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Debt and productivity: Evidence from firm-level data

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Debt and productivity: Evidence from firm-level data[1]

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Abstract

There are relatively few studies that use micro data to shed light on the relationship between finance and economic growth – the few that exists show that there is a positive relationship between debt and future productivity growth. Meanwhile, several new macro-econometric studies have shown that there is a threshold of financial development above which finance negatively impacts growth – our paper contributes to this literature by examining whether this finding holds when we examine firm level data. Our data covers over 100 countries, both advanced and developing & emerging and spans close to 30 years (1986-2014). Our preliminary results are the following: i) firm level leverage is positively associated with productivity; ii) the strength of this association declines in employment of the firm; iii) there is diminishing returns to leverage in terms of its impact on productivity but we don't see a threshold beyond which the returns drop; iv) aggregate leverage in a country has a negative effect on firm productivity, controlling for strength of institutions and level of economic and financial development in the country. Furthermore, given the potential issue of endogeneity, we examine the impact of leverage on expected and unexpected components of productivity – our results show that leverage is positively associated with the unexpected component of firm productivity, thus providing evidence against reverse causality.

Keywords: total factor productivity (TFP), debt, finance and growth

JEL classifications: D24, G21, G30, O16, O40

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I. Introduction

There are relatively few studies that use micro data to shed light on the relationship between finance and economic growth. A recent study by Levine and Warusawitharana (2014) is among the exceptions as it uses firm level data – it shows that there is a positive relationship between debt and future productivity growth and this relationship strengthens as financing becomes more costly.[4] The authors address the potential issue of reverse causality by differentiating TFP into expected and unexpected component (building on the work done by Levinsohn and Perrin, 2003) and show that the relationship between debt and TFP growth arises mainly due to the unexpected component. This is a notable finding in the literature as it supports the macro evidence -- finance is good for growth -- by employing micro data.

Building on this work by LW (2014), our study goes further and examines whether there is a non-linear relationship between firm level debt and TFP by making use of the micro-data for firms (as used in chapter 2). Indeed, several new studies have shown that there is a threshold of financial development (measured by private sector credit to GDP) above which finance negatively impacts growth (Cecchetti and Kharroubi, 2012; Arcand, Berkes and Panizza, 2011). Our study contributes to the literature by examining whether this finding holds when we examine firm level data. Furthermore, LW (2014) look at four large European economies (France, Italy, Spain and the U.K) and the sample period extends from 2000 to 2010. Our data covers over 100 countries, both advanced and developing & emerging and spans close to 30 years (1986-2014).

Meanwhile, there are many dimensions of financial development as highlighted by Sahay et al (2015), but a country's level of financial development is generally captured by the availability of credit in the economy. Most macro-econometric studies tend to look at private sector credit as a share of GDP as the indicator of financial development (for a representative sample of studies, see Cecchetti and Kharroubi, 2012; Arcand, Berkes and Panizza, 2011; King, Levine and Loayza, 2000). In this chapter we examine the relationship between leverage and firm level productivity. We believe that leverage – which is a proxy for access to credit and the level of credit available in the economy – is a good measure of the level of financial development prevalent in a country. This is in line with LW (2014); they use debt as a measure of finance.

We use standard panel data model to assess the relationship between debt and productivity, by controlling for the age of the firm, total sales and capital expenditure (variables that are available through the micro database). In particular, we examine the impact of current period debt on future productivity. In order to account for the inherent endogeneity in the model, we use dynamic panel data techniques commonly used in the literature.[5] However, since firm's borrowing decision could be influenced by future expectations of productivity, we decompose TFP into expected and unexpected components following the methodology used by Levinsohn and Petrin (2003) and LW (2014). We also examine the relationship between aggregate level debt and firm productivity by controlling for country characteristics such as GDP per capita and level of financial development, and we draw out sectorial differences.

Our preliminary results are the following: i) firm level leverage is positively associated with TFP; ii) the strength of this association declines in employment of the firm; iii) we don't see a relevant threshold beyond which the returns drop; iv) aggregate leverage in a country has a negative effect on TFP. The first result

[4] Hereafter referred to as LW (2014).

[5] For the development of dynamic methods see Arellano and Bover (1995) and Arellano & Bond (1997) and for the applications of such models to study the link between productivity and finance, see Levine and Warusawitharana (2014).

shows that external financing plays an important role towards the future productivity of a firm. Moreover, the results hold when we account for endogeneity – we find that there is an economically and statistically significant relationship between leverage and unexpected component of future TFP. The second result suggests that access to finance and ability of firms to take on more debt is more important for firms that are smaller. In other words, for the small and medium sized enterprises (SMEs) debt plays an important role in allowing them to engage in more productive activities and hence raise their future TFP. The fourth result is notable because we not only replicate LW 2014 (find positive relationship between firm level debt and productivity), we find a negative relationship between aggregate debt and firm productivity, essentially bridging the gap between micro and macro-econometric studies.

The rest of the paper is organized as follows: Section II provides a review of the literature that looks at the relationship between financial development and economic growth. Section III discusses the firm level data used in the paper and presents summary statistics. Section IV presents the empirical methodology employed by the paper, Section V discusses the results and Section VI concludes.

II. Literature Review

1. Efficient allocation of resources and impetus for growth

Finance plays a pivotal role in the allocation of capital resources. The functioning of financial system is vitally linked to economic growth and countries with larger banks and more active stock markets have grown faster even after controlling for other determinants of economic growth (Levine, 1997). Financial intermediaries provide access to economies of scale and they increase economic efficiency by reducing technological and incentive frictions (Becsi & Ping, 1997). They increase the "quality of aggregate investment by enhancing profitable opportunities" thus contributing to economic growth (Becsi & Ping, 1997). Channels through which financial development is linked to growth are: growth rate of physical capital and efficiency in the allocation of capital (King and Levine, 1993). Furthermore, cross-country evidence on the role of financial development is consistent with the Schumpeterian view: financial intermediaries affect economic development primarily by influencing total factor productivity (TFP) growth (Beck, Levine, and Loayza, 2000).

Industries and sectors that rely on external financing grow disproportionately faster in countries with well-developed financial sector. Indeed, Rajan and Zingales (1998) show that financial development leads to economic growth by reducing the cost of external finance to financially dependent firms. They show that financial development is particularly beneficial to new firms in an economy by lowering the barriers to entry. In other words, low levels of financial development favours incumbent firms. This view echoes the famous work on economic development by Schumpeter (1911), where he said that access to credit was the basis for innovation and creation of new enterprises.

The prevalent view among economists and policy makers was that financial development follows economic development (Robinson, 1952). This view suggests financial sector will develop to cope with the needs of the real economy. But, relatively recent literature suggests that there is a firs-order relationship between financial development and growth. In fact, financial development is a good predictor of future economic development (Levine, 1997). "Finance does not only follow growth; finance seems importantly to lead economic growth" (King and Levine, 1993). Levine (1997) argues that theory and evidence makes it difficult to argue that financial system merely responds to industrialization and economic activity. He says that a well-functioning financial system acts as an important precursor to economic growth.

Indeed, studies that look at the financial and economic history of the world show that economic leadership grew out of a strong financial base following a "financial revolution" (Rousseau, 2002; Sylla, 2000). Among the main features of this "financial revolution" includes four key aspects: i) strong public finance; ii) stable money that serves as a useful medium of exchange; iii) banking system that accepts deposits of money and lends it to credit-worthy borrowers; and iv) a central bank that serves as the government's bank and a regulator and supervisor of the financial system.

2. Financial development does not necessarily lead to growth

On the eve of the Great Recession in 2006, Rajan (2006) suggested that while financial development on the whole had provided much greater access to finance for firms and households, it had also increased the exposure to risks and rendered the real economy vulnerable to severe fluctuations. Rodrik and Subramanian (2009) show that financial development has not necessarily led to higher investment growth or GDP growth in emerging economies, in fact, it might have led to more volatility and exposure to risks and increased likelihood of financial crisis. So the evidence on the link between financial development and growth is far from settled. For example, Demetriades and Hussein (1996) find no evidence of financial development leading to growth. Meanwhile, Arestis, Demetriades and Luintel (2001) show that financial development

measured as stock market capitalization ratio does not necessarily lead to growth. Also, they point out that stock market volatility negatively affects real economic activity. They also show that bank-based financial development is better than capital-market based ones.

Arcand, Berkes and Panizza (2011) have shown that there is a non-monotonic relationship between financial development and the authors show that their results are significant controlling for macroeconomic volatility, banking crises, and institutional quality. Their finding is similar to that of Easterly, Islam and Stiglitz (2000), who show that there is a non-monotonic relationship between financial depth and output volatility, particularly that volatility starts increasing when private credit as a share of GDP reaches 100 per cent. Similarly, Cecchetti and Kharroubi (2012) show that there is an inverted-U relationship between financial development and productivity growth – when private credit reaches a point where it exceeds GDP, it becomes a drag on productivity growth. Other studies that highlight the non-monotonic relationship between financial development and growth are Deidda and Fattouh (2002) and Rioja and Valev (2004).

Cecchetti and Kharroubi (2012) argue that the financial industry competes for human resources with the rest of the economy. In fact, they attract the best and the brightest away from other sectors of the economy. Cecchetti and Kharroubi (2012) show that when the share of employment in the financial industry exceeds 3.5 per cent total employment, further increases tends to be detrimental to growth. While subsidizing the financial sector can increase the investments that entrepreneurs can undertake, it can also decrease the number of entrepreneurs by attracting more individuals to the financial sector (Philippon, 2007). Baumol (1990), Murphy, Shleifer, & Vishny (1991), and Philippon (2007) argue that the flow of talented individuals into financial services is not socially desirable because the social returns is higher in other occupations, even though the private returns are not.

One of the ways to examine the usefulness of finance to firms is to look at financial innovation and its impact on firms and the broader economy. In the wake of the Great Recession, Paul Volcker, former chairman of the Federal Reserve, argued that the only socially useful financial innovation of the last few decades is the automatic teller machine (ATM).[6] While the verdict on the usefulness of financial innovation is not as damning as Volcker's assertion, recent studies have cast doubt on the usefulness of financial innovation, particularly underscoring their impact on financial fragility. Studies show that financial innovation doubled between the late 1990s and the late 2000s and most of these were in the structured market (securitization and derivatives). A cross-country study of financial innovation shows that countries where banks spend more on financial innovation, they are also more fragile (Beck, Chen, Lin and Song, 2012).

