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DO CRISES CATALYZE CREATIVE DESTRUCTION? FIRM-LEVEL EVIDENCE FROM INDONESIA

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Abstract—Using Indonesian manufacturing census data (1991–2001), this paper rejects the hypothesis that the East Asian crisis unequivocally improved the reallocative process. The correlation between productivity and employment growth did not strengthen, and the crisis induced the exit of relatively productive firms. The attenuation of the relationship between productivity and survival was stronger in provinces with comparatively lower reductions in minimum wages, but not due to reduced entry, changing loan conditions, or firms connected to the Suharto regime suffering disproportionately. On the bright side, firms that entered during the crisis were relatively more productive, which helped mitigate the reduction in aggregate productivity.

I. Introduction

WHILE crises are periods of intensified adjustment, firm-level evidence on the impact of crises on resource allocation is limited. Moreover, their impact is theoretically uncertain. The idea that crises may accelerate the Schumpetarian (1939) process of creative destruction by "cleansing" out unproductive arrangements and freeing up, resources for more productive uses features prominently in macromodels (see Hall, 1995; Caballero & Hammour, 1994, 1999; Gomes, Greenwood, & Rebelo, 1997). On the other hand, some recent papers suggest that rather than being cleansing, crises scar the economy and undermine long-run productivity growth by exacerbating market imperfections and destroying productive firms (see Barlevy, 2002 and Ouyang, 2009). Which view is correct matters for policy, since at issue is whether there is a trade-off between minimizing the short-term impact of crises and maximizing long-run growth prospects. If crises are cleansing policies to dampen short-term impacts, they may obstruct long-run recovery and be not only costly but also counterproductive. By contrast, if crises are scarring, policies to minimize short-term impacts are consistent with maximizing long-run growth prospects (see Paci, Revenga, & Rijkers, 2012). Given the critical role of the reallocative process in facili-

tating recovery and growth and the paucity of available firm-level studies on the impact of crises on resource allocation, empirically discriminating between these competing paradigms is important.

This paper uses plant-level manufacturing census data from Indonesia to examine the impact of the East Asian crisis on the process of creative destruction. Aggregate productivity growth decompositions help assess macrolevel trends in the contributions of entry, exit, and reallocation to productivity growth during and after the crisis. These decompositions are a prelude to firm-level analysis of exit and employment growth patterns, which assesses whether and how firm dynamics during the crisis were different from those operating in pre- and postcrisis periods. Thus, we examine both the impact of the crisis on resource allocation and the reallocative process itself.

Previous work on allocative efficiency has largely avoided periods of crisis, and work on crises has rarely examined firm responses. By using firm-level data to examine the impact of a major crisis on resource allocation, this paper combines and contributes to several strands of literature that have evolved fairly separately up until this point. The evidence on the impact of crises on resource allocation typically relies on aggregate data. The few previous attempts to empirically validate the predictions of the cleansing paradigm using firm-level data, discussed in detail in section II, have either failed to examine changes in the reallocative process itself or suffer methodological shortcomings. Second, existing plant-level studies of reallocation dynamics have demonstrated that business cycles are important determinants of both the pattern and pace of reallocation (see the surveys by Bartelsman & Doms, 2000; Caves, 1998; and Syverson, 2010) but typically deliberately exclude crisis periods. It is therefore not clear to what extent the conclusions based on them generalize to crisis times. Third, cross-country studies based on aggregate data suggest that plant dynamics are a key determinant of the depth and duration of crises (Bergoeing, Loayza, & Repetto, 2004; Collier & Goderis 2009), but they do not examine how these dynamics matter. Fourth, microstudies of the impact of crises on labor market outcomes mostly rely on household and labor market data (see McKenzie 2003, 2004; Fallon & Lucas, 2002; Manning, 2000, Beegle, Frankenberg, & Thomas, 1999), which are ill suited for analyzing the impact of crises on reallocation dynamics and labor demand. Firm-level data are better suited for this purpose and enable us to document heterogeneity in firm vulnerability and adjustment patterns.

Examining the impact of the East Asian crisis on the Indonesian manufacturing sector provides an interesting case study of how financial crises reverberate through the

real economy. Lessons could be relevant for recovery from the current global crisis, which is also characterized by a sharp contraction of demand, reduced access to credit, and uncertainty (although with less dramatic depreciations). In addition, our analysis may be relevant for those concerned with the impact of transitions to democracy, such as those currently taking place in the Middle East, on private sector dynamics, as we are able to assess whether the regime change that accompanied the crisis differentially affected firms connected with the Suharto regime.[1]

The main findings can be summarized as follows: the data do not unequivocally support the cleansing paradigm. The crisis led to a spike in exit, a slowdown in entry, and excessive employment reallocation. Productive firms on average experienced lower employment losses, but the correlation between productivity and employment growth did not strengthen. Rather than raising the productivity threshold for survival, the crisis was more indiscriminate in terms of the productivity of firms driven out of business. Firms more vulnerable to changing credit market conditions were much more likely to exit during the crisis, but the attenuation of the link between productivity and survival did not increase with vulnerability to changing loan conditions. The attenuation was also not an artifact of reduced entry rates or driven by political transition. The results are robust to excluding firms with connection to the Suharto regime. Moreover, if anything, among the politically connected firms, productivity became a more important determinant of firm survival. By contrast, the attenuation was particularly pronounced in provinces with comparatively high minimum wages, suggesting that labor regulations obstructed efficiency-enhancing reallocation. The effects are not all negative, however. The protective power of productivity against exit was restored postcrisis, and the crisis appears to have weeded out the weakest potential entrants; while entry rates were lower during the crisis, those firms that entered were on average much more productive, which helped mitigate the loss in aggregate productivity.

The remainder of this paper is organized as follows. The next section reviews related literature and describes the context. Section III summarizes our hypotheses and explains our approach. Section IV describes the data, while section V presents descriptive statistics on job flows and decompositions of aggregate productivity growth. Section VI which constitutes the core of the paper, presents firm survival and employment growth models. A final section concludes.

II. Related Literature and Context

A. Related Literature

According to Schumpeter (1939), business cycles are driven by a process of creative destruction by which innova-

tive, high-productivity firms drive relatively unproductive firms out of business. Some prominent macromodels predict that recessions may speed up this process by "cleansing" out unproductive firms and freeing up resources for more productive uses (see, e.g., Caballero & Hammour, 1994, 1999). While longitudinal manufacturing firm-level studies provide empirical evidence that the creative destruction process facilitates productivity growth, they also raise questions about how this process varies over time. Decompositions of aggregate productivity growth only weakly support the hypothesis that allocative efficiency increases during cyclical downturns (see Griliches & Regev, 1995; Baily et al., 1992). Yet such studies typically exclude extreme economic events, and it is therefore uncertain whether lessons based on them apply during times of crisis.

In the presence of market imperfections, downturns may hamper, rather than facilitate, adjustments and protract the recovery process (see, e.g., Loayza, Perry, & Serven, 2005). Distortionary labor market regulations and policies governing firm dynamics appear particularly detrimental to the efficiency of the reallocative process (see Collier & Goderis, 2009; Haltiwanger, Scarpetta, & Schweiger, 2008). Barlevy (2002, 2003), moreover, has pointed out that crises can obstruct the process of creative destruction by exacerbating credit market imperfections, which may hurt efficient firms disproportionately as such firms are likely to have higher financing needs, contradicting the creative destruction hypothesis. Empirical evidence supporting the idea that crises exacerbate credit constraints is provided by Blalock, Gertler, and Levine (2008) who, using the same data set as considered in this paper, show that foreign-owned firms, which are arguably less vulnerable to liquidity constraints, fared much better during the crisis than comparable domestically owned firms.[2]

Discriminating between the competing predictions of the cleansing and scarring paradigms requires firm-level analysis on the impact of crises on resource allocation, as it requires one to analyze the link between productivity, exit, and firm growth. Although such analysis is scant, a few studies shed light on the debate. Liu and Tybout (1996) compare the performance of continuing plants and exiting plants in Chile and Colombia from 1980 to 1985 but find no evidence for systematic covariance of the efficiency gap between these two groups of firms over the business cycle in either country, even though Chile suffered a recession in 1982. Exit rates of Chilean firms increased only modestly during the recession. Casacuberta and Gandelsman (2012) examine the impact of the 2002 banking crises in Uruguay on resource allocation. Even during the crisis, productivity

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[1] We use the data on political connections collected by Mobaraq and Purbasari, 2008.

[2] Similarly Oh et al. (2009) find that the Korean credit guarantee scheme for SMEs implemented in response to the Asian crisis stifled the creative destruction process by enabling relatively inefficient firms to survive and maintain their size. By contrast, Borensztein and Lee (2002) find evidence that in response to the East Asian crisis, Korean banks reallocated credit from conglomerate (*chaebol*) firms to relatively more efficient firms.

was negatively correlated with exit, although the evidence suggests the crisis may have attenuated the link between productivity and exit somewhat. Nishimura, Nakajima, and Kiyota (2005) use a cohort analysis comparing productivity of entrants and survivors to examine the impact of the Japanese recession on productivity growth and find that the 1996–1997 banking crisis induced the exit of some relatively efficient firms among the youngest cohorts. Similarly, Eslava et al. (2010) demonstrate that Colombian firms dependent on external credit were more likely to exit during the 1998–2001 recessions, even if they were highly productive. Using manufacturing data from Russia, Brown and Earle (2002) show that the recession induced by the transition from communism to a market-based economy coincided with an improvement in the reallocative process.

In short, theoretical models yield competing predictions regarding the impact of crises on resource allocation and the empirical evidence on the impact of crises on firm dynamics is limited and ambiguous.

B. Context: The Indonesian Crisis

The East Asian crisis struck after an extended period of industrialization and economic growth, which was in part driven by expansion of labor-intensive exports (Dwor-Frecault, Colaco, & Hallward-Driemeier, 1999). After a reduction in FDI flows in response to the depreciation of the Thai baht, the rupiah depreciated dramatically, precipitating a sharp increase in inflation rates. Interest rates were raised to defend the currency, which exacerbated the decline in demand. GDP growth contracted severely in 1997 and fell in absolute terms by over 13% in 1998. Manufacturing was one of the first and hardest-hit sectors due to its greater reliance on imported inputs, exposure to changes in foreign demand (particularly given the importance of intraregional trade), and greater reliance on external financing, often in foreign currency, which became an enormous burden after devaluation. The drop in manufacturing output both preceded and exceeded the drop in aggregate GDP. In fact, the census data suggest that manufacturing suffered its largest decline in 1997.

The crisis also led to the end of the Suharto regime, which exposed firms with ownership connections to Suharto to greater competitive pressure (Fisman, 2001; Mobarak & Purbasari, 2008). To the extent that such firms had been able to generate high profits (and consequently record high productivity) during the Suharto era by virtue of such connections, the removal of Suharto might attenuate the relationship between observed productivity and firm survival, even though the likely concomitant reduction of cronyism associated with connectedness is efficiency enhancing rather than scarring. By virtue of having detailed information on political connectedness with the Suharto regime at the firm-level compiled by Mobaraq and Purbasari (2008), we are able to explore this issue.

The fall of Suharto also sparked prolabor pressures and precipitated the introduction of more stringent labor market regulation. During the New Order government, minimum wages had been low and enforcement was fairly lax. In real terms, they collapsed during the crisis, yet they recovered very quickly. Moreover, enforcement became more stringent (World Bank, 2010). In short, Indonesian labor markets during the Suharto areas were flexible but became more rigid postcrisis. In our empirical analysis, we will explore the impact of such changing labor regulations on the reallocative process.

