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# IMF Working Paper

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Benefits and Costs of Corporate Debt Restructuring:  
An Estimation for Korea

by Jae Chung and Lev Ratnovski

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I N T E R N A T I O N A L M O N E T A R Y F U N D

**IMF Working Paper**

Asia and Pacific Department

**Benefits and Costs of Corporate Debt Restructuring:  
An Estimation for Korea**

**Prepared by Jae Chung and Lev Ratnovski<sup>1</sup>**

Authorized for distribution by Kalpana Kochhar

October 2016

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**Abstract**

The paper offers a method to quantify benefits and costs of corporate debt restructuring, with an application to Korea. We suggest a “persistent  $ICR < 1$ ” criterion to capture firms that had  $ICR < 1$  for multiple consecutive years and thus will likely require restructuring. We assess the benefits of debt restructuring by estimating the effects of removing a firm’s debt overhang on its investment and hiring decisions. We refine the assumptions on the cost of debt restructuring based on the literature, and focus not only on creditor losses, but also on the employment impact of corporate restructuring. Benchmark results for Korea suggest 5.5-7.5 percent of GDP creditor losses and a 0.4-0.9 percent of the labor force employment impact from the debt restructuring. These are compensated by a permanent 0.4-0.9 percentage points increase in future GDP growth thanks to higher corporate investment and 0.05-0.1 percent of labor force higher hiring in the subsequent years. The key qualitative result is that corporate debt restructurings “pay off” in the medium term: their economic cost is recouped over about 10 years.

JEL Classification Numbers: E22, E32, G33, G34

Keywords: Corporate Debt, Stress-tests, Debt Restructuring, Korea

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## I. INTRODUCTION

**The purpose of this paper is to offer a template for quantifying benefits and costs of corporate debt restructuring, based on a transparent set of assumptions.** Corporate debt overhang is a feature of multiple crises and growth slowdowns, most recently in Europe and some emerging markets (Aiyar et al., 2015; Bergthaler et al., 2015; Elekdag et al., 2015; Lindner and Jung, 2014; and Chuvakul and Lam, 2015). While a debt overhang impedes economic activity, many countries face operational difficulties or political costs associated with debt restructuring. In this context, a cost-benefit assessment might make it easier to advocate for debt restructuring (by highlighting its tangible medium-term benefits) and to budget for it appropriately (by offering a reasonable estimate of the costs).

**The paper offers three innovations on the standard ways to assess debt vulnerabilities:**

- **Refining the ICR measure.** We refine the standard approach to assessing corporate debt vulnerabilities – a share of firms with a low interest coverage ratio (ICR). To focus it on the firms that will likely require debt restructuring rather than those that have the possibility to grow themselves out of a temporary slowdown, we suggest a more selective “persistent ICR” P-ICR<1 measure that captures firms that had ICR<1 over three consecutive years. The P-ICR<1 criterion covers only about a half of the firms with ICR<1. We believe that this stronger metric points to a defensible set of firms that, given their *persistently* weak performance in the past, are likely unable to grow themselves out of financial difficulties and thus will require debt restructuring.
- **Evidence-based assumptions on creditor losses and – importantly – *employment impact*, to assess the cost of debt restructuring.** We refine the standard “rule of thumb” 60 percent loss-given-default assumption to account for: who owns the debt (bank-based restructurings are on average more efficient); the type of a restructuring (out-of-court more efficient); and the stage of the business or the industry cycle. Further, while most studies focus on losses to creditors, we believe that assessing the employment impact of corporate restructurings is also essential to gauge its full social implications and fiscal costs. The literature suggests average employment losses of 20-25 percent in historic corporate restructurings in advanced economies.
- **An econometric estimation of the impact of debt overhang on corporate investment and hiring decisions, to assess the benefits of debt restructuring.** We show that firms with debt overhang invest less and hire less. The economic effects are substantial: removing debt overhang can boost the investment ratio (as a share of fixed assets) and the hiring ratio (as a share of pre-existing employment) by 2.5-3 percentage points each year. Additional benefits not considered in the paper may include higher R&D investment and fiscal benefits as firms return to profitability.

**The key qualitative insight is that corporate debt restructurings “pay off” in the medium-term.** Our quantitative results hinge on a set of assumptions and estimates that, although being reasonable first approximations, can be refined to better reflect country-specific circumstances and industry conditions. However, any refinement will still support the key *qualitative* result. When benefits and costs of debt restructuring are considered jointly, it becomes apparent that the economic costs of debt restructuring – both the cost to the creditors and the employment impact – are fully offset in the medium term by more rapid output growth and higher hiring. Corporate restructurings pay off.

**Korea is an instructive case to study benefits and costs of corporate debt restructuring.** After years of rapid growth, many of Korean export-oriented industries face headwinds from a global economic slowdown. Shipping and shipbuilding are especially affected. Steel and petrochemicals may become distressed if the global slowdown deepens. The technology-intensive industries, such as automobiles and electronics, are exposed to intensifying international competition. Corporate debt vulnerabilities are high, and the government is taking steps to “to agree, and then swiftly implement, plans for the operational and financial restructuring of vulnerable firms, while ensuring an adequate social safety net to assist affected workers” (IMF, 2016B).

**We use the Orbis dataset, which has extensive coverage of Korean firms.** Orbis covers 60 percent of Korean firms by volume of corporate debt in 2012-2014. The coverage is narrower in the preceding years, and limited in 2015 due to a two-year data lag. As Orbis reports both consolidated and unconsolidated financial statements, we use only unconsolidated financial statements when both consolidated and unconsolidated ones are available for a given firm, to avoid double counting (as per Kalemlı-Ozcan et al., 2015B). We also exclude financials and utilities, the latter because their “cost-plus” pricing makes the ICR estimates uninformative of debt vulnerabilities.<sup>2</sup>

**The rest of the paper proceeds as follows.** Section II describes corporate debt vulnerabilities in Korea. It starts with a summary of recent corporate sector developments, and proceeds to estimate debt-at-risk and employment-at-risk (those in  $P\text{-ICR} < 1$  firms), both actual and under stress-test scenarios. Section III assesses the benefits and costs of corporate debt restructuring, based on the estimations and the review of the literature. It then brings the benefits and costs of debt restructuring together, to argue that corporate restructuring pays off in the medium term. Section IV concludes.

