are reported in Table 7.

Table 7 Correlation coefficients between *DRP* and *NEPR*, China, 1978 and 1987

	Unweighted	Weighted	
	(OLS)	WLS ^G	WLS ^N
1978	0.253	0.275	0.317
1987	0.638	0.630	0.618

Notes: OLS—Ordinary least squares.

WLS^G—Weighted least squares with gross output values as weights.

WLS^N—Weighted least squares with net output values as weights.

Three estimated correlation coefficients are quite similar for the two years. The correlation coefficients between *DRP* and *NEPR* are estimated to be between 0.25 and 0.32 in 1978, indicating little correlation. This result implies that, at that time, China's pattern of trade specialisation was not based on its international comparative advantage.

As shown in the table, all three sets of estimates after 1978 indicate a convergence between China's patterns of trade and its comparative advantage. During the period 1978–87, the correlation coefficient between estimates of *DRP* and *NEPR* rose from 0.25/0.32 to 0.62/0.64 (Table 7).⁸ The increase in correlation between *DRP* and *NEPR* measures indicates a movement toward more optimal pattern of trade. It also implies that domestic resources were allocated among tradable good producing sectors more efficiently.

The correlation coefficients can be decomposed into ones for different commodity groups to reveal the extent to which each group contributed to the overall convergence between China's trade pattern and comparative advantage. These decomposition also indicates in which industries resources allocation became more efficient.