Indonesia provides a useful testing ground to examine the impact of crises on resource reallocation. The unexpected nature of the crisis facilitates identification of firm responses, and Indonesia has a very detailed manufacturing-level census, discussed in detail in section IV, which allows us to measure productivity, entry, and exit dynamics while controlling for a rich set of firm characteristics. Moreover, although the extent to which reallocation dynamics in developing countries resemble those in developed countries is an actively researched issue (see, e.g., Aw, Chung, & Roberts, 2002, and Eslava et al., 2004, for evidence of the importance of creative destruction in Taiwan and Colombia, respectively), in their comparative analysis of harmonized firm-level data from seventeen developing and developed countries Bartelsman, Haltiwanger, and Scarpetta (2004) conclude that reallocation dynamics in Indonesia are very similar to those operating in developed countries and other Asian economies. Thus, our findings are likely to be relevant for other countries.

III. Hypotheses and Approach

A. Hypotheses

The cleansing and scarring paradigms yield competing testable predictions at both the macro- and the microlevels. If the cleansing view is correct, one would expect crises to accelerate the weeding out of unproductive firms, resulting in a stronger association between productivity and survival at the microlevel; in other words, unproductive firms would be disproportionately affected. Furthermore the correlation between firm productivity and employment growth would be expected to strengthen, as less productive firms should contract more in response to shocks. At the macrolevel, one would expect to see a corresponding increase in the contribution of exit and, possibly, entry to aggregate productivity growth, as well as stronger correlations between productivity and changes in market share.

By contrast, if crises are scarring, one would anticipate the efficiency of resource allocation to deteriorate and the link between productivity, exit, and employment growth to attenuate, undermining aggregate allocative efficiency. To the extent that these scarring effects arise because of increased credit market imperfections, one might expect firms more reliant on finance to be more severely affected by the crisis and the attenuation of the link between productivity and survival to be especially strong for firms more vulner-

able to changing loan conditions. Likewise, if they are driven by labor market regulation, one would expect these effects to be particularly strong for firms located in provinces with more stringent labor regulations. Finally, if attenuation is driven by regime change, one would expect the attenuation effect to be strongest for firms with connections to the Suharto regime.

B. Macrolevel Analysis: Decomposing Productivity Growth

To assess whether crises catalyze or retard efficiency enhancing reallocation and to analyze how industry dynamics during crises differ from pre- and postcrisis dynamics, the evolution of aggregate productivity is decomposed using an extended version of the Foster-Haltiwanger-Krizan decomposition (1998) proposed by Brown and Earle (2008):

$$\Delta P = \underbrace{\sum_{i \in C} \theta_{t-k} \Delta p_{it}}_{Within} + \underbrace{\sum_{i \in C} \Delta \theta_t (p_{it-k} - P_{t-k})}_{between} + \underbrace{\sum_{i \in C} \Delta \theta_{it} \Delta p_{it}}_{cross}$$
$$+ \underbrace{\sum_{i \in N} \theta_{it} (P_t - P_{t-k})}_{proportionate\ entry} + \underbrace{\sum_{i \in N} \theta_{it} (p_{it} - P_t)}_{disproportionate\ entry} + \underbrace{\sum_{i \in X} \theta_{it-1} (p_{it-k} - P_{t-k})}_{exit},$$

where P_t represents average productivity at time t, Δ denotes changes between period $\pm$–k, and period t, p_{it} represents the productivity of firm i at time t, and θ_{it} is the market share of firm i at time t. C denotes the set of incumbent firms surviving from period $t-1$ to period t, N denotes the set of entrants, and X is the set of firms that exited. The first term in this decomposition represents the "within" effect, the contribution of within-establishment productivity growth of surviving firms, weighted by initial market share. The second term reflects the "between effect," the contribution of market share reallocation to productivity growth. The third term represents the "cross-effect," the covariance between the within and the between effect. The fourth terms captures the "proportionate entry effect," the change in average sector productivity weighted by entrants' market share. The fifth term measures the "disproportionate" entry effect, defined as the difference between entrants' productivity and average sector productivity in year t. As Brown and Earle (2008), explained the latter term provides a better measure of the relative contribution of entrants than the entry term in the original FHK decomposition which covaries with aggregate productivity growth because it is the sum of the disproportionate and proportionate entry terms.[3] The final term presents the contribution of exit.

If crises catalyze creative destruction, one would expect the relative contribution of within-firm adjustment to aggregate productivity growth to be proportionately smaller than during less turbulent times. Rather, one would expect to see an increase in the 'between' term—relatively more produc-

tive firms gaining market share—as well as higher contributions from exit and proportionate entry and increases in the cross term—firms that are experiencing larger productivity losses suffering simultaneous reductions in market share. Since the process of creative destruction may take time, we present decompositions using both one- and three-year time horizons. The longer time horizon offers the additional advantage of shielding against the impact of measurement error (since the signal-to-noise ratio is higher over longer time horizons). This is important because aggregate productivity growth decompositions are very sensitive to measurement error. Suppose, for example, that output is measured with error. This will result in a spuriously high cross term and an underestimation of the within, and, to a lesser extent, between terms. Thus, our decompositions will have to be interpreted cautiously.

C. Microlevel Analysis

Firm survival: Basic test. To examine whether crises catalyze creative destruction and to examine how the determinants of firm-survival varied over time, a discrete-time proportional hazards survival model is used (Cox, 1972). Period-specific hazard rates, $\lambda_{it}(t)$, are modeled as a function of firm productivity P_{it} and other covariates x_{it}, which we interact with dummies for the crisis and the recovery, to assess how, during the crisis and subsequent recovery periods, the relationship between exit and covariates differed from the precrisis process. Our estimable equation is

$$\lambda_{it}(t) = log\ \lambda_0(t) + \beta'_{xi} x_{it} + \beta'_{C \times x_i} Crisis \times x_{it}$$
$$+ \beta'_{Rec \times x_i} Recovery \times x_{it} + \beta'_p P_{it} + \beta_{CP}' Crusis \times P_{it}$$
$$+ \beta'_{RecP} Recovery \times P_{it} + \beta'_C Crisis + \beta'_{Rec} Recovery + v_{it}$$

where *Crisis* is a dummy variable for 1997 and 1998 and *Recovery* a dummy for the period 1999 to 2001.[4] This testing strategy is very general as all parameters of the hazard function are allowed to vary over time. The proportional hazard specification is convenient since it enables us to test whether firms with certain characteristics were disproportionately more or less likely to exit in certain periods.

Under the null hypothesis of no short-run differential effect of crises on creative destruction, $e^{\beta CP} = 1$. If crises catalyze creative destruction, $e^{\beta CP} > 1$, while $e^{\beta CP} < 1$ if they hamper it. At the risk of belaboring the point, if $e^{\beta CP} = 1$, this does not mean that crises are not weeding out productive firms; whether this happens also depends on β_P. The interaction term tells us whether productive firms were overrepresented among the exiters relative to other periods.

Accounting for attenuation: Finance, labor market regulations, reduced entry, and regime change. Salient explanations for the attenuation between productivity and

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[3] This implies that the entry effect can be positive (or negative) even if the average productivity of entrants is identical to that of incumbents in each year. In years where average productivity growth increases, the contribution of net entry will be exaggerated, and in years where it decreases, the relative contributions of entrants will be underestimated.

[4] Alternatively we used year dummies to allow greater flexibility in capturing changes over time. The results are very consistent.

survival are credit market imperfections and labor market frictions impeding efficient adjustment, reduced entry, and regime change. To test these explanations, a difference-in-difference approach is used. Although we do not observe which firms are credit constrained and which ones are not, we compare the precrisis, crisis, and postcrisis performance of firms that are likely to differ in their exposure to changing credit market conditions by exploiting information on differences in dependence on external finance following Rajan and Zingales (1998) and asset tangibility following Braun (2003). These measures capture different aspects of firms' financing needs. Indicators of external financing dependence predominantly relate to firms' long-run financing needs, whereas measures of tangibility are likely to correlate with access to credit since assets that are more tangible offer investors more protection against default from borrowers (as they offer more collateral).[5]

We include indicators of financial characteristics, F_{it}, interacted with period dummies, and, moreover, interactions of these measures with our productivity measure:

$$
\begin{aligned}
\lambda_{it}(t) = {}& log\,\lambda_0(t) + \beta_{x_i}{}'x_i + \beta'_{C\times x_i}Crisis \times x_i \\
&+\beta'_{Rec\times x_i}Recovery \times x_i + \beta_P{}'P_{it} + \beta_{CP}{}'Crisis \times P_{it} \\
&+\beta'_{RecP}Recovery \times P_{it} + \beta_F{}'F_{it} + \beta'_{CF}Crisis \times F_{it} \\
&+\beta'_{RecF}Recovery \times F_{it} + \beta_{FP}{}'F_i \times P_{it} + \beta_{CFP}{}'Crisis \\
&\times F_i \times P_{it} + \beta'_{RecFP}Recovery \times F_i \times P_{it} \\
&+\beta'_C Crisis + \beta'_{Rec}Recovery + v_{it}.
\end{aligned}
$$

If changing credit conditions are driving the attenuation effect, one would expect that firms more exposed to such changes to be more likely to exit. $\beta_{CF} > 0$, and the attenuation would be especially pronounced for firms more vulnerable to such changing conditions, $\beta_{CFP} > 0$. The protective impact of productivity should become stronger once exposure to changing credit market conditions is accounted for.

Analogous regressions are run using real minimum wages, MW_{jt} as a proxy for labor market regulation. Minimum wages are a suitable proxy for labor regulation because they are politically salient, because they increased substantially in the aftermath of the crisis, and because they varied both over time and by province, which facilitates identification of their impact. The null hypothesis is that minimum wages do not affect reallocation dynamics ($\beta_{MW} = \beta_{CMW} = \beta_{RecMW} = \beta_{MWP} = \beta_{CMWP} = \beta_{RecMWP}$.

In addition, we examine the impact of reduced entry. Having fewer entrants could result in an attenuation of the link between productivity and exit in aggregate since entrants tend to be both less productive and more likely to exit. We examine this possibility by including dummies for whether a firm was an entrant and allowing for a differential relationship between productivity and survival for entrants.

Finally, we assess to what extent the attenuation is driven by firms that had been benefiting from ownership connections with Suharto losing their privileged status. If this is the explanation for the attenuation effect, the attenuation should be especially strong for firms with such connections.

Employment growth. To examine which firms grow fastest and assess whether employment growth became more strongly associated with productivity during the crisis, or whether, as is the case with survival, the link between employment and productivity was attenuated, we estimate the following employment growth model:

$$
\begin{aligned}
\Delta L_{it+1} = {}& \gamma'_P P_{it} + \gamma_{CP}{}'Crisis \times P_{it} + \gamma_{RecP}Recovery \times P_{it} \\
&+\gamma_x x_{it} + \gamma_{Cx}Crisis \times x_{it} + \gamma_{Rx}Recovery \times x_{it} \\
&+\gamma_C Crisis + \gamma_{Rec}Recovery + u_i + v_{it},
\end{aligned}
$$

where ΔL_{it+1} is firm growth from period t to $t + 1$ and μ_i is a firm-fixed effect. Under the null hypothesis that the crisis did not improve the allocative efficiency of employment reallocation among continuing firms $\gamma_{CRISIS \times P} = 0$, whereas $\gamma_{CRISIS \times P} > 0$ ($\gamma_{CRISIS \times P} < 0$) under the alternative hypothesis that the crisis enhanced (diminished) the importance of productivity as a determinant of firm growth.

