Financial Development and TFP Growth: Cross Country and Industry Level Evidence

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Abstract

We estimate the impact of financial development on industry-level TFP growth using a largely unexploited panel of 77 countries with data for 26 manufacturing industries for the years 1963 to 2003. We find a significant relationship between financial development and industry-level TFP growth when controlling for country-time, and industry-time fixed effects. Our results are both statistically and economically significant. TFP growth can accelerate up to 0.6% per year, depending on the external finance requirement of industries, following a one standard deviation increase in financial development. Our results are robust to different samples and specifications.

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1. Introduction

Evidence on the link between financial development and economic growth is abundant. Many studies based on cross-country aggregate data find a positive effect of various measures of financial development on growth.[1] One of the most amply studied mechanisms through which credit can impact growth is the productivity channel.[2] Both from a theoretical perspective, as well as from an empirical one, there is support for the idea that credit can increase total factor productivity.

The basic idea of financial development affecting productivity is based on Schumpeter (1912) and Bagehot (1873). The main intuition is that financial markets enhance productivity through efficient capital reallocation in the process of creative destruction, shifting capital from declining industries to those with good growth prospects. In fact, and as shown by recent work by Hsieh and Klenow (2007) and Restuccia and Rogerson (2007) among others, the lower TFP of developing countries can be explained by the misallocation of resources across productive units.

When financial frictions are present, the misallocation of resources is increased. As financial systems develop, and financial frictions are reduced, the information and transactions costs associated to capital reallocation are lowered and TFP is boosted. Several papers provide an analytical basis for this idea.[3] Most of them provide models describing how financial restrictions lead to an inefficient allocation either across sectors or across activities with differential productivities.[4] The empirical evidence available is in general supportive of the predictions of these models.[5]

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[1] Most of the studies showing strong links between financial development and growth are based on cross sectional growth regressions (see, for instance, King and Levine (1993a), King and Levine (1993b), Levine (1997), Levine and Zervos (1998)), others on pooled time series-cross sectional country level data (see Beck et al. (2000) and Levine et al.(2000)). At the macro level depth of access is negatively correlated with poverty rates (Levine 1997, Honohan 2004).

[2] As discussed by Levine (2004), the channels through which finance operates include higher savings rates, greater investment, technological innovations and productivity gains.

[3] See Levine (1997) and Bencivenga, Smith and Starr (1995) for a general discussion.

[4] Buera and Shin (2008), Buera et al (2008), Aghion et al (2005), and Greenwald et al (1990), are examples of this literature.

[5] See, for example, Hartmann et al (2007), and Fisman and Love (2004)

The focus of this paper is to test the relationship between TFP growth and financial development building on these insights. In particular, this paper is an extension of the empirical literature documenting the link between productivity and financial markets, and is intended to fill important gaps found in such literature.

On the one hand we circumvent difficult identification issues arising in pure cross country studies by using a sectoral dataset. On the other hand we contribute to the existent literature that uses sectoral datasets to test the impact of financial development on productivity enhancing activities, by estimating the direct impact of financial development on productivity growth rather than on intermediate outcomes.

We find that financial development is a significant (both statistically and economically speaking) determinant of total factor productivity growth. Our estimates suggest that a one standard deviation increase in financial development can lead to up to an increase of 0.6% per year in productivity growth, depending on the external financing requirements of the industry. These results are robust to changes in the empirical specification. We also find that the impact of financial development on productivity can be hampered by macroeconomic volatility.

The rest of the paper is organized as follows. In section 2, we review the recent theoretical and empirical literature on financial development and productivity based on sectoral data. In section 3 we describe our measures of productivity. Section 4 describes the methodology used in this study. In sections 5 and 6 we present the baseline results and some robustness exercises and extensions.

2. Financial Development and Productivity: what do we know?

Several theoretical models explore the channels through which financial frictions lead to an inefficient allocation of resources in the economy. Buera and Shin (2008) extend a neoclassical model to incorporate entrepreneurship and financial frictions. In their model productivity is constrained given that capital allocation is hampered by the fact that talented and highly productive entrepreneurs cannot enter the market given that they need to accumulate capital to use as collateral and overcome financial frictions.