3. Finance and firm growth

While, the debate on whether financial development leads to growth is not settled, what is undoubtedly true is that financing plays an important role in the functioning and growth of small and medium sized enterprises (SMEs), defined as enterprises with up to 250 employees -- they tend to constitute over 60 per cent of total employment in manufacturing in many countries (Ayyagari et al, 2007).[7] Beck and Demirguc-Kunt (2006) show that SMEs are financially more constrained than large firms, and thus face growth constraints. On average, the share of investment financed with bank loans for small firms is 15 per cent, while it is 22 and 28 per cent respectively for medium and large firms (Beck et al, 2004). Also, not surprisingly, larger firms finance a greater share of investments with equity than smaller firms. According

[6] Accessed on May 28, 2013:
http://online.wsj.com/article/SB10001424052748704825504574586330960597134.html

[7] For example, in Chile, Greece, and Thailand more than 80 per cent of the workforce is employed in SMEs (Ayyagari et al, 2007). SMEs contribution to both employment and GDP exhibits a strong positive correlation with GDP per capita.

to Beck et al (2005), higher financing obstacles faced by small firms translate into slower growth. They show that smallest firms are adversely affected by financial, legal, and corruption constraints; therefore, financial and institutional development helps to close the gap between small and large firms.

Indeed, industries and sectors that rely on external financing grow disproportionately faster in countries with well-developed financial sector. Indeed, Rajan and Zingales (1998) show that financial development leads to economic growth by reducing the cost of external finance to financially dependent firms. They show that financial development is particularly beneficial to new firms in an economy by lowering the barriers to entry. In other words, low levels of financial development favours incumbent firms. This view echoes the famous work on economic development by Schumpeter (1911), where he said that access to credit was the basis for innovation and creation of new enterprises.

While access to finance plays an important role for firm growth, depending on the nature and types of finance, it could also have a negative impact on firms. For e.g., Kalemli-Ozcan, Sorensen and Volosvych (2010) show that firms in the EU-15 with higher levels of foreign ownership are more volatile and changes in foreign ownership over time is positively associated with volatility.[8] In fact, if the largest owner of a firm is foreign, then sales growth of the firm is 20 per cent more volatile than the average in the sample. Furthermore, this micro-level effect translates into the macro level. The authors show that financial integration explains around 12 per cent of the variation in regional volatility. In order to establish causality, the authors use propensity matching to compare firms with no foreign ownership with the ones that have foreign ownership and are observationally similar – the result showing 'higher ownership associated with increased volatility' holds.

Meanwhile, Gennaioli, Shleifer and Vishny (2012) show that the securities that were created leading up to the Great Recession "neglected risks," which in turn were amplified by the excessive leverage. The authors argue that "the stronger is the ex-ante belief that securities are safe, the higher is the borrowing against them, and the more extreme the fire sales" (p. 466). They say that financial sector reform should go beyond just regulating the amount of leverage in the system and also include new financial innovation, particularly the creation of new claims (securities).

4. Debt and firm level productivity

LW (2014) is one of the few studies in the literature to document the relationship between the use of finance and productivity growth at the firm-level. They make use of firm level data available through Bureau van Dijk that constructs the data set from regulatory filings for firms in each European country. They focus on four large European countries – France, Italy, Spain and UK – and find that debt growth leads to future TFP growth for firms (a 10 per cent increase in debt leads to productivity increases between 0.8 and 2.1 per cent). They obtain similar results when they look at labour productivity instead of TFP and also when the definition of financing is either debt or equity financing.

In order to address the issue of reverse causality prevalent in trying to disentangle the impact of debt on productivity, LW 2014 decompose TFP into an expected (inside the information set of the firm) and unexpected component (outside the information set of the firm) (as done by Levinsohn and Petrin, 2003).[9] They find that the relationship between debt growth and future productivity growth arises mainly due to the part of productivity that is outside the information set of the firm. Furthermore, the authors find that the relationship between debt growth and TFP growth strengthens with the increase in financing costs (proxied by spread on sovereign bonds for the 4 countries in the sample). The authors highlight the

[8] Kalemli-Ozcan et al use AMADEUS for firm level data.

[9] The way this is done is by looking at the material inputs available for the firm which would have direct impact on the future productivity of the firm. This would be expected TFP – inside the information set of the firm.

economic significance of the debt and productivity nexus by showing that the slowdown in debt growth in the aftermath of the Great Recession contributed to lower output growth. Their finding is in line with the papers discussed earlier that show that financial crises tend lead to misallocation in capital and have a negative impact on output, which tends to persist.

There is a strand of literature that shows the link between financial development at the country level and the impact on firm level productivity. Most notable among these studies is the one by Beck, Levine and Loyaza (2000) who show that financial intermediaries affect economic development primarily by influencing total factor productivity (TFP). Their results hold using different indicators of financial development and also when accounting for potential endogeneity (employing an IV estimator and dynamic panel estimator).

III. Data & Summary Statistics

1. Data: FactSet[10]

In a growing trend of private data providers used in academic research, FactSet is one that contains publicly listed firms in over 100 countries, covering the time period between late 1970s and 2014. What makes the database particularly attractive for researchers looking into firm dynamics and labour market outcomes is the data coverage in terms of countries, sectors and period. Indeed, a large number academic studies use FactSet or similar databases. Compustat North America particularly is a popular choice in the finance and macro-finance literature – this database is a subset of FactSet, as coverage of the later has a global scope. Overall, much of the growth in the use of firm level data in the economic literature has relied on databases that retrieve the data from public financial statements; thus the use of FactSet can be considered standard in academic research. For instance, a search in Google Scholar with the key word Compustat returns approximately 37,000 results, 17,500 for 2010 or after. A search for FactSet returns 1,800 results, 1,300 of which for 2010 or after. Thus, Factset is not as popular as Compustat in academic research, but it is starting to become more popular.

One of the limitations of FactSet is that it contains only publicly listed firms, hence it is missing an important component of the production side of the economy -- private companies. Aside from this, the dataset presents further limitations, such as asymmetry in collection between countries and regions, delays in data collection, illogical entries, etc. Despite all the limitations, after a careful cleaning up, we can build a sample that allows us to do sound empirical analysis. Figure 1 (panel A) shows the GDP in current USD from the World Development indicators of the World Bank and total sales figures for all companies using FactSet. As it is expected, the levels from Factset substantially differ from the WDI GDP, which is natural given only a fraction of global production is captured by FactSet; and that aggregate sales do not correspond with GDP – aggregate sales are not obtained through a value added approach. Sales for adjusted data are substantially smaller than for unadjusted data – also to be expected as the adjustment removes firms from the database, hence from the total sales. As can be seen in Figure 1, the level of consistency of the data is acceptable. Furthermore, if one is interested in the levels of variables or levels of ratios susceptible to be affected by firm's survivor bias, then the unadjusted version of the data will be more suitable.

Meanwhile, Figure 1 (panel B), presents a similar exercise – growth rates of the world GDP and total sales from FactSet. Two salient features from this figure are worth mentioning: i) the growth rate of FactSet data is more volatile than the GDP data; in (broadly defined) expansion years the growth rate of sales is above GDP, whereas in (broadly defined) contraction years it is below. ii) The second fact is the poor performance

[10] The ILO's Research Department has annual subscription to FactSet. Please contact the authors for more information about the data and subscription.

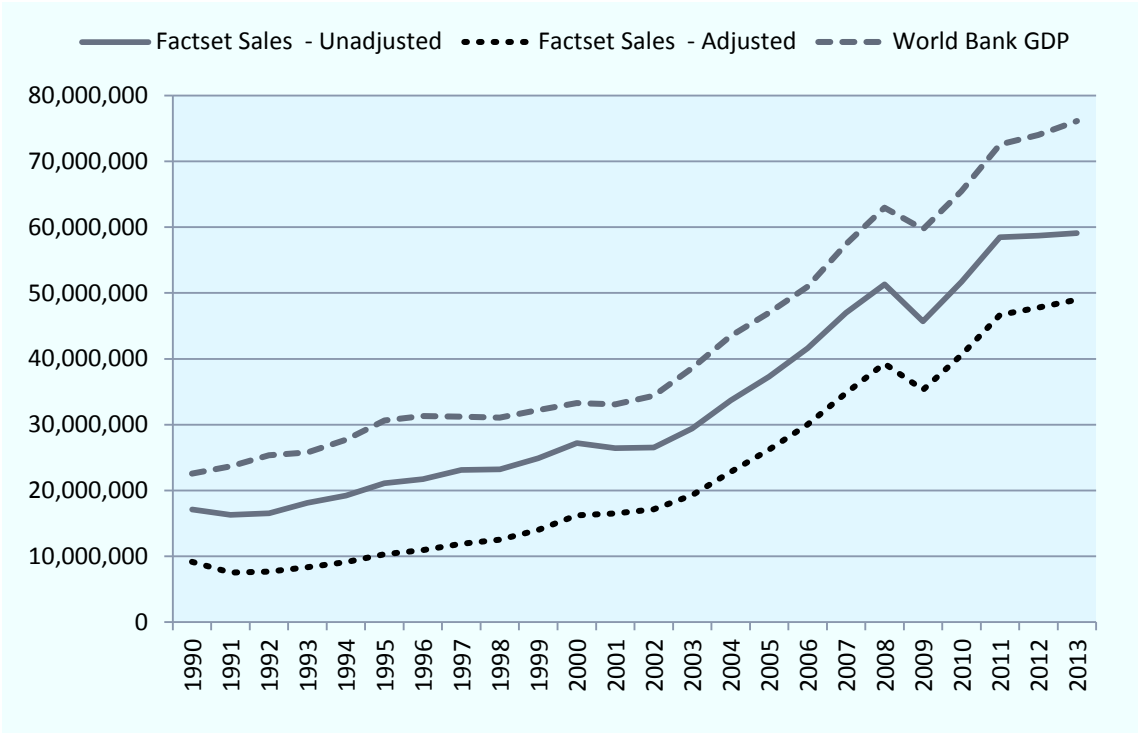
of the unadjusted data towards the end of the sample (2014 is excluded from Figure 1); this is not surprising; data collection requires time, and most recent years will be disproportionately affected. The problem is evident in 2014, before that, the discrepancy is not exceptional compared to the rest of the sample, nonetheless some bias appears to be present. Thus when analysing the end of the sample and particularly 2014, it is convenient to use adjusted data. Nonetheless in some occasions, since it is a ratio that is of interest unless a serious reporting bias affects the data – which can be the case – unadjusted data can be consistent enough.

Meanwhile, when we examine the GDP growth figures and compare that to sales growth from FactSet, one period that stands out is 1995-2000. During this period, firms reported by FactSet saw significant changes in growth figures but the global GDP growth, albeit positive and strong during this period, does not nearly mimic the trend from FactSet. This might be reflective of the tech boom in the US and since FactSet is comprised of only publicly listed firms, the discrepancy might be due to this. Furthermore, it could also be the case that more firms went public during this period, riding the wave of tech boom. In any case, this needs to be investigated further and when we do the empirical analyses using FactSet we will need to make adjustments for this period to get a true picture of firm dynamics and employment creation.