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<sup>2</sup> A low ICR in regulated utilities does not necessarily indicate a debt vulnerability, rather it can be a result of “cost-plus” pricing. Related, should debt servicing problems arise, the margins can plausibly be adjusted to maintain the financial soundness of a utility.

## II. CORPORATE DEBT VULNERABILITIES IN KOREA

### A. Corporate debt in Korea

**Corporate debt in Korea – at about 100 percent of GDP – is relatively high by international standards (Figure 1A).** While this level is similar to that in Japan, and lower than that in China, it is noticeably higher than that in other comparable economies. Corporate debt in other Asian-Pacific economies (Australia, India, Indonesia, Malaysia, Thailand) and in large emerging market economies elsewhere (Brazil, Mexico, Turkey, Poland) is clustered at 40-70 percent GDP – a markedly lower level than that in Korea.

**An offsetting factor to high corporate debt in Korea is that it is mostly domestic currency-denominated (Figure 1B).** As of end-2015, only 5 percent of corporate debt was foreign currency-denominated. This is lower than the 10 percent median share of foreign currency-denominated corporate debt in comparable economies, and substantially lower than the 20-70 percent share in other large emerging market economies – Brazil, Indonesia, Mexico, and Turkey. Coupled with the fact that Korea is an export-intensive economy (see below), this implies that Korean firms run a *negative* foreign currency mismatch – their foreign revenues are higher than their foreign currency-denominated debt service obligations. Consequently, and in contrast to other open economies, Korean firms are not exposed to debt service capacity risks associated with exchange rate depreciation shocks.

**The export-intensity of the Korean economy exposes corporate revenues to risks from global economic conditions.** Korea's share of exports in GDP is higher than that in most comparable economies (Figure 2A), and the ratio of net exports to GDP – at over 6 percent in 2015 – is the highest among the comparable economies (Figure 2B).<sup>3</sup> The export-intensity of the economy is mirrored by a high share of export revenue in total revenue of Korean firms: 55 percent in manufacturing overall and 65 percent in the export-oriented manufacturing sectors (automobiles, electronics, petrochemicals, shipbuilding and steel; Figure 3A). With the slowdown of global trade, the growth rate of Korean corporate earnings, particularly in export-oriented manufacturing and shipping, has been declining and has recently turned negative (Figure 3B).

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<sup>3</sup> Outside the comparator countries, higher net exports are only present in some commodity-producing economies, “northern” European economies (in the context of the currency union), Taiwan POC and Singapore.