Buera et al (2008) develop a model with tradable and non-tradable sectors that differ in the size of the fixed costs needed to pay to operate. They show that financial frictions disproportionally affect TFP in the tradable sector where fixed costs are higher. In their model lower financial development leads to inefficient capital allocation, and is biased towards the lower productivity activities.

Aghion et al (2005) show that under the assumption that firm investment can be divided between short term and long term productivity enhancement investment with higher liquidity risk, credit constraints lead to less of the longer term one. With credit imperfections long term investment becomes procyclical and the business cycle is amplified because long term investment may be interrupted by a liquidity shock that reduces the desire to engage ex ante in them, the more so in recessions when liquidity is scarce[6].

Greenwald et al (1990) focus on failures in markets for the sale of equity securities, and on the failure of markets to diversify the risks of real investments. Productivity is modeled in two ways: learning by doing and the cumulative impact of investment in technology. Financial constraints in their model push firms away from productivity enhancing operations such as investment in technology or in on-the-job training.

Overall, empirical evidence is supportive of these channels. In a cross-country growth regression framework, Beck et al (2000) and Levine and Zervos (1998) among others, show that financial development positively and significantly affects total factor productivity.[7] In contrast they find that measures of financial development do not have a significant impact on the quantity of investment. This finding suggests that the impact of financial development does not come through capital accumulation, but rather

[6] The authors also present econometric results showing that deeper financial development reduces the volatility of the business cycle.

[7] In similar lines, Behr and Lee (2005) show that when mechanisms to transfer credit risk are in place, productivity enhancement investments are stimulated and the mechanism strengthened.

through other forms of productivity enhancement investments such as investment in R&D, technology, or on the job training, among others.

Other authors are slightly less enthusiastic and argue that the productivity channel is restricted to certain stages of economic development. Rioja and Valev (2003) for example, argue that the channel through which financial development affects growth depends on the stage of development of each economy and that the productivity channel is restricted mostly to developed countries. These authors test Acemoglu, Aghion and Zilibotti's (2002) claim about how stages of development differ in determining a country's growth strategy. The main idea is that less developed countries adopt a capital accumulation strategy in which there is less innovation and productivity growth. In these countries the financial sector finances capital accumulation usually in the more established firms. The capital stock can be raised, increasing labor productivity, but TFP may remain unaltered. In developed countries there is a stronger incentive for TFP improvement via innovation and technological developments, since firms compete across countries with similar capital stocks. Financial markets in these economies fund these innovations leading to larger productivity gains.[8] Rioja and Valev test this in a panel of countries and find that that in less developed countries finance affects capital accumulation more than in developed ones and that the contrary happens with TFP.[9]

While cross country studies on the impact of credit on productivity are abundant in most cases they fail to properly address endogeneity problems arising from the fact that aggregate TFP growth can also affect the supply of credit. Most papers try to overcome this by instrumenting financial development with past values of itself and other variables of the dataset in many cases using dynamic panel data approaches. An alternative to this strategy is using less aggregated data, and identifying the impact of financial development through other mechanisms.

[8] In a similar spirit, Lee (1996) shows that learning by doing is enhanced as investment grows.

[9] Fink, Haiss, Mantler (2005) in a European study find that in transition economies the productivity nexus is stronger than in market economies.

Studies using less aggregated data sets, such as industry level data, that allow for more effective ways of identifying the credit-productivity nexus are scarce. Moreover, most of these studies focus on intermediate links between financial development and productivity rather than on the final impact.

Using a sample of European countries, Hartmann et al (2007) show that financial development in European countries has led to faster capital reallocation. The authors test directly the Schumpeterian channel by creating an index of capital reallocation across economic sectors and testing if financial development alters the velocity with which capital is allocated towards most profitable uses. The study is conducted using a two step methodology. In the first step sectoral investment is regressed on sectoral value added growth, time, country and industry effects. This estimation yields an elasticity of investment to value added (a proxy for profit opportunities). This elasticity is then used as the measure for reallocation speed. In a second stage reallocation speed is regressed on several explanatory variables including financial development. The authors conclude that deeper credit markets enhance capital reallocation and through this mechanism increases economy wide productivity growth, thought here is no direct test on the impact on productivity.