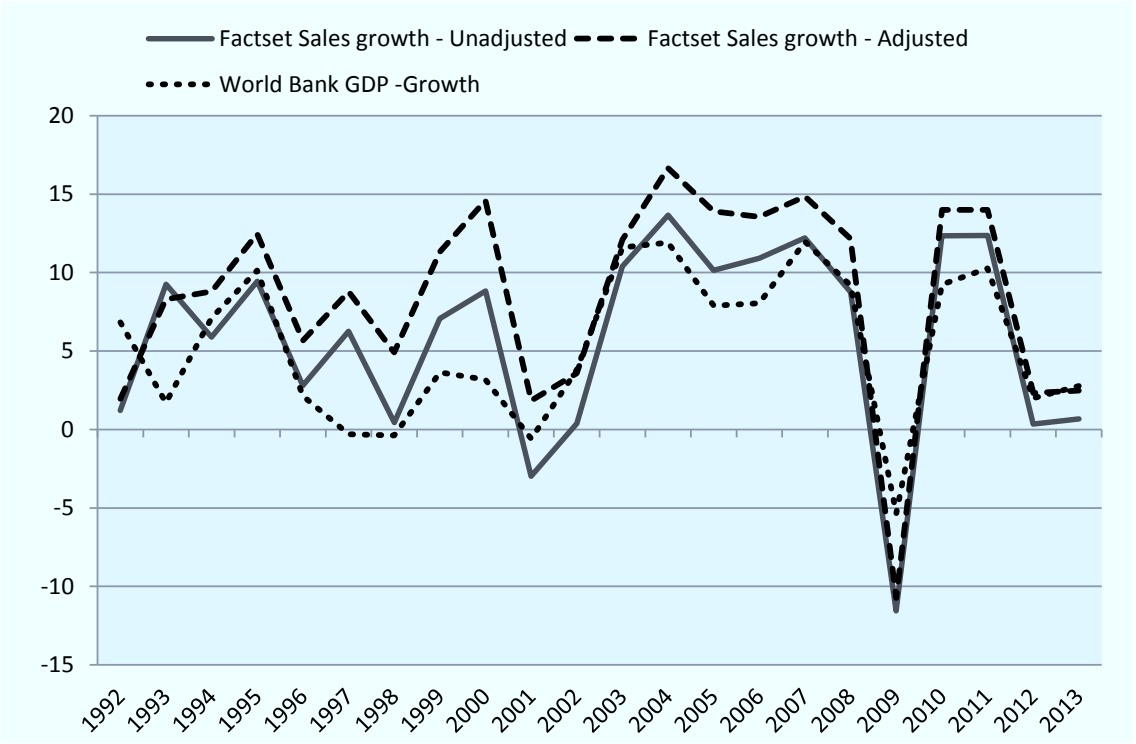
After cleaning up the database for descriptive trends and analysis – where the key criteria was availability of employment information – the total sample we have is 71,672 firms, out of which 18,918 are in the United States (see the appendix for details on sample selection strategy). Countries with more than 5,000 firms include Canada, Japan and the United Kingdom. Meanwhile, countries with more than 3,000 firms include China and India; over 2,000 firms include Australia, Korea and Taiwan; likewise, over 1,000 firms include France, Germany, Hong Kong and Malaysia (see the Appendix for firm break down for other countries).

Figure 1: World GDP from the WDI vs. aggregate sales from Factset

Panel A: Levels



Panel B: Growth

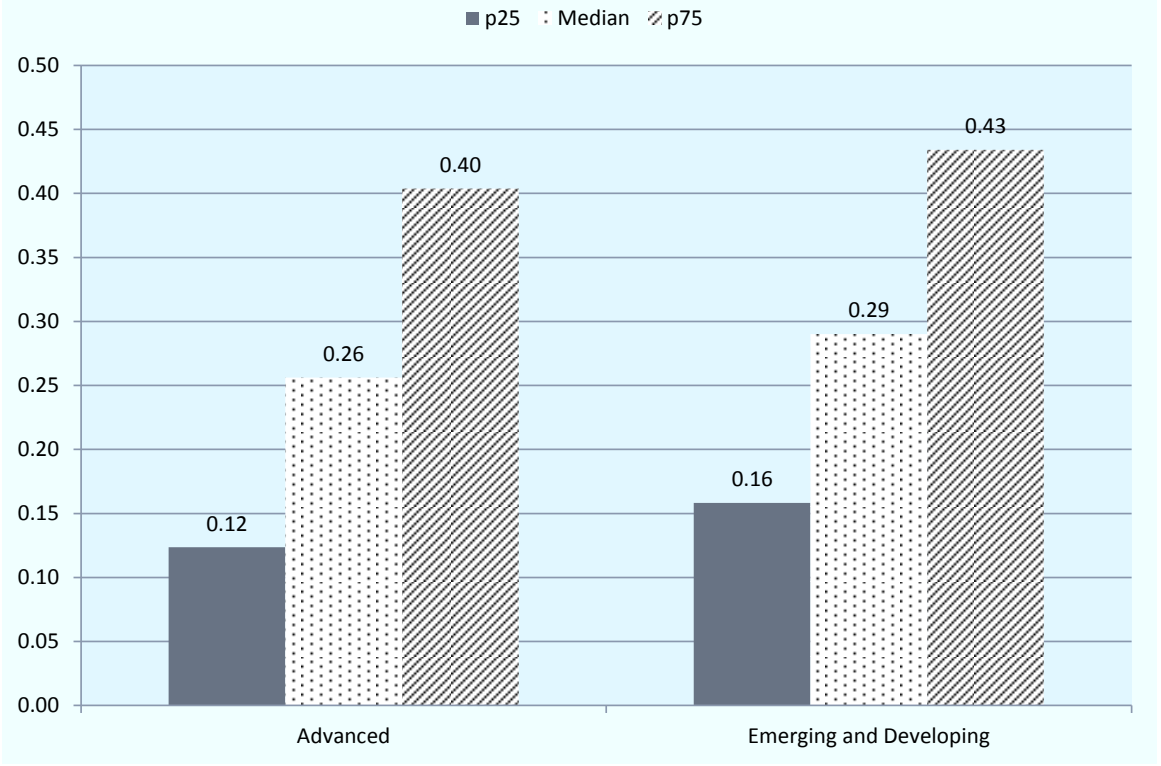


Note: Adjusted data refers to data that excludes firms which at some point of the sample period stopped having entries in the database (due to disappearance or delays in data collection). Unadjusted data refers to the data that does not leave out non-reporting firms from the sample. Source: Authors' calculations based on FactSet and the World Bank.

2. Summary statistics

We define leverage as the ratio of debt over assets and debt refers to total debt incurred by firms, including both short-term and long-term debt. As it is evident from Figure 2, there is a slight difference in leverage by income groups. Median leverage for emerging and developing economies is larger than it is in case of the advanced economies – 0.29 vs. 0.26. However, when we examine just total debt, it is higher for advanced economies than for emerging and developing -- 3.69 vs. 3.47 respectively (see the appendix for detailed data on debt and leverage). In short, firms in emerging and developing economies tend to be more leveraged, while total debt tends to be higher in the advanced economies.

Figure 2: Leverage by income groups

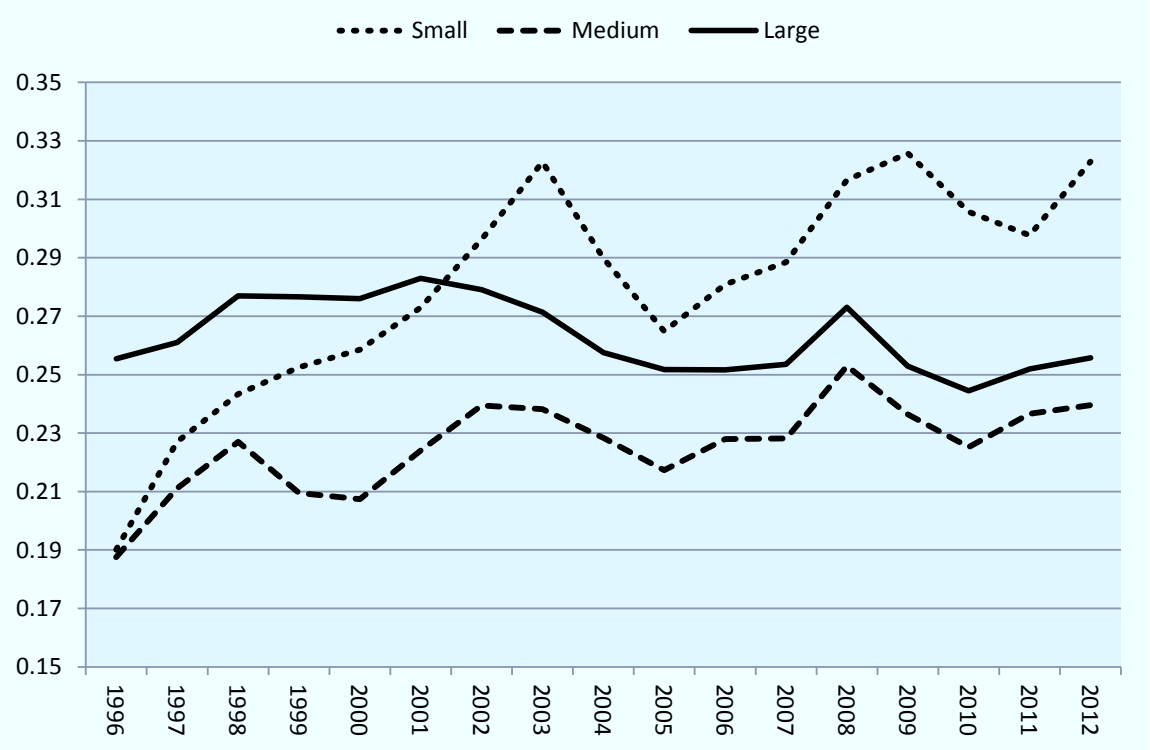


Note: leverage is total debt over total assets.

When we look at leverage and debt by firm size, an interesting picture emerges. In terms of total debt, large firms have more debt than both medium and small firms – 4.47, 1.84 and 0.69 respectively in logarithms. But, small firms are relatively more leveraged (0.32) than their medium (0.23) and large counterparts (0.26) (Figure 3).[11] Thus, data suggest that the leverage ratio is independent of firm size as higher debt of larger firms is compensated by higher assets. Meanwhile, in terms of the sectors, the most leveraged sectors include utilities, accommodation and restaurant, mining and quarrying. Note that financial sector is not included in our sample and it is not part of the real estate and business sector, which in our sample is in fact among the least leveraged. Furthermore, if we just focus on total debt, then the sectors with the most debt are utilities, wholesale and retail trade mining and quarrying and construction.