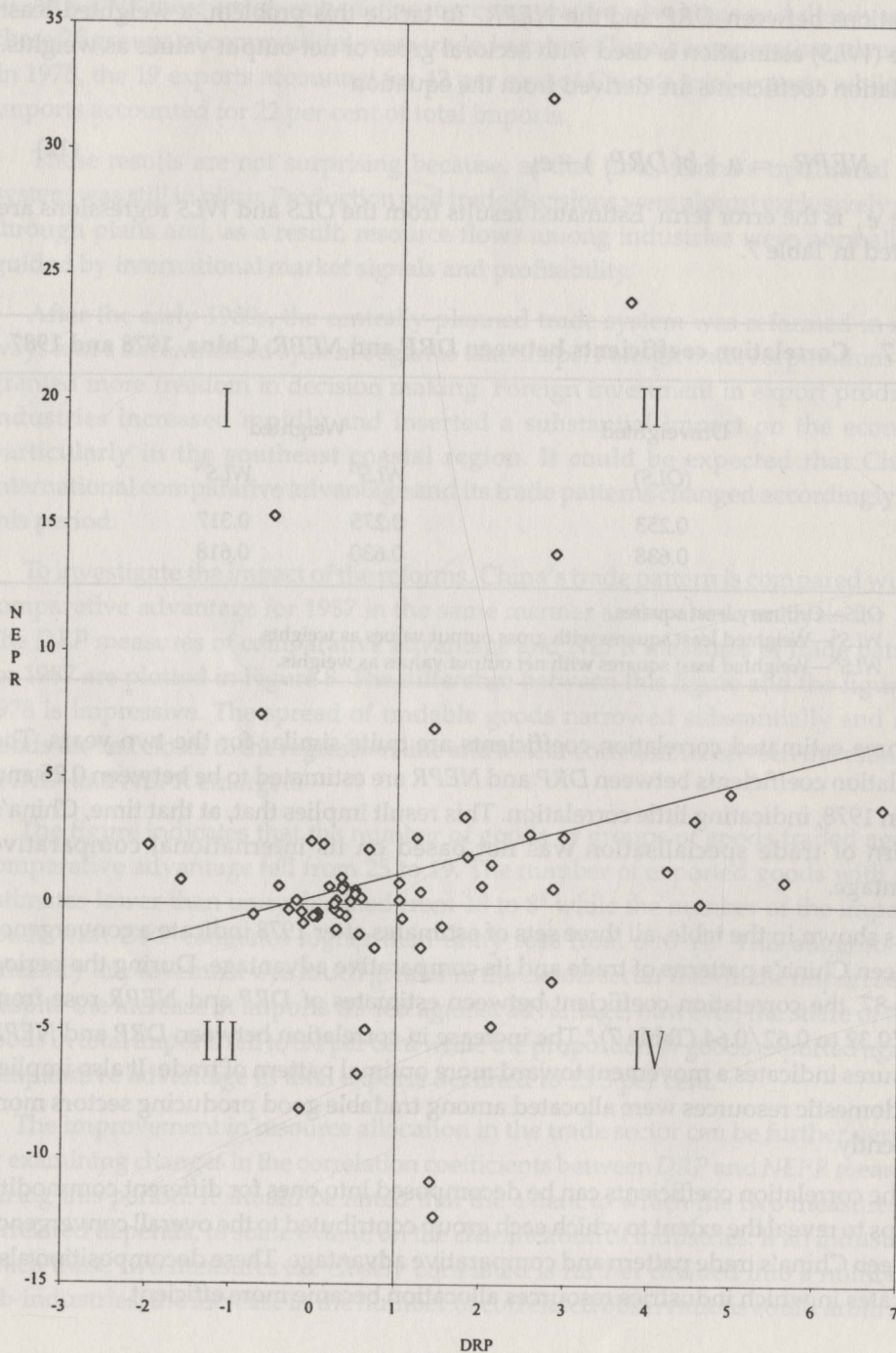
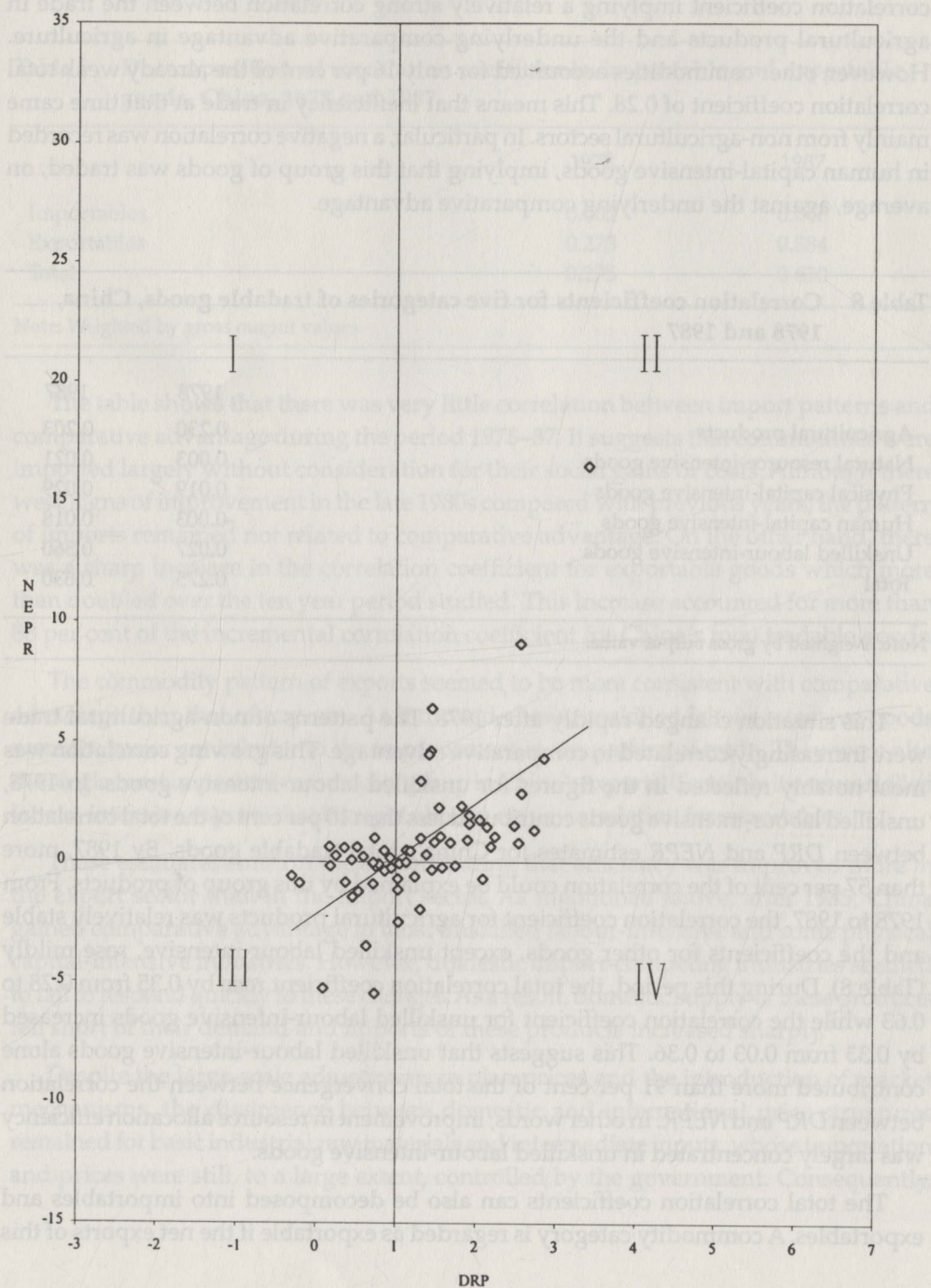
Figure 7 Estimates of *DRP* and *NEPR* for 61 tradable goods, China, 1978