Serial correlation in the error term, in conjunction with the presence of lagged size as an explanatory variable, would render OLS estimates of the employment growth equation biased. To address this concern, we also use a fixed-effects estimator. The fixed-effects transformation is biased due to the correlation between the transformed error and the transformed explanatory variables (Nickell, 1981), but as the OLS and fixed-effects estimators are biased in opposite directions, they provide a confidence interval within which the true parameters lie (Bond 2002).[6]

IV. Data

The Indonesian Manufacturing Census (1991–2001) collected by the Indonesian Statistical Agency, BPS (Badan Pusat Statistik), provides the empirical basis for our analysis. It contains information on all Indonesian manufacturing establishments with more than twenty employees and spans the pre- and postcrisis periods, as well as the crisis itself. It has very detailed information on employment, inputs and outputs, industrial classification, exporting, ownership, investment behavior, and capital stock, which we measure as the replacement value of machinery and equipment at the end of the calendar year. Employment is measured as the

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[5] Our results are also robust to using alternative measures of access to finance such as liquidity needs (Raddatz, 2006), which capture firms' short-term financing needs, as well as measures of reliance on loans to finance investment. Results are omitted to conserve space but available from the authors on request.

[6] While the difference and systems GMM estimators developed by Arellano and Bond (1991) are in principle capable of yielding unbiased estimates, these estimators are not well suited for our data. The difference GMM estimator is likely to result in poorly behaved estimates when variables are highly persistent, as is the case with our data (for surviving firms, the correlation between lnL_t and lnL_{t-1} is 0.98—in both crisis and noncrisis years), while the systems GMM estimators rely on a mean stationarity assumption that is palpably undesirable in the context of a crisis (see Roodman, 2006, for a discussion). We therefore eschew this approach.

average number of workers per day. We augmented the data with industry-level measures of financial dependence, asset tangibility, employment turnover, and the natural rate of establishment entry obtained from secondary sources (Braun, 2003; Micco & Pages, 2004) and information on provincial-level minimum wages (World Bank, 2010).

In addition, we complemented the data with two measures of political connectedness constructed by Mobaraq and Purbasari (2008). The first builds on an insight by Fisman (2001) and identifies firms traded on the Jakarta Stock Exchange (JSX) whose stock returns responded negatively to news reports about Suharto's health. Mobaraq and Purbasari (2008) identify the major shareholders on the boards of these firms and all conglomerates run by these entrepreneurs, as well as firms owned by these conglomerates, and classify those as connected. This measure, however, may identify only those firms for which connections mattered or spuriously include firms for which an adverse stock market valuation spuriously coincided with news reports about Suharto's health. The second proxy, an indicator of whether a firm has a relative of Suharto on its board, overcomes these limitations. (For more information, see Mobaraq & Purbasari, 2008.)

The survey design affects the definitions of key explanatory variables. Entry is defined as entry into the survey; it is when establishments cross the twenty-employee threshold, not necessarily when they began operations. Conversely, exit is defined as exit from the survey; we cannot distinguish whether firms go out of business or continue operating with fewer than twenty employees.[7] Information on the capital stock was not collected in 1996. We use data from 1991 to 1995 to predict the capital stock based on output, investment, material inputs, labor usage, ownership characteristics, whether the firm exports, province, and lagged capital.[8] We also confirmed the robustness of our results by omitting 1996 from the regressions.

Our preferred proxy for productivity is value-added per worker.[9] We also examine the robustness of our results using TFP computed by means of the Solow and Ackerberg-Caves-Frazer (2006) procedures.[10] It should be noted that in

addition to conventional endogeneity concerns, our TFP estimates may be biased because our capital measure, which is partially imputed, is not perfectly synchronized with output and employment measures, which creates potential bias in TFP estimates. The magnitude of this bias is correlated with the size of price movements and is likely to peak during crisis times, when prices were most volatile. Although value-added per worker is only a partial productivity measure, it does not suffer this drawback. Moreover, it is available for a larger number of observations.

Nonetheless, it is important to recognize that measuring productivity in volatile times is tricky. Measurement error might induce a spurious attenuation in the relationship between productivity and firm survival and employment growth and could thus bias our regressions against finding evidence for cleansing. Productivity growth decompositions are even more vulnerable to measurement error as they rely on the accurate measurement of both productivity and market share of all firms. To ensure our results are not an artifact of measurement error, we have removed all anomalous observations from our data set (see the online appendix for a detailed discussion on how anomalous observations were identified). In addition, we conduct a large number of robustness checks, presented in section VIB, including using a range of alternative productivity proxies, focusing exclusively on long-run survival using precrisis productivity (to avoid having to rely on measures of productivity obtained during the crisis) and controlling for sector-specific shocks (to check our results are not driven by inappropriate deflators). (See the online appendixes for more information on the construction of our data and key explanatory variables.)

V. A Bird's Eye-View of Reallocation: Job Flows and Aggregate Productivity Dynamics

A. Job Flows, Entry, and Exit

Table 1 and Figures 1 and 2 present aggregate entry, exit, and employment growth statistics. Average exit over the entire period is 8.8%, while average entry is 11.1%. Firm exit spiked during the crisis—in 1997, 10.8% of firms exited, while in 1998, 11.2% of all firms exited—and dropped precipitously during the recovery in 1999 and 2000, to peak again in 2001 (see appendix A4). Employment growth followed a similar trend but did not spike in 2001; before the crisis, manufacturing employment grew quite rapidly. The crises induced substantial job losses; on average firms shrank employment by 1.4% in 1997 and 3.7% in 1998. Employment growth recovered in 1999 and 2000 but dropped in 2001.

The high job losses during the crisis were driven by both a slowdown in job creation and a spike in job destruction, predominantly accounted for by employment adjustment by incumbents (see figure 2). The share of job flows accounted for by firm entry and exit is likely to be underestimated,

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[7] As establishments are not required to report their closure, exit is inferred from establishments ceasing to file reports to BPS. We do not count as exits temporary lapses in reporting. Temporary exits account for 0.6% of all the data.

[8] For firms that enter in 1996, we use data from 1997 to 2000 to back-cast their capital stock using the same set of explanatory variables (but using leads rather than lags where appropriate).

[9] In our analysis, we use the log of value-added per worker. Over the entire sample period, on average 10.1% of all firms reported negative value-added. In 1997, 10.2% of all firms reported negative value-added, while in 1998, 12.2% of all firms reported negative value-added. These firms are excluded from analyses that use the log of value-added per worker as a proxy for productivity.

[10] Of the two, the Solow method is our preferred TFP estimator in this context since it does not require lagged information on factor inputs and thus can be computed for a greater number of observations. Moreover, the ACF estimator assumes that productivity evolves according to a Markov process, thereby implicitly assuming stationarity, which may not be appropriate in the context of a crisis. By contrast, the Solow procedure allows factor shares to vary over time.

TABLE 1.—ENTRY, EXIT, AND EMPLOYMENT GROWTH

			Employment Growth (Survivors)		% Negative Employment Change	No Employment Change	% Positive Employment Change
	Entry	Exit	Mean	SD			
1992	14.54%	9.74%	2.12%	32.02%	30.03%	12.66%	41.49%
1993	10.51%	9.02%	4.27%	28.78%	28.34%	13.31%	46.98%
1994	11.70%	7.41%	2.13%	26.94%	29.75%	18.52%	39.37%
1995	17.96%	6.19%	0.80%	24.70%	26.14%	20.35%	34.69%
1996	14.41%	8.97%	0.61%	23.49%	28.44%	22.73%	33.38%
1997	8.07%	10.78%	−1.41%	24.60%	36.29%	22.40%	32.39%
1998	7.93%	11.21%	−3.74%	26.90%	44.05%	16.48%	30.55%
1999	7.61%	5.06%	0.60%	25.30%	30.17%	28.34%	32.14%
2000	5.65%	5.20%	0.76%	24.02%	26.11%	37.72%	29.54%
2001	9.36%	13.66%	−0.81%	25.37%	33.28%	29.20%	26.46%

Entry and exit are defined as entry into the survey and exit from the survey (see the appendix). Entry and exit statistics are based on the raw data; all other statistics are based on the sample that excludes outliers.

FIGURE 1.—FIRM ENTRY AND EXIT
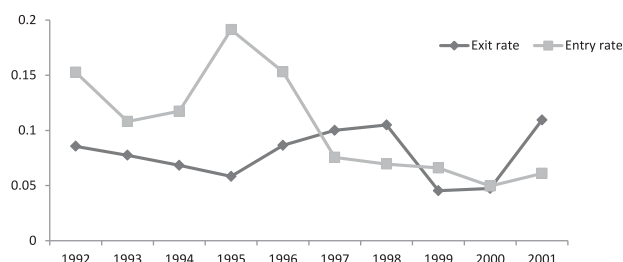
FIGURE 2.—AGGREGATE JOB FLOWS
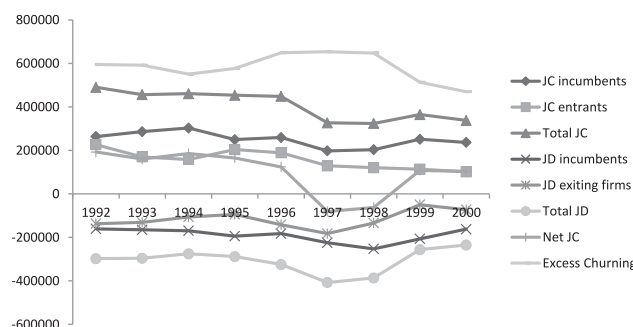
however, since we observe only firms with at least twenty employees. The amount of gross reallocation far exceeded the amount required to achieve net employment adjustment, leading to enormous excess churning. The increase in excess churning attests to the importance of heterogeneity across firms: even during the crisis, almost a third of all firms reported expanding employment. Nevertheless, a striking feature of the data is how persistent employment is; over the entire period considered, on average 21% of firms did not change their labor input each year. The figure also shows a longer trend toward lower job creation in both aggregate and in net creation rates.

B. Decomposing Aggregate Productivity Growth

Figure 3 presents a decomposition of the annual growth in average value-added per worker. The decomposition is a weighted average of industry-specific decompositions conducted at the two-digit industry level with weights proportional to each industry's contribution to total output. The crisis is associated with a pronounced increase in the contributions of the cross, between, and disproportionate entry terms, as well as a decrease in the contributions of proportionate entry, exit, and within-firm productivity growth.

The decomposition is only partially consistent with the cleansing paradigm. On the one hand, the improvement in the contribution of the cross term, in conjunction with the decreased contribution of the within term, suggests that the firms that experienced the largest declines in productivity also suffered the largest reductions in market share, although the magnitude of the cross term may be upward-

biased because of measurement error. The between term was generally negative, but became less so during the crisis (and was only positive, just, in 1998); the contribution of reallocation of market share from less productive to more productive firms was very modest (though measurement error may bias the between term downward). The increase in the disproportionate entry term is also indicative of cleansing. Although there were fewer entrants, they were on average more productive than incumbents, and this helped mitigate the overall loss in average productivity. Yet the more negative contribution of exit during the crisis, which was especially pronounced in 1997, suggests that relatively productive firms were more likely to exit, which is indicative of scarring.

Figure 4 displays the same decomposition using a three-year time window to minimize measurement error and avoid underestimation of the contributions of entry and exit. Lengthening the window to three years does smooth out the series and increases the contributions of entry and exit, thus underscoring that the long-run contribution of turnover to productivity growth is likely to exceed its initial contribution (see Liu & Tybout, 1996). However, using a longer window does not substantially alter the qualitative pattern of results.