[11] The figures in parenthesis refer to the averages across firms in 2012.

Figure 3: Leverage by firm size



Note: leverage is total debt over total assets.

IV. Empirical Methodology

1. Estimating total factor productivity

In order to calculate total factor productivity (TFP) we use the neoclassical production function used by Baily, Hulten and Campbell (1992). Here, Y_{it} is the real gross output for *i* firm in year *t*, K_{it}, L_{it} and M_{it} are capital, labour and intermediate inputs. Output is proxied by sales, capital by plant and equipment, labour by the number of employees, and intermediate inputs by cost of goods sold minus labour expenses.[12]

$$Y_{it} = F(K_{it}, L_{it}, M_{it})$$

As in most studies in the literature, we use Olley and Pakes method.[13] Based on a standard Cobb-Douglas function where value added is $Y_{it} - M_{it}$,thus intermediate inputs are directly subtracted from sales. It can be expressed as the following:

$$lnTFP_{it} = ln(Y_{it} - M_{it}) - \alpha_L lnL_{it} - \alpha_K lnK_{it} - c$$

where c is a constant. The Olley and Pakes method is then applied, which is substantially more convoluted. The basic structure is the same as the standard Cobb-Douglas case, however Olley and Pakes assume that the productivity in each period is observed before some input decisions and exiting decisions gives rise to endogeneity issues. For instance labour input can increase, and exit probability decrease, as a response to an observed productivity shock by the firm, but unobserved by the researcher. The methodology controls for the effects of simultaneity by employing an auxiliary variable that is positively related to productivity – for this study we use investment proxied by capital expenditure. The details of the method can be found in the seminal paper by Olley and Pakes (1996).

2. Relationship between finance and TFP

We use the following standard panel data model to examine the relationship between finance use and TFP at the firm level (Cameron and Trivedi, 2010; Wooldridge, 2010):

$$y_{i,t+1} = \alpha_i + \lambda y_{i,t} + \varphi y_{i,t-1} + \gamma L_{i,t} + x'_{i,t}\,\beta + \varepsilon_{i,t}$$

Where, $y_{i,t}$ refers to productivity (log TFP or log labour productivity) in firm *i*, and year *t*, $L_{i,t}$ is a measure of financial usage (we use different measures of leverage), $x'_{i,t}$ are set of controls which include age of the firm, sales, capital expenditure etc. Lastly, $\varepsilon_{i,t}$ refers to unobservables that have an effect on productivity. To estimate this equation one cannot use OLS or FE, in fact the autoregressive coefficients of productivity will be overestimated using OLS and underestimated using FE – see Bond (2002). We use the strategy suggested by Arellano and Bover (1995) and Arellano and Bond (1997) – they use lagged levels to estimate the first-difference equation and lagged differences to estimate the level equation. In our paper, for the differenced equation, we use as instruments lags 2 and 3 of TFP (and labour productivity)[14] and the differences of all the controls and the variables of interest. To estimate the level equation, we use the difference in productivity at time t -- we set up this structure[15] because it gives results that are between OLS

[12] Cost of goods sold is the costs of operations -- as such they do not include overhead expenses amongst others. Therefore, intermediates are approximated as the total costs involved in production of the goods minus labour expenses. Total labour expenses are used due to data availability.

[13] Using directly a Cobb Douglas function without the Olley & Pakes correction delivers very similar results -- see Baily, Hulten and Campbell (1992) for a discussion of both methods.

[14] Using further lags as instruments does not change the results much -- we use this specification because of its parsimony. In the baseline regression this setup entails using 84 instruments.

[15] This structure is obtained by the xtdpdsys command of Stata, and adding the limitation of maximum lags of levels to be used as instruments.

and FE as expected, and because the tests of autocorrelation using the estimated point at order 1 autocorrelation – also expected if the specification is correct.

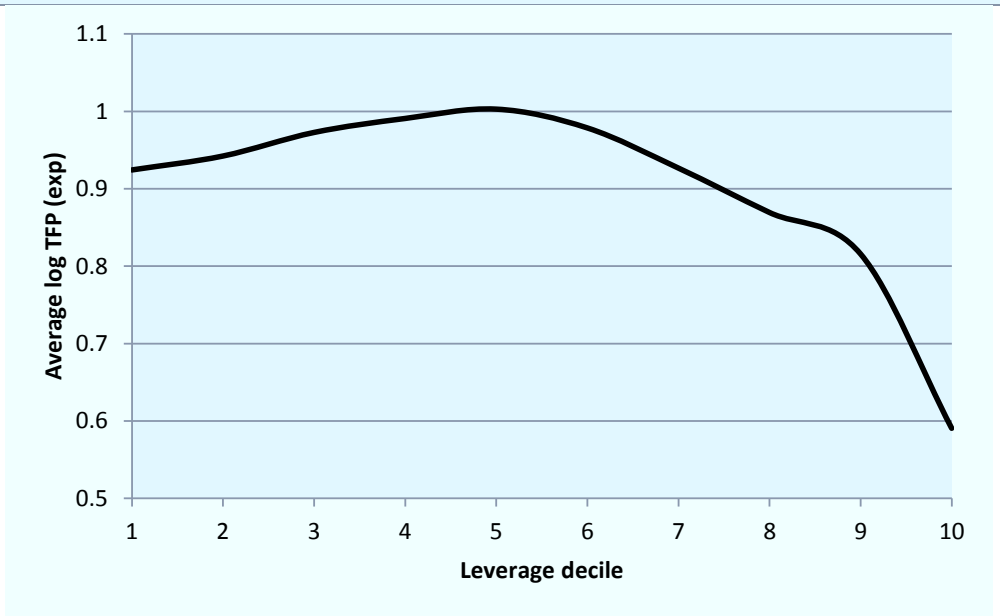
Our methodology is very similar to Levine and Warusawitharana (2014). The main difference is that we consider productivity and the financial usage indicator in levels, whereas they use growth of those variables. We use the level specification because it is less restrictive, and in an unreported Monte Carlo simulation we find that using a difference specification can cause an upward bias of a positive relation, with only an imperceptible efficiency gain in the case that an exact difference specification happens to be correct.[16]

V. Results

1. Leverage and TFP

When we plot average TFP in logs and leverage decile in our sample, we see that firms that are highly leveraged tend to have lower average TFP than the ones with low levels of leverage (Figure 4). In fact, firms that are below the 5th decile tend to have higher TFP than the firms above the 7th decile. Note that this is just a bivariate plot – doesn't necessarily show any kind of relationship between leverage and productivity. However, this picture does reflect the literature showing non-monotonic (or inverted-U) relationship between the level of financial development and economic growth (most notably: Arcand, Berkes and Panizza, 2011 and Cecchetti and Kharroubi, 2012). Next, we examine whether we actually see this relationship when we control for other relevant covariates.

Figure 4: Leverage and TFP



Note: This picture is based on regressions without controls.

Our baseline regressions show positive effect of leverage on future TFP (Table 1) – 10 per cent increase in leverage for a firm in time *t* results in 0.5 per cent increase in TFP in *t+1*. Not surprisingly, current TFP and past TFP plays a statistically significant role in determining future TFP – 10 per cent increase in TFP time *t* leads to 6 per cent increase in TFP in *t+1* and a 10 per cent increase in *t-1* leads to 0.7 per cent increase in TFP in *t+1*. So in other words, for TFP in period *t+1*, leverage in time *t* and TFP in preceding year (*t-1*) play about the same role in terms of their economic significance.

[16] This could be made available upon request.

We also see that the age of firms is positively associated with future TFP – i.e., older firms are likely to be more productive on average. Sales on the other hand is negatively associated with future TFP – increase in sales in current period leads to a decline in productivity in future period. Capital expenditure in current period has a statistically significant –albeit very small - impact on future TFP. Finally, year dummy is statistically significant, which means that when firms were in operations determines their TFP. Using this specification the sum of the coefficients on the lags of TFP are bounded by the FE and OLS estimates, as expected of a consistent estimator in a large panel.

The results hold across different measures of leverage: log of leverage in period *t*, log of leverage in period *t-1* and log of net leverage in period *t*. Furthermore, enabling for dynamic effects of leverage, control for years, adding assets (not included in baseline because of collinearity) and limiting to countries with a certain number of firms (300 and 1000) do not change results, the last two are not shown.

Table 1: TFP and leverage at the firm level

Dependent variable: TFP (t+1)				
	(1)	(2)	(3)	(4)
TFP	0.60***	0.60***	0.60***	0.62***
TFP(t-1)	0.07***	0.09***	0.09***	0.09***
Log Age	0.2***	0.19***	0.20***	0.2***
Log Sales	-0.42***	-0.41***	-0.39***	-0.42***
Log Capex	0.00*	0.00*	0.01***	0.00
Year	0.01***	0.01***		0.01***
Log Leverage	0.05***	0.05***	0.05***	
Log Leverage (t-1)		0.01***		
Log Net Leverage				0.03***
No. of observations	88,778	88,778	88,778	73,176

Table 2: Aggregate leverage and TFP

Dependent variable: TFP (t+1)		
	(1)	(2)
TFP	0.58***	0.59***
TFP (t-1)	0.08***	0.08***
Log age	0.189***	0.194***
Log sale	-0.404***	-0.411***
Log capex	0.007***	0.005***
Year	0.015***	0.016***
Log leverage		0.051***
Log Aggregate leverage	-0.313***	-0.336***
No. of Obs	88,778	88,778

We considered aggregate leverage by country and year and its relationship with firm level productivity. Here, the relationship seems to be the opposite (Table 2) – 10 per cent increase in aggregate leverage (at

the country level) leads to about 3 per cent decrease in firm level productivity. Interestingly, both impacts – individual and aggregate leverage to TFP – seem to co-exist (0.5 per cent increase in TFP when firm's leverage goes up by 10 per cent; while 3 per cent decline in firm's TFP when aggregate leverage goes up by 10 per cent) (see column 2). Furthermore, the results are robust to reducing the sample to countries with more than 1,000 firms in FactSet (Canada, China, France, Germany, Hong Kong SAR, India, Japan, Korea, Republic of Malaysia, Taiwan, the United Kingdom and the United States). Likewise, when we use year controls. Lastly, when we use a different measure of aggregate leverage – average log average[17] – the results hold and remain significant even after controlling for firm leverage (log leverage). Furthermore, the negative relationship between aggregate leverage and TFP holds when we control for financial development and GDP per capita (Table 3).[18]

Table 3: Controlling for level of development

Dependent variable: TFP (t+1)		
	(1)	(2)
TFP	0.62***	0.61***
TFP (t-1)	0.05***	0.05***
Log age	0.165***	0.158***
Log sale	-0.492***	-0.486***
Log capex	-0.003	-0.003
Year	0.016***	0.018***
Financial development	0.44***	0.44***
GDP per capita	-0.29***	-0.29***
Log leverage	0.036***	0.039***
Log aggregate leverage		-0.35***
No. of Obs	75,973	75,973