Figure 1A

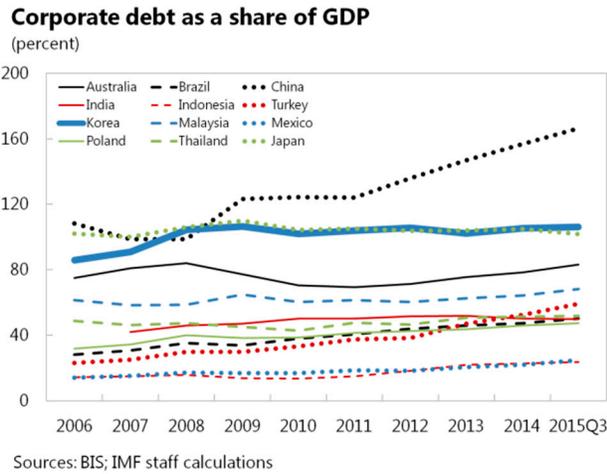


Figure 1B

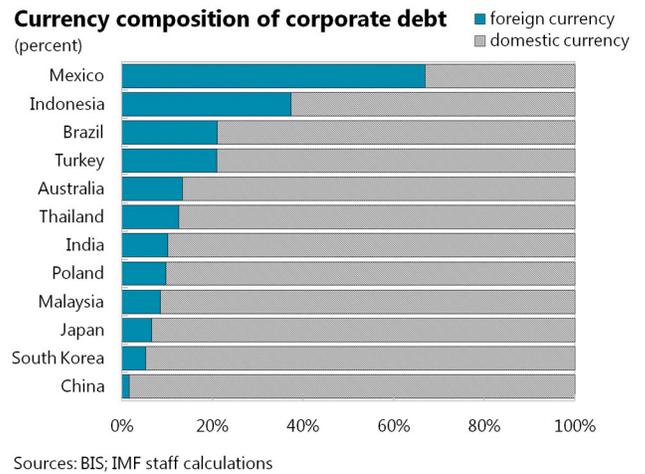


Figure 2A

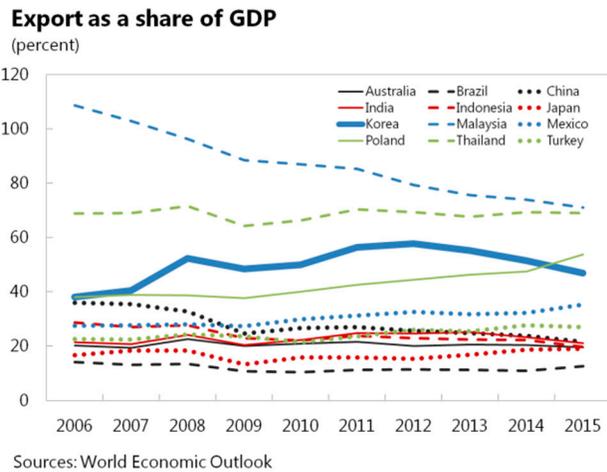


Figure 2B

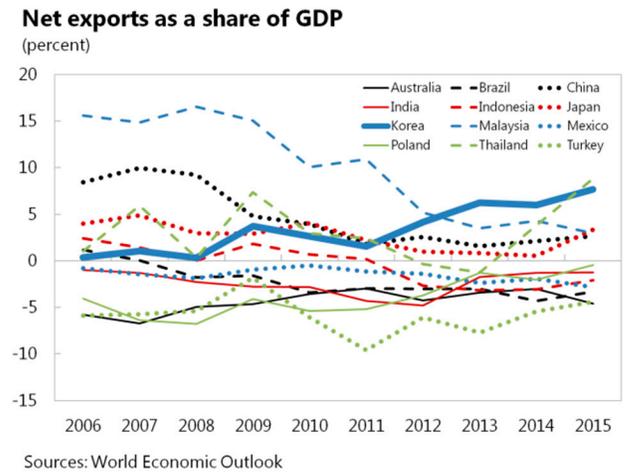


Figure 3A

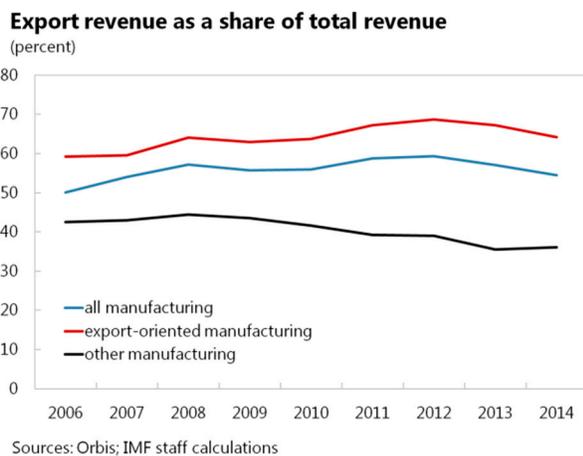
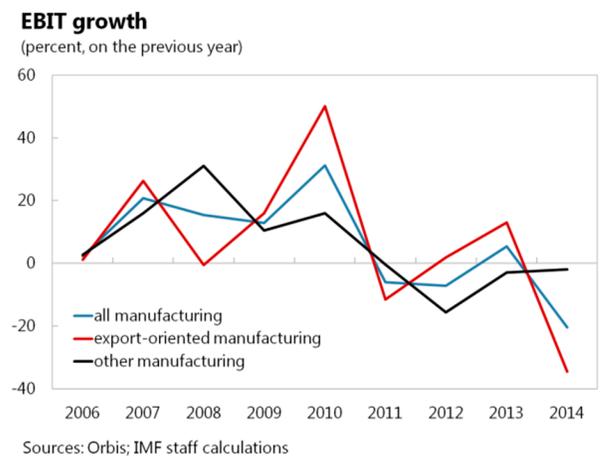


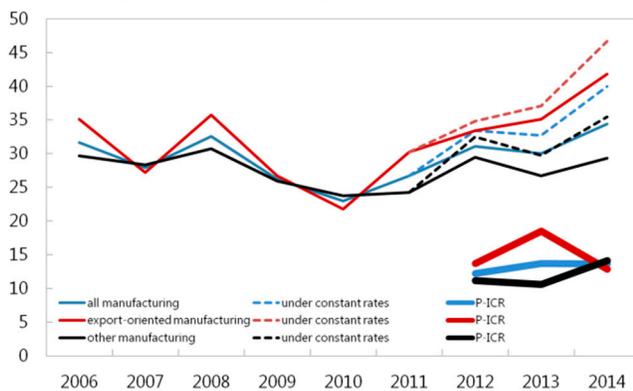
Figure 3B



**The share of financially vulnerable firms has been increasing in export-oriented manufacturing, but is relatively stable (if high) in the rest of the economy, thanks to accommodative monetary policy.** Corporate vulnerability is often assessed through a share of firms with a low interest coverage ratio (ICR, a ratio of earnings to the interest paid). There is no single best ICR benchmark. An  $ICR < 1.5$  benchmark might be appropriate for manufacturing firms that need free cash flow to maintain routine investment and inventory. But a lower benchmark, say,  $ICR < 1$ , might be appropriate for firms that employ high leverage to maintain substantial fixed assets, e.g. those in shipping and construction. Figures 4A and 4B show the share of  $ICR < 1$  firms in Korean manufacturing and non-manufacturing industries. Dashed lines show hypothetical ICRs in the case that the Bank of Korea did not cut policy interest rates from 3.25 percent in 2012 to 2 percent in 2014, implying that the corporates' interest expenditure in 2014 would have been 28 percent higher.<sup>4</sup> This highlights the role of monetary accommodation in helping stabilize corporate financial conditions.

Figure 4A

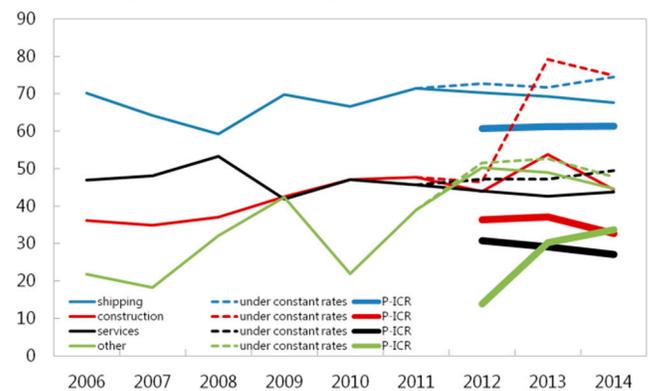
**Share of  $ICR < 1$  Firms in Manufacturing**  
(percent, weighted by debt outstanding)



Sources: Orbis; IMF staff calculations

Figure 4B

**Share of  $ICR < 1$  firms outside manufacturing**  
(percent, weighted by debt outstanding)



Sources: Orbis; IMF staff calculations

**While  $ICR < 1$  is a useful indicator of corporate vulnerability, it is likely to overstate the share of firms at risk, since not all  $ICR < 1$  firms are expected to go bankrupt.** Some firms have a low ICR due to one-off shocks to revenues or costs, or because they are new firms that have not yet realized their revenue potential. In these cases, a low ICR may be cured over time.

<sup>4</sup> According to the Bank of Korea data, the average corporates' borrowing cost is the policy rate + 250 basis points. Then, a counterfactual increase in the 2014 policy rate from 2 to 3.25 percent is equivalent to an increase in the corporate borrowing cost from 4.5 to 5.75 percent, a 28 percent difference. This calculation assumes that interest rate changes are passed through to the firms' cost of funding immediately; a slower pass through would make the short-term impact of rate cuts on the firms' cost of funding smaller.