Figure 5 presents a similar graph using TFP as our proxy for productivity. The graph resembles figure 4, although the relative magnitude of the decrease in the contribution of the within term is larger, whereas the improvements in the between, cross, and proportionate entry terms appear smaller.

FIGURE 3.—FHK DECOMPOSITION OF THE GROWTH OF REAL VALUE-ADDED PER WORKER, OUTPUT MARKET SHARE
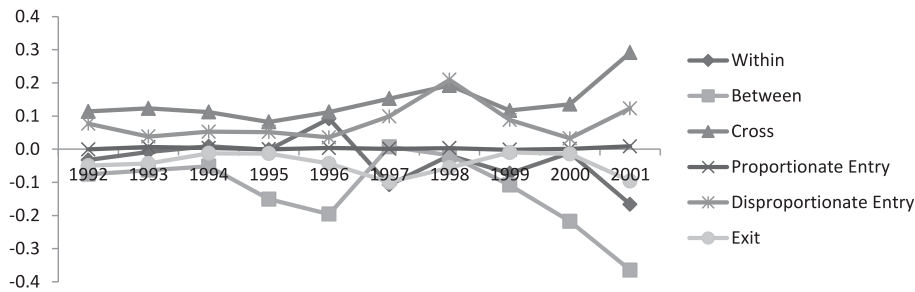
Decompositions are conducted at the two-digit industry level and subsequently aggregated with weights proportional to each industry's contribution to total output.

FIGURE 4.—FHK DECOMPOSITION USING THREE-YEAR WINDOW: REAL VALUE-ADDED PER WORKER
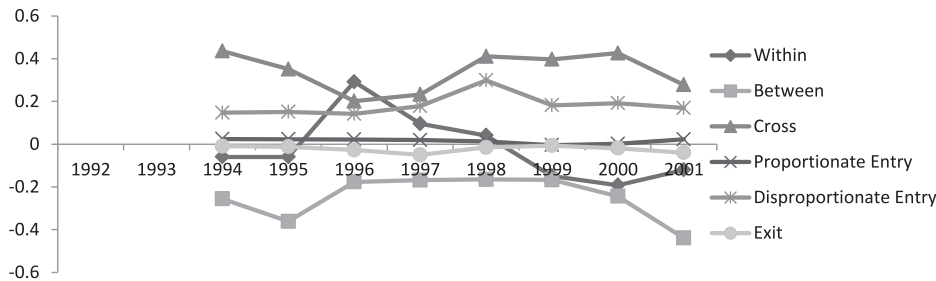
Decompositions are conducted at the two-digit industry level and subsequently aggregated with weights proportional to each industry's contribution to total output.

FIGURE 5.—FHK DECOMPOSITION OF THE GROWTH OF TFP (SOLOW METHOD), OUTPUT MARKET SHARE
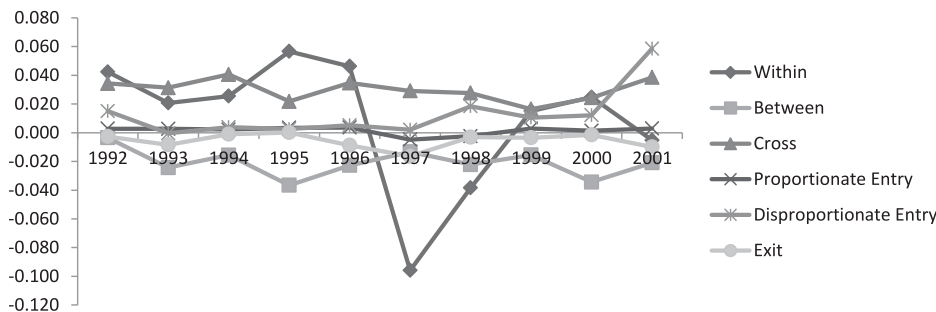
Decompositions are conducted at the two-digit industry level and subsequently aggregated with weights proportional to each industry's contribution to total output.

Overall, the aggregate productivity decompositions only partially support the cleansing hypothesis. The facts that relatively productive firms appear to have suffered somewhat less, that the correlation between changes in productivity and changes in market share strengthened, and that entrants were relatively more productive than incumbents are consistent with the cleansing hypothesis. However, the contribution of exit to aggregate productivity growth also became negative, contradicting the cleansing hypothesis. Bear in mind, however, that the results obtained using these decompositions have to be interpreted with caution as they are vulnerable to measurement error.

VI. Firm-Level Analysis

A. Firm Survival

Descriptive statistics. Table 2 presents summary statistics for survivors and exiting firms, disaggregated by time

period. Firms that exit are on average less productive, smaller, younger, smaller, less capital intensive, employ proportionately more unskilled workers, are less likely to be government owned, are more likely to be foreign owned, and are less likely to export than firms that survive.

Comparing across columns enables one to examine how average productivity differences between surviving firms and exiting firms evolved. The productivity gap between exiting and surviving firms narrowed during the crisis; before the crisis, the difference in the average log value-added of surviving firms compared to exiting firms was about .370. It narrowed to .205 during the crisis yet increased to .487 during the recovery. These productivity gaps between exiting and continuing firms are significantly different from each other at the 1% level. The shrinking of the gap between productivity and exit accounts for an aggregate average loss of value-added per worker of about 4% over the course of the crisis (since the exit rates in both 1997 and 1998 were approximately 12% and the gap narrowed by approximately 17%).

Table 2.—Descriptive Statistics (Means), by Period

Descriptive Statistics by Period (1 of 2)				
Period		Precrisis	Crisis	Recovery
ln (V/L)	All	7.757	7.968	8.019
	Surviving[1]	7.787	7.991	7.996
	Exiting[2]	7.417	7.786	7.509
	Difference[1−2]	0.370***	***0.205****	***0.487****
ln (V/L)(demeaned by sector)	All	−0.133	0.070	0.112
	Surviving[1]	−0.110	0.093	0.079
	Exiting[2]	−0.395	−0.119	−0.299
	Difference[1 − 2]	0.284***	***0.212****	***0.378****
ln (V/L)(demeaned by sector-year)	All	0.000	0.000	0.000
	Surviving[1]	0.022	0.023	0.031
	Exiting[2]	−0.256	−0.184	−0.351
	Difference[1−2]	0.278***	***0.206****	***0.383****
TFP—Solow	All	2.277	2.483	2.400
	Surviving[1]	2.281	2.475	2.348
	Exiting[2]	2.230	2.557	2.357
	Difference[1 − 2]	0.051***	***−0.082****	***−0.009***
TFP—Solow (demeaned by sector)	All	−0.075	0.118	0.039
	Surviving[1]	−0.070	0.117	−0.009
	Exiting[2]	−0.137	0.129	−0.036
	Difference[1−2]	0.067***	***−0.012***	***0.026****
TFP—Solow (demeaned by sector-year)	All	0.000	−0.000	0.000
	Surviving[1]	0.004	−0.002	0.002
	Exiting[2]	−0.057	0.015	−0.038
	Difference[1−2]	0.062***	***−0.016***	0.040**
Ln (Y/L)	All	8.981	9.089	9.081
	Surviving[1]	9.013	9.120	9.073
	Exiting[2]	8.623	8.839	8.502
	Difference[1−2]	0.390***	***0.281****	***0.572****
TFP-ACF	All	6.726	6.767	6.735
	Surviving[1]	6.728	6.768	6.737
	Exiting[2]	6.701	6.756	6.711
	Difference[1−2]	0.027**	0.012	0.026
Firmage	All	11.409	11.682	13.349
	Surviving[1]	11.554	11.981	13.165
	Exiting[2]	9.817	9.261	12.443
	Difference[1−2]	1.737***	***2.720****	***0.722****
lnL	All	4.216	4.149	4.178
	Surviving[1]	4.254	4.211	4.216
	Exiting[2]	3.801	3.655	3.644
	Difference[1−2]	0.453***	***0.557****	***0.571****
Unskilled Ratio	All	0.856	0.861	0.860
	Surviving[1]	0.855	0.860	0.861
	Exiting[2]	0.871	0.875	0.889
	Difference[1−2]	−0.016***	−0.016***	***−0.028****
Foreign owned	All	0.050	0.057	0.072
	Surviving[1]	0.053	0.060	0.074
	Exiting[2]	0.025	0.032	0.038
	Difference[1−2]	0.028***	0.029***	***0.036****
Government owned	All	0.031	0.025	0.021
	Surviving[1]	0.032	0.026	0.020
	Exiting[2]	0.019	0.014	0.012
	Difference[1−2]	0.013***	0.012***	0.008***
Exporter	All	0.164	0.157	0.135
	Surviving[1]	0.166	0.164	0.129
	Exiting[2]	0.144	0.103	0.094
	Difference[1−2]	0.022***	***0.061****	***0.035****
Ln (K/L)	All	6.819	6.712	6.619
	Surviving[1]	6.837	6.750	6.650
	Exiting[2]	6.598	6.383	5.928
	Difference[1−2]	0.239***	***0.367****	***0.721****
Financial dependence (RZ)	All	0.163	0.169	0.227
	Surviving[1]	0.164	0.169	0.231
	Exiting[2]	0.146	0.174	0.193
	Difference[1−2]	0.019***	***−0.005***	***0.038****
Liquidity needs	All	0.048	0.048	0.048
	Surviving[1]	0.048	0.048	0.049
	Exiting[2]	0.046	0.049	0.045
	Difference[1−2]	0.002***	***−0.001***	***0.003****

TABLE 2.—(CONTINUED)

Descriptive Statistics by Period (1 of 2)

Period		Precrisis	Crisis	Recovery
Tangibility	All	0.314	0.313	0.316
	Surviving[1]	0.315	0.315	0.316
	Exiting[2]	0.304	0.298	0.316
	Difference[1−2]	0.011***	*0.016****	*0.000*
Minimum wages	All	4.152	4.594	4.344
	Surviving[1]	4.152	4.593	4.301
	Exiting[2]	4.153	4.604	4.325
	Difference[1−2]	−0.002	*−0.012****	*−0.024****

Significance of the difference between surviving and exiting firms: *90% confidence interval, **95% confidence interval, ***99% confidence interval for two-tailed t−test. Differences in bold indicate 90% confidence level in rejecting that the difference between surviving and existing firms in the indicated period is not different from the difference between surviving and exiting firms precrisis. Those in italic bold indicate the 95% confidence level. "Exiting" implies the firm is not in the data in year $t + 1$' "surviving" implies the firm is present in year $t + 1$. For example, firms that disappear from the data in 1997 are marked as exiting in 1996. Accordingly, "crisis" refers to the years 1996 and 1997, and the "precrisis" and "recovery" periods to the years before and after that; respectively.

Demeaning value-added per worker by sector or by sector-year yields a similar but slightly less dramatic pattern. Thus, the aggregate attenuation effect is due to a combination of more productive sectors being more severely affected by the crisis, as well as a decrease in the productivity differential between continuing and surviving firms within sectors. TFP proxies exhibit a similar pattern.

Table 2 furthermore shows that young and small firms were especially vulnerable during the crisis, whereas exporters were less likely to exit (compared to other years), perhaps because of favorable exchange rate movements. During the crisis, survivors were not, on average, more likely to operate in sectors highly dependent on external finance, whereas pre- and postcrisis they were, suggesting that the crisis hit sectors more dependent on external finance relatively harder. Similarly, firms in sectors with higher liquidity needs and lower levels of assets tangibility appear to have been particularly exposed. In short, firms' financial characteristics were correlated with vulnerability to the crisis.