2. Impact of aggregate leverage controlling for country characteristics

In light of the negative association between aggregate leverage and the firm level TFP, we considered controlling for a broad measure of the strength of institutions in a country. One such index is the Economic Freedom Index (EFI) by the Heritage Foundation – they use 10 quantitative and qualitative factors which can be grouped into the following four broad categories: i) rule of law (property right, freedom from corruption); ii) limited government (fiscal freedom, government spending); iii) regulatory efficiency (business freedom, labour freedom, monetary freedom); and iv) open markets (trade freedom, investment freedom, financial freedom). When we use the EFI as our measure of the strength of institutions, we see that it does matter for future TFP of a firm and the association between aggregate leverage and TFP. In fact, when we interact the value of the index and the aggregate leverage, we see that for an increase in the value of the index leads to a positive relationship between aggregate leverage and TFP. In other words, even though the impact of aggregate leverage by itself on future TFP is negative, strength of institutions in a country seem to lower the magnitude of this negative impact

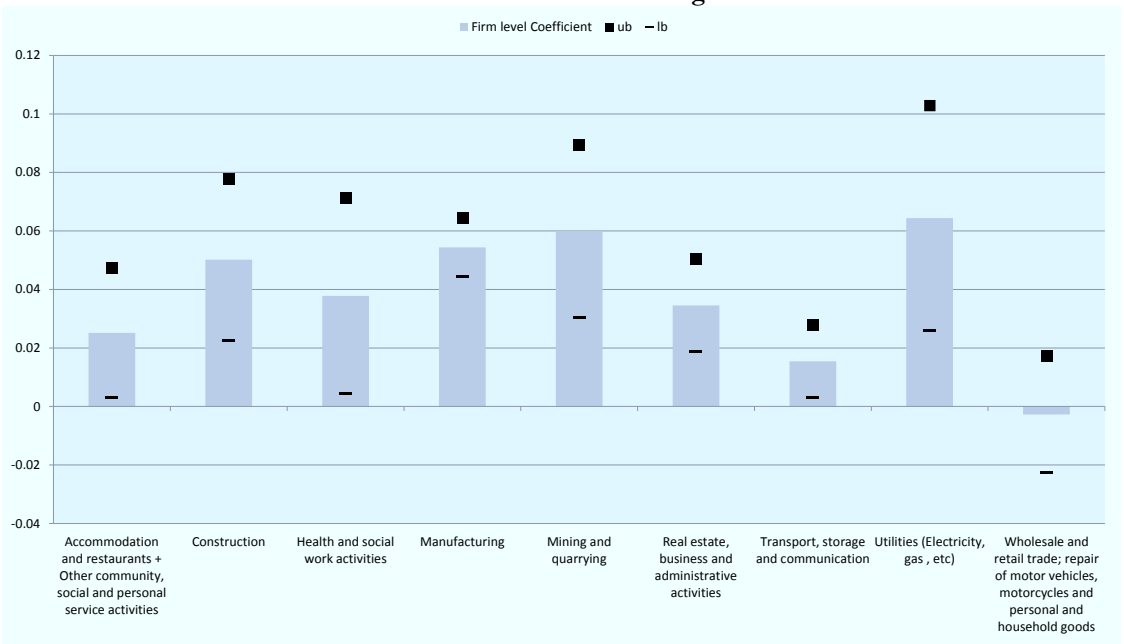
[17] This distinction is important; albeit the fact that both measures have a negative impact is significant, aggregate leverage could be driven by firms holding the most debt.
[18] For financial development we use the index of financial development by the IMF (Shahay et al, 2015).

3. Sectoral differences

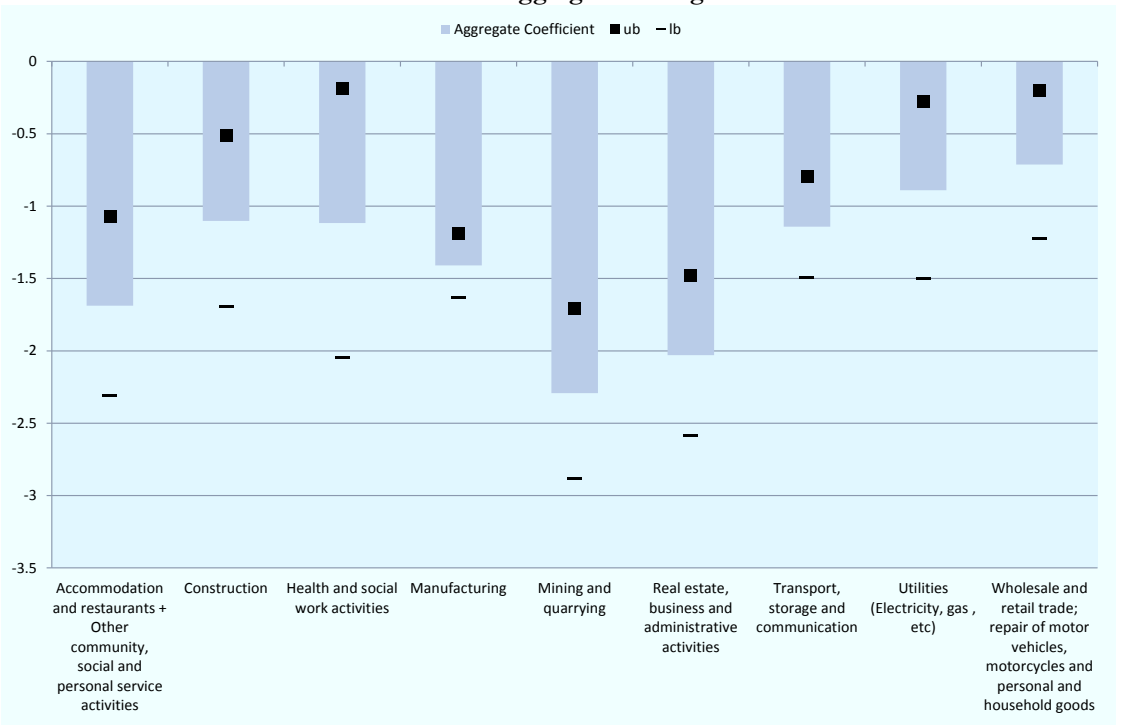
Meanwhile, when we re-do the analysis by dividing up the firms in our sample into sectors, we see similar results (panels A & B, Figure 5) – firm level leverage has a positive impact on future TFP while aggregate leverage (at the country level) has a negative impact on future TFP. In particular, sectors where firm level leverage has the most positive impact on future TFP include utilities, mining and quarrying, construction and manufacturing. On the other hand, when we look at the aggregate leverage, sectors where it has the most negative impact on future TFP include real estate, business and administrative activities and mining and quarrying. One sector where firm level leverage does not have a statistically significant impact but the aggregate leverage has a statistically significant negative impact on future TFP is wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods.

Figure 5: Leverage and TFP by broad sectors

Panel A: Firm level leverage



Panel B: Aggregate leverage



Note: the bars refer to coefficient estimates, while the dots (squares and lines) refer to the upper and lower bound of the estimates.

4. Addressing the issue of endogeneity

In this section we attempt to disentangle the positive relationship between firm leverage and future TFP. One of the explanations for our result is that future productivity of a firm tends to inform their borrowing decisions in the current period; hence, there could be reverse causality in the relationship between leverage and productivity (LW, 2014). In light of this, we decompose TFP into expected and unexpected components --- basically, one that is within the information set of the firm and one that is outside. The purpose of the analysis is to see whether the positive relationship stems from the relationship between leverage and *unexpected* component of TFP. Here we follow the methodology used by Levinsohn and Petrin (2003) and LW (2014), in particular the following:

$$\log va_{i,t} = c + \alpha\, logK_{i,t} + \beta\, logL_{i,t} + \omega_{i,t} + \eta_{i,t}$$

Where, $va_{i,t}$ is the value added for firm *i* in time *t* – it is sales minus the intermediates, while the latter is proxied by costs of goods sold (proxy of variable cost). Similarly, $K_{i,t}$ and $L_{i,t}$ are capital and labour inputs for firm *i* in time *t* – capital is proxied by plant and equipment over total assets and labour by total number of employees (see the appendix for a list of variables available through FactSet). Meanwhile, $\omega_{i,t}$ and $\eta_{i,t}$ denote the parts of TFP that are expected and unexpected to the firm in time *t*. Presumably, the known component impacts the material input decision of the firm (intermediates) while the unknown component has no impact on that decision. In order to obtain the expected and unexpected components of TFP, we use Levinson and Petrin (2003) approach -- TFP is regressed against a second degree polynomial of capital and intermediates inputs, thus the explanatory variables include: capital, capital square, intermediates, intermediates square and the interaction between capital and intermediates.[19] In this model, the residual is the unexpected component of TFP.

As Table 4 shows, the relationship between firm leverage and *unexpected* TFP is positive and statistically significant. In fact, a 10 per cent increase in firm leverage leads to an increase of 0.4 per cent TFP in period *t+1*. Somewhat surprisingly however, the relationship between *expected* TFP and leverage is negative and statistically significant; but, the magnitude is relatively small – 10 per cent increase in leverage is associated with 0.05 per cent decline in expected TFP. In any case, the more important result here is the one between unexpected component of productivity and firm leverage, as this casts aside concerns that the positive relationship between leverage and productivity could be due to reverse causality. If anything, our results show that the positive relationship between current leverage and future productivity is quite robust, reflecting the results obtained by LW (2014).

[19] Levine and Warusawitharana (2014) also follow the same approach. One small difference between our approach and theirs is that we add the constant c and $\omega_{i,t}$ as c is the average TFP and is perfectly predictable.

Table 4: Leverage and expected & unexpected TFP

Dependent variable: TFP (t+1)		
	Expected	Unexpected
	(1)	(2)
TFP	0.98***	0.46***
TFP (t-1)	-0.12***	0.065***
Log age	0.071***	0.069***
Log sales	-0.19***	-0.22***
Log capex	0.02***	-0.004***
Year	0.0037***	0.011***
Log leverage	-0.005***	0.042***
No. of Obs	88,612	88,612

5. Considering alternative measures of productivity, non-linearity and firm size

We repeat the above exercise by using labour productivity instead of TFP. We use two measures of labour productivity: i) value added per employee; and ii) sales per employee. As we saw with TFP before, using labour productivity does not fundamentally change the nature of the relationship. Indeed, 10 per cent increase in leverage at the firm level leads to 0.5 per cent increase in future labour productivity (value added per employee) of a firm and this result is statistically significant. Similarly, aggregate leverage is negatively associated with productivity.[20] When we use sales per employee as the measurement of labour productivity, the signs on the coefficients and significance stay the same but the magnitude is slightly smaller. Meanwhile, for other variables in our regressions, looking at labour productivity instead of TFP does not change the results that much.