Figure 8 Estimates of *DRP* and *NEPR* for 61 tradable goods, China, 1987

Correlation coefficients for five categories of tradable goods are provided in Table 8. In 1978, agricultural products as a group contributed 83.5 per cent of the total correlation coefficient implying a relatively strong correlation between the trade in agricultural products and the underlying comparative advantage in agriculture. However, other commodities accounted for only 16 per cent of the already weak total correlation coefficient of 0.28. This means that inefficiency in trade at that time came mainly from non-agricultural sectors. In particular, a negative correlation was recorded in human capital-intensive goods, implying that this group of goods was traded, on average, against the underlying comparative advantage.

Table 8 Correlation coefficients for five categories of tradable goods, China, 1978 and 1987

	1978	1987
Agricultural products	0.230	0.203
Natural resource-intensive goods	0.003	0.021
Physical capital-intensive goods	0.019	0.029
Human capital-intensive goods	-0.003	0.018
Unskilled labour-intensive goods	0.027	0.360
Total	0.275	0.630

Note: Weighted by gross output value.

This situation changed rapidly after 1978. The patterns of non-agricultural trade were increasingly correlated to comparative advantage. This growing correlation was most notably reflected in the figures for unskilled labour-intensive goods. In 1978, unskilled labour-intensive goods contributed less than 10 per cent of the total correlation between *DRP* and *NEPR* estimates for China's total tradable goods. By 1987, more than 57 per cent of the correlation could be explained by this group of products. From 1978 to 1987, the correlation coefficient for agricultural products was relatively stable and the coefficients for other goods, except unskilled labour-intensive, rose mildly (Table 8). During this period, the total correlation coefficient rose by 0.35 from 0.28 to 0.63 while the correlation coefficient for unskilled labour-intensive goods increased by 0.33 from 0.03 to 0.36. This suggests that unskilled labour-intensive goods alone contributed more than 91 per cent of the total convergence between the correlation between *DRP* and *NEPR*. In other words, improvement in resource allocation efficiency was largely concentrated in unskilled labour-intensive goods.

The total correlation coefficients can also be decomposed into importables and exportables. A commodity category is regarded as exportable if the net exports of this

category are positive, otherwise it is importable. Correlation coefficients are calculated for these two groups of goods for 1978 and 1987, respectively (Table 9).

Table 9 Decomposition of correlation coefficients: importable and exportable goods, China, 1978 and 1987

	1978	1987
Importables	0.002	0.046
Exportables	0.273	0.584
Total	0.275	0.630

Note: Weighted by gross output values.

The table shows that there was very little correlation between import patterns and comparative advantage during the period 1978–87. It suggests that commodities were imported largely without consideration for their social gains or costs. Although there were signs of improvement in the late 1980s compared with previous years, the pattern of imports remained not related to comparative advantage. On the other hand, there was a sharp increase in the correlation coefficient for exportable goods which more than doubled over the ten year period studied. This increase accounted for more than 88 per cent of the incremental correlation coefficient for China's total tradable goods.