Modeling survival: Baseline results. Table 3 present our baseline firm-survival model, which models firm exit as a function of the log of the age of the firm, firm size and its square to allow for nonlinearity in the size-survival relationship, the proportion of blue-collar workers in the total workforce (the "unskilled ratio"), foreign and government ownership, whether the firm exports, and productivity. All of these variables are interacted with crisis and recovery period dummies to assess which firms were more vulnerable to the crisis. In addition, industry, year, and province dummies are included to eliminate time, industry, and location effects. The first column uses value-added per worker as our proxy for productivity and is our preferred specification. The second column uses TFP estimated by means of the Solow method, while the third column uses TFP estimated by means of the ACF procedure. Note that using TFP leads to a substantial reduction in sample size, especially when we use the ACF estimates (inter alia because TFP can only be computed for firms for which we have information on their current and lagged capital stock).

The results are consistent with the descriptive statistics presented in the previous section and other studies of firm survival in developing countries and this data set (see Bernard & Sjoholm 2003, Frazer, 2005, Söderbom, Teal, & Harding, 2006); size, age, and productivity all increase the probability of survival. Interestingly, foreign-owned firms are less likely to exit, while exporters are more likely to exit, ceteris paribus.

However, these effects are not stable over time. Starting with the result of focal interest, the conditional correlation between productivity and crisis seems to be attenuated by the crisis; the crisis-productivity interaction term is always positive and significant at the 1% level, regardless of which productivity proxy we use. This is not consistent with cleansing; while more productive firms remain less likely to exit, the protective impact of productivity is significantly weaker than it was precrisis. On the bright side, the attenuation effect did not last; postcrisis, the conditional correlation between productivity and survival is not significantly different from what it had been before the crisis: the protective impact of productivity is restored postcrisis.

Young and small firms were especially vulnerable to the crisis. By contrast, exporting firms did relatively well, perhaps because they benefited from increased international competitiveness due to the depreciation of the rupiah. Although exporting was associated with a higher propensity to exit during other periods, exporters were not ceteris paribus more likely to exit during the crisis. During the recovery, some of these effects were reversed: firm age was even less strongly correlated with exit than it had been before the crisis, while exports were once again more likely to exit than nonexporters ceteris paribus.

Robustness. Tables 4, 5, and 6 present alternative specifications and robustness checks. To conserve space, we report the coefficients on only our preferred productivity proxies, but the regressions include all explanatory variables that are included in table 3 unless indicated otherwise.

First, to alleviate concerns that the weakened association between productivity and exit is an artifact of the difficulties of measuring productivity during turbulent times table 4A presents models that use deeper lags of value-added per worker and TFP as our productivity proxy. Since productiv-

TABLE 3.—FIRM SURVIVAL

	Value-Added	TFP -Solow	TFP-ACF
Logistic Survival Model: Baseline Model			
	Coeffficient/SE	Coefficient/SE	Coefficient/SE
ln(V/L)	0.834***		
	(0.011)		
Crisis × ln(V/L)	1.187***		
	(0.025)		
Recovery × ln(V/L)	0.990		
	(0.020)		
TFP (Solow)		0.755***	
		(0.033)	
Crisis × TFP (Solow)		1.556***	
		(0.090)	
Recovery × TFP (Solow)		1.111*	
		(0.069)	
TFP (Solow)			0.724***
			(0.034)
Crisis × TFP (Solow)			1.144**
			(0.071)
Recovery × TFP (Solow)			1.075
			(0.059)
lnfirmage	0.829***	0.832***	0.813***
	(0.013)	(0.015)	(0.017)
Crisis × lnfirmage	0.845***	0.869***	0.975
	(0.021)	(0.031)	(0.048)
Recovery × lnfirmage	1.154***	1.069	1.131**
	(0.032)	(0.044)	(0.055)
lnL	0.243***	0.273***	0.237***
	(0.024)	(0.027)	(0.026)
Crisis × lnL	0.565***	0.588***	0.810
	(0.091)	(0.103)	(0.164)
Recovery × lnL	0.530***	0.301***	0.458***
	(0.084)	(0.064)	(0.082)
$\ln L^2$	1.111***	1.095***	1.111***
	(0.011)	(0.010)	(0.013)
Crisis × $\ln L^2$	1.046***	1.046***	1.004
	(0.018)	(0.018)	(0.023)
Recovery × $\ln L^2$	1.051***	1.101***	1.055***
	(0.017)	(0.023)	(0.020)
Unskilled Ratio	0.764**	1.113	0.847
	(0.081)	(0.161)	(0.124)
Crisis × Unskilled Ratio	1.468**	0.987	1.396
	(0.245)	(0.221)	(0.410)
Recovery × Unskilled Ratio	1.880***	1.799**	3.577***
	(0.324)	(0.485)	(1.240)
Foreign Owned	0.826**	0.703***	0.821*
	(0.076)	(0.074)	(0.090)
Crisis × Foreign Owned	1.217	1.365*	1.464
	(0.172)	(0.227)	(0.375)
Recovery × Foreign Owned	1.419**	1.299	1.266
	(0.194)	(0.254)	(0.293)
Government Owned	0.955	0.936	0.804
	(0.105)	(0.112)	(0.136)
Crisis × Government Owned	1.206	1.424	1.726
	(0.225)	(0.307)	(0.617)
Recovery × Government Owned	1.482**	1.269	1.519
	(0.292)	(0.477)	(0.609)
Exporter	1.314***	1.279***	1.285***
	(0.059)	(0.063)	(0.071)
Crisis × Exporter	0.690***	0.677***	0.611***
	(0.052)	(0.060)	(0.089)
Recovery × Exporter	0.834**	1.308***	1.372***
	(0.065)	(0.129)	(0.144)
Province dummies	Yes	Yes	Yes
Period dummies	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes
N	153,115	95,966	73,196
Pseudo-R^2	0.075	0.072	0.058

***$p < 0.01$, **$p < 0.05$, and *$p < 0.1$ Standard errors for specifications that use TFP as a proxy for productivity (columns 2 and 3) are bootstrapped using 100 replications.

TABLE 4.—ROBUSTNESS CHECKS I: LAGGED PRODUCTIVITY

Logistic Survival Model: Robustness Checks: Alternative Productivity Measures
Odds Ratios: Relative Probability of Exit

	Value-Added		TFP-Solow	
	Coefficient/SE	Coefficient /SE	Coefficient /SE	Coefficient /SE
A Lagged Productivity				
Lag Length	*One Year*	*Two Years*	*One Year*	*Two Years*
$\ln(V/L)_{t-1}$	0.866***			
	(0.014)			
Crisis × $\ln(V/L)_{t-1}$	1.157***			
	(0.028)			
Recovery × $\ln(V/L)_{t-1}$	0.956**			
	(0.021)			
$\ln(V/L)_{t-2}$		0.907***		
		(0.017)		
Crisis × $\ln(V/L)_{t-2}$		1.120***		
		(0.031)		
Recovery × $\ln(V/L)_{t-2}$		0.979		
		(0.024)		
TFP (Solow)$_{t-1}$			0.740***	
			(0.033)	
Crisis × TFP (Solow)$_{t-1}$			1.470***	
			(0.091)	
Recovery × TFP (Solow)$_{t-1}$			1.114*	
			(0.072)	
TFP (Solow)$_{t-2}$				0.767***
				(0.049)
Crisis × TFP (Solow)$_{t-2}$				1.492***
				(0.114)
Recovery × TFP (Solow)$_{t-2}$				1.380***
Controls	Yes	Yes	Yes	Yes
N	134,318	110,583	70,595	58,733
Pseudo-R^2	0.080	0.076	0.081	0.078
B. Coarse Productivity Ranking (by sector-year)				
Model	*Empty*	*Full*	*Empty*	*Full*
Low Productivity (1st tercile)	1.724***	1.330***	1.375***	1.341***
	(0.059)	(0.049)	(0.060)	(0.058)
Medium Productivity (2nd tercile)	1.172***	0.970	0.920*	0.905**
	(0.042)	(0.036)	(0.041)	(0.041)
Crisis × Low Productivity	1.365***	6.390***	1.091*	5.604***
	(0.049)	(2.604)	(0.050)	(2.787)
Crisis × Medium Productivity	1.424***	6.887***	1.508***	7.508***
	(0.057)	(2.814)	(0.086)	(3.807)
Crisis × High Productivity	1.478***	7.600***	1.542***	7.925***
	(0.061)	(3.105)	(0.081)	(3.946)
Recovery × Low Productivity	1.100***	4.149***	0.683***	12.051***
	(0.037)	(1.704)	(0.036)	(7.050)
Recovery × Medium Productivity	0.922**	3.557***	0.815***	14.301***
	(0.037)	(1.465)	(0.056)	(8.490)
Recovery × High Productivity	0.858***	3.792***	0.730***	13.380***
	(0.037)	(1.561)	(0.049)	(7.971)
Controls	No	Yes	No[1]	Yes
N	153,115	153,115	95,966	95,966
Pseudo-R^2	0.024	0.074	0.020	0.072

***$p < 0.01$, **$p < 0.05$, and *$p < 0.1$. Standard errors for specifications that use TFP as a proxy for productivity (columns 3 and 4) are bootstrapped using 100 replications. Controls include province, period, and industry dummies, as well as the following variables and their interactions with crisis and recovery dummies: lnL, lnL2 Unskilled Ratio, Foreign Owned, and Government Owned. [1] The "empty" model presented in part B includes province dummies. "Low Productivity," "High Productivity," and "Medium Productivity" denote firms in the bottom, middle, and top productivity terciles (this ranking obviously varies with the productivity proxy used).

ity is very strongly correlated over time (the autocorrelation coefficients on log value-added per worker and the Solow residual are .85 and .79, respectively), lagged productivity is a good proxy for current productivity. Moreover, because it is measured during noncrisis times, it is arguably less vulnerable to measurement error. While the differences in the protective power of productivity become somewhat smaller, the pattern of results is robust to using these lagged productivity measures. We interpret this as strong evidence that the attenuation effect is genuine and not driven by measurement error. Incidentally, since lagged productivity measures are not available for entrants, this table also demonstrates that the attenuation effect is not solely driven by differential survival dynamics for entrants.