Table 5: The effect of leverage on labour productivity

DV: Log VA/n(t+1)	Coefficient	DV: Log Sale/n(t+1)	Coefficient
Log VA/n	0.56***	Log Sale/n	0.64***
Log VA/n(t-1)	0.07***	Log Sale/n(t-1)	0.04***
Log Age	0.15***	Log Age	0.007***
Log Sales	-0.35***		
Log Capex	-0.00	Log Capex	-0.01***
Year	0.01***	Year	0.01***
Log Leverage	0.05***	Log Leverage	0.02***
Aggregate Leverage	-1.14***	Aggregate Leverage	-0.90***
No. of observations	92,085	No. of observations	257,283

Note: for the left hand side, value added per employee is the measure of labour productivity and for the right hand side, sales per employee is the measure of labour productivity.

[20] Note that in Table 5 aggregate leverage is not in logarithms.

Here we consider levels[21], and trim based on leverage[22] at the 99th percentile and enter leverage in both linear and quadratic form. There is a certain parabolic fit, however the point in which it will start decreasing is given by: $\beta_1 - 2|\beta_2|x^* = 0 \Rightarrow x^* = \frac{\beta_1}{2|\beta_2|}$, given than the 95 percentile of leverage is approximately 0.5, at least we would want the threshold to be 0.5, thus we would need equality in the coefficient. This is most definitely not the case. In short, the negative coefficient obtained on the quadratic term appears to reflect that a logarithmic transformation is more convenient -which is natural since estimated TFP is in log terms), but not a negative relationship above a reasonable threshold (Table 6). The results hold when we use net leverage.

Table 6: Allowing for non-linearity

Dependent variable: TFP (t+1)		
	(1)	(2)
TFP	0.61***	0.64***
TFP(t-1)	0.08***	0.10***
Log Age	0.2***	0.2***
Log Sales	-0.42***	-0.44***
Log Capex	0.00	0.00*
Year	0.01***	0.01***
Leverage	0.30***	
Leverage^2	-0.00***	
Net Leverage		0.31***
Net Leverage^2		-0.01***
No. of observations	88,670	72,461

Our results show that the effect of leverage decreases with firm employment, whether using the firms' average employment across all years or each employment observation. Using the average is our preferred specification because the estimated coefficients for productivity lags seem more consistent – due to avoiding the introduction of employment[23] at the firm level and moreover, differences across firms are perhaps the most interesting case. The negative relation can be seen in the sign of the interaction terms, which are negative in both cases (Table 7).

[21] As the objective is to assess a non-linear relation, a straight forward approach is to use linear and quadratic terms of the variable of interest. The use of levels instead of logs is required as a large share of observations in logs are negative, and this restrict the non-linearity rather arbitrarily since the quadratic term is v shaped and centred at a 100% leverage.

[22] Instead of partly using the information of observations above the threshold, as it is the case when Winsorizing, we follow trimming and discard said observations.

[23] Employment at time t is used to determine TFP at time t, therefore it is likely that the impact on contemporaneous values of TFP is due to collinearity.

Table 7: Relation to firm size (employment)

Dependent variable: TFP (t+1)		
	(1)	(2)
TFP	0.52***	0.49***
TFP (t-1)	0.043***	0.054***
Log age	-0.25***	0.057***
Log capex	-0.035***	-0.026***
Year	0.004***	0.001
Log leverage	0.0822**	0.113***
Log Employment	0.114***	
Average log employment		-0.142***
Interaction (leverage & emp)	-0.007***	-0.011***
	88,784	88,784

VI. Conclusion

To assess the impact of finance on growth, this paper examined the relationship between leverage and firm productivity by making use of a firm level database covering both advanced and developing & emerging economies. It showed that firm leverage has a positive and statistically and economically significant impact on future total factor productivity (TFP) -- 10 per cent increase in leverage for a firm in current period leads to a 0.5 per cent increase in TFP in future period. The results hold controlling for firm level determinants of TFP. In order to deal with the issue of endogeneity – firms take on more debt because they expect to be more productive in the future – we divide up our measure of TFP into expected and unexpected components (following the methodology first used by Levinson and Petrin, 2003). Our results show that there is an economically and statistically significant relationship between leverage and unexpected component of future TFP.

Meanwhile, when we repeat the above exercise by using labour productivity instead of TFP and we see very similar results -- 10 per cent increase in leverage at the firm level leads to 0.5 per cent increase in future labour productivity (value added per employee) of a firm and this result is statistically significant. Similarly, we see the negative relationship between leverage at the aggregate level and labour productivity at the firm level and the result is statistically significant. When we use sales per employee as the measurement of labour productivity, the signs on the coefficients and significance stay the same but the magnitude is slightly smaller. Meanwhile, we do not see a threshold effect and our results show that the effect of leverage decreases with firm employment.

Furthermore, we also examined whether aggregate leverage has an impact on firm level productivity and here the relationship seems to be the opposite – 10 per cent increase in aggregate leverage (at the country level) leads to about 3 per cent decrease in firm level productivity. The results are robust controlling for level of economic and financial development. Furthermore, strength of institutions matters for future TFP of a firm and the relationship between leverage and TFP. In fact, even though the impact of aggregate leverage by itself on future TFP is negative, strength of institutions in a country seem to lower the magnitude of this negative impact. Interestingly, both impacts – individual and aggregate leverage to TFP – seem to

co-exist and the results are robust to reducing the sample to countries with more than 1,000 firms in FactSet.[24] When we divide up our sample into different sectors, we see similar results.

The empirical evidence presented in our paper bridges the gap between micro studies that show that debt at the firm level has a positive impact on productivity and macro studies that show that too much debt could be a bad thing for firms and the overall economy. The mechanism through which we see this apparently confounding result (using the same data) needs to be explained further. Our priors include the following:[25] i) there are differences in cost of monitoring firms by creditors at the individual vs. aggregate level; ii) at the aggregate level, availability of easy capital tends to allow less productive firms to take on more debt; iii) there are negative externalities of excess leverage in the system; iv) the relationship between leverage and productivity at the firm level is linear but the relationship between the negative externalities at the aggregate level and the firm productivity is non-linear. Future research on the topic should delve into the potential channels through which increased leverage at the firm vs. aggregate level could have such disparate effects on firm productivity. This is of particular relevance to emerging and developing economies looking to further develop their financial markets, as our paper provides a note of caution.

[24] These include: Canada, China, France, Germany, Hong Kong SAR, India, Japan, Korea, Republic of Malaysia, Taiwan, the United Kingdom and the United States

[25] Please note that we don't have strong arguments yet to support these statements.

References

Aghion, Philippe; Howitt, P.; Mayer-Foulkes, D. 2005. "The Effect of Financial Development on Convergence: Theory and Evidence", *Quarterly Journal of Economics*, 120:173-222.

Arcand, J.-L., Berkes, E.; Panizza, U. 2012. Too Much Finance?, IMF Working Paper 12/161.

Arellano, M.; Bover, O. 1995. "Another look at the instrumental variable estimation of error component models", *Journal of Econometrics*, Vol. 68, No. 1, pp.29-51.

Arellano, M.; Bond, S. 1998. Dynamic panel data estimation using DPD98 for GAUSS: a guide for users, Mimeo, Institute for Fiscal Studies, London.

Arestis, P.; Demetriades, P. O.; Luintel, K. 2001. "Financial Development and Economic Growth: The Role of Stock Markets," *Journal of Money, Credit and Banking*, 33(1), 16-41.

Ayyagari, M.; Beck, T.; Demirgüç-Kunt, A. 2007. "Small and Medium Enterprises across the Globe", *Small Business Economics* 29:415-434.

Beck, T.; Chen, T.; Lin, C.; Song, F.M. 2012. "Financial Innovation: The Bright and the Dark Sides", HKIMR Working Paper 05/2012

Beck, T.; Demirguc-Kunt, A.; Levine, R. 2004. Finance, inequality, and poverty: Cross-country evidence, NBER Working Paper No. 10979.

Bond, S.; "Dynamic Panel Data Models: A guide to Micro Data Methods and Practice", CEMMAP working paper 2002.

Cecchetti, S. G.; Kharroubi, E. 2012. "Reassessing the impact of finance on growth," Bank of International Settlement (BIS), Working Paper No. 381.

Cihak, M.; Demirguc-Kunt, A.; Feyen, E.; Levine, R. 2013. "Financial Development in 205 Economies, 1960 to 2010," NBER Working Paper No. 18946.

Cochrane, J. H. 2013. "Finance: Function Matters, Not Size," NBER Working Paper No. 18944.

Deidda, L.; Fattouh, B. 2002. "Non-linearity between finance and growth," *Economics Letters*, 74, pp.339-345.

Easterly, W.; Islam, R.; Stiglitz, J. 2000. "Shaken and Stirred, Explaining Growth Volatility," Annual Bank Conference on Development Economics, World Bank, Washington DC.

Gennaioli, N.; Shleifer, A.; Vishny, R. 2012. "Neglected risks, financial innovation, and financial fragility," *Journal of Financial Economics*, 104, pp. 452-468.

IMF. 2013. "Central, Eastern and Southeastern Europe," *Regional Economic Issues*, April, 2013.

Kalemli-Ozcan, S.; Sorensen, B.; Volosovych, V. 2010. "Deep Financial Integration and Volatility," NBER Working Paper No. 15900.

Kalemli-Ozcan, S., B. Sorensen and S. Yesiltas. 2011. "Leverage across firms, banks and countries," NBER Working Paper No. 17354

Levine, O.; Warusawitharana, M. 2014. "Finance and Productivity Growth: Firm-level Evidence," Finance and Economics Discussion Series, Divisions of Research & Statistics and Monetary Affairs, Federal Reserve Board, Washington DC.

Mishkin, F. S. 2007. "Is Financial Globalization Beneficial?" *Journal of Money, Credit and Banking*, Blackwell Publishing, vol. 39(2-3), pages 259-294, 03.

Murphy, K.; Shleifer, A.; Vishny, R. 1991. "The Allocation of Talent: Implications for Growth", *Quarterly Journal of Economics*, 106(2): 503-30.

Philippon, T. 2007. Why has the U.S. financial sector grown so much? The role of corporate finance, NBER Working Paper No. 13405, revised Jan. 2008.

—; Reshef, A. 2007. Skill biased financial development: Education, wages and occupations in the U.S. financial sector, NBER Working Paper No. 13437.

—; Reshef, A. 2009. Wages and human capital in the U.S. financial industry: 1909–2006, NBER Working Paper No. 14644.

Rajan, R. G. 2010. Fault Lines: How Hidden Fractures Still Threaten the World Economy, Princeton University Press.

