

Winners and Losers during a Deep Economic Crisis: Firm-level Evidence from Indonesian Manufacturing*

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Received 12 February 2007; Accepted 23 July 2007

What happens to firms during periods of deep economic crisis? Depending on the nature of the crisis, the general effects are well known. However, owing to data availability, there are relatively few detailed firm-level studies. With the aid of an unusually rich database, the present paper investigates the effects of Indonesia's 1997–1998 crisis on manufacturing establishments. Consistent with studies of other crisis episodes, foreign ownership and prior export orientation are found to be highly significant determinants of survival and recovery. The effects of firm size are ambiguous. The industry in which firms are located, in particular its factor proportions, is also found to be significant.

Keywords: crisis, Indonesia, industrial adjustment, manufacturing.

JEL classification codes: L60, N85.

doi: 10.1111/j.1467-8381.2007.00261.x

I. Introduction

Deep economic crises have profound effects on firms. However, are they uniform, in the sense that all firms contract by approximately the same proportion? Theory and empirical evidence suggest that the effects are uneven. Firms have heterogeneous characteristics, *inter alia* in terms of history, size, ownership, sales orientation, access to technology, and financial arrangements. Their owners too are diverse, in terms of objective functions and entrepreneurial capacities. Moreover, crises are invariably uneven in their industrial, sector and sometimes regional impacts.

The nature of crises also varies greatly. Some take the form of mild recessions, as part of business cycle fluctuations. Others might be deep, entail widespread business collapse, and result in a major shakeout in the corporate world. They can range in duration from 'V' shaped recovery trajectories to 'L' shaped protracted stagnations. The trigger for crises can also take many forms, including

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financial collapse, a sudden fall in the exchange rate, political/regime collapse, or a combination of all these events.

There is a large general published literature on the causes and consequences of crises (Glick et al., 2001; Krugman, 2001). Much of this literature is general in nature, and less commonly provides a detailed and disaggregated examination of effects at the enterprise level. The purpose of the present paper is to contribute to our understanding of crisis impacts by investigating the firm-level effects of Indonesia's deep economic crisis of 1997–1998, with the aid of a rich and comprehensive dataset.

Indonesia is ideally suited to such a study. In the wake of 3 decades of very rapid economic and industrial growth, the economy contracted sharply, by more than 13 percent in 1998. The contraction was initially triggered by capital flight, which resulted in an extremely sharp fall in the country's exchange rate and a financial sector collapse. This in turn fed into the real sector and also had deep political ramifications, including the demise of the 32-year Soeharto regime. Indonesia's statistical agency, the Central Board of Statistics (Badan Pusat Statistik (BPS)) monitored the effects of this crisis in the industrial sector through its annual survey of manufacturing firms with at least 20 employees. Crucially for the purposes at hand, these enterprises are assigned an identification code that enables them to be monitored over time, and which therefore facilitates the construction of a rich panel dataset linking firm outcomes to a range of industrial organization and firm-specific characteristics. Therefore, we are able to obtain insights into the nature of both the crisis impacts and the immediate post-crisis recovery trajectory.

The organization of this paper is as follows. In Section II we provide background to the study. This includes a summary of the international evidence on adjustment to crises, particularly major crises in developing countries. We also briefly describe the Indonesian crisis of 1997–1998, and provide some background regarding the country's rapid industrialization and structure preceding the crisis. In Section III, the data sources are provided and we explain how the database used in this study was constructed. Our methodology and results are presented in Section IV, based on firm-specific impacts. In Section IV, the key factors explaining inter-firm variations in performance and adjustment are also identified. Section V sums up our findings, and draws attention to some analytical and policy implications.

II. The Context: Adjustment to Crises and Indonesian Development

II.1 Indonesian industrialization before the crisis

In the mid-1960s, Indonesia had barely commenced the process of modern industrialization. It then experienced very rapid industrial growth and structural change through to 1997 (Hill, 1997). Annual industrial growth was at least 9 percent in all but 2 years between 1970 and 1996. Initially, catch-up and import substitution were the principal drivers of growth. From the mid-1980s, labor-intensive exports became a significant engine of growth. Accompanying

this growth was rapid structural change, as the industrial sector evolved from the production of simple consumer goods and basic resource processing to a wide range of manufactures of increasing technological sophistication.

Indonesia's emergence as a significant industrial exporter from the mid-1980s was the result of a highly successful reform program involving the lowering of protection, a more open foreign investment regime, and simplified export procedures, combined with effective macroeconomic and exchange rate management.

The country's industrial ownership patterns are characterized by high levels of ownership concentration, both in the sense of corporate conglomeration and seller concentration. Among major industry groups, these ownership patterns reflect the interplay of history, policy and industrial organization factors. By the mid-1960s, no foreign capital was present, and the 'commanding heights' of the economy were in state hands. State-owned enterprises (SOE) continued to be important throughout the Soeharto era. Foreign investment returned to the country from the late 1960s in response to the newly liberal policy regime and generous fiscal incentives. Following the government's policy signals, most FDI initially went into import substituting 'tariff factories'. Then, following the successful 1980s reforms, efficiency-seeking, export-oriented FDI became more important. Notwithstanding the importance of the state and foreign firms, domestic firms are the major players in Indonesian industry. In the mid-1990s, they accounted for more than 50 percent of manufacturing value added in all two-digit industries except International Standard Industrial Classification (ISIC) 38 (fabricated metals, electronics and machinery) and ISIC 39 (miscellaneous manufacturing). They were also the major employer, accounting for almost 80 percent of the industrial workforce.

II.2 Indonesia's economic crisis of 1997–1998

Indonesia's economic crisis of 1997–1998 was the most serious among the four East Asian economies. Internationally, it ranks with that of the Philippines in 1985–1986, Mexico in 1994–1995 and Argentina in 2001. Triggered initially by the collapse of the Thai baht, Indonesia experienced large-scale capital flight, resulting in a sharp depreciation of the rupiah and deep financial distress.¹ At the peak of the crisis, the dollar exchange rate had fallen from Rp2500 to Rp17 500, and credit in the modern financial sector had effectively dried up. In the first half of 1998, there was a loss of macroeconomic control, and inflation on an annualized basis exceeded 100 percent. The economy contracted sharply from late 1997, by over 13 percent in 1998.

The economic crisis in turn precipitated a political crisis, culminating in May 1998 in the end of the 32-year authoritarian Soeharto regime. Investment, both domestic and foreign, also collapsed. In the 6 years prior to the crisis, net

1. For detailed analyses of the crisis, see the four-monthly 'Survey of Recent Developments' in the Bulletin of Indonesian Economic Studies.

annual FDI inflows averaged US\$2.7 bn, whereas there were net annual outflows of US\$1.4bn for the 5 years after the crisis.

As a result of these 'twin crises', Indonesia also recovered more slowly than its East Asian neighbors. Growth was negligible in 1999, but recovered to nearly 5 percent in 2000. For the period 2000–2005, growth averaged 4.5 percent, in contrast to the 7.3 percent recorded in the pre-crisis period 1990–1996. In the immediate post-crisis period, exports responded significantly to the exchange rate depreciation, with a lag. However, in spite of buoyant commodity prices in the early years of the 21st century, export growth since 1998 has been sluggish, compared to both neighboring East Asian economies and the country's pre-crisis record (Athukorala, 2006).