**To correct for this, we suggest a “persistent ICR” P-ICR<1 estimate, which captures firms that had ICR<1 for three consecutive years.** We interpret these firms as those that have no evident possibility of improvement, due to the persistency of their financial distress. The share of firms with P-ICR<1 is shown in thick lines in the lower right part of Figures 4A and 4B. Note that only about half of manufacturing firms with ICR<1 satisfy the stronger P-ICR<1 condition, and thus are at a material risk of bankruptcy. In contrast, a majority of ICR<1 firms in shipping also have P-ICR<1, highlighting the persistent industry-wide distress of that sector. The share of ICR<1 firms in construction and other non-manufacturing industries (services, trade, mining, etc.) that are also P-ICR<1 is about 70 percent.<sup>5</sup>

### **B. Debt-at-risk and employment-at-risk: actual and stress-tests**

**We use the P-ICR estimates to calculate the debt-at-risk and employment-at-risk in the Korean economy.** Debt-at-risk and employment at risk are defined as total debt and employment in P-ICR<1 firms. Thus these are volumes of debt and employment that are likely to be affected by corporate restructuring. Importantly, they should not be confused with the cost or the employment impact of corporate restructuring, which will be estimated later as a fraction of these numbers.

**We report debt-at-risk and employment-at-risk by industry (Figures 5A and 5B).** We report the estimates based on 2014 actual P-ICR<1 firms (ICR<1 in 2012-2014), as well as for the scenarios when the ICRs are calculated based on 10, 20, and 30 percent decreases in earnings from the 2012-2014 levels.<sup>6</sup> We interpret the estimates for the 2014 actual and the 10 percent decrease in earnings as the baseline case, allowing for a degree of uncertainty, reflecting the fact that we are restricted to lagged 2014 data. We interpret the estimates for 20 and 30 percent decreases in earnings as stress-tests that represent, respectively, moderate and severe shocks to corporate financial conditions. Note that the 20 and 30 percent declines in corporate earnings have historically been rare in Korea. Average corporate earnings growth was around zero in 2008-2009, and was negative only in three years in the last decade: negative 6-7 percent in 2011 and 2012, and negative 20 percent in 2014.<sup>7</sup>

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<sup>5</sup> Note that here is a degree of arbitrariness in using ICR<1 or P-ICR<1 estimates. Future research could explore which ICR threshold and low-ICR duration are best predictors of corporate defaults.

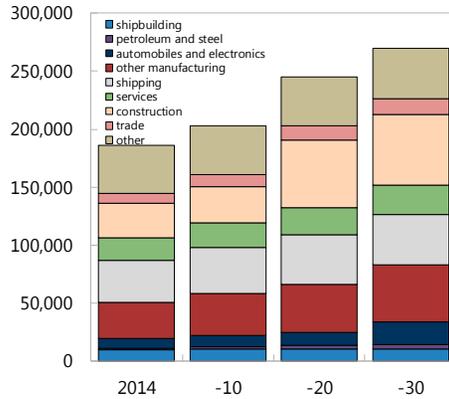
<sup>6</sup> A hypothetical shock to earnings reduces the interest coverage ratio in all firms, and thus increases the number of firms that fall under the ICR<1 and P-ICR<1 criteria.

<sup>7</sup> We do not use the standard IMF stress-test based on a combination of earnings, exchange rate, and interest rate shocks (see e.g. Chow and Valencia, 2015, and Mano, 2015) because such a scenario seems to have limited relevance for Korea. Since most corporate debt is denominated in domestic currency and much of the corporate revenue is foreign, devaluation is not a direct corporate vulnerability risk in Korea. Similarly, while capital outflows may be a broad concern, given that most debt is domestic, an abrupt currency attack that would induce the Bank of Korea to rapidly increase the interest rate seems unlikely.

Figure 5A

**Debt-at-risk**

(in billions of Korean Won)

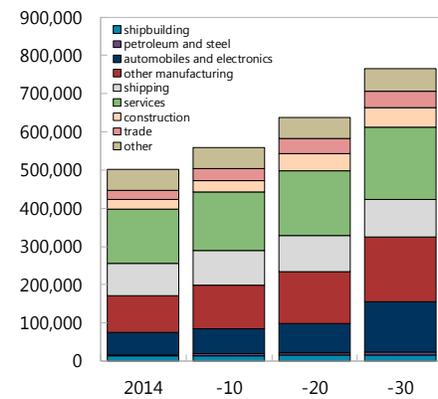


Sources: Orbis; IMF staff calculations (Earnings shock from 2014, percent)

Figure 5B

**Employment-at-risk**

(Individuals)



Sources: Orbis; IMF staff calculations (Earnings shock from 2014, percent)

**The estimates show that, in the baseline, debt-at-risk in the Korean economy is 12-14 percent GDP, and employment-at-risk is 1.9-2.1 percent of the labor force.<sup>8</sup> The benchmark scenario covers actual 2014 earnings and a 10 percent decline in corporate earnings as a confidence range (two left stacked bars in each Figure). Debt-at-risk is dominated by manufacturing (including shipbuilding), shipping, and construction. A large part of employment-at-risk is also in services, reflecting the relative labor-intensiveness of the services sector. Debt-at-risk increases to 16-18 percent GDP, and employment-at-risk to 2.4-3 percent of the labor force in the stress scenarios of 20 or 30 percent declines in corporate earnings (two right stacked bars in each Figure).**

### III. BENEFITS AND COSTS OF CORPORATE DEBT RESTRUCTURING

#### A. Benefits of corporate debt restructuring

**We link the benefits of corporate debt restructuring to an increase in corporate investment and hiring after the elimination of a firm's debt overhang.** To assess these benefits, we estimate regressions that link corporate investment and hiring decisions to the presence of a debt overhang (P-ICR<1 and ICR<1 dummies), as well as a set of control variables that aim to capture a firm's growth opportunities: return on assets, past sales growth, and a firm's size. The regressions are firm-level, use industry and year fixed effects, and cover 2012-2014 (the years for which reliable P-ICR estimates are available). The specification is similar to that in Kalemlı-Ozcan et al. (2015A). Corporate investment is

<sup>8</sup> Based on 2014 nominal GDP (KRW 1485 trillion) and the end-2014 labor force (26.4 million persons).

measured as the growth rate of fixed assets, and hiring as a growth rate of the number of employees. Accordingly, the coefficients on the ICR dummies can be interpreted as the percentage point /100 effects of the debt overhang on the firm's investment and hiring ratios. The regressions results are shown in Table 1.<sup>9</sup>