TABLE 5.—ROBUSTNESS CHECKS II: ALTERNATIVE SPECIFICATIONS, SAMPLE RESTRICTIONS, AND EXIT THRESHOLDS

	VA	TFP (Solow)	VA	TFP (Solow)
	Coefficient/SE	Coefficient /SE	Coefficient /SE	Coefficient /SE

Logistic Survival Model: Additional Robustness Checks
Odds Ratios: Relative Probability of Exit

A. Alternative Specifications

	Controlling for ln(K/L)		Including Sector Year Dummies	
ln(V/L)	0.823***		0.837***	
	(0.014)		(0.012)	
Crisis × ln(V/L)	1.212***		1.125***	
	(0.035)		(0.027)	
Recovery × ln(V/L)	1.000		0.986	
	(0.030)		(0.022)	
TFP (Solow)		0.671***		0.747***
		(0.027)		(0.050)
Crisis × TFP (Solow)		1.642***		1.508***
		(0.099)		(0.152)
Recovery × TFP (Solow)		0.967		1.146
		(0.068)		(0.135)
Ln(K/L)	1.020*	0.929***		
	(0.011)	(0.012)		
Crisis × Ln(K/L)	0.953**	1.041*		
	(0.019)	(0.023)		
Recovery × Ln(K/L)	0.903***	0.900***		
	(0.018)	(0.021)		
Controls	Yes	Yes	Yes	Yes
N	111,331	95,966	153,115	95,966
Pseudo-R^2	0.078	0.074	0.082	0.078

B. Alternative Sample Restrictions

	Excluding Firms with Outliers		Raw Data	
ln(V/L)	0.830***		0.836***	
	(0.014)		(0.010)	
Crisis × ln(V/L)	1.229***		1.170***	
	(0.032)		(0.022)	
Recovery × ln(V/L)	0.989		1.026	
	(0.026)		(0.018)	
TFP (Solow)		0.731***		0.943***
		(0.036)		(0.016)
Crisis × TFP (Solow)		1.629***		1.148***
		(0.115)		(0.031)
Recovery × TFP (Solow)		1.149		1.047
		(0.114)		
Controls	Yes	Yes	Yes	Yes
N	67,250	37,871	180,660	108,752
Pseudo R^2	0.068	0.083	0.069	0.069

C. Different Exit Thresholds

	Thirty-People Threshold		Fifty-People Threshold	
ln(V/L)	0.827***		0.827***	
	(0.010)		(0.010)	
Crisis × ln(V/L)	1.160***		1.150***	
	(0.021)		(0.021)	
Recovery × ln(V/L)	1.008		0.984	
	(0.017)		(0.017)	
TFP (Solow)		0.828***		0.943***
		(0.029)		(0.016)
Crisis × TFP (Solow)		1.375***		1.148***
		(0.074)		(0.031)
Recovery × TFP (Solow)		1.107*		1.047
		(0.058)		(0.035)
Controls	Yes	Yes	Yes	Yes
N	153,115	95,966	153,115	95,966
Pseudo R^2	0.073	0.076	0.056	0.055

***$p < 0.01$, **$p < 0.05$, and *$p < 0.1$. Standard errors in specifications that use TFP as a proxy for productivity (columns 2 and 4) and/or control for capital per worker (panel A) are bootstrapped using 100 replications. Controls include province, period, and industry dummies (except when sector-year dummies are included in which case industry and period dummies were dropped), as well as the following variables and their interactions with crisis and recovery dummies: lnL, lnL2 Unskilled Ratio, Foreign Owned, and Government Owned.

TABLE 6.—LONG-RUN SURVIVAL

Logistic Survival Model:
Odds Ratios: Relative Probability of Exit

	VA TFP (Solow)		TFP (Solow)	
	Coefficient/SE	Coefficient/SE	Coefficient/SE	Coefficient/SE
Survival Period (from – to)	Precrisis 1993–1996	Crisis 1996–1999	Precrisis 1993–1996	Crisis 1996–1999
Three-year window				
ln(V/L)	0.791***	0.939***		
	(0.019)	(0.019)		
TFP (Solow)			0.757***	1.009
			(0.052)	(0.066)
lnfirmage	0.818***	0.696***	0.832***	0.693***
	(0.021)	(0.015)	(0.027)	(0.020)
lnL	0.261***	0.114***	0.271***	0.123***
	(0.041)	(0.015)	(0.045)	(0.017)
ln L^2	1.096***	1.177***	1.090***	1.166***
	(0.018)	(0.016)	(0.018)	(0.016)
Unskilled ratio	0.650**	0.740**	0.841	0.806
	(0.115)	(0.103)	(0.172)	(0.134)
Foreign owned	0.800*	0.950	0.685**	0.925
	(0.108)	(0.106)	(0.101)	(0.123)
Government owned	1.110	1.249	0.984	1.369**
	(0.175)	(0.191)	(0.189)	(0.208)
Exporter	1.666***	0.905	1.496***	0.912
	(0.117)	(0.060)	(0.117)	(0.066)
Province dummies	Yes	Yes	Yes	Yes
Period dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
N	14,109	18,025	10,161	11,655
Pseudo R^2	0.078	0.109	0.063	0.118
Survival Period (from – to)	Precrisis 1991–1996	Crisis 1996–2001	Precrisis 1991–1996	Crisis 1996–2001
Five = year window				
ln(V/L)	0.811***	0.885***		
	(0.017)	(0.016)		
TFP (Solow)			0.723***	1.055
			(0.040)	(0.068)
lnfirmage	0.917***	0.767***	0.909***	0.760***
	(0.021)	(0.015)	(0.026)	(0.019)
lnL	0.356***	0.137***	0.387***	0.151***
	(0.050)	(0.016)	(0.056)	(0.020)
ln L^2	1.072***	1.156***	1.060***	1.143***
	(0.015)	(0.013)	(0.015)	(0.015)
Unskilled ratio	0.702**	0.951	1.029	1.027
	(0.115)	(0.120)	(0.161)	(0.164)
Foreign owned	0.725**	1.055	0.629***	0.962
	(0.095)	(0.100)	(0.092)	(0.107)
Government owned	0.903	1.246*	1.057	1.253
	(0.123)	(0.165)	(0.131)	(0.194)
Exporter	1.339***	1.047	1.256***	1.046
	(0.089)	(0.060)	(0.095)	(0.071)
Province dummies	Yes	Yes	Yes	Yes
Period dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
N	12,489	18,025	9,278	11,655
Pseudo R^2	0.076	0.106	0.063	0.105

***$p < 0.01$, **$p < 0.05$, and *$p < 0.1$. Standard errors in specifications that use TFP as a proxy for productivity (columns 3 and 4) are bootstrapped using 100 replications.

Second, we discretize our productivity measure into terciles, defined by sector and year. The resulting ranking is arguably less sensitive to measurement error. Moreover, it is ordinal, which helps shield against the impact of mismeasurement that is common across all firms in a sector in a given year, such as using inappropriate deflators. Table 4B presents specifications that control only for productivity, province and industry dummies, "empty" models, and ones that controls for all other covariates, "full" models. The results demonstrate that while all firms are much more likely to exit during the crisis, firms in higher-productivity terciles suffered the largest increases in exit propensity. Thus, the crisis decreased the survival prospects of both productive and unproductive firms yet hit productive firm disproportionately hard. By contrast, the cleansing hypothesis predicts that such firms should have suffered relatively less.

Third, we use alternative specifications, which are presented in table 5A. Controlling for capital intensity does not alter the pattern of results as shown in columns 1 and 2 in table 5A.[11] Columns 3 and 4 furthermore demonstrate that the results are robust to inclusion of sector-year dummies, which control for sector-specific shocks and also shield against the impact of using inappropriate deflators. Note that the attenuation effect weakens. Thus, it seems that it is partially, but not exclusively, the result of more productive sectors being more severely affected by the crisis.

Fourth, table 5B shows that the pattern of results remains when we include anomalous observations (see appendix B) that we have excluded from our estimation sample. The results are also robust to dropping all plants for which at least one of the observed values is anomalous (we typically exclude such anomalous observations but do not drop other plant-year observations from plants characterized by such outliers).

Fifth, by setting arbitrary size thresholds for exit and examining how our results change, we assess whether it is likely that our results are due to sample selection bias because we are observing only firms with twenty or more employees. Table 5C aggravates such sample selection bias by excluding firms with, respectively, fewer than thirty (columns 1 and 2) and fifty (columns 3 and 4) employees and defining a firm as having exited when it either disappears from the data altogether or fails to report having more than, respectively, 29 or 49 employees in any of the subsequent years. The results are robust to using different exit thresholds and, if anything, using higher thresholds for exit reduces the attenuation effect; to the extent there is sample selection bias because we are only observing firms with more than 20 employees, it appears to be making it harder to reject cleansing.

Finally, to address the concern that exit is a protracted process and that by focusing on short-term effects, we are missing the action, table 6 presents estimates using longer time horizons using our baseline model but without crisis and recovery interaction terms. The top panel presents models of the likelihood of being in business in 1996 for firms operating in 1993 and juxtaposes those with models of the likelihood of being in business in 1999 conditional on operating in 1996. The bottom panel presents models of surviving from 1991 until 1996 and from 1996 to 2001. The pattern of results does not change when longer time horizons are considered; productivity offers less protection during the crisis than it did precrisis, ceteris paribus. Incidentally, this exercise also offers another check against the influence measurement error; since our productivity measures are based on the precrisis periods, they are not vulnerable to potential mismeasurement of productivity during crisis times.

B. Accounting for Attenuation

Given the robust evidence for the attenuation effect, we now examine the most prominent possible explanation for this effect: credit market failures,[12] labor regulations, reduced entry, and political regime change.

Finance and firm survival.   Table 7 presents regressions that examine the link between firm survival and a firm's financial characteristics. The relationship between firm survival and external financing dependence, proxied by the share of assets that is financed with external funds (following Rajan & Zingales, 1998), is examined in the top half of the table. The bottom half focuses on asset hardness using Braun (2003)'s indicator of asset tangibility. The usefulness of the U.S.-based external financing dependence and asset tangibility measures relies critically on the assumption that the U.S. rankings can be extrapolated to Indonesia, which in turn depends on the assumption that there are certain technological factors that are industry specific.[13] The other explanatory variables are the same as those presented in table 3, although the first six columns exclude industry dummies but control for a sector's financial dependence, competitiveness, and contestability, proxied by the Herfindahl index, the "natural" rate of entry and of employment turnover.

The results provide ample evidence that changing credit conditions were an important driver of firm exit during the crisis; firms operating in industries more dependent on external finance and with lower asset tangibility were ceteris paribus significantly more likely to exit during the crisis, both in absolute terms and relative to other periods, as is evidenced between the significant interactions between the crisis dummy and these financial characteristics. These results hold using both productivity proxies. However, controlling for these financial characteristics does not eliminate the attenuation effect.

In addition, the protective impact of productivity in industries more dependent on external finance rose significantly (columns 2 and 4). By contrast, the crisis interactions between productivity and asset hardness, as well as liquidity needs, are not statistically significant (columns 2 and 4). Thus, it appears that firms in sectors that are more sensitive to changing credit conditions were hit harder, but this does not account for the observed attenuation of the conditional correlation between productivity and survival.

In summary, firms more exposed to fluctuations in credit market conditions were hit harder by the crisis, yet these effects cannot fully account for the attenuation of the link between productivity and exit during the crisis. If anything,

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[11] Our preferred specifications do not control for capital because this would introduce sample selection bias as the response rate for capital is far lower for measures of the capital stock than for other variables. It is also missing in the 1996 data, requiring it to be estimated for that year (see the appendix).

[12] They may also explain the attenuation between firm growth and productivity and explain reduced entry (see Aghion, Fally, & Scarpetta, 2007, for evidence on the impact of credit constraints on firm entry and growth).

[13] The impact of liquidity needs proxied by the inventories to sales ratio (following Raddatz, 2006) does not rely on this assumption as this measure was constructed using the SI data. Again, while not shown, the results with this measure give the same results.