II.3 International evidence on adjustment to crises

Crises take many forms and, therefore, the international literature on their impacts is diverse. There is published literature relating to the effects of a general contraction in economic activity, as well as to specific impacts of a financial crisis and to sharp exchange rate depreciation. Adjustment processes are also affected by the behavior of particular groups of investors (foreign, state, domestic private or large vs small firms), policy responses to the crisis (e.g. whether trade and investment regimes become more or less liberal, the quality of macroeconomic management), and the nature of labor market outcomes.

In the case of the industrial sector, because exchange rates invariably depreciate significantly during a crisis, and because almost all of manufacturing consists of tradable goods, this depreciation will boost competitiveness. However, this mechanism might fail to operate, or its effects could be blunted, for at least five reasons.

First, crises often entail exchange rate volatility, introducing price uncertainty and the possibility that a competitive boost will not be durable, or at least durable enough to induce major new investments. Second, crises are often accompanied by the loss of macroeconomic control, which results in rising inflation, thus nullifying the initial exchange rate advantage. In the limiting case of widespread exchange rate depreciations among a group of countries with very similar export structures, the competitive boosts would be minimal. Related to this are demand conditions in major export markets, a consideration for the East Asian economies given their rapidly growing interdependence (World Bank, 2000; ADB, 2002).

Third, for firms that are both import-dependent and domestic-market oriented, the combination of higher input costs and the collapse in domestic demand might render them worse off. For highly import-dependent firms that are also export-oriented (e.g. in electronics components, the dominant export of most East Asian economies), the exchange rate impacts are likely to be positive but minimal. However, if the share of imported inputs is high and the exchange rate depreciation significantly increases the cost of capital, the beneficial effects of

the depreciation can be muted, a point developed by Forbes (2002a). Fourth, in the case of generalized economic and political crisis, other factors might nullify the exchange rate effects. These factors include widespread financial and corporate collapses, flight of export-oriented foreign investors, and general security problems.²

Finally, and most importantly, much depends on the performance of the financial sector. In turn, financial sector effects centre on whether the banking sector remains intact during a crisis, how these institutions allocate credit, and the impact of the crisis on firms' collateralized net worth. A typical feature of a crisis is increased interest rates, as the monetary authorities seek to defend the exchange rate. The impact of a financial crisis is likely to differ among firms and countries.³ Highly leveraged firms, with a higher proportion of short maturity debt, and which are also exposed to exchange rate risk, are likely to be the most adversely affected.⁴ Firms with established connections to international financial markets are likely to be less severely affected, unless there is a generalized financial crisis. Credit rationing is likely to be more severe for younger and smaller firms. Studies of the impact of financial crises on firms have indeed found that larger firms, especially those that are export-oriented and foreign owned, are more likely to borrow from international financial markets and, therefore, are less affected by a domestic financial collapse.⁵

More generally, the published literature has examined the relevance of firm heterogeneity in response to major crises, and found it to be a significant factor.⁶ In the present paper, we briefly draw attention to some of these key characteristics, and test them below.

In the case of *size*, larger firms might be expected to be more competitive, owing to economies of scale, market power and stronger financial resources. However, this relationship might break down in the face of extreme shocks to the business environment. Small firms might be more flexible and nimble, they are less 'top heavy', and they might be less connected to the collapsing financial sector, and be less heavily indebted. The published literature cited above points to different conclusions, although in the empirics the coefficients are generally not very significant.

There are a number of considerations in the case of *ownership*. Foreign-owned firms should be less affected by a crisis. They have 'deeper pockets', are less connected to the failing domestic financial sector and, with their global market reach and knowledge, they are able to more quickly capitalize on the exchange rate depreciation and to facilitate sales redirection from domestic to export

2. See Kawai et al. (2000) in general and Rosner (2000) for the case of Indonesia.

3. See Dwor-Frecaut et al. (2000) for evidence on the latter proposition among the East Asian economies.

4. See Claessens et al. (2000) for East Asian evidence on this issue.

5. See, for example, Kawai et al. (2000) on the East Asian economies and Krueger and Tornell (1999) on Mexico.

6. For general surveys, see Dwor-Frecaut et al. (2000) and Claessens et al. (2000).

markets. This is hypothesized and demonstrated in several studies (Blalock and Gertler, 2005; Desai et al., 2004; Kawai et al, 2000; Ramstetter, 1999). Interestingly, the findings seem to apply independently of foreign parentage. For example, Fukao (2001) and Urata (2002) show that Japanese companies continued to support their distressed affiliates in the crisis-affected East Asian economies, even though Japan itself was in the midst of a protracted recession.

However, much depends on the host economies' foreign investment climate, and the response to a financial crisis on the part of foreign investors, especially those that are export-oriented. If the rules of the game are stable and predictable, FDI might well increase, owing to the well-known 'fire-sale' phenomenon, occasioned by financial distress, cheaper asset prices and liberalized entry (Athukorala, 2003; Lipsey, 2001). Conversely, an abrupt change in the institutional environment might lead to increased legal uncertainty and less secure property rights. Moreover, economic nationalism might intensify in the wake of a crisis and an IMF-orchestrated rescue package with heavy conditionality. Therefore, community sentiment could be hostile to the notion of foreigners buying assets cheaply, and the investment climate might, therefore, be nominally open but in practice uninviting.

Where there is a significant state enterprise sector, as is the case in Indonesia, the response is difficult to predict as much depends on the government's objective function and its capacity to pursue it in times of crisis. One might expect the government to seek to bail out distressed SOE. The inefficiencies that frequently characterize these firms might also provide scope for increased productivity if managers are allowed more freedom to profit-maximize and to shed excess staff. Conversely, a crisis might diminish the capacity of governments to bankroll these SOE, particularly if they have signed on to IMF rescue packages.

In the case of *sales orientation*, export-oriented firms are expected to perform better than domestic-oriented ones. This is principally because the former are able to take advantage of the boost to competitiveness from the sharp exchange rate depreciation. This is particularly so when, as in the East Asian economic crisis, the global economy continued to be buoyant. Using a cross-country dataset, Forbes (2000b) found this to be the case for a range of performance indicators, although larger firms and those with higher debt ratios weakened these effects.

Switching from firm to *industry* characteristics, firms in labor-intensive and natural resource-intensive industries in a country like Indonesia should be less affected compared to those in capital-intensive industries. Exchange rate movements will be expected to reinforce the country's comparative advantage in these activities, particularly in the case of the high domestic value-added resource-based industries. Firms in these industries are also more likely to be export-oriented and, therefore, be able to adjust more quickly to changing relative price signals occasioned by exchange rate changes. In contrast, firms in capital-intensive industries, in which a low-income economy does not typically have a comparative advantage, are more likely to be domestic market oriented, more likely to receive import protection (which is generally lowered during a crisis), and they are more likely to be heavily in debt.

III. Data

This study utilizes a very rich dataset based on the annual survey of large and medium firms conducted by Indonesia's Central Board of Statistics (BPS). The series is designed to survey all manufacturing establishments employing at least 20 workers. The survey is published as *Statistik Industri*, but we use here the raw data from the unpublished establishment-level data tapes. The data cover the period 1993–2000, which can be broadly classified into pre-crisis, crisis and post-crisis periods.

The survey questionnaire covers most operating aspects of these establishments. Crucially for our purposes, establishments are identified by a code, which enables them to be traced over time. Therefore, we are able to construct a panel data series, and to examine the behavior of firms over this period of growth, crisis and recovery.