**Table 1. Effects of corporate debt overhang on firms' investment and hiring decisions**

	(1)	(2)	(3)	(4)
Dependent variable:	<b>Growth of fixed assets</b>		<b>Growth of N employees</b>	
P-ICR<1	-0.0179*** (0.00363)	-0.0352*** (0.00573)	-0.00535** (0.00211)	-0.00969*** (0.00330)
ICR<1	-0.0128*** (0.00265)	-0.00429 (0.00386)	-0.0179*** (0.00154)	-0.0226*** (0.00224)
Sales growth	0.000303*** (4.75e-05)	0.000851*** (0.000148)	3.64e-05** (1.85e-05)	0.00105*** (0.000183)
Sales growth.L1	3.95e-05*** (8.58e-06)	1.51e-05 (2.10e-05)	6.88e-06 (5.20e-06)	6.43e-05 (4.24e-05)
ROA	0.233*** (0.00804)	0.279*** (0.0128)	0.102*** (0.00480)	0.108*** (0.00779)
Log(Total assets)	0.000370 (0.000538)	0.000332 (0.000778)	0.00239*** (0.000302)	0.00287*** (0.000452)
Constant	0.121*** (0.0150)	0.111*** (0.0197)	-0.0238*** (0.00875)	-0.0412*** (0.0117)
Manufacturing only	N	Y	N	Y
Industry and year FE	Y	Y	Y	Y
Observations	233,530	96,783	129,392	54,746
R-squared	0.008	0.010	0.011	0.014

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**We find that both a persistent debt vulnerability (the P-ICR<1 dummy) and one-off ICR shocks (the ICR<1 dummy) have negative effects on a firm's investment and**

<sup>9</sup> Robustness checks show that the coefficients on the ICR and P-ICR dummies are sensitive to the trimming of the dataset. Trimming is required to correct for outliers. Trimming too little (say, by 1 or 3 percent on both ends of the dependent variable) would retain many new or closing-down firms, which are unlikely to undergo debt restructuring, and would artificially inflate the coefficients on the dummies. Trimming too much (say, by 10 percent) would exclude 20 percent of observations, implying a loss of informativeness, given that only around 40 percent of firms have P-ICR<1. The reported regressions are based on a 5 percent trim. In other specifications (not reported), we have also controlled for ICR level (rather than the ICR dummy) and found the resulting coefficient to be insignificant. This validates our use of the ICR and P-ICR dummies rather than the ICR level in the regressions. In yet other specifications, we used only one of the dummies – either ICR<1 or P-ICR<1 – and found that P-ICR is a more important factor than ICR in explaining growth of fixed assets also in those specifications. We have also examined specifications that included leverage variables: both a continuous debt to assets ratio and a dummy for the debt to assets ratio above the industry-year mean, as well as specifications based on lagging all explanatory variables (not reported) and found that our results are robust.

**hiring.** For P-ICR<1 firms, these effects are cumulative. Should a firm cure its persistent debt vulnerability thanks to a corporate restructuring, it would eliminate both a P-ICR<1 and an ICR<1 –related impediments to investments and hiring. Columns 1 and 3 show the estimates for all firms, while columns 2 and 4 are restricted to manufacturing firms only. Interestingly, from column 2, the investment in manufacturing firms responds predominantly to P-ICR<1 rather than to ICR<1. That is, in manufacturing, the investment decisions are more affected by a persistent debt vulnerability than by one-off ICR shocks. This confirms our emphasis on P-ICR<1 as a better proxy for corporate debt vulnerability than ICR<1.

**The results suggest that moving a firm from P-ICR<1 to ICR>1 increases in its investment by 3.1 percentage points of fixed assets and increases its hiring by 2.3 percentage points of the number of employees annually.** These estimates are based on the sum of the coefficients on P-ICR<1 and ICR<1 dummies in columns 1 and 3 of Table 1, the specifications that cover all firms in the sample. We use the estimates from Table 1 in Section III-C to quantify the benefits of corporate debt restructuring in Korea.

**Corporate debt restructuring may have additional benefits, beyond those considered in the regressions of Table 1.** For example, restructured firms may have higher R&D expenditure. Also, there might be positive fiscal implications since the restructured firms are expected to make positive profits (as opposed to loss-making pre-restructured firms). These additional effects would make the true economic benefits of debt restructuring higher than those obtained with our estimates. While some of the additional benefits can be estimated using Orbis data, we restrict our focus on the results on investment and hiring because they are most comparable with the costs of corporate debt restructuring that we describe below.

## **B. Costs of corporate debt restructuring**

**The cost of debt restructuring for the firms’ creditors can be estimated using loss-given-default (LGD) data for corporate debt.** There are two key sources of data.

Schuermann (2004), based on Moody’s data for large U.S. obligors, 1970-2003, shows that:

- Average LGD across all obligors is 60 percent. However, during recessions, or for distressed industries, LGD increases to 70 percent.<sup>10</sup>
- Average LGD for bank loans is lower: 50 percent in normal times, and 60 percent in recessions, because banks are more effective in restructuring non-performing loans than bondholders are.

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<sup>10</sup> Schuermann (2004) further shows that average LGD are consistent across most industries. Exceptions are retail, lodging, and hospitality (a higher average LGD of 70 percent) and utilities (a lower average LGD of 30 percent). Further, Schuermann finds no systematic relationship between firm size and LGD.

Shibut and Singer (2015), based on FDIC-resolved U.S. banks in 2008-2013, show that:

- Average LGD for commercial and industrial bank loans is 60 percent during the recession (2009-10), and 45 percent outside the recession (2011 onwards). These estimates appear consistent with those in Schuermann (2004) for bank loans.
- LGD is up to 7.5 percentage points lower in non-judicial (out-of-court) resolutions.<sup>11</sup>

**Assuming that corporate restructuring in Korea will proceed in the most effective manner, we adopt the most optimistic LGD assumptions within the plausible range.** The assumptions imply that much of restructuring will be bank-led and out-of-court, resulting in:

- **LGD of 40 percent in most industries,** and
  - **LGD of 50 percent in the distressed industries.**
- The distressed industries are shipping and shipbuilding only in the benchmark, and also petrochemicals and steel in the stress-tests.