The commodity pattern of exports seemed to be more consistent with comparative advantage than that of imports. As indicated above, unskilled labour-intensive goods were the major contributor to the improvement in the pattern of trade. They were also the single most important commodity group in China's exports. Certainly it was unskilled labour-intensive exports that brought about a closer correlation for exportables.

These estimates confirm the earlier finding that efficiency was improved more in the export sector than in the import sector. As mentioned above, after 1985, China gained comparative advantage in most unskilled labour-intensive and some physical capital-intensive industries. However, domestic import-competing industries seemed to fail to respond quickly to these changes. As a result, domestic supply of these products fell short of their demand and imports of these products increased sharply.⁹

Despite the large-scale adjustments in plan prices and the introduction of market mechanisms, the divergence between domestic and international price structures remained for basic industrial raw materials and intermediate inputs, whose importation and prices were still, to a large extent, controlled by the government. Consequently,

import subsidies to state enterprises could not be completely abolished. These remaining administrative controls and subsidies encouraged domestic producers to use more imported intermediate goods and further distort import patterns.

In such a partially-reformed trade system, the decentralisation of import decision-making, combined with a centrally-subsidised financial arrangement, became the major source of import inefficiency and a sustained trade deficit in the mid-1980s.

It should also be pointed out that, even in 1987, the correlation between China's trade patterns and comparative advantage remained moderate. The correlation coefficient of 0.64 implies that only 41 per cent of the variation in the total sum of squares of deviations that could be explained by *DRP*. In other words, only 41 per cent of variation in commodity patterns of trade can be explained by comparative advantage. This mild correlation indicates that inefficiency remained in China's foreign trade sectors and that further reforms in the trade sector and other related areas are necessary.

Table 10 Changes in the distortion triangle, China, 1978 and 1987

	OLS	WLS ^G	WLS ^N
1978	47.90	46.54	37.44
1987	23.29	23.27	22.85

Notes: OLS—Ordinary least square.

WLS^G—Weighted least square with gross output values as weights.

WLS^N—Weighted least square with net output values as weights.

During 1978–87, when the Chinese economy opened up to the outside world, the level of distortions in terms of price differentials between domestic and international markets was reduced markedly. World market price signals were increasingly linked to, and reflected in, domestic prices. As a result, the domestic relative price structure exhibited a converging trend with that of the world. This can be seen in the decline in the degree of the distortion triangle of the regression line (Table 10). As mentioned above, an angle of zero degrees implies that the economy is in free trade equilibrium in which domestic and international relative prices are identical. It can be seen in Table 10 that in the first five years of reform the distortion triangle varied in size between 39° and 51° (gross output *WLS*) and by 1987 had dropped to 23° . In other words, the regression line rotated toward the vertical axis by between 16° – 28° . The Chinese economy had moved somewhat closer to a free trade equilibrium after the decade of economic reforms.

Policy implications

The following conclusions can be drawn from the above discussion.

- In the pre-reform period, China's foreign trade was not related to its structure of comparative advantage. By 1987, after ten years of economic reforms, China's pattern of commodity trade had changed dramatically and moved towards its comparative advantage. This is evidence of an improvement of resource allocation brought about by the economic reform.
- The pattern of exports improved more than that of imports as indicated by their correlations with comparative advantage. Changes in exports resulted from the fact that exporting firms enjoyed more autonomy, with informal direct foreign investment in exports also playing an important role. Inefficiency in the import sector was largely due to the limited nature of the reforms. But, despite inefficiency in imports in the 1980s, the overall improvement in China's foreign trade patterns was evident and gradually increasing.
- Optimisation of trade patterns reflects the improvement in resource allocation efficiency in tradable goods-production industries. The above results seem to indicate that resource allocation in export production improved considerably while import competing industries responded very slowly. Domestic production changed at a much slower pace than that of the structure of the trade sector over the same period. Despite ten years of reforms and the open door policy, by 1987, its domestic economy had not been fully incorporated into the international economy and therefore, the influence of foreign trade on the structure of domestic production was limited. This also demonstrates the rigidity and the sluggishness associated with structural adjustment for the economy as a whole. However, as the current economic reforms and the open-door policy are pursued further, the Chinese economy will become more closely linked with the world market. Its domestic resource allocation is expected to be increasingly influenced by its foreign trade.