Although the survey is comprehensive, the following limitations should be noted. First, the unit of observation is the establishment, not the enterprise. Therefore, we cannot detect whether an establishment is a stand-alone operation or is part of a business group.⁷ Henceforth, we use the terms 'firm' and 'establishment' interchangeably, but strictly speaking we are referring to the latter concept. Second, information on firms' debt and financial leverage is incomplete. In particular, we lack information on the currency in which the debt is denominated, the nature of the financial institution from which funds were borrowed, and whether the borrowings were hedged. Finally, we lack high-frequency (monthly or quarterly) data and, therefore, have to work with annual series. In practice, of course, the occurrence of the crisis and firms' adjustment to it do not neatly correspond to such a time period.

A plant-level unbalanced panel is constructed from 1993 to 2000. The panel is constructed by matching the plants according to the plant-code variable (*PSID*). The panel has been cleaned and adjusted for some possible mistakes in data entry, for changes in ISIC, and for variable definitions. The cleaned panel contains between 11 000 and 13 600 plants over the period 1993–2000. The plants in the cleaned panel cover 71 and 60 percent of manufacturing value added and employment, respectively.⁸ Oil and gas refining sectors (ISIC 353 and 354) are excluded. They were included in the survey only in the 1990s and the data quality is still weak.

IV. Results

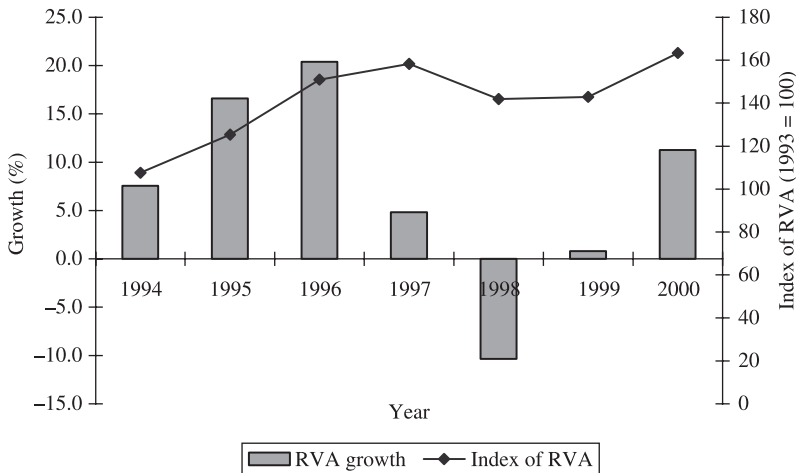
IV.1 The aggregate picture

This section analyzes the impact of the crisis at the industry level. We focus on two aspects: the impact on performance and the impact on firm demographics.

7. The extent of multi-plant firms in Indonesia is unknown. However, a recently conducted in-house BPS survey suggests that they number between 500 and 1000 firms out of the more than 15 000 surveyed in the early 2000s.

8. See Narjoko (2006) for a detailed description on the data cleaning and adjustment.

Figure 1 Real value added (RVA) growth and index, 1994–2000 (% , 1993 = 100)



Source: Annual manufacturing survey, BPS.

The performance measure is real value added (*RVA*); that is, nominal value added deflated by the wholesale price index, with the latter measured at the three-digit ISIC level. A range of alternative performance measures (e.g. real gross output, employment, labor productivity and profitability) could of course be used, but as shown by Narjoko (2006), the results do not vary significantly.

The impact on performance

Manufacturing was growing rapidly before the crisis, but *RVA* declined substantially during 1998 and 1999 (Figure 1). It is evident that the crisis began to affect performance immediately in 1997: *RVA* growth declined from 20.4 percent in 1996 to 4.8 percent in 1997. Figure 1 also shows that recovery commenced in 2000 and was reasonably robust, as both the level and growth of *RVA* began to return to that prevailing in the immediate pre-crisis period.

To obtain a clearer picture of the impact, the percentage difference of *RVA* between the crisis and pre-crisis period is computed by broad industry group. The difference is formally defined as

$$\% \Delta RVA_{j,t} = \frac{RVA_{j,t} - \overline{RVA}_{j,9596}}{\overline{RVA}_{j,9596}} \times 100,$$

where *RVA* and *j* denote real value added and industry *j*, respectively. *t* = 1997, . . . , 2000 and is defined as the crisis period, with subdivisions as noted later. The definition is based on the fact that the crisis began during the fourth quarter of 1997, whereas recovery got underway from late 1999. It is important to note, however, that the 1997 data present an ambiguous picture, as there was a

Table 1 Aggregate real value added difference by broad industry group (%)

<i>ISIC</i>	<i>Industry</i>	<i>1997</i>	<i>1998</i>	<i>1999</i>	<i>2000</i>
31	Food and tobacco products	14.3	16.8	15.4	19.5
32	Textile, garment and leathers	8.5	30.7	18.6	24.4
33	Wood products, including furniture	8.2	58.0	33.0	31.0
34	Paper and paper products	15.7	52.0	27.5	40.0
35	Chemical, rubber and plastics	33.2	16.3	49.2	64.2
36	Non-metallic mineral products	29.3	2.6	-1.3	29.1
37	Basic metal industries	22.6	-74.7	-69.9	-63.9
38	Machinery and equipment	4.7	-3.9	-3.6	56.2
39	Other manufacturing	39.9	86.6	44.0	52.8

Note: ISIC, Standard Industrial Classification.

Source: Authors' computation.

time lag in order for the crisis to show some negative impact. $\overline{RVA}_{j,9596}$ is the average *RVA* for the years 1995 and 1996, which we define as the pre-crisis period.

Table 1 shows that the impact of the crisis differed across industries, a point that has been noted in previous studies (Thee, 2000; Fukuchi, 2000). Some industries actually survived quite effectively, notably textiles and garments and particularly wood and paper products (ISIC 32–34), all of which recorded higher positive percentage differences during the peak of the crisis compared to its beginning. Other industries were adversely affected, with the metals and machinery industries (ISIC 37 and 38) recording the largest contractions. There were also pronounced inter-industry variations between years. Output of the wood and paper products industries expanded but growth began to decline, whereas there was a delayed but dramatic recovery in the chemicals and machinery industries (ISIC 35 and 38).

Impact on firm demographics

This section investigates the impact of the crisis on firm demographics. On first examination, it appears that the crisis did not severely affect these demographics. The number of firms declined modestly, by just 4 percent in 1998, in contrast to the 12 percent contraction in output.

However, this does not reveal the full story. We extend the analysis with reference to several other demographic variables, beginning with firm entry and exit. We follow usual practice and define entry and exit rates in terms of the number of plants and employment. Entry and exit rates in terms of number of plants and employment are referred to as *EN1* and *EX1*, and *EN2* and *EX2*, respectively.