Rajan, R. G. 2005. "Has financial development made the world riskier?" Proceedings of the 2005 Jackson Hole Conference organized by the Kansas City Fed.

Rajan, R. G.; Zingales, L. 1998. "Financial dependence and growth," *American Economic Review*, 88, pp. 559-86.

Rioja, F.; Valev, N. 2004. "Does one size fit all? A re-examination of the finance and growth relationship," *Journal of Development Economics*, 74(2), pp. 429-447.

Robinson J. 1952. "The Generalization of the General Theory," in *The Rate of Interest and Other Essays*, Mac Millan, London.

Rodrik, D.; Subramanian, A. 2009. "Why Did Financial Globalization Disappoint?" IMF Staff Papers, 56(1), pp.112-138.

Schumpeter, J. A. 1911. "A Theory of Economic Development," Harvard University Press, Cambridge, MA.

Sahay, et al. 2015. "Rethinking Financial Deepening: Stability and Growth in Emerging Markets," IMF Staff Discussion Note.

Tobin, J., 1984, "On the Efficiency of the Financial System" in *Lloyd's Bank Review*, Vol. 153, pp. 1-15.

Appendices

Appendix 1: Sample Selection – FactSet

In-source selection: The FactSet database has an interface labelled "screening". This interface is one of the possible access pathways to the data for bulk download. The interface permits universe restrictions (type of data to retrieve) and variable selection. It is important to recall that the FactSet database is composed of securities, not firms –albeit some securities will contain the data of firms. In this step the universe was restricted as follows. First only securities which have an assigned economic sector (variable FG_FACTSET_SECTOR) are selected. This step removes securities unrelated to firms, such as financial derivatives or currency exchange rate. Second, only 10 years of data were retrieved, the period 2005-2014. This selection allows analysing data before, during and after the global financial crisis.

Variable id homogenization: Due to computational burden each variable is better retrieved separately. The id of each security in the FactSet database is in an extremely small number of cases not unique. The duplicates in terms of the id are removed from the sample – maintaining the first observation according to alphabetical and numerical order of the ids. In the variable most affected the number of securities removed is 172 of 119,822. In the variables least affected is 4 of 119,822.

Database merging: The FactSet database is under continuing updates, and downloading the data requires time. This leads to different variables presenting different number of securities. When merging, the sector variables and company name (which were obtained at the same time) is used as the master data. Observations that are not in the master data are removed. In the most affected variables this implied the removal of 23 securities, in the least affected only 1 security was removed. The merged sample contains 119,834 observations.

Removing duplicates: As the data contained are securities, the same firm can have several securities, for instance in account of being traded in different markets. In this step where the duplicates are removed, the data is in a long format, therefore the number of observations is not the number of securities, rather is the number of security-year observation. In the beginning of this step – consistent with the data above – there are 1,198,340 security year observations. In the next step crucial variables to identify duplicates are ensured existence. One crucial variable to identify the duplicates is FF_CO_NAME, the name of the company. Securities with a missing value of this variable are discarded, 81,700 observations are dropped. Securities with missing country are dropped as well (11,600 cases). Finally securities without any employment observations[26] during the whole sample are discarded (528,820 cases). Further discarding is done, removing 99,890 observations that share the same year, name, country and sector. Of those observations with different country and sector (but same year and name) the ones that share the same number of employees are removed, 94027. When possible to choose, the observation of a security is selected

[26] This step is the most restrictive one. To remove duplicates using the criteria described, it would suffice to drop securities with all missing values for employment and have another security or more sharing its company name. However as the focus of the use of the database is in labour market outcomes, we have removed all the firms that do not have any entry for employment – since it is the most densely covered labour market indicator.
[27] Securities sharing name, but not country and sector, generally presented a larger amount of coincidence in employment than in sales. Therefore the strictest requirement is used.

before others by having the largest employee and then sales data – consistent with consolidated accounting. Having removed duplicates, the remaining securities are referred to as firms.

Preparing data for trends and econometric analysis: In a first step observations with sales smaller than 0.1$ are set to missing (50,800 cases), as well as firms with 0 employees (4,676 cases). Further conditions are imposed to the rest of the variables, as non-negativity or forbidding that a component exceeds its container. For the econometric analysis the log transformation is used on the unrestricted data, this delivers the same results in terms of employment, but for sales only firms with 0 or less are set to missing (47,625).

Appendix 2: Descriptive statistics on leverage, debt and TFP

Table 8: Leverage across countries & independent territories

All countries	Median	5th percentile	95th percentile
Argentina	0.251	0.017	0.655
Australia	0.212	0.005	0.641
Austria	0.259	0.028	0.595
Bahrain	0.184	0.027	0.306
Bangladesh	0.322	0.022	0.786
Barbados	0.205	0.120	0.336
Belgium	0.255	0.023	0.583
Bermuda	0.353	0.054	0.673
Bosnia and Herzegovina	0.004	0.002	0.009
Botswana	0.160	0.062	0.397
Brazil	0.278	0.032	0.668
Bulgaria	0.251	0.020	0.607
Canada	0.266	0.011	0.943
Cayman Islands	0.134	0.019	0.851
Chile	0.259	0.042	0.515
China	0.306	0.061	0.599
Colombia	0.158	0.012	0.403
Costa Rica	0.273	0.271	0.441
Croatia	0.255	0.018	0.633
Curacao	0.337	0.301	0.633
Cyprus	0.313	0.049	0.696
Czech Republic	0.189	0.010	0.509
Côte d'Ivoire	0.193	0.028	0.642
Denmark	0.270	0.031	0.607
Ecuador	0.126	0.067	0.219
Egypt	0.268	0.021	0.583
Estonia	0.243	0.005	0.571
Faeroe Islands	0.242	0.123	0.314
Finland	0.286	0.034	0.633
France	0.216	0.020	0.532
Germany	0.214	0.013	0.583
Ghana	0.383	0.041	0.837

Greece	0.344	0.059	0.676
Guernsey	0.582	0.001	0.810
Hong Kong SAR, China	0.226	0.016	0.625
Hungary	0.170	0.005	0.444
Iceland	0.435	0.196	0.627
India	0.353	0.038	0.736
Indonesia	0.347	0.019	0.902
Iraq	0.108	0.080	0.135
Ireland	0.262	0.014	0.615
Isle of Man	0.375	0.007	0.648
Israel	0.324	0.022	0.733
Italy	0.277	0.030	0.565
Jamaica	0.088	0.013	0.367
Japan	0.260	0.017	0.627
Jordan	0.210	0.035	0.516
Kazakhstan	0.232	0.009	0.588
Kenya	0.225	0.015	0.542
Korea, Republic of	0.316	0.038	0.653
Kuwait	0.235	0.033	0.545
Latvia	0.263	0.044	0.666
Lebanon	0.209	0.033	0.326
Liberia	0.431	0.138	0.559
Lithuania	0.299	0.006	0.587
Luxembourg	0.256	0.028	0.777
Malawi	0.162	0.011	0.356
Malaysia	0.242	0.012	0.618
Malta	0.266	0.107	0.545
Mauritius	0.269	0.023	0.471
Mexico	0.250	0.036	0.522
Morocco	0.187	0.020	0.526
Namibia	0.135	0.004	0.231
Netherlands	0.242	0.023	0.554
New Zealand	0.276	0.047	0.613
Nigeria	0.277	0.045	0.615
Norway	0.363	0.061	0.690
Oman	0.335	0.046	0.866
Pakistan	0.386	0.038	0.753
Panama	0.396	0.271	0.514
Peru	0.249	0.030	0.596
Philippines	0.268	0.027	0.617
Poland	0.182	0.010	0.502
Portugal	0.331	0.053	0.652
Qatar	0.217	0.024	0.719
Romania	0.209	0.017	0.615
Russian Federation	0.279	0.027	0.651
Saudi Arabia	0.257	0.030	0.552

Serbia	0.267	0.050	0.550
Singapore	0.211	0.009	0.543
Slovakia	0.260	0.023	0.595
Slovenia	0.302	0.063	0.623
South Africa	0.168	0.010	0.547
Spain	0.258	0.018	0.566
Sri Lanka	0.256	0.021	0.614
Sweden	0.237	0.024	0.560
Switzerland	0.250	0.022	0.577
Taiwan, China	0.266	0.046	0.536
Tanzania, United Republic of	0.032	0.001	0.316
Thailand	0.351	0.014	0.797
Yugoslav Republic of Macedonia	0.083	0.054	0.294
Trinidad and Tobago	0.186	0.009	0.592
Tunisia	0.278	0.028	0.663
Turkey	0.249	0.021	0.673
Uganda	0.284	0.028	0.537
Ukraine	0.245	0.046	0.675
United Arab Emirates	0.232	0.021	0.653
United Kingdom	0.196	0.012	0.589
United States	0.276	0.011	1.011
Venezuela	0.159	0.024	0.379
Viet Nam	0.330	0.052	0.662
Virgin Islands, British	0.207	0.032	0.690
West Bank and Gaza Strip	0.166	0.013	0.467
Zambia	0.255	0.003	0.719
Zimbabwe	0.178	0.028	0.650

Note: leverage is debt over assets.

Table 9: Debt across countries & independent territories

Log Debt	**Average**	**5 percentile**	**95 percentile**
Argentina	3.87	0.29	7.20
Australia	2.50	-2.87	7.03
Austria	4.27	0.97	7.77
Bahrain	3.68	1.95	7.05
Bangladesh	2.83	0.09	5.28
Barbados	5.14	4.26	6.10
Belgium	3.95	0.08	7.87
Bermuda	4.24	0.93	6.96
Bosnia and Herzegovina	1.26	0.39	2.02
Botswana	1.83	0.12	3.36
Brazil	4.91	1.33	8.24
Bulgaria	2.40	-1.16	5.03

Canada	3.04	-1.79	7.47
Cayman Islands	3.04	-0.76	5.71
Chile	4.13	0.62	7.40
China	4.54	1.91	7.52
Colombia	4.04	-0.44	7.51
Costa Rica	5.94	5.47	6.56
Croatia	3.25	0.30	5.48
Curacao	3.64	3.47	3.92
Cyprus	3.27	0.32	6.02
Czech Republic	3.73	0.74	7.17
Côte d'Ivoire	3.17	0.28	5.01
Denmark	3.44	0.00	6.71
Ecuador	3.62	2.81	5.00
Egypt	3.83	0.45	7.03
Estonia	2.90	-1.25	7.01
Faeroe Islands	2.72	2.02	3.30
Finland	4.12	0.42	7.56
France	3.60	-0.65	8.51
Germany	3.72	-0.21	7.92
Ghana	2.62	-1.85	5.55
Greece	3.69	0.74	6.58
Guernsey	4.34	-1.99	9.04
Hong Kong SAR, China	3.57	-0.44	7.45
Hungary	2.58	-1.22	7.32
Iceland	5.00	3.24	7.30
India	2.92	-0.53	6.33
Indonesia	3.54	-0.39	6.88
Iraq	5.56	5.33	5.79
Ireland	3.60	-1.26	7.59
Isle of Man	3.27	-0.87	6.44
Israel	3.35	-0.50	7.16
Italy	4.66	1.21	8.29
Jamaica	2.10	-0.79	4.95
Japan	4.30	0.99	7.93
Jordan	2.31	0.03	4.76
Kazakhstan	3.75	0.65	6.42
Kenya	3.15	0.00	6.13
Korea, Republic of	3.97	0.83	7.55
Kuwait	3.81	0.85	6.63
Latvia	1.95	-1.96	5.83
Lebanon	3.30	1.46	4.52
Liberia	4.63	3.20	5.39
Lithuania	2.92	0.46	5.24
Luxembourg	5.32	2.31	8.60
Malawi	2.26	0.86	3.35
Malaysia	2.76	-1.11	6.18