**To assess the employment impact of corporate restructuring, we use data from Kang and Shivdasani (1997, KS).** KS study the corporate implications of performance declines in listed Japanese and U.S. firms in 1986-1990. Since a performance decline is a wider measure of vulnerability than financial distress, we focus on those KS firms that had to implement layoffs – i.e. those with a genuine need for corporate restructuring. KS show that, in both Japan and U.S., when layoffs take place, they are on average 20 percent of the workforce, but higher in distressed sectors (up to 30 percent in the case of e.g. Nippon Steel).<sup>12</sup> Most of layoffs occur in the first two years of the restructuring. Accordingly, we make the following assumptions:

- **Employment loss of 20 percent in most industries,** and
- **Employment loss of 25 percent in the distressed industries.**

The impact of corporate restructuring on employment is, conveniently, half of that on the creditors as captured by the LGD.

**As with the benefits of corporate debt restructuring, some costs of corporate debt restructuring remain outside the scope of our analysis.** These include declines in output (even if such output was produced at a loss before) and in consumption as a result of the employment impact. Also, if the losses realized in the process of corporate restructuring would weaken bank capital positions, this might lead to credit supply constraints with

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<sup>11</sup> See also Grunert and Weber (2009) and references therein for additional evidence on LGD, which is broadly consistent with the determinants of LGD established in Schuermann (2004) and Shibut and Singer (2015).

<sup>12</sup> Layoffs in Japan and U.S. have strikingly similar magnitude different labor markets flexibility. The key difference is that US firms resort more frequently to organizational restructuring (related to the Japanese phenomenon of zombie firms) – but this is irrelevant for our analysis. The fact that the layoffs have similar magnitude in very different labor markets gives us some comfort in applying these historic estimates.

negative effects on investment and consumption. Finally, to an extent that corporate restructuring leads to offshoring, the employment losses might be larger than the estimates.

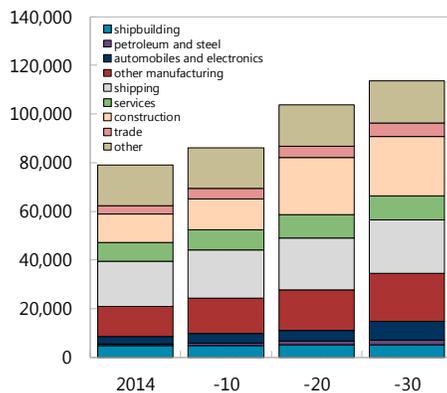
**The risks surrounding our estimates of the costs of corporate restructuring are tilted towards higher costs.** First, we use the cost assumptions that are at the optimistic end of the plausible range. Second, we use assumptions derived from U.S. data, and thus implying a strong institutional environment. This seems appropriate for Korea. But LGD in countries with weaker institutional environment may be materially higher. For example, a higher 60 percents LGD estimate of the cost of corporate restructuring in China used in IMF (2016A) seems entirely appropriate. Finally, we focus only on losses to creditors; shareholder would also incur costs in corporate restructuring, likely even steeper ones.

**Figures 6A and 6B summarize the estimated costs of corporate restructuring by industry.** To obtain the costs of corporate debt restructuring, we apply the LGD and employment impact assumptions described above to the debt-at-risk and employment-at-risk estimates from Figure 5. We find the costs of corporate restructuring to creditors to be 5.3-5.8 percent of GDP in the baseline, increasing to 7-7.6 percent of GDP in stress-tests. The estimated employment impact is 0.4-0.45 percent of the labor force in the baseline, increasing to 0.5-0.6 percent of the labor force in stress-tests. As with debt-at-risk and employment-at-risk, the costs to creditors stem predominantly from manufacturing, shipping, and construction, whereas a large part of the in employment impact comes from services.

**An important caveat is that we do not consider the distribution of the costs of debt restructuring across the sectors of the economy.** Part of the cost may accrue to banks, and can be offset against capital and provisions. Bank will require close monitoring to ensure that they have sufficient capital to maintain credit supply to the economy after recognizing losses associated with corporate debt. Part of the cost may need to be borne fiscally, to alleviate pressures on banks and to provide incentives for a speedy and effective restructuring.

Figure 6A

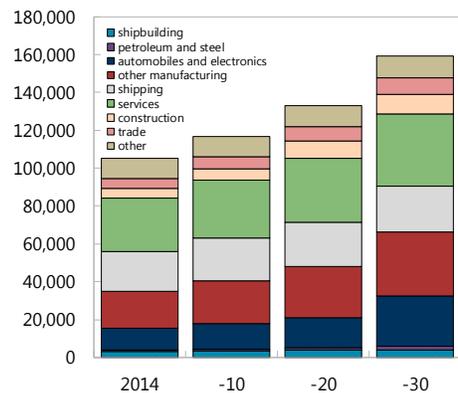
**Estimated resolution cost**  
(in billions of Korean Won)



Sources: Orbis; IMF staff calculations (Earnings shock from 2014, percent)

Figure 6B

**Estimated employment impact**  
(individuals)



Sources: Orbis; IMF staff calculations (Earnings shock from 2014, percent)

### C. Bringing the benefits and the costs together

**We use the estimates of the benefits and the evidence-driven assumptions on the costs of corporate debt restructuring to outline its cost-benefits implications.**

- The costs of corporate restructuring are taken from Figure 6. This is a one-time cost.
- The benefits of corporate restructuring are obtained in two steps.
  - First, we take the 2014 fixed assets and employment numbers in P-ICR<1 firms (those that will require a restructuring), and reduce them by 20 or 25 percent, consistent with the assumptions on the employment impact of debt restructuring (which we extrapolate to its impact on firms' assets utilization), to obtain post-restructuring fixed assets and employment volumes in the restructured firms.
  - Second, we apply the estimates of increased investment and hiring in restructured firms from Table 1 columns 1 and 3 to the post-restructuring fixed assets and employment volumes obtained above. This is a repeated, annual benefit.

**Table 2 summarizes the findings, for the baseline case and the stress-test scenarios.** We find that the baseline one-off costs to creditors of 5.3-5.8 percent of GDP is offset by a future annual increase in corporate investment of about 0.45 percent of GDP. The baseline one-off impact on employment of 0.4-0.45 percent of labor force is offset by 0.03-0.04 percent of labor force higher hiring in subsequent years. Both the costs and the benefits of corporate restructuring are higher in stress-test scenarios. Note that, for any scenario, the accumulated benefits of corporate restructuring offset the one-time costs in about 10-12 years.