Figures 2 and 3 show trends in both rates in terms of the number of plants and employment, respectively. The figures clearly show the dramatic impact of

Figure 2 Entry and exit rates in Indonesian manufacturing in terms of number of plants (EN1 and EX1) (%), 1994–2000

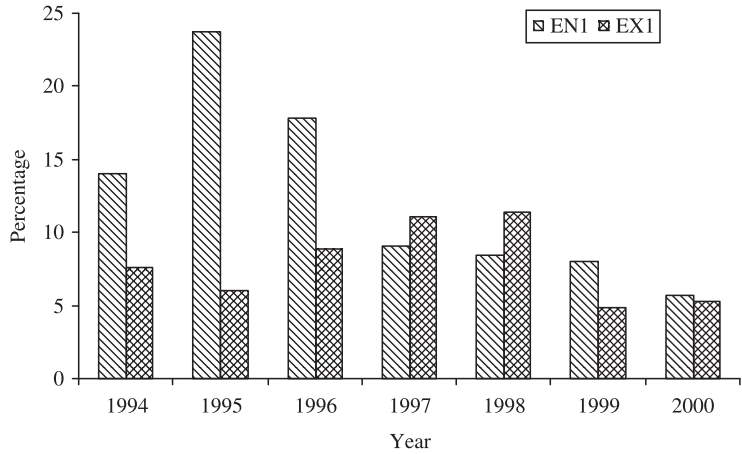
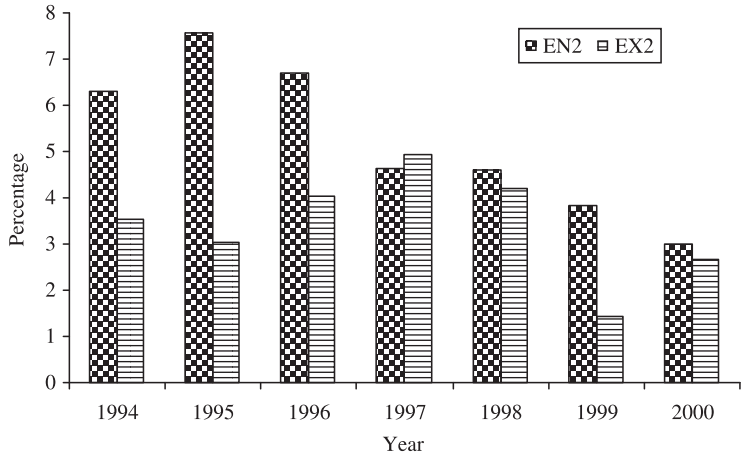


Figure 3 Entry and exit rates in Indonesian manufacturing in terms of employment (EN2 and EX2) (%), 1994–2000



the crisis on firm creation and destruction. In terms of creation, Figure 2 shows that entry rates during the period 1997–2000 fell to approximately half that during the period 1993–1996. The picture is similar if measured by employment (Figure 3), although the magnitude of the decline is slightly lower. Moreover, the rate of creation of firms does not seem to have recovered in 2000. This is in contrast to the earlier observation that, in terms of *RVA*, industry appeared to

have recovered by this year. The decline in entry rates and their sluggish post-crisis recovery could be explained by the lagged response to levels of business confidence. However, in addition, the factors governing entry behavior have been shown to alter during changed business conditions. They are consistent with empirical studies on firm entry (Highfield and Smiley, 1987; Yamawaki, 1991) that have found that the determinants of firm entry are sensitive to changes in business cycles.

Turning to the impact on the closure of firms, Figure 2 shows that exit rates increased at the peak of the crisis. However, this negative impact seems to have disappeared by 1999–2000. The exit rates returned to, and in fact were slightly below, that of the pre-crisis period. Unlike the entry rates, the trend in the exit rates is consistent with the general impression of fairly quick industrial recovery. In other words, most of the output recovery originated from firms that survived the crisis.

As defined, EN2 and EX2 measure the employment effects originating from the entering and exiting firms. The adjustment obviously does not only come from these firms, but also from incumbents. Computing employment change for incumbents indicates how the crisis affected their expansion and contraction. We define the rate of expansion (POS) in industry j at time t as

$$POS_{j,t} = \frac{EMPL_POS_{j,t}}{EMPL_T_{j,t-1}}$$

and the rate of contraction (NEG) in industry j at time t as

$$NEG_{j,t} = \left| \frac{EMPL_NEG_{j,t}}{EMPL_T_{j,t-1}} \right|,$$

where:

$EMPL_POS$ = employment of plants that expand between t and $t - 1$ and

$EMPL_NEG$ = employment of plants that contract between t and $t - 1$.

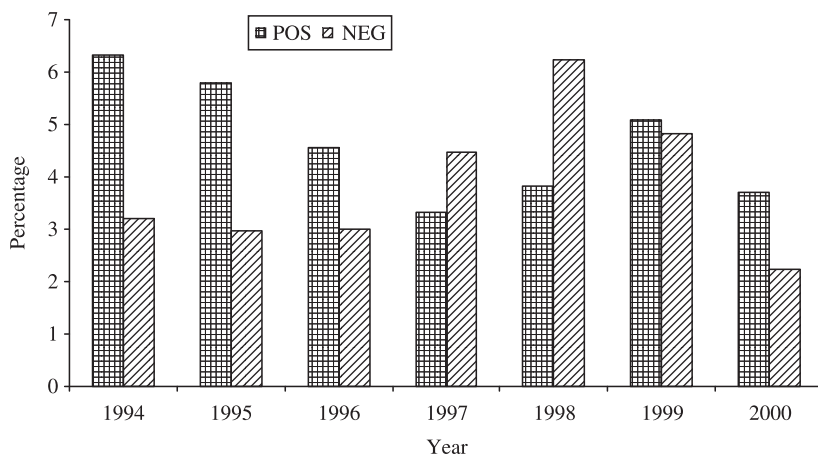
A simple relationship that links EN2, EX2, POS and NEG is the following:

$$EMPL_GROWTH_{j,t} = EN2_{j,t} + POS_{j,t} + EX2_{j,t} + NEG_{j,t},$$

where $EMPL_GROWTH_{j,t}$ is the annual employment growth between t and $t - 1$.⁹ In other words, the relationship decomposes the annual employment change into the component associated with ‘growing-and-new’ and ‘shrinking-and-exiting firms’.

Figure 4 shows trends in the expansion and contraction rates for the period 1993–2000. The expansion rate declined significantly in 1997 and 1998 but recovered immediately in the following year. This is in contrast to the continuously declining trend in the entry rates observed earlier, but supports the inference that much of the output recovery originated from firms that survived the crisis. The contraction rates shown in Figure 4 underline how dramatic the adjustment

9. The relationship and the definition of POS and NEG follow those devised in Davis et al. (1996).

Figure 4 Expansion (POS) and contraction (NEG) rates (%), 1994–2000

of the incumbents were. The rate in 1998 jumped to approximately double that of the pre-crisis period. Consistent with the recovery story, however, the rate started to decline in 1999 and by 2000 returned to that of the average pre-crisis period.

Figures 5(a) and (b) decompose the annual employment change for the period 1994–2000, combining the estimates of EN2, POS, EX2 and NEG. The results show that the aggregate annual employment contraction in 1998 and 1999 was dominated by contraction from the incumbents, rather than from those that exited the industry (see Figure 5(b)). This indicates a high survival rate of firms, in the sense of weathering the crisis by reducing employment rather than declaring bankruptcy. It also contrasts with the pre-crisis pattern. As shown in Figure 5(a), employment destruction in this period was almost evenly divided between that originating from incumbents and the exiting plants.