Malta	2.94	0.55	5.98
Mauritius	3.74	-0.51	5.70
Mexico	5.16	1.87	8.05
Morocco	3.65	0.69	6.87
Namibia	2.54	-0.09	3.50
Netherlands	4.40	0.65	8.50
New Zealand	3.58	-0.53	7.27
Nigeria	3.18	0.24	6.38
Norway	4.41	0.79	7.64
Oman	2.47	-0.07	5.63
Pakistan	2.76	-0.46	5.67
Panama	6.78	6.15	7.10
Peru	3.40	0.09	6.19
Philippines	3.74	-0.07	7.31
Poland	2.10	-2.03	5.60
Portugal	4.42	1.18	8.21
Qatar	5.15	1.70	8.83
Romania	2.74	0.01	6.22
Russian Federation	5.26	1.95	8.59
Saudi Arabia	4.84	1.22	8.88
Serbia	3.45	0.58	6.95
Singapore	2.77	-1.15	6.33
Slovakia	3.46	0.81	5.87
Slovenia	4.00	0.22	6.71
South Africa	2.86	-1.24	6.66
Spain	4.74	0.95	9.22
Sri Lanka	1.70	-2.09	4.60
Sweden	3.50	-1.30	7.74
Switzerland	4.62	1.63	7.90
Taiwan, China	3.46	0.62	6.57
Tanzania, United Republic of	1.23	-1.58	4.66
Thailand	3.11	-1.11	6.61
The former Yugoslav Republic of Macedonia	2.36	1.55	2.79
Trinidad and Tobago	3.06	-0.33	5.57
Tunisia	2.66	0.22	5.85
Turkey	3.60	0.28	7.06
Uganda	2.25	-1.36	4.85
Ukraine	3.59	1.33	5.77
United Arab Emirates	4.86	1.38	8.68
United Kingdom	3.00	-1.39	7.52
United States	3.59	-1.25	8.15
Venezuela	3.90	0.63	8.19
Viet Nam	2.17	-0.74	4.94
Virgin Islands, British	2.48	-1.26	6.54
West Bank and Gaza Strip	2.24	-1.76	4.79
Zambia	3.48	-1.78	6.20

Zimbabwe	2.81	0.47	5.52

Note: debt refers to total debt -- includes both short-term and long-term debt.

Table 10: Measured effect of leverage on TFP (t+1), by country

	Coefficient Firm Leverage	Coefficient Aggregate Leverage
Argentina	0.05	-1.84
Australia	0.06	-0.91
Austria	0.17	-2.79
Bahrain	-0.11	
Bangladesh	-0.24	-2.43
Belgium	0.08	-0.65
Bermuda	1.24	5.83
Brazil	0.09	-3.00
Bulgaria	-0.07	0.54
Canada	-0.13	-1.67
Chile	0.16	-0.37
China	0.07	-1.50
Colombia	0.05	-1.16
Croatia	0.24	-3.62
Cyprus	-0.03	-2.11
Czech Republic	-0.01	-1.16
Denmark	0.00	-0.41
Egypt	-0.06	-5.25
Estonia	-0.04	-1.57
Faeroe Islands	7.53	-36.55
Finland	0.05	-1.67
France	0.04	-1.93
Germany	0.02	0.08
Ghana	-0.82	
Greece	0.02	-1.18
Hong Kong SAR, China	0.03	-0.11
Hungary	0.05	-1.93
Iceland	-0.21	0.47
India	0.05	-2.04
Indonesia	-0.01	-1.88
Ireland	0.05	2.05
Israel	-0.03	-0.54
Italy	0.08	-0.45
Jamaica	-0.01	-4.78
Japan	0.18	-1.28
Jordan	-0.04	-1.68
Kazakhstan	0.33	-12.60

Kenya	-0.24	2.11
Korea, Republic of	0.10	-2.33
Kuwait	0.24	-1.45
Latvia	0.14	-1.87
Lithuania	-0.04	2.19
Luxembourg	0.04	-0.59
Malaysia	0.05	-3.40
Malta	0.01	3.74
Mauritius	-0.01	0.12
Mexico	0.02	-4.08
Morocco	-0.10	-1.28
Namibia	-0.34	3.96
Netherlands	-0.01	-1.04
New Zealand	0.13	-1.34
Nigeria	0.18	-0.73
Norway	0.10	-2.49
Oman	-0.10	0.05
Pakistan	-0.06	-1.64
Peru	0.06	-5.76
Philippines	-0.02	-0.37
Poland	0.02	-1.78
Portugal	0.05	-0.21
Qatar	0.06	1.97
Romania	0.02	1.87
Russian Federation	-0.02	-2.03
Saudi Arabia	0.00	-4.11
Singapore	0.04	-0.90
Slovakia	-0.06	-1.79
Slovenia	-0.25	2.68
South Africa	-0.04	-3.96
Spain	0.02	0.54
Sri Lanka	0.05	-1.75
Sweden	0.04	-1.96
Switzerland	0.04	-0.31
Taiwan, China	0.08	-2.59
Tanzania, United Republic of	-0.05	
Thailand	0.11	0.53
The former Yugoslav Republic of Macedonia	0.13	-2.43
Trinidad and Tobago	-0.11	5.74
Tunisia	-0.02	
Turkey	0.06	-2.18
Ukraine	0.00	-21.09
United Arab Emirates	-0.01	-1.77
United Kingdom	0.03	-2.74
United States	0.03	-1.82

Viet Nam	-0.09	-0.15
West Bank and Gaza Strip	-0.10	-21.03
Zambia	0.09	1.19
Zimbabwe	0.08	

Note: not all the coefficients are statistically significant, particularly the ones for aggregate leverage.

Appendix 3: Variables and number of firms by country

Table 11: Variable coverage of Factset

Performance Measures	TFP: Sales/ Employment
	Margin: OIBDP/Sales
	Sales
	Employment
	Wages: Labour Expenses/Employees
	Investment by Sales : Capex / Sales
	Firm death rate: Firms with 1st year inactive/Total active firms
	Firm birth rate: Firms with 1st year active/Total active firms
Financial Measures	Equity to Debt Ratio: Total Debt/Total Equity
	Cash and ST of total assets: Cash and Equivalents / Total Assets
	Short Term to Long Term Debt: Short Term Debt /Long Term Debt
	Net Debt to sales: Net Debt / Sales
	Interest expense on debt to sales: Interest Expense / Sales
	Plant and Equip to total assets: Plant and equipment / Total Assets
	Equipment to total assets: Equipment / Total Assets
	Intangible to total assets: Intangible Assets / Total Assets
	Selling General and Admin to Sales: Selling, General and Administrative Expenses/Sales
	ST Recivables to assets: Short term receivables / Assets
Tax Measures	Income Tax to Sales: Income tax / Sales
	Income Tax to Assets: Income Tax/ Total Assets
	Income Tax to Cash: Income Tax / Cash and equivalents
	Income Foreign Tax to Sales: Foreign Income Tax / Sales
	Income Foreign Tax to Assets: Foreign Income Tax /Total Assets
	Income Foreign Tax to Cash: Income Foreign Tax / Cash and Equivalents
"Globalization" measures	Domestic Sales of Total Sales: Domestic Sales / Sales
	Domestic Assets of Total Assets: Domestic Assets / Total Assets
Other	Price to Book Ratio: Market price / Book Value (Weighted by Sales)
	Days held of inventory: Days of inventory (Weighted by Sales)

Table 12: Data sample: country coverage using Factset

Entity	No. of Firms	Entity	No. of Firms	Entity	No. of Firms	Entity	No. of Firms
All countries	**71,672**	Netherlands	396	Bulgaria	111	Serbia	24
United States	18,918	Turkey	393	Cyprus	95	Trinidad and Tobago	22
Japan	5,200	Denmark	371	Czech Republic	93	Cayman Islands	20
United Kingdom	5,049	Spain	353	Romania	90	Malta	20
Canada	5,037	Philippines	307	Luxembourg	87	Zambia	19
China	3,611	Pakistan	299	Morocco	85	Estonia	18
India	3,368	Belgium	297	Colombia	82	Malawi	12
Australia	2,889	Sri Lanka	289	Hungary	70	Lebanon	10
Korea, Republic of	2,163	Chile	287	Tunisia	70	Iraq	8
Taiwan, China	2,157	New Zealand	259	Kenya	58	Tanzania, United Republic of	8
France	1,791	Jordan	242	Slovenia	53	Virgin Islands, British	8
Germany	1,600	Mexico	236	Venezuela	52	Namibia	7
Hong Kong SAR, China	1,532	Finland	227	Qatar	47	Ecuador	7
Malaysia	1,301	Egypt	226	Bahrain	46	Uganda	6
Singapore	928	Kuwait	219	West Bank and Gaza Strip	45	Isle of Man	6
South Africa	907	Austria	201	Mauritius	45	Jersey	4
Sweden	868	Peru	176	Slovakia	44	Barbados	3
Thailand	750	Ireland	169	Bermuda	43	The former Yugoslav Republic of Macedonia	3
Viet Nam	637	Saudi Arabia	169	Lithuania	41	Panama	3
Brazil	631	Nigeria	168	Kazakhstan	40	Costa Rica	2
Israel	628	Ukraine	166	Jamaica	33	Faeroe Islands	2
Poland	627	Portugal	154	Guernsey	31	Bosnia and Herzegovina	2
Italy	583	Oman	131	Zimbabwe	31	Antigua and Barbuda	1
Indonesia	566	Argentina	131	Iceland	30	Bahamas, The	1
Norway	520	United Arab Emirates	126	Côte d'Ivoire	29	Curacao	1
Switzerland	515	Croatia	121	Latvia	26	Georgia	1
Russian Federation	478	Bangladesh	116	Ghana	25	Liberia	1
Greece	443			Botswana	25		