**Table 2. Benefits and costs of corporate debt restructuring**

Initial conditions	COST	BENEFIT	COST	BENEFIT
	Cost to creditors (one off)	Increase in investment (yearly)	Employment loss (one off)	Increase in hiring (yearly)
	percent of GDP		percent of labor force	
2014 EBIT	5.32	0.43	0.40	0.03
-10	5.80	0.46	0.44	0.04
-20	6.98	0.59	0.51	0.04
-30	7.65	0.66	0.60	0.05

**At this stage, it is useful to reflect on the limitations to our method, which we will aim to correct at the next stage of the estimation.** First, the estimates are based on only 60 percent of firms by the value of corporate debt that are covered in Orbis. Second, some P-ICR>1 firms (those that, we assume, do not need debt restructuring) still have ICR<1, and so may

need to implement corporate actions to restore financial health, which may involve layoffs. Accounting for these additional considerations would increase the estimates of both benefits and costs of corporate restructuring, as we discuss below.

#### **D. Adjustments: Sample coverage and layoffs without debt restructuring**

**The estimates so far have been based entirely on specific firm-level data, econometric results, and evidence-based assumptions.** This allowed us to provide the most defensible estimates. However, the results can be refined to reflect additional factors for which similarly good data and rigorous estimates and assumptions are not available. Specifically, there are two key omissions to our method so far:

- **Sample coverage.** 40 percent of firms by volume of corporate debt are not in the sample. We need to account for the possible costs and benefits of debt restructuring in those firms;
- **A possibility of layoffs without debt restructuring.** We have argued that firms with  $ICR < 1$  but  $P-ICR > 1$  (i.e., a non-persistent debt vulnerability) may be able to cure their financial distress by methods other than debt restructuring, e.g. by improving corporate efficiency and/or thought consolidation. While these actions may help avoid imposing a cost on a firm's creditors, they may still require layoffs that should be accounted for in the estimates of the costs of corporate restructuring.

**We adjust our benefits and costs estimates for these additional factors using well-specified but judgmental arguments.** Since there is no fully rigorous evidence base to support the assumptions that we will use, we report the “adjusted” results separately from the fully evidence-driven results of the previous subsection.

**We extrapolate the results to the 40 percent for firms that are not in the Orbis sample.** The firms omitted from Orbis coverage are disproportionately smaller firms (Kalemli-Ozcan et al., 2015B). A large part of small firms' credit is secured loans (especially so in Korea), implying that the cost of debt restructuring to firms' creditors is likely lower than that for large firms. In contrast, the employment impact of corporate restructuring for smaller firms might be higher than that in large firms, due to a higher prevalence of irregular and self-employment. Accordingly, we extrapolate our cost and benefits estimates to the firms missing from the sample (inflating our results by  $100/60=66$  percent), but apply a lower LGD coefficient: 20 percent overall and 25 percent for distressed industries (instead of 40 and 50 percent) to account for a lower cost debt restructuring to the creditors. We keep the original, full estimates of the employment impact. This allows us to maintain a unidirectional, upward risk to our estimates of the costs of debt restructuring. We fully extrapolate the benefits of corporate debt restructuring to these firms.

**We also consider the benefits and costs of those corporate restructurings that do not involve debt restructuring.** Some  $ICR < 1$  firms may undertake layoffs to improve their financial health even though they might avoid debt restructuring. We assume that half of the firms with  $ICR < 1$  but  $P-ICR > 1$  will undertake corporate actions to improve their profitability. We assume that these corporate actions – such as increased efficiency or consolidation – will involve employment losses that are half those in the case of debt restructuring: 10 percent for all industries, and 12.5 percent for distressed industries. We apply a smaller estimate for the benefits of corporate debt restructuring, which is based only on the coefficient on the  $ICR < 1$  dummy in Table 1 (rather than on the sum of the coefficients on the  $P-ICR < 1$  and  $ICR < 1$  dummies) as these firms are not  $P-ICR < 1$  firms. The results are inflated by 66 percent to account for sample coverage.<sup>13</sup>

**The results of the above adjustments are shown in Table 3.** Compared to Table 2, both the costs and benefits of corporate restructuring increase. There is a particular increase in the employment impact, as we extrapolate the results to smaller firms that are not part of Orbis coverage and to  $ICR < 1$  firms that may undertake layoffs without debt restructuring. Still, as before, the costs of corporate restructuring are recouped in the medium term through its benefits. We find that the baseline cost to creditors of 7-7.75 percent of GDP is offset by a future increase in corporate investment of about 0.85-0.9 percent of GDP. And the baseline impact on employment of 0.9-0.95 percent of labor force is offset by 0.1 percent of labor force higher hiring in subsequent years. Both the costs and the benefits of corporate restructuring are higher in stress-test scenarios. For any scenario, the accumulated benefits of corporate restructuring offset the one-time costs in about 10 years.

**Table 3. Benefits and costs of corporate debt restructuring – adjusted for the sample coverage and other corporate restructuring**

Initial conditions	COST	BENEFIT	COST	BENEFIT
	Cost to creditors (one off)	Increase in investment (yearly)	Employment loss (one off)	Increase in hiring (yearly)
	percent of GDP		percent of labor force	
2014 EBIT	7.12	0.85	0.87	0.09
-10	7.75	0.91	0.95	0.10
-20	9.33	1.12	1.06	0.11
-30	10.23	1.24	1.23	0.12

<sup>13</sup> Fukuda and Nakamura (2011) discuss the Japanese experience of corporate restructuring without debt restructuring.

**An illustration that helps assess the overall validity of our results is the estimated cost of corporate restructuring in the shipping and shipbuilding industries.** Our method gives that cost at about KRW 31 trillion in the adjusted baseline. This compares to the KRW 12 trillion support package for the state-owned KDB and KEXIM banks and about KRW 10 trillion internal loss-absorption capacity available in those banks.<sup>14</sup> The numbers are broadly consistent: although much of shipping and shipbuilding exposures are consolidated in KDB and KEXIM, some are held by commercial banks or other creditors who may share in the costs. Our estimate of the employment impact of the restructuring in shipbuilding only is 10 thousand persons, lower than the 20 thousand suggested by some analysis,<sup>15</sup> consistent with an upward bias in our estimates.