TABLE 7.—FINANCE AND FIRM SURVIVAL

Logistic Survival Model: Additional Robustness Checks
Odds Ratios: Relative Probability of Exit

	VA		TFP (Solow)	
	Coefficient/SE	Coefficient/SE	Coefficient/SE	Coefficient/SE
A. Financial Dependence (RZ)				
	Baseline	Extended	Baseline	Extended
RZ_fin_dependence	0.988	0.313***	1.184**	0.914
	(0.070)	(0.108)	(0.092)	(0.349)
Crisis × RZ_fin_dependence	1.329**	6.727***	1.167	1.049
	(0.148)	(3.818)	(0.156)	(0.696)
Recovery × RZ_fin_dependence	0.745***	1.198	0.446***	0.169**
	(0.077)	(0.567)	(0.067)	(0.133)
ln(V/L)	0.836***	0.819***		
	(0.011)	(0.012)		
Crisis × ln(V/L)	1.160***	1.194***		
	(0.026)	(0.029)		
Recovery × ln(V/L)	0.991	0.999		
	(0.021)	(0.023)		
RZ × ln(V/L)		1.168***		
		(0.053)		
Crisis × RZln(V/L)		0.805***		
		(0.059)		
Recovery × RZln(V/L)		0.939		
		(0.059)		
TFP (Solow)			0.780***	0.759***
			(0.029)	(0.040)
Crisis × TFP (Solow)			1.592***	1.578***
			(0.098)	(0.138)
Recovery × TFP (Solow)			1.173**	1.052
			(0.081)	(0.112)
RZ × TFP (Solow)				1.126
				(0.196)
Crisis × RZ × TFP (Solow)				1.028
				(0.270)
Recovery × RZ × TFP (Solow)				1.549
				(0.531)
Controls	Yes	Yes	Yes	Yes
N	153,115	153,115	95,966	95,966
Pseudo-R^2	0.074	0.074	0.071	0.071
B. Tangibility				
	Baseline	Extended	Baseline	Extended
Tangibility	0.962	7.892**	1.297	3.230
	(0.203)	(8.020)	(0.341)	(2.844)
Crisis × Tangibility R	0.341***	0.298	0.329***	0.022**
	(0.115)	(0.511)	(0.141)	(0.034)
Recovery × Tangibility	2.651***	0.018**	1.082	0.405
	(0.851)	(0.029)	(0.484)	(0.766)
ln(V/L)	0.836***	0.911**		
	(0.011)	(0.039)		
Crisis × ln(V/L)	1.161***	1.150**		
	(0.025)	(0.080)		
Recovery × ln(V/L)	0.981	0.799***		
	(0.020)	(0.054)		
Tangibility × ln(V/L)		0.759**		
		(0.099)		
Crisis × Tangibility × ln(V/L)		1.026		
		(0.222)		
Recovery × Tangibility × ln(V/L)		1.934***		
		(0.398)		
TFP (Solow)			0.786***	0.892
			(0.030)	(0.106)
Crisis × TFP (Solow)			1.581***	1.116
			(0.100)	(0.222)
Recovery × TFP (Solow)			1.170**	1.021
			(0.082)	(0.266)
Tangibility × TFP (Solow)				0.674
				(0.233)

TABLE 7.—(CONTINUED)

Logistic Survival Model: Additional Robustness Checks
Odds Ratios: Relative Probability of Exit

	VA		TFP (Solow)	
	Coefficient/SE	Coefficient/SE	Coefficient/SE	Coefficient/SE
	B. Tangibility			
	Baseline	Extended	Baseline	Extended
Crisis × Tangibility × TFP (Solow)				2.923*
				(1.736)
Recovery × Tangibility × TFP (Solow)				1.527
				(1.139)
Controls	Yes	Yes	Yes	Yes
N	153,115	153,115	95,966	95,966
Pseudo-R^2	0.074	0.074	0.070	0.070

***$p < 0.01$, **$p < 0.05$, and *$p < 0.1$. Standard errors in specifications that use TFP as a proxy for productivity (columns 3 and 4) are bootstrapped using 100 replications. Controls include province, period, and industry dummies, as well as the following variables and their interactions with crisis and recovery dummies: lnL, lnL2 Unskilled Ratio, Foreign Owned, and Government Owned.

TABLE 8.—MINIMUM WAGES AND FIRM SURVIVAL

Logistic Survival Model:
Labor Regulations and Firm Survival
Odds Ratios: Relative Probability of Exit

	VA TFP (Solow)		TFP (Solow)	
	Levels	Interacted	Levels	Interacted
	Coefficient/SE	Coefficient/SE	Coefficient/SE	Coefficient/SE
ln(V/L)	0.820***	0.847***		
	(0.011)	(0.014)		
Crisis × ln(V/L)	1.189***	1.049		
	(0.026)	(0.036)		
Recovery × ln(V/L)	1.040*	1.005		
	(0.021)	(0.023)		
MW × ln(V/L)		1.194***		
		(0.062)		
MW × Crisis × ln(V/L)		1.176***		
		(0.064)		
MW × Recovery × ln(V/L)		0.819***		
		(0.049)		
TFP (Solow)			0.753***	0.746***
			(0.031)	(0.034)
Crisis × TFP (Solow)			1.555***	1.417***
			(0.094)	(0.144)
Recovery × TFP (Solow)			1.111	1.137*
			(0.074)	(0.081)
MW × TFP (Solow)				0.950
				(0.137)
MW × Crisis × TFP (Solow)				1.489**
				(0.296)
MW × Recovery × TFP (Solow)				0.492**
				(0.154)
Minimum Wage (log)	0.821	0.215***	0.725*	0.794
	(0.111)	(0.088)	(0.124)	(0.280)
Crisis × Minimum Wage (log)	0.958	0.795	1.247	1.060
	(0.144)	(0.134)	(0.262)	(0.252)
Recovery × Minimum Wage (log)	0.168***	0.189***	0.117***	0.130***
	(0.028)	(0.033)	(0.035)	(0.041)
Controls	Yes	Yes	Yes	Yes
N	153,115	153,115	95,966	95,966
Pseudo R^2	0.076	0.076	0.074	0.074

***$p < 0.01$, **$p < 0.05$, and *$p < 0.1$. Standard errors in specifications that use TFP as a proxy for productivity (columns 3 and 4) are bootstrapped using 100 replications. Controls include province, period, and industry dummies, as well as the following variables and their interactions with crisis and recovery dummies: lnL, lnL2 Unskilled Ratio, Foreign Owned, and Government Owned. MW denotes demeaned real minimum wages.

to the extent that the crisis had a differential impact on firms with different financial characteristics, it induced a cleansing effect among firms more exposed to the changing credit conditions.

Labor regulations. Table 8 presents survival models that control for provincial-level real minimum wages and allow their impact to vary over time (the baseline models presented in columns 1 and 3) as well as to interact with

TABLE 9.—ENTRY AND ATTENUATION

Logistic Survival Model:
Entrants and Firm Survival
Odds Ratios: Relative Probability of Exit

	Value-Added		TFP (Solow)	
	Coefficient/SE	Coefficient/SE	Coefficient/SE	Coefficient/SE
ln(V/L)	0.836***	0.815***		
	(0.011)	(0.012)		
Crisis × ln(V/L)	1.182***	1.204***		
	(0.025)	(0.028)		
Recovery × ln(V/L)	0.988	1.007		
	(0.020)	(0.021)		
Entrant × ln(V/L)		1.110***		
		(0.031)		
Crisis × Entrant × ln(V/L)		0.930		
		(0.046)		
Recovery × Entrant × ln(V/L)		0.977		
		(0.061)		
TFP (Solow)			0.757***	0.730***
			(0.031)	(0.032)
Crisis × TFP (Solow)			1.554***	1.605***
			(0.093)	(0.107)
Recovery × TFP (Solow)			1.109	1.130*
			(0.075)	(0.079)
Entrant × TFP (Solow)				1.141*
				(0.082)
Crisis × Entrant × TFP (Solow)				0.887
				(0.129)
Recovery × Entrant × TFP (Solow)				1.028
				(0.250)
Entrant	1.302***	0.599**	1.499***	1.141*
	(0.052)	(0.129)	(0.079)	1.118
Crisis × Entrant	0.577***	0.985	0.582***	(0.181)
	(0.041)	(0.378)	(0.052)	0.758
Recovery × Entrant	0.591***	0.694	0.525***	(0.285)
	(0.053)	(0.331)	(0.070)	0.482
				(0.299)
Controls	Yes	Yes	Yes	Yes
N	153,115	153,115	95,966	95,966
Pseudo-R^2	0.075	0.076	0.073	0.073

***$p < 0.01$, **$p < 0.05$, and *$p < 0.1$. Standard errors in columns 3 and 4 are bootstrapped using 100 replications. Controls include province, period, and industry dummies, as well as the following variables and their interactions with crisis and recovery dummies: lnL, lnL2 Unskilled Ratio, Foreign Owned, and Government Owned.

productivity (the extended specifications presented in columns 2 and 4). Since our models include province dummies, the impact of minimum wages is essentially identified off within-province temporal variation in real minimum wage levels.

The baseline models suggest that firm survival was not on average strongly correlated with minimum wage levels before and during the crisis, though postcrisis firms facing higher minimum wages were less likely to exit. Controlling for minimum wages does not reduce the attenuation effect. Yet the extended specifications suggest that the baseline specifications hide significant heterogeneity; firms in provinces with higher minimum wages are on average less likely to exit, yet the odds ratio associated with the interaction between value-added per worker and demeaned province-level minimum wage levels is significantly larger than 1, indicating that highly productive firms are more likely to exit when minimum wages are relatively high. Labor regulation thus appears to interfere with market selection. Importantly, this distortionary effect is especially pronounced during the crisis; the crisis interaction term between minimum wages and productivity is strongly statistically significant using both log value-added per worker and the Solow residual, indicating that relatively productive firms confronted with relatively low reductions in real minimum wages were proportionately more likely to exit. Note also that including this interaction reduces the coefficient on the crisis-productivity interaction term. In other words, labor regulations appear to provide a partial explanation for the attenuation effect.

Reduced entry. Table 9 presents regressions that include a dummy for whether a firm is an entrant, interacted with period dummies and productivity. The results suggest that while entrants' survival is typically less strongly correlated with productivity, this result was not different during the crisis. Allowing for differential productivity-survival dynamics for entrants does not reduce the attenuation effect. Thus, the attenuation effect documented in this paper is not simply an artifact of reduced entry.

TABLE 10.—CONNECTIONS AND CREATIVE DESTRUCTION

Logistic Survival Model:
Impact of Political Connections on Survival, 1997–2001
Odds Ratios: Relative Probability of Exit

	VA		TFP (Solow)	
	Coefficient/SE	Coefficient/SE	Coefficient/SE	Coefficient/SE
A. Connected—Based on JSX Response				
	Baseline	Extended	Baseline	Extended
ln(V/L)'96	0.798***	0.802***		
	(0.028)	(0.028)		
TFP (Solow)			1.110	1.147
			(0.186)	(0.190)
Connected, JSX regressions	1.513	92.554	1.374	596.378***
	(0.586)	(255.060)	(0.643)	(1,406.310)
Connected, JSX regressions × ln(V/L)'96		0.636		
		(0.197)		
Connected, JSX regressions × TFP (Solow)				0.078**
				(0.082)
Controls	Yes	Yes	Yes	Yes
N	11,877	11,877	6,957	6,957
Pseudo-R^2	0.101	0.101	0.078	0.080
B. Suharto Family Member on the Board				
	Baseline	Extended	Baseline	Extended
ln(V/L)'96	0.799***	0.801***		
	(0.028)	(0.028)		
TFP (Solow)			1.113	1.125
			(0.107)	(0.108)
Connected, Suharto	1.244	51.671	1.622	117.730*
	(0.669)	(209.327)	(0.594)	(338.755)
Connected, Suharto × ln(V/L)'96		0.658		
		(0.305)		
Connected, Suharto × TFP (Solow)				0.158
				(0.204)
Controls	Yes	Yes	Yes	Yes
N	11,877	11,877	6,957	6,957
Pseudo-R^2	0.101	0.101	0.078	0.078
C. Suharto Family Member on the Board and/or JSX Connection (A&B)				
	Baseline	Extended	Baseline	Extended
ln(V/L)'96	0.798***	0.804***		
	(0.028)	(0.028)		
TFP (Solow)			1.113	1.160
			(0.107)	(0.160)
Connected (JSX/Suharto)	1.390	227.982**	1.622	1,871.488*
	(0.482)	(576.428)	(0.594)	(7,284.427)
Connected, (JSX/Suharto) × ln(V/L)'96		0.565**		
		(0.164)		
Connected (JSX/Suharto) × TFP (Solow)				0.046
				(0.093)
Controls	Yes	Yes	Yes	Yes
N	11,877	11,877	6,957	6,957
Pseudo-R^2	Yes	Yes	0.078	0.081

***$p < 0.01$, **$p < 0.05$, and *$p < 0.1$, standard errors in columns 3 and 4 block bootstrapped using 100 replications. Controls include province dummies, as well as lnL, lnL2 Unskilled Ratio, Foreign Owned, Government Owned, and Exporter.