Economic reforms since 1978 have generated positive impacts on resource allocation in China's foreign trade. A relatively flexible trade system has allowed enterprises to choose commodity compositions of trade more closely in line with China's underlying comparative advantage. Large-scale price adjustments and the liberalisation of domestic markets have brought domestic relative prices more in line with international patterns allowing enterprises to increase the gains from trade through improved allocative efficiency.

This does not necessarily mean that China's trade patterns and production structure are optimised. To maximise potential gains from trade, the production structure must also be adjusted in a way that allows resources to be reallocated from industries in which China has less or no comparative advantage to those in which it has high

comparative advantage. Such structural change requires further and deeper reform measures to remove remaining distortions and to allow markets to play a highly beneficial role in guiding resource allocation as seen in market economies.

The policy implications of the study are clear. Market-oriented reforms can improve efficiency in allocation of resources in trade and production. In a partially reformed centrally planned economy where remaining market distortions still exist in various areas, the estimation of comparative advantage such as *DRP* measures can play an important role in guiding government policies. To transform China's heavy-industry biased economy, the government and enterprises need to know in which industries investment would be of greatest benefit in both shorter and longer terms. *DRP* estimates can serve as a basis for such decision making.

The *DRP* analysis is static in nature but in this study the analysis is applied to a period in an attempt to shed some light on the dynamic aspect of China's comparative advantage. The study shows that although China still had *DRP* estimates above unity for agricultural and natural resource products, comparative advantage was gradually moving away from these primary products and toward manufactured goods. Unskilled labour-intensive goods accounted for a large proportion of Chinese exports and were the main source of benefits from trade. The *DRP* measures, however, show that the level of comparative advantage in this commodity group was decreasing. In the future, some capital-intensive industries are likely to become more internationally competitive. Although ten years might be too short a period to base any long-term projections, *DRP* estimates can signal possible directions in which future changes in China's comparative advantage, and therefore its trade patterns, may follow.

Future study of this type should be conducted on a regional basis. China consists of diverse regions each of which has unique conditions. Factor mobility between regions is still restricted both by geography and in economic terms. Factor prices are unlikely to be equalised and factor concentrations or distributions unlikely to be even in near future. Regional disparities give rise to a situation in which different areas could enjoy comparative advantage in different productive activities. Even intra-regional or intra-provincial divergences could be so substantial as to lead to a variety of productive activities. China as a whole could be competitive in a wide range of products. This study provides a method for assessing resource allocation but the application of this method to a specific region will require incorporation of regional characteristics into the analysis.

Appendix Table 1 Concordance between 61 Chinese tradable commodities and items of the SITC (revised)

Commodities	SITC (Revised)
Agricultural resource-intensive goods (13)	
1. Paddy rice	0421
2. Wheat	0410
3. Other grains	043, 044, 045, 2214, 08111, 2214
4. Oil bearing crops	2211, 2216, 2218
5. Cotton	2631, 2633
6. Other industrial crops	05482, 1210, 2611, 2612, 2640, 265
7. Vegetables	0541, 0542, 0544, 0545, 0546, 05481, 05483, 05484, 05489, 08112, 08119
8. Fruits	0511, 0512, 0513, 0514, 0515, 0519, 052
9. Forest products	0517, 0711, 0721, 075, 2212, 2213, 2215, 2217, 29299, 2219, 2311, 2921, 29291, 29294.
10. Wool and hides	211, 212, 2621, 2623, 2625, 29111, 29113, 29191, 29195, 29199
11. Meat, eggs and milk	00, 011, 0250, 0223, 29192, 29193, 29196, 41131, 41132, 41139, 9410
12. Fish	0311, 0313, 29112, 29114, 29115, 29194, 29197, 4111
13. Other agricultural products	29198, 2922, 2924
Other natural resource-intensive goods (6)	
14. Coal	3214, 3215, 3216, 3217
15. Crude petroleum	3310, 3411
16. Ferrous ores	281, 282
17. Non-ferrous ores	283, 284, 285, 286
18. Non-metallic minerals	2712, 2713, 2714, 273, 274, 275, 276, 667
19. Timber	24, 2923, 29292, 29293
Physical capital-intensive goods (15)	
32. Petroleum refining	332, 5211
33. Coal products	3218, 3412, 5214
34. Inorganic chemicals	511, 513, 514, 515
35. Chemical fertilizers	2711, 5213, 561, 5992
36. Organic chemicals	512, 53, 571, 5995, 5997, 5999
38. Other chemicals	2312, 2313, 2314, 266, 571, 581, 5996
42. Plastic articles	893
43. Cement	6612, 66183
44. Glass	664, 665
45. Ceramic products	6623, 6624, 6637, 6639, 666
47. Iron	6711, 6712, 6713, 6714, 6715
48. Steel	672, 673, 674, 675, 676, 677, 678, 679
49. Non-ferrous metals	68
50. Metal products	69