Fisman and Love (2004) also conduct a sectoral level experiment to test how financial development affects productivity growth. The authors use the Rajan and Zingales (1998) framework to identify industries relying on external finance to test how financial development affects growth in the short and in the long run. The authors find that regardless of the reliance on external finance, in the short run financial development promotes growth by allocating funds towards the most profitable investments, a result in line with the Hartmann et al (2007) paper. They find that in the long run, more financially developed countries allocate a higher share of resources towards the sectors that rely most on external finance. These financially dependent industries, as noted by the authors are also the most likely to invest in R&D and technology. In this sense, in the long run, access to credit, stimulates greater productivity growth. Productivity in this paper is more linked with a concept of TFP that is increasing the returns on each factor of production, rather than exploiting profitable opportunities as in Hartmann et al.

As noted by Papaioannou (2007), there are other sectoral studies that follow this line of research. Wurgler (2000), Fisman and Love (2003), Bekaert et al (2007), Ciccione and Papaioannou (2006), are similar types of studies showing how deeper credit markets allow sectors to exploit technological innovations better. In countries with deeper credit markets sectors that are more likely to stimulate technical progress are able to attract funding. Through this channel, access to credit fosters productivity gains.

In a similar spirit, Beck, Demirguc-Kunt, Laeven and Levine (2004) employ a cross country, cross industry approach to explore the effect of financial sector efficiency on firm entry. They construct a variable measuring the industry reliance in each country on small firms and find that industries with a high share of small firms grow faster in financially developed countries. This result can be interpreted not necessarily on credit impacting total factor productivity, but more likely on credit enhancing labor productivity by allowing small firms to accumulate capital, and graduate faster from SMEs to larger firms.

Notably, papers using sectoral data do not test directly if financial markets impact TFP, rather they explore if they affect intermediate outcomes that presumably increase TFP. Our paper fills in this gap by exploring the impact of financial development on TFP growth using a cross industry, cross country dataset.

3. TFP Estimation

The first step to address the main objective of this paper is to estimate industry level TFP. We use a panel of 77 countries with data for 26 manufacturing industries for the years 1963 to 2003. The source is the United Nations Industrial Development Organization (UNIDO) database. In particular we exploit the information available at the cross-country, industry and time dimensions on the number of employees, value-added and gross fixed capital formation (the last two are in current US dollars) to construct TFP growth for these industries and analyze how it is affected by financial development.

Taking advantage of the data on capital formation, we construct series of capital stocks for each industry in every country using a perpetual inventory approach, where the initial capital K_0 is defined, following Caselli (2005), by equation (1) (country, industry and time subscripts are omitted):

$$K_0 = \frac{I_0}{g + \delta} \quad (1)$$

In equation (1) I_o represents real gross fixed capital formation for a given industry for the first year when the data is available, *g* corresponds to the average growth rate of output in that industry for the entire sample period (1963-2003), and δ constitutes the depreciation rate of physical capital that we set equal to 6%.

Having determined the initial capital stock K_0, then the equation of motion of capital (2) yields the estimates for the capital stocks for the subsequent years.

$$K_t = (1-\delta) * K_{t-1} + I_{t-1} \qquad (2)$$

This procedure is applied for the 26 industries in all countries where data is available. Having constructed the physical capital stock series for every country and industry for the complete timeframe, we proceed to compute three alternative measures of TFP that we subsequently use in the estimation.