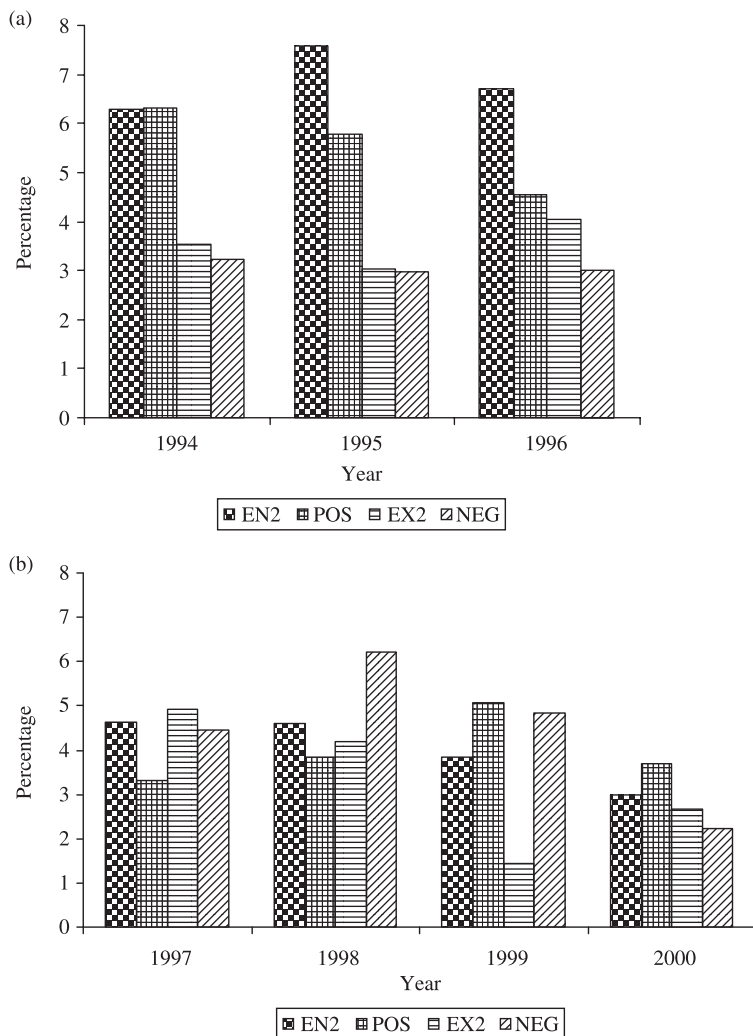
IV.2 The micro picture

This section examines the impact of the crisis at the plant level. It addresses the question of whether the impact was distributed evenly across firms. Based on the discussion in the previous section, we hypothesize that the impacts are uneven. We advance the following predictions for a range of firm and industry characteristics.

Sales orientation

Export-oriented firms are expected to have performed better than domestic-oriented ones. As argued above, it is expected that they were able to take advantage of the boost in competitiveness from the sharp exchange rate depreciation, allowing for some of the factors discussed earlier that might have blunted these competitiveness impacts.

Figure 5 Decomposition of employment growth (%), 1994–2000:
(a) 1994–1996 and (b) 1997–2000.



Ownership

We hypothesize a positive relationship between foreign ownership and firm performance, and that these firms will outperform the domestic-private and SOE. It might also be conjectured that the expected better performance of foreign firms would depend on the foreign equity share in these firms, although both the analytics and the published literature provide less clear guidance on this issue. Similarly, for reasons advanced above, the relationship between SOE ownership and firm performance is likely to be ambiguous.

Size

As noted, the impact of firm size on performance during the crisis is difficult to predict a priori. Large firms might have been more successful because of advantages that stem from economies of scale, market power and employment of more skilled managers. Moreover, they are less likely to suffer from credit rationing as banks tended to adopt more stringent lending policies after the crisis. However, inflexibility to changes in the business environment and dependence on the financial sector might also have made them less successful than small firms. Small firms might also have performed better because of less expensive overheads and an ability to operate in niche markets that might not be so severely affected by the crisis.

Factor intensity

For reasons outlined above, firms in labor-intensive and resource-intensive industries should have been less affected than those in capital-intensive industries.

To test these hypotheses, the mean of the percentage difference in RVA at plant level ($\% \Delta RVA_{i,t}$) is computed for every group of plants over the period 1998–2000. These results are presented in Table 2. $\% \Delta RVA_{i,t}$ is defined in a similar fashion as the difference at industry level,

$$\% \Delta RVA_{i,t} = \frac{RVA_{i,t} - \overline{RVA}_{i,9596}}{\overline{RVA}_{i,9596}} \times 100,$$

where i denotes plant i . The period t covers the peak of the crisis (1998) and the early recovery period (1999–2000). Note that this definition unavoidably excludes 1997 owing to data ambiguities in that year. The variables related to firm characteristics are described in more detail in the Appendix.

Sales orientation

Plants are categorized into four groups based on their average export propensity in 1995 and 1996 ($EXP_{i,9596}$): domestic-oriented plants ($EXP_{i,9596}$ equal to zero); low export-oriented plants ($EXP_{i,9596}$ between zero and 0.1); moderately export-oriented ($EXP_{i,9596}$ between 0.1 and 0.5) and highly export-oriented ($EXP_{i,9596}$ greater than 0.5). For the entire period, Table 2 suggests a positive relationship, in that the contraction in RVA decreases as export propensity increases. On average, the output of domestic and low export-oriented plants contracted by approximately 20 percent, whereas moderately export-oriented plants contracted by only 3 percent. Plants with high export propensity benefited from the crisis, in the sense that their output expanded. Therefore, the findings support the hypothesis that export-oriented firms performed better than domestic-oriented ones.

Comparing the crisis peak and the early recovery periods, the positive impact of sales orientation seems to have been weaker during the early recovery. This is particularly clear for the group of plants with high export intensity, where the expansion was significantly lower in this period. This suggests that the one-off boost to competitiveness was relatively short-lived. An additional factor is that,

Table 2 The crisis performance impact by plant characteristics

Plant characteristic class	%ΔRVA _{it}		
	1998–2000	1998	1999–2000
Sales orientation class			
Domestic oriented	–19.6	–22.2	–12.1
Low export oriented	–19.9	–22.1	–13.6
Moderately export oriented	–3.0	–4.2	1.4
Highly export oriented	8.9	11.5	5.0
Ownership class			
Foreign	8.6	4.6	20.9
Private-domestic	–16.0	–17.9	–9.7
Government	–26.6	–26.3	–23.7
Foreign ownership class			
Low	–42.5	–45.4	–19.1
Moderately low	–6.4	–14.5	18.0
Moderately high	–4.8	–7.8	3.2
High	31.9	29.6	38.5
Size class			
Small 1	–15.4	–17.4	–8.5
Small 2	–21.5	–23.2	–15.6
Medium 1	–17.5	–19.8	–11.8
Medium 2	–11.1	–13.4	–5.3
Large	1.4	1.2	2.3
Industry factor intensity class			
Resource-intensive	–18.9	–14.9	–16.2
Labor-intensive	–5.7	–9.0	1.7
Capital-intensive	–25.0	–31.7	–12.8

Source: Authors' computation.

although Indonesia's real effective exchange rate remained below the other crisis-affected economies, it was beginning to appreciate from the second half of 1998 owing to higher inflation.

Ownership

Plants are classified into groups according to three dummy ownership variables: domestic private ($DPRI_{i,9596}$), foreign ($DFOR_{i,9596}$) and government plants ($DSOE_{i,9596}$). The results support the hypothesis that foreign firms outperformed the two domestically owned groups. The average output differences are positive during the peak of the crisis only for foreign firms. Moreover, the positive impact of foreign ownership is even higher in the early recovery period. In contrast, government firms were severely affected by the crisis. RVA on average fell by more than 20 percent for the entire period 1998–2000. Evidently, the government was unable to support these firms, a factor attributable to its sharply deteriorating fiscal position.

Does the level of foreign ownership matter? To answer this question, foreign firms are classified into four groups: low foreign ownership (average foreign share in 1995 and 1996, or $FOR_{i,9596}$ up to 20 percent); moderately low foreign ownership ($FOR_{i,9596}$ between 20 and 50 percent); moderately high foreign ownership ($FOR_{i,9596}$ between 50 and 80 percent); and high foreign ownership ($FOR_{i,9596}$ greater than 80 percent).