Human capital-intensive goods (13)

37. Household chemicals	41133, 41134, 41135, 431, 55, 59953, 59954, 59955, 59956, 59957, 59959, 8623, 8624.
39. Medicines	541
51. Agricultural machinery	712
52. Industrial equipment	7141, 7149, 715, 716, 7171, 7172, 718, 71911, 71913, 71914, 71915, 71919, 7192, 7193, 7195, 7196, 7197, 7198, 7199, 721, 726, 8121
53. Power station equipment	711, 7221
54. Household mechanical and electric appliances	7173, 71912, 7194, 7250, 7331, 8614, 8615, 8616, 864
55. Railway equipment	731
56. Motor vehicles	732
57. Ships	735
58. Other transport equipment	7333, 7334, 734, 95101
59. Other engineering products	7222, 723, 7291, 7292, 7294, 7295, 7296, 7297, 72992, 72993, 72994, 72998, 72999, 8123, 8124, 8613, 8618, 8619, 899, 95102, 95103, 95104, 95105, 95106
60. Electronic products	7142, 7143, 72491, 72492, 72499, 7293, 72991, 72995
61. Household electronics	7241, 7242, 8911, 8912

Unskilled labour-intensive goods (12)

20. Sugar, tobacco and alcohol	0611, 0612, 0615, 0619, 112, 122
21. Other processed food	012, 013, 0221, 0222, 023, 024, 0312, 032, 0422, 046, 047, 048, 053, 055, 0616, 0620, 0713, 0722, 0723, 073, 074, 0812, 0813, 0814, 0819, 09, 111, 42, 59951, 59952
22. Cotton textiles	6513, 6514, 6516, 6517, 652, 6535, 6536, 6540, 6555, 6558, 6559, 6562, 65662
23. Wool textiles	2628, 6512, 6532, 65392, 65393, 6551, 65661, 6575, 6576, 6577
24. Hemp textiles	6515, 6519, 6533, 6534, 65391, 65394, 65395, 65396, 6554, 6556, 6561, 65669, 6569, 6574, 6578
25. Silk textiles	6511, 6531
26. Knitted goods	6537, 84141, 84142, 84143
27. Other textiles	2613, 2622, 2626, 2627, 2629, 2632, 2634, 267
28. Clothing and leather goods	61, 6557, 831, 8411, 8412, 8413, 84144, 84145, 8415, 8416, 851
29. Furniture	63, 821
30. Paper	251, 641, 6421
31. Cultural and sporting goods	6422, 6423, 6429, 863, 8914, 8918, 8919, 892, 894, 895, 896, 897, 9610
41. Rubber manufactures	62
46. Other building materials	6518, 6538, 6611, 6613, 66181, 66182, 6631, 6632, 6634, 6635, 6636, 6638, 72996, 8122, 8611, 8612

Source: United Nations, *Standard International Trade Classification*, 1960 Revision, New York.