**Another useful comparison is that with the related analysis in Bank of Korea (2015) Financial Stability Report.** The FSR analysis of chronically marginal firms uses a metric similar to our P-ICR. Our sample is larger: 106,870 vs 27,995 firms. The share of distressed firms in total firms is comparable: 10.5 percent of firms by number in the FSR vs. 9.2 percent by number and 22 percent by debt volume in our analysis. While we proceed to estimate the costs of corporate restructuring, the FSR provides some additional cuts of the data. In particular, it reports that about 30 percent of distressed firms' debt is from commercial banks (another 40 percent is from the policy banks, and 30 percent from other creditors). This implies that, from our 5.5-7.5 percent of GDP baseline estimate of the costs of corporate restructuring, about 1.6-2.25 percent of GDP may accrue to commercial banks. This is higher than the current 1.2 percent of GDP total provisions in commercial banks,<sup>16</sup> consistent with the Bank of Korea (2015) risk assessment that “non-performing loans can increase ... at times of future domestic or external shock occurrence.” Losses exceeding the provisions would reduce bank risk-weighted capital ratios from the current average of 14.5 percent. Although bank capital ratios will in all likelihood remain above the 11.5 percent minimum,<sup>17</sup> it would be important to monitor bank financial conditions to ensure that bank credit supply is not compromised as a result of corporate restructuring-related loan loss recognition.

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<sup>14</sup> As of end-2015, KDB and KEXIM had provisions KRW 3 trillion and KRW 0.5 trillion respectively, and KDB could use KRW 7 trillion of “excess” Tier 1 capital (which would reduce its Tier 1 capital ratio from 12 to 9 percent).

<sup>15</sup> <http://www.bloomberg.com/news/articles/2016-05-18/mass-layoffs-loom-in-south-korea-as-corporate-revamp-starts>

<sup>16</sup> Staff calculations based on Bank of Korea (2015).

<sup>17</sup> 8 percent Basel minimum requirement, 1 percent D-SIB surcharge, 2.5 percent capital conservation buffer.

#### IV. CONCLUSIONS

**The paper offered a method to assess the benefits and costs of corporate debt restructuring, and applied it to Korea.** The method involved: establishing the set of firms that are likely to require debt restructuring using a novel “P-ICR<1” criterion that captures firms that had a low ICR for multiple years; assessing the benefits of debt restructuring by estimating the effects of debt overhang on corporate investment and hiring decisions; drawing on the literature to obtain loss-given-default and employment impact assumptions; and then, reported separately, using judgmental arguments to correct for the sample coverage and possible layoffs absent a debt restructuring.

**The baseline estimates point to material economic cost of corporate debt restructuring, recouped by stronger economic activity over about 10 following years.** The economic cost of debt restructuring is not directly a fiscal cost, but may imply the need for fiscal support, to incentivize corporate restructuring; to compensate individuals that might be affected by the employment impact of corporate restructuring (e.g. by providing unemployment benefits and retraining); to maintain the solvency and viability of banks that may recognize losses;<sup>18</sup> and to offset the short-term drag on economic activity from lower output and consumption. Higher fiscal revenue associated with accelerated medium-term output growth and hiring post-restructuring may help offset the short-term fiscal costs.<sup>19</sup>

**Overall, the key qualitative insight is that corporate debt restructurings “pay off”.** The quantitative results hinge on a set of assumptions and estimates that, although being reasonable first approximations, can be refined to better reflect country-specific and industry circumstances. However, any refinement will still support the key qualitative result. When benefits and costs of debt restructuring are considered jointly, it becomes apparent that the economic costs of debt restructuring – both the cost to the creditors and the employment impact – are offset in the medium term by more rapid output growth and higher hiring.

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<sup>18</sup> Gianetti and Simonov (2013) demonstrate that corporate restructurings are more successful when banks are sufficiently well-capitalized.

<sup>19</sup> Note that the cost-benefits analysis does not imply that corporate restructuring is optional to start with. Since the to-be-restructured firms are unviable, restructuring will have to occur at some stage. The longer the restructuring is delayed, the higher will be the total economic cost (e.g. in the form of low investment and hiring by these firms). Rather, the cost-benefits analysis represents a positive statement that the economic costs of restructuring will be recovered over time in the future.

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## ANNEX 1. DATA SOURCE AND SUMMARY STATISTICS

### A. Firm-Level Data Source

For firm-level analysis, this paper uses annual data downloaded from Orbis. Orbis obtains balance sheet and income statement data from NICE Information Service Co., a credit ratings agency and a supplier of financial data on Korean firms. Due to a roughly two-year reporting lag in Orbis, we restrict attention to 2006-2014. Starting 2010, Orbis covers approximately 60 percent of non-financial corporate debt in Korea by debt volume.

	2006	2007	2008	2009	2010	2011	2012	2013	2014
Number of companies in the sample	122,205	115,758	120,124	118,141	133,280	144,523	142,213	131,810	106,870
Total debt of companies in the sample (percent of GDP), Orbis data	44	45	55	56	59	63	65	63	60
Total credit to non-financial sector (percent of GDP), BIS data	86	91	104	106	102	104	106	102	105

We made considerable efforts in cleaning the data to construct a nationally representative firm sample. We downloaded from Orbis financial accounts of all non-financial, non-government companies. Then, following Kalemlı-Ozcan et al. (2015B), we kept only the unconsolidated accounts (U1 + U2) to avoid double counting. We dropped utilities as their ICRs are not always informative of a firm's true financial state. Further, we dropped duplicate observations, those for firms with negative total assets, and those for firms that had less than four data-years available. We assigned industry dummies to each account according to either KSIC-9 or US SIC industry classifications, whichever was available in Orbis.

### C. ICR Regressions: Summary Statistics

The table below reports summary statistics for the key variables used in the ICR regressions. The growth rates of fixed assets and number of employees were trimmed at 5 and 95 percentiles. (Trimming at lower percentiles is insufficient as it retains many outlier observations).

	Obs	Mean	Std Dev	Min	Max	Min*	Max*
Fixed asset growth rate	321,837	0.14	0.39	-0.35	2.30	-0.71	12.54
Number of employees growth rate	164,905	0.03	0.17	-0.38	0.70	-0.69	2.33

\* For 1 percent trim