The results suggest that the level of foreign ownership matters. During the peak of the crisis, a positive relationship between contraction in performance and foreign ownership is indicated. That is, the contraction was lower among plants with higher foreign ownership. The output expansion observed earlier originated from those firms with high foreign ownership, as the expansion is large, approximately 30 percent. In contrast, the average output contraction in firms with very low foreign ownership share was very large during the peak of the crisis, approximately 45 percent.

This positive relationship continues into the early recovery period, but the pattern is less pronounced. The high foreign ownership group again outperformed the others, but firms with moderately low foreign ownership performed better than those with moderately high foreign ownership. This is consistent with the frequently observed proposition that multinational enterprises are more willing to support their subsidiaries the more control they have over them (Caves, 1996).

Size

Firms are classified into five groups based on employment levels. These in turn can be broadly aggregated into small, medium and large firms. The small group includes those with employment in 1995 and 1996 (expressed as $SIZE_{i,9596}$) between 20–49 and 50–99), medium ($SIZE_{i,9596}$) is employment in the ranges 100–199 and 200–499 employees, and large firms ($SIZE_{i,9596}$) are those with more than 500 employees.

Both for the entire period 1998–2000 and the sub-periods, the results point to a positive relationship, in that the contraction is consistently lower for larger plants, with some large firms actually expanding their output. Among the small groups, the smallest firms (Small 1) contracted less than the next group (Small 2). Therefore, it is difficult to derive strong inferences from the results. One possible explanation for the mixed finding is that size might represent other plant characteristics that significantly affected performance. Large firms are often multinationals, exporters and located in concentrated industries. Therefore, these characteristics need to be controlled to reveal the true relationship between size and performance, an issue we address in the following subsection.

Factor intensity

Firms are classified into three groups based on the dummy-variables representing industry factor intensity (DRI , DLI and DCI). The results indicate that, as hypothesized, factor intensity was a significant determinant of performance. For the full period 1998–2000, a clear pattern is observed: firms in capital-intensive

industries contracted the most severely whereas the opposite is the case for firms in labor-intensive industries. The pattern changes somewhat in the early recovery period. The average contraction for firms in capital-intensive industries was less for this period than during the peak of the crisis. This finding is consistent with the case study material cited earlier, which reported radical and prompt corporate change in response to the collapse in domestic demand at the peak of the crisis in industries such as chemicals and machinery.

IV.3 *Econometric analysis*

The previous descriptive analysis revealed a number of relationships between firm characteristics and performance during the crisis. However, these results are at best suggestive, of course, owing to the fact that firms typically share several characteristics. For example, foreign firms are often large and export-oriented and, therefore, the positive effect of foreign ownership observed above could simply be a result of some other characteristics. To ascertain whether these suggested relationships are robust, this section provides an integrated econometric analysis of the relationship between these characteristics and firm performance.

Specifically, we regress the percentage change in *RVA* ($\% \Delta RVA_{i,t}$) on the firm characteristic variables over the period 1998–2000, controlling for differences across years, industries, regions and some additional variables not elsewhere considered in this paper. The estimating equation is as follows

$$\% \Delta RVA_{i,t} = \alpha + \beta' X_i + \delta' Y_j + \varepsilon_{i,t}, \quad (1)$$

where X_i and Y_j are sets of explanatory variables capturing the firm characteristics at firm and industry level. The additional firm characteristic variables included in the equation are age, financial leverage, import dependence, industry concentration and import penetration, and trade protection. The dummy variables to represent region and industry are defined at the level of province and four-digit ISIC, respectively.

The sample is an unbalanced pooled cross-section that consists of 10 050 firms for the period 1996–2000. Approximately 75 percent of the sample is made up of firms that are observed for the entire period 1995–2000.

An important statistical issue regarding the estimation is sample censoring. The dependent variable ($\% \Delta RVA_{i,t}$) can only be calculated for the plants observed throughout the period 1995–2000. An examination of the sample indicates that approximately 33 percent of the observed plants were no longer recorded in one or more years during the period 1997–2000. As a result, the distribution of the sample is truncated and estimating Equation (1) only using the selected sample might lead to bias. To solve this problem, the Heckman (1976) two-step estimation approach was employed. That is, the selection problem is solved by including an inverse Mills ratio as another explanatory variable in Equation (1). This is done in two steps. First, a probit model of firm survival is regressed and the

estimates of the inverse Mills ratio are constructed. Second, Equation (1) is regressed with the estimated inverse Mills ratio as an additional regressor.¹⁰ A test for the selectivity problem can be undertaken by evaluating the statistical significance of the estimated coefficient of the inverse Mills ratio.

In its general form, the survival equation is:

$$S_{i,t} = 1[\gamma'Z_i + \varepsilon_{2i,t} > 0], \quad (2)$$

where $S_{i,t} = 1$ if plant i is observed and zero otherwise, and Z_i includes variables that determine the survival; that is, whether plant i is observed or not.

We use a similar analytical framework to explain firm survival during the crisis as was used to understand the impact of the crisis. Hence, the same set of explanatory variables is included in both Equations (1) and (2).¹¹ Although financial distress is likely to be a key determinant of survival, Geroski and Gregg (1997) and Schary (1991) have pointed out that the decision to put a firm into receivership could be constrained by firm characteristics. These include size (see Jovanovic, 1982; Ghemawat and Nalebuff, 1985), age (Jovanovic, 1982) and financial leverage (Jones, 1987; Schary, 1991).

The regression results from Equation (1) are reported in Table 3. These are OLS estimations from the second stage of the Heckman selection model. The F -test for overall statistical significance passes at the 1 percent level. The White's robust F -statistics and t -statistics were used to correct for heteroscedasticity. Graphical examination and heteroscedasticity tests (Cook–Weisberg and White) at the experimental stage reveal that the variance is not homogenous. $SIZE_{9596}$ was introduced in its natural logarithm form, following previous studies that found that firm size is nonlinearly related to performance.

We experimented with five specifications. Specifications 1 and 2 are the results for the entire period 1998–2000, whereas specifications 3–5 are the results of separate regressions for each year within the period. The last three specifications are motivated by the possibility that the effect of the characteristics might have changed as the economy began to recover in 1999.

The results based on specifications 1 and 2 show that export-oriented firms performed better than domestic-oriented ones. The coefficients of EXP_{9596} are positive and statistically significant across the equations. The effect of sales orientation is sizeable. A 10-percent increase in exported output (as a ratio to total output) lowers the contraction in RVA by 10 percent. The finding is consistent with expectations from theory regarding the positive impact of exchange rate depreciation, and it supports findings from other studies (Forbes, 2000b;

10. See, for example, Johnston and Dinardo (1997) for a fuller discussion of the Heckman method.

11. Other variables are included to control for differences across plants and industry, but to simplify the presentation they are not reported. The variables represent firm experience, technology, trade protection, market concentration and industry at the four-digit ISIC level (i.e. the dummy variables for industry). Dummy variables for year and province are also included to control for differences across time and region.