Connectedness and creative destruction. Another possible explanation of the attenuation effect is that the fall of Suharto may have hurt firms affiliated with the Suharto regime disproportionately (see Fisman, 2001, and Mobaraq & Purbasari, 2008). If these firms were highly productive, their exit may result in an attenuation of the link between productivity and survival. Table 10 examines this possibility. The data on political connectedness are available for firms in 1997, constructed using JSX and board member-

ship information from 1995 to 1997. Thus, to test the role of political connections, we look at survival patterns from 1997 to 2001, controlling too for factors in our baseline specifications presented in table 3.[14] Also note that relatively few firms are identified as being politically connected to

[14] Since the proxy for connectedness is in part based on stock market reactions over the period 1995 to 1997, conditioning on connectedness in prior periods might thus induce survivor bias.

TABLE 11.—EMPLOYMENT GROWTH

	Ln (V/L)empvafe		TFP (Solow)	
	OLS	FE	OLS	FE
	Coefficient/SE	Coefficient/SE	Coefficient/SE	Coefficient/SE
ln(V/L)	0.023***	0.009***		
	(0.001)	(0.002)		
Crisis × ln(V/L)	−0.005**	0.002		
	(0.002)	(0.002)		
Recovery × ln(V/L)	−0.001	0.004**		
	(0.002)	(0.002)		
TFP (Solow)			0.004	0.025***
			(0.003)	(0.005)
Crisis × TFP (Solow)			−0.004	−0.018***
			(0.005)	(0.006)
Recovery × TFP (Solow)			−0.004	−0.021***
			(0.004)	(0.006)
Lnfirmage	−0.018***	0.032***	−0.022***	0.028***
	(0.001)	(0.006)	(0.001)	(0.008)
Crisis × lnfirmage	−0.000	−0.009***	0.002	−0.012**
	(0.002)	(0.003)	(0.003)	(0.005)
Recovery × lnfirmage	0.004	−0.011**	0.008***	−0.017***
	(0.002)	(0.005)	(0.003)	(0.007)
lnL	−0.069***	−0.570***	−0.028***	−0.490***
	(0.009)	(0.022)	(0.008)	(0.029)
Crisis × lnL	−0.118***	−0.133***	−0.124***	−0.128***
	(0.014)	(0.013)	(0.014)	(0.015)
Recovery × lnL	−0.023*	−0.082***	−0.038***	−0.085***
	(0.012)	(0.013)	(0.014)	(0.017)
lnL^2	0.004***	0.014***	0.001	0.006*
	(0.001)	(0.002)	(0.001)	(0.003)
Crisis × $ln L^2$	0.010***	0.011***	0.010***	0.010***
	(0.001)	(0.001)	(0.001)	(0.002)
Recovery × L^2	0.002*	0.007***	0.003**	0.008***
	(0.001)	(0.001)	(0.001)	(0.002)
Unskilled Ratio	0.013	0.029**	−0.016	0.025
	(0.010)	(0.014)	(0.011)	(0.018)
Crisis × Unskilled Ratio	0.009	0.013	0.023	0.004
	(0.018)	(0.018)	(0.023)	(0.023)
Recovery × Unskilled Ratio	−0.022	0.013	−0.008	0.014
	(0.014)	(0.017)	(0.016)	(0.021)
Foreign Owned	0.034***	−0.013	0.049***	−0.021
	(0.006)	(0.013)	(0.006)	(0.013)
Crisis × Foreign Owned	−0.005	0.031***	−0.003	0.040***
	(0.011)	(0.012)	(0.012)	(0.013)
Recovery × Foreign Owned	−0.023***	0.023**	−0.031***	0.021*
	(0.009)	(0.011)	(0.011)	(0.012)
Government Owned	−0.011	0.000	−0.011	−0.005
	(0.009)	(0.013)	(0.008)	(0.016)
Crisis × Government Owned	0.032*	0.010	0.042***	0.015
	(0.017)	(0.018)	(0.013)	(0.022)
Recovery × Government Owned	0.001	−0.025	0.008	−0.028
	(0.018)	(0.021)	(0.024)	(0.024)
Exporter	0.015***	−0.002	0.012***	−0.003
	(0.004)	(0.005)	(0.004)	(0.005)
Crisis × Exporter	0.030***	0.018**	0.033***	0.018**
	(0.007)	(0.007)	(0.007)	(0.008)
Recovery × Exporter	−0.007	0.000	0.004	0.002
	(0.006)	(0.008)	(0.006)	(0.008)
Province dummies	Yes	Yes	Yes	Yes
Period dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
N	138,997	138,997	88,530	88,530
R^2	0.029	0.219	0.025	0.213
Adjusted R^2	0.029	0.219	0.024	−0.048

$P < 0.01$, **$p < 0.05$, and *$p < 0.00$. Standard errors of specifications that use TFP as a proxy for productivity (columns 3 and 4) are bootstrapped using 100 replications.

Suharto; 210 firms that are connected based on the stock market response to adverse news about Suharto's Health, and 97 firms have a Suharto family member on their boards, which may make it hard to estimate the effects with preci-sion. Panel A uses the connectedness measure that is based on the response of the Jakarta Stock Exchange to news about Suharto's health and the business networks of those adversely affected by this news, while Panel B uses as a

proxy for connections whether a firm had a Suharto family member on its board. Panel C combines these two definitions. The baseline regressions presented in columns 1 and 3 merely control for connectedness, while the extended specifications presented in columns 2 and 4 include interactions between connectedness and productivity.

The baseline regressions demonstrate that firms with political connections to Suharto were not, on average, more likely to exit over the period 1997 to 2001 ceteris paribus. However, the extended models suggest that among firms with connections to the Suharto regime, the least productive ones were most at risk of exiting as the correlation between productivity and survival strengthened, while being connected became associated with an increased risk of exit. Note, however, that the estimated coefficients in these regressions are large and imprecisely estimated, reflecting the fact that few firms were identified as being politically connected. Thus, the attenuation effect does not appear to be driven by regime change.

C. Employment Growth

Firm survival and employment growth are determined by the same data-generating process, notably the one determining firm size, and we therefore use the same explanatory variables as in the firm survival models. The results are presented in table 11. Columns 1 and 3 present OLS specifications, while columns 2 and 4 present fixed-effects models, which effectively estimate deviations from growth trends. Columns 1 and 2 use value-added per worker as the proxy for productivity, whereas columns 3 and 4 use TFP, measured by the Solow residual.

It is very difficult to predict employment growth as evidenced by the consistently low R^2s, even though we are including a rich set of firm characteristics and dummy variables. The results are generally consistent with the literature on firm growth: younger firms, smaller firms, and more productive firms grow faster (see Bigsten and Gebreeyesus, 2007). The crisis appears to have attenuated the link between employment growth and productivity somewhat (column 1), but this finding is not very robust; it does not obtain when we estimate the growth model by OLS and use TFP as a proxy for productivity or control for fixed-effects and use value-added per worker as our productivity proxy. The finding that more productive firms that survived were not less likely to shed labor, ceteris paribus, suggests that employment reallocation among surviving firms was not especially efficiency enhancing during the crisis. Interestingly, the relationship between productivity and employment growth appears to continue to be attenuated postcrisis.

Other results accord with intuition: exporters fared significantly better during the crisis, whereas large firms shed more labor, in part because such firms were less likely to go out of business (our regressions are conditional on firm survival). Government firms also appear to have shed less labor.

VII. Conclusion

While crises are recognized to be periods of intensified adjustment and aggregate studies suggest that firm dynamics are a key determinant of the depth and duration of crises, firm-level evidence on their impact on the efficiency of resource allocation is scant. Perhaps because of the paucity of the empirical evidence, there is an active debate as to whether crises have a silver lining by improving resource allocation. On the one hand, a host of macroeconomic models is predicated on the idea that the additional competitive pressure induced by the crisis will hurt inefficient producers disproportionately. They predict that the crisis will "cleanse" out unproductive firms and reallocate resources toward more efficient producers. On the other hand, a series of recent papers point out that in the presence of market imperfection, these conclusions may be overturned and that crises may scar the economy by driving productive firms out of business.

Using Indonesian manufacturing census data from 1991 to 2001 to examine the impact of the East Asian crisis on resource allocation, this paper rejects the hypothesis that the crisis unequivocally improved the reallocative process. Decompositions of aggregate productivity growth reveal that firms that suffered the largest productivity losses also suffered the largest reductions in market share. In addition, market share reallocation between firms contributed more positively to average productivity than during noncrisis times, although the magnitude of this contribution was modest and positive in absolute terms only in 1998. However, the correlation between productivity and employment growth did not strengthen, which is concerning given the excessive amount of job reallocation taking place during the crisis. More worrying, the link between productivity and exit of existing firms was significantly attenuated during the crisis, suggesting that the crisis was less discriminating in terms of the productivity of firms driven out of business. Fortunately, postcrisis, the link between firm survival and productivity was restored, suggesting that the crisis did not permanently scar the Schumpeterian process of creative destruction. In addition, although there were fewer entrants, the contributions of entrants rose; the firms that entered were typically more productive than incumbents, and this helped mitigate the loss in productivity. In other words, the crisis appears to have weeded out the weakest potential entrants, which helped mitigate the loss in aggregate productivity.

Labor market imperfections more so than credit market imperfections help account for the attenuation effect. Firms in sectors more dependent on external finance and with lower levels of asset tangibility were indeed disproportionately more likely to exit during the crisis. However, controlling for these financial characteristics did not reduce the conditional attenuation effect, suggesting that changing credit market conditions do not account for the attenuated link between productivity and exit. By contrast, labor regulations provide a possible explanation for the attenuation of the link

between productivity and firm survival; during the crisis, productivity was a relatively less important determinant of survival in provinces with high minimum wages, suggesting that labor regulations possibly distorted the adjustment process. Finally, the attenuation is not a statistical artifact due to a reduction in entry and is not driven by firms that had been able to achieve high profits by virtue of their connections with Suharto being differentially affected. If anything, the crisis induced a cleansing effect among these firms.

This work has focused on the impact of the East Asian crisis on Indonesia. Because it is the fourth most populous country and widely portrayed as a "tiger cub" with a bright future, understanding the crisis dynamics in Indonesia is of inherent interest. Focusing on a developing country may be testing the cleansing hypothesis in a context where it is more likely to be rejected. However, with crises more prevalent in developing countries, this can be a particularly relevant case to examine. The shock that hit Indonesia was also large, although the recent financial crisis shows that far more developed countries have not been immune to significant financial shocks. Assessing the extent to which our findings generalize to other crisis episodes is a promising area for further research.

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