Appendix Table 2 China's net export performance ratio (NEPR), 1978 and 1987

	1978	1987
1. Paddy rice	13.96	0.01
2. Wheat	-10.94	-5.21
3. Other grains	-0.84	0.81
4. Oil bearing crops	2.82	3.07
5. Cotton	-12.34	-0.37
6. Other industrial crops	1.41	0.72
7. Vegetables	3.41	1.71
8. Fruits	1.61	0.30
9. Forest products	-0.55	0.39
10. Wool and hides	2.71	1.32
11. Meat, eggs and milk	4.47	1.02
12. Fish	3.88	2.31
13. Other agricultural products	24.01	8.80
14. Coal	0.66	1.08
15. Crude petroleum	0.75	0.64
16. Ferrous ores	-1.70	-0.25
17. Non-ferrous ores	0.77	0.41
18. Non-metallic minerals	0.51	0.59
19. Timber	0.09	-0.17
20. Sugar, tobacco and alcohol	-1.72	-0.49
21. Other processed food	2.32	0.75
22. Cotton textiles	3.51	0.74
23. Wool textiles	2.40	1.03
24. Hemp textiles	7.51	2.71
25. Silk textiles	32.09	13.57
26. Knitted goods	2.19	3.01
27. Other textiles	15.40	4.56
28. Clothing and leather goods	2.52	5.19
29. Furniture	0.97	0.31
30. Paper	-0.41	-0.48
31. Cultural and sporting goods	1.06	2.96
32. Petroleum refining	0.63	0.00
33. Coal products	0.19	1.76
34. Inorganic chemicals	-0.46	0.87
35. Chemical fertilisers	-4.95	-2.51
36. Organic chemicals	-0.76	-0.28
37. Household chemicals	0.72	-0.38
38. Other chemicals	-0.23	-1.07
39. Medicines	0.95	0.24
40. Chemical fibres	-8.10	-3.15

41. Rubber manufactures	0.15	-0.03
42. Plastic articles	0.15	0.98
43. Cement	1.94	-0.12
44. Glass	0.88	-0.17
45. Ceramic products	2.66	1.53
46. Other building materials	0.57	0.15
47. Iron	-4.79	1.91
48. Steel	-6.70	-1.55
49. Non-ferrous metals	-1.01	-0.04
50. Metal products	0.41	0.50
51. Agricultural machinery	-0.35	-0.19
52. Industrial equipment	-0.50	-0.94
53. Power station equipment	-0.33	-0.60
54. Household mechanical goods	0.25	0.99
55. Railway equipment	0.12	0.21
56. Motor vehicles	-0.48	-0.15
57. Ships	-1.18	-0.30
58. Transport equipment	-0.31	-0.59
59. Other engineering products	0.71	0.12
60. Electronic products	-0.19	-0.45
61. Household electronics	0.03	1.70

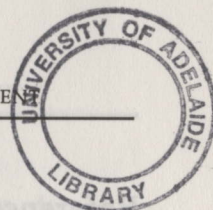
Source: International Economic Databank, The Australian National University, Canberra.

Appendix Table 3 Ratios of border to domestic prices of 61 tradable goods, China, 1978 and 1987

	1978	1987
1. Paddy rice	2.19	1.58
2. Wheat	1.10	1.09
3. Other grains	1.18	1.15
4. Oil bearing crops	1.83	1.59
5. Cotton	1.21	1.58
6. Other industrial crops	2.90	2.61
7. Vegetables	4.05	2.06
8. Fruits	2.41	1.52
9. Forest products	1.28	1.39
10. Wool and hides	2.22	2.23
11. Meat, eggs and milk	2.91	2.11
12. Fish	5.05	1.79
13. Other agricultural products	3.29	2.94
14. Coal	3.11	3.35
15. Crude petroleum	2.17	1.86
16. Ferrous ores	1.56	1.68
17. Non-ferrous ores	0.70	1.13
18. Non-Metal minerals	1.44	2.85
19. Timber	5.11	1.63
20. Sugar, tobacco and alcohol	1.07	2.28
21. Other processed food	1.28	1.80
22. Cotton textiles	1.78	2.31
23. Wool textiles	1.14	2.22
24. Hemp textiles	1.04	2.24
25. Silk textiles	2.79	3.64
26. Knitted goods	1.15	2.67
27. Other textiles	1.78	2.31
28. Clothing	1.25	2.99
29. Furniture	4.60	1.47
30. Paper	0.68	1.23
31. Cultural goods	1.08	2.33
32. Refined petro-products	1.14	1.80
33. Coal products	2.30	2.50
34. Inorganic chemicals	0.80	1.10
35. Chemical fertilizers	1.06	1.85
36. Organic chemicals	0.49	1.46
37. Household chemicals	0.62	0.88