Table 3 The determinants of performance impact of the crisis: regression results

Dependent variable Period or year Specification	Entire period 1	1998–2000 2	% $\Delta RVA_{i,t}$ 1998 3	1999 4	2000 5
$EXP_{i,9596}$	0.181 (6.04)**	0.174 (5.79)**	0.285 (4.65)**	0.195 (3.09)**	0.148 (2.20)*
$FOR_{i,9596}$	0.230 (5.62)**		0.217 (2.38)*	0.291 (3.55)**	0.392 (4.75)**
$DFOR_{i,9596}$		-0.304 (3.56)**			
$DFOR_{i,9596} * FOR_{i,9596}$		0.620 (5.26)**			
$DGOV_{i,9596}$		0.050 (1.51)			
$\log(SIZE_{i,9596})$	-0.022 (1.71)+	-0.020 (1.60)	-0.030 (1.02)	0.046 (1.70) +	0.038 (1.22)
$DLI_{j,9596}$	0.045 (0.86)	0.047 (0.92)	0.228 (2.04)*	0.097 (0.99)	-0.068 (0.60)
$DCI_{j,9596}$	-0.192 (1.42)	-0.206 (1.51)	-0.012 (0.06)	-0.450 (2.25)*	-0.401 (1.02)
Dummy variables for Industry, at four-digit ISIC level.	Included	Included	Included	Included	Included
R^2	0.05	0.05	0.06	0.08	0.07
F -statistics	14.34	14.28	4.79	5.92	4.95
Observations	30 327	30 327	7604	7341	7045

Notes: The results of the other variables are suppressed. Robust t -statistics in parentheses. ** and * denote 5% and 10% levels of significance, respectively.

Bappenas, 2000; Blalock and Gertler, 2005). Nevertheless, and as noted above, the positive impact of sales orientation begins to ‘wash out’ fairly quickly, as shown by the difference between the peak of the crisis and the early recovery period.

There is strong evidence regarding the positive effect of foreign ownership, confirming the finding from the descriptive analysis that firms with a higher foreign share perform more strongly during the crisis. The coefficients of FOR_{9596} are positive and statistically significant. In addition, the magnitude of the coefficients suggests that the effect of foreign ownership is economically important. A 10-percent increase in foreign share leads to a smaller RVA contraction by 12 percent.

Specification 2 replaces the continuous ownership-variables (FOR_{9596} , GOV_{9596}) with the dummy ownership-variables ($DPRI_i$, $DFOR_i$ and $DSOE_i$) and adds an interaction variable between the dummy for foreign plants and the share of foreign ownership ($DFOR_{i,9596} * FOR_{i,9596}$). The substitution and addition aim to test whether the level of foreign ownership matters. The results do indeed

support the hypothesis. The coefficient of the interactive variable is positive and statistically highly significant. Therefore, this finding supports the proposition that parent companies are more likely to support their affiliates when they have a greater equity stake in them.

The parameter estimates of the second specification are used to estimate the minimum foreign share required to have at least a zero percentage difference in performance (i.e. $\% \Delta y_{i,t} = 0$). It turns out that the estimate is quite high, approximately 40 percent. Based on this estimate, it can be concluded that foreign firms in general did not necessarily perform better than the others. Rather, it was only those with a high foreign ownership share that exhibited superior performance.

Contrary to the results from the descriptive analysis, the regression results suggest that large firms contracted more than smaller firms. The coefficient of $\log(SIZE_{9596})$ is negative in specifications 1 and 2. This inference, however, is not very strong, because the coefficient is statistically significant only at the 10-percent level in specification 1 and is not statistically significant in specification 2.

The results support the observations from the descriptive analysis regarding the importance of factor intensity, based on the coefficients of DLI_{9596} and DCI_{9596} . After controlling for other plant characteristics, on average, firms in capital-intensive industries contracted more than those in resource-intensive industries. This is shown by the negative coefficients of DCI_{9596} in all equations, even though only a few are statistically significant. (DRI_{9596} here is used as the base dummy variable.) The positive coefficients of DLI_{9596} in the equations suggest that firms in labor-intensive industries performed better than those in resource-intensive industries. Nevertheless, none of the results is statistically significant, which suggests that performance in these two industries is quite similar.

The results of specification 3–5 reveal several interesting findings. First, there is some evidence of a positive and substantial effect for firm size in the early recovery period. The coefficients of $\log(SIZE_{9596})$ are positive and larger in the results for 1999 and 2000 compared with those for 1998. Despite this, the coefficients are only significant at the 10-percent level for 1999.

This finding differs somewhat from some previous studies that conclude that smaller firms perform better than larger ones during the crisis (Forbes, 2000b; Berry et al., 2001). For example, using firm-level data from the Indonesian Ministry of Cooperatives and Small and Medium Enterprise (MOCSME), Berry et al. found that small firms expanded their value added by approximately 35 percent in 1998 compared to a contraction of 5–27 percent experienced by large firms.¹² Nevertheless, the finding is in line with previous studies that examine the relationship using other performance measures and a different data

12. However, it is important to bear in mind that the data used in the present study (i.e. the SI data) are different from those of MOCSME in three respects. First, the SI data do not include plants with fewer than 20 employees. Second, MOCSME data define size in terms of output rather than employment. Third, MOCSME data include all types of commercial activities, not only manufacturing.

source. Using the World Bank firm level survey, Dwor-Frecaut et al. (2000) found that the firms that expanded exports in Thailand and Malaysia during the period 1998–1999 were mostly large (approximately 60 percent of firms in the sample). Moreover, Claessens et al. (2000) found that the 1998 sales margin of some publicly listed companies in six East Asian economies (the four crisis-affected together with Singapore and Hong Kong) is positively related to firm size, the latter proxied by the log of firms' sales in 1996.

The second key finding is that the positive effect of foreign ownership became more important in the recovery period. The coefficients of FOR_{9596} increase and become more statistically significant over the period. This finding presumably reflects the effects of an intensifying competitive environment. Foreign firms have both the deeper pockets necessary to endure a domestic demand collapse, and greater opportunities for export expansion. They are also more likely to be able to capitalize on structural reforms triggered by the economic recovery program.

A third finding is that the effect of sales orientation is less important in the early recovery period. Both the coefficients of EXP_{9596} and their statistical significance decrease over time. This suggests that the export response to the crisis was significantly lower over the recovery period, for reasons discussed above.

Table 4 reports the probit regression results relating to the determinants of survival during the period 1997–2000. They correspond to the OLS regression results presented in Table 3. The probit regressions are the first step in the Heckman selection model.

The results of specifications 6 and 7 for the entire period 1998–2000 show that size is important in increasing plant survival probability during the period. The coefficients of $\log(SIZE_{9596})$ are positive, large and statistically very significant in all specifications. This finding is consistent with much of the published literature on the determinants of firm survival, which draws attention to financial market access and economies of scale (Audretsch, 1994; Bernard and Jensen, 2002). This was a period when many Indonesian firms were experiencing serious financial difficulties. The results support anecdotal observations at the time that banks were willing to bear the risks in allowing large firms to keep operating. This too is consistent with the credit rationing literature, and with the fact that banks are likely to have better information on the financial conditions and investment opportunities of larger firms (Petersen and Rajan, 1994).

The results indicate that the probability of survival is higher for foreign and export-oriented firms. The coefficients of variables that represent foreign ownership (FOR_{9596} and $DFOR_{9596}$) are positive, albeit only statistically significant at the 10-percent level. This finding is consistent with the results reported above concerning both foreign ownership variables.