The starting point in all three measures is an industry-level production function, which we assume to be a standard Cobb-Douglas function with technological coefficients α (for physical capital) and β (for labor):

$$Y_{i,c,t} = A_{i,c,t} K_{i,c,t}{}^{\alpha} L_{i,c,t}{}^{\beta} \quad (3)$$

Where Y, A, K and L are: real value added, total factor productivity, real capital stock, and labor respectively.[10] We are interested in finding a measure for A for every industry and country in every year ($A_{i,c,t}$). The first proxy we use is *ltfp,* which is defined as the residual from the following regression:

[10] We transform the series to constant prices using US Consumer Price Index base 2000 taken from the IMF International Financial Statistics (IFS). The list of countries industries and time periods as well as descriptive statistics of the data used in the study is reported in the appendix.

$$y_{i,,c,t} = \sum_{i=1}^{26} \alpha_i k_{i,c,t} + \sum_{i=1}^{26} \beta_i l_{i,c,t} + \eta_i + \lambda_c + \varepsilon_{i,c,t} \qquad (4)$$

Equation (4) is the result of the log-linearization of equation (3), where *y*, *k* and *l* refer to the natural logarithm of value added, capital and labor, respectively, and η_i and λ_c are industry and country fixed-effects. Coefficients α and β are estimated by OLS. We allow these coefficients to vary across industries, but not across countries or over time. As explained, the measure of TFP is derived from the residuals of the regression.

A drawback for this first method is that equation (3) could be miss-specified (for example, due to endogeneity of the regressors or to omitted variable bias). In that case, the residuals from that regression might be unreliable. Therefore, we seek alternative methods of estimating TFP at the industry level that do not rely on estimating equation (3).[11]

The second measure of productivity we calculate is *ltfp1,* defined as a growth accounting residual of the log-linearized version of (3), where we use the standard values of 0.3 and 0.7 for the capital and labor shares in the production function. Under the assumption of Cobb-Douglas production functions and perfect competition, these shares are the technological coefficients of the production function. Thus, *ltfp1* is given by equation (5):

$$ltfp1_{i,c,t} = y_{i,c,t} - 0.3k_{i,c,t} - 0.7l_{i,c,t} \qquad (5)$$

A drawback of this methodology is the restrictive assumption of fixed coefficients across industries. Thus, we construct an alternative third measure that improves on this dimension. This new proxy (*ltfp2*) is calculated in two steps: first, we use US aggregate data to estimate the rate of return for physical capital in the US. Then, assuming that this rate of return is the same for all industrial sectors in the country, we use it to compute industry specific capital and labor coefficients for the 26 industrial sectors.

[11] Ideally we would wish to instrument K and L in a way in which we could overcome the endogeneity problem, however due to data limitations we do not follow this course of action.

More specifically, the procedure is as follows: first we use the labor share α_L for the Unites States economy estimated by Bernanke and Gurkaynak (2001) to infer the capital share α_K for that country. Assuming constant returns of scale for the technological process we have that the capital share α_K is equal to:

$$\alpha_K = 1 - \alpha_L \quad (6)$$

Under perfect competition and Cobb Douglas production function, the following relationship holds at the economy-wide level:

$$\alpha_K = \frac{r * K}{VA} \quad (7)$$

Where K is the capital stock, VA the value added for the US economy and r is the rate of return to physical capital. Thus:

$$r = \frac{\alpha_K * VA}{K} \quad (8)$$

We use (6) and (8) to infer a rate of return of capital *r* for the United Sates. For this purpose, we use data from the National Bureau of Economic Research's Manufacturing Industry Productivity Database for VA and K. Once we have estimated *r,* we can estimate α_{Ki}, i.e., the capital share *for each* industry assuming that *r* remains constant for the entire manufacturing sector:

$$\alpha_{Ki} = \frac{K_i}{VA_i} * r \quad (9)$$

Next, we assume that these capital shares are the same in the other countries. Thus, the TFP measure, *ltfp2*, corresponds to the growth accounting residual of the log-linearized version of (3) that is obtained using α_{Ki} and the correspondent $\alpha_{Li} = 1 - \alpha_{Ki}$ as the capital and labor technological coefficients respectively, for each industry in every country/year:

$$ltfp2_{i,c,t} = y_{i