38.	Other chemicals	0.58	1.33
39.	Medicines	0.42	1.24
40.	Chemical fibres	0.40	0.90
41.	Rubber manufactures	0.61	1.69
42.	Plastic articles	0.61	1.49
43.	Cement	1.99	2.08
44.	Glass	1.23	2.04
45.	Ceramic products	1.49	2.90
46.	Other building materials	0.93	2.07
47.	Iron	2.33	2.44
48.	Steel	1.20	1.81
49.	Non-Ferrous metals	0.70	1.13
50.	Metal products	0.93	1.36
51.	Agricultural machinery	0.49	1.46
52.	Industrial equipment	0.48	1.21
53.	Power Station equipment	0.67	1.77
54.	Household mechanical appliances	0.83	1.38
55.	Railway equipment	0.89	1.40
56.	Motor vehicles	0.40	0.96
57.	Ships	0.90	1.42
58.	Transport equipment	0.27	0.77
59.	Other engineering products	0.59	1.49
60.	Electronic products	0.53	1.36
61.	Household electronics	0.53	1.16

Sources: Zhang Xiaoguang, 1993. China's Trade Patterns and International Comparative Advantage, PhD dissertation, The Australian National University, Canberra.



Notes

- ¹ It should be noted that the increase in human capital-intensive exports could be partially due to an increase in exports from processing or assembling operations using imported inputs. These operations could be labour-intensive. However, the present available information does not allow for further distinction between assembled and non-assembled exports.
- ² The *NEPR* measures of individual commodities for 1978 and 1987 are given in Appendix Table 2.
- ³ For a concordance between the classifications of the modified 69-sector table and the original 117-sector table see Appendix Table 1.
- ⁴ A major advantage of *DRP* over *DRC* is that *NEPR* can be illustrated as a linear function of *DRP* and therefore a comparison can be made directly between the two measures.
- ⁵ The 19 categories of exports were Non-Ferrous Ores (17), Petroleum Refining (32), Plastic Articles (42), Metal Manufactures (50), Household Chemicals (37), Medicines (39), Household Mechanical and Electrical Goods (54), Railway Equipment (55), Other Engineering Products (59), Household Electronics (61), Other Processed Food (21), Wool Textiles (23), Hemp Textiles (24), Knitted Goods (26), Other Textiles (27), Clothing (28), Cultural and Sporting Goods (31), Rubber Manufactures (41) and Other Building Materials (46). The 6 groups of imports were Wheat (2), Other Grains (3), Cotton (5), Forest Products (9), Ferrous Ores (16) and Iron (47).
- ⁶ The 8 groups of exports were Other Grains (3), Non-Ferrous Ores (17), Inorganic Chemicals (34), Plastic Articles (42), Non-Ferrous Metals (49), Metal Manufactures (50), Medicines (39) and Household Electronics (61).
- ⁷ The 11 groups of imports were Forest Products (9), Ferrous Ores (16), Timber (19), Chemical Fertilizers (35), Cement (43), Glass (44), Steel (48), Power Station Equipment (53), Sugar, Tobacco and Alcohol (20) and Rubber Manufactures (41).
- ⁸ The differences between the two correlation coefficients of 1978 and 1987 from *OLS* and gross output value *WLS* were significant at the 0.95 level. The difference between two coefficients from the net output value *WLS* regression was significant at the 0.90 level.
- ⁹ In addition, the rapid growth of exports has also changed import patterns. This is particularly so in coastal areas where more and more enterprises are involved in export processing and assembling activities which rely heavily on imported intermediate inputs and materials. To assess this intra-industry trade or production integration requires more disaggregated analysis than the data of this study allow.

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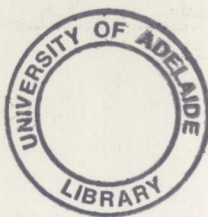
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