However, unlike the finding on foreign ownership, the positive coefficients of EXP_{9596} are statistically significant only at the 12-percent level. Therefore, export-oriented plants were not more likely to survive than domestic-oriented ones. This finding most likely reflects the effect of many factors contributing to

Table 4 The determinants of survival: regression results

<i>Dependent variable</i>	<i>Entire period</i>	<i>1998–2000</i>	<i>S_{it}</i>	<i>1999</i>	<i>2000</i>
<i>Period or year</i>	<i>6</i>	<i>7</i>	<i>1998</i>	<i>9</i>	<i>10</i>
<i>Specification</i>			<i>8</i>		
<i>EXP</i> _{<i>i,9596</i>}	0.017 (1.59)	0.015 (1.59)	0.024 (0.77)	0.015 (1.08)	0.008 (0.86)
<i>FOR</i> _{<i>i,9596</i>}	0.091 (1.74)+		0.096 (1.87)+	0.091 (1.71)+	0.049 (0.51)
<i>DFOR</i> _{<i>i,9596</i>}		–0.075 (0.69)			
<i>DFOR</i> _{<i>i,9596</i>} * <i>FOR</i> _{<i>i,9596</i>}		0.187 (1.88)+			
<i>DGOV</i> _{<i>i,9596</i>}		0.015 (0.24)			
<i>log</i> (<i>SIZE</i> _{<i>i,9596</i>})	0.403 (35.66)**	0.404 (35.48)**	0.418 (18.21)**	0.444 (19.95)**	0.412 (19.86)**
<i>DLI</i> _{<i>j,9596</i>}	0.265 (3.05)**	0.265 (3.05)**	0.328 (1.81)+	0.269 (1.63)	0.237 (1.49)
<i>DCI</i> _{<i>j,9596</i>}	–0.111 (0.56)	–0.112 (0.57)	–0.085 (0.21)	–0.165 (0.42)	–0.222 (0.59)
Dummy variables for industry, at four-digit ISIC level.	Included	Included	Included	Included	Included
Pseudo <i>R</i> ²	0.15	0.15	0.15	0.15	0.14
Wald χ^2	3774.41	3767.73	955.11	1026.24	1068.09
Observations	37 572	37 572	9367	9383	9393

Notes: The results of the other variables are suppressed. Robust Z-statistics in parentheses. ** denotes 10% level of significance.

sluggish export performance during the crisis, as noted above and highlighted in several studies (Duttagupta and Spilimbergo, 2004; ADB, 2002; World Bank, 2000).

Factor intensity is also an important determinant of firm survival. The coefficient of *DLI*₉₅₉₆ is positive and statistically significant, indicating that firms in labor-intensive industries survived better than those in resource-intensive industries. This finding is consistent with the results of the performance equation above. The higher survival probability presumably reflects the success of these firms in managing financial distress through intensified export orientation. The positive coefficient also suggests the likelihood of labor hoarding during the crisis, as found in a number of studies (Dwor-Frecaut et al., 2000; Manning, 2000).

The results of the last three specifications do not change this general picture. There is no change in terms of the determinants of survival, or the direction of the effects over time. Nevertheless, two additional findings deserve comment. First, the results for *FOR*₉₅₉₆ suggest that the positive effects of foreign ownership

were greatest at the peak of the crisis. This differs from the finding in the performance equations, but it does provide evidence to support the hypothesis that foreign firms tend to support struggling affiliates. It is consistent, for example, with the observation made by Fukao (2001) that Japanese parent companies financially assisted their crisis-affected affiliates and enabled them to switch from local to export sales.

Second, the positive effect of sales orientation on survival is lower in the early recovery period, as indicated by the declining coefficients of EXP_{9596} over time. This again supports the observation that the initially strong export response to the crisis tapered off as the recovery proceeded.

V. Conclusions and Implications

This paper has examined firm-level impacts of Indonesia's deep economic crisis of 1997–1998 with the aid of detailed, establishment-level data. These impacts were highly variable, and many of the outcomes can be explained with reference to the published crises literature. In particular, foreign ownership and prior export orientation were generally found to be highly significant determinants of survival and recovery. Firm size was found to be ambiguous, a result that tends to refute the popular notion that smaller firms are more adaptable in times of crisis. The industry in which firms are located, in particular its factor proportions, is also found to be significant.

Even though the database is rich by developing country standards, inevitably there are some limitations. Very small firms, employing fewer than 20 workers, are not included in the survey. We also lack detailed information on financial arrangements and, for multi-plant operations, the nature of inter-affiliate transactions.

Data Appendix: Definition of Variables

The following variables are used to describe firm characteristics. Unless otherwise stated, the variables are defined by their pre-crisis values (i.e. the average values of 1995 and 1996, two 'normal' years).

Sales orientation

Sales orientation is proxied by plant export propensity (EXP). For plant i , it is defined as the ratio of exports to total output:

$$EXP_i = \frac{EX_i}{Output_i},$$

where EX_i is export of plant i . EX_i is estimated by multiplying the percentage of exported output in production (i.e. $PRPREX$ in SI data) by the value of output.

Ownership

Two types of variables were created for firm ownership: continuous and dummy ownership variables. A continuous ownership variable was created for every plant i : the percentage share of foreign ownership (FOR_i). Three dummy variables were created for every plant i : domestic-private ($DPRI_i$), foreign ($DFOR_i$) and state-owned plants ($DGOV_i$). $DPRI_i$ and $DFOR_i$ are defined as

$$DPRI_i \begin{cases} = 1 \text{ if the share of domestic-private ownership in} \\ \text{plant } i \text{ is equal to 100 percent} \\ = 0 \text{ otherwise.} \end{cases}$$

$$DFOR_i \begin{cases} = 1 \text{ if } FOR_i > 0 \text{ percent} \\ = 0 \text{ otherwise.} \end{cases}$$

Joint venture plants require special treatment and assumptions. Three joint venture groups of plants, foreign-government, foreign-domestic and foreign-government-domestic, are considered foreign plants (i.e. $DFOR_i = 1$). This classification is based on previous empirical studies that show that foreign partners are dominant, particularly on matters related to finance and technology, even when they are minority shareholders (AswicaHyono and Hill, 1995; Ramstetter, 1999).

In the case of state-owned plants, and following a similar argument as for $DFOR_i$, the government-domestic group is classified as 'government' and, hence, $DGOV_i$ is defined as

$$DGOV_i \begin{cases} = 1 \text{ if } GOV_i > 0 \text{ percent} \\ = 0 \text{ otherwise.} \end{cases}$$

Size

Size ($SIZE_i$) is proxied by number of employees. The other common alternatives, such as output or profits, are not used, as they tend to be more sensitive to changes in the business cycle, a factor of particular significance in this study (Domowitz et al., 1986; Rotemberg and Saloner, 1986). An employment-based measure also avoids index number problems associated with deflating output values, an important consideration in times of very high inflation.

Factor intensity

We employ dummy variables based on an industry classification defined by Ariff and Hill (1985) to measure factor intensity at industry level: resource-intensive (DRI_j), labor-intensive (DLI_j) and capital-intensive industries (DCI_j). For industry j , which is defined at the four-digit ISIC level,

$$DRI_j \begin{cases} = 1 \text{ if industry } j \text{ is classified as a} \\ \text{resource-intensive industry.} \\ = 0 \text{ otherwise.} \end{cases}$$

$$DLI_j \begin{cases} = 1 \text{ if industry } j \text{ is classified as an} \\ \text{unskilled labor-intensive industry.} \\ = 0 \text{ otherwise.} \end{cases}$$

$$DCI_j \begin{cases} = 1 \text{ if industry } j \text{ is classified as a} \\ \text{capital-intensive industry.} \\ = 0 \text{ otherwise.} \end{cases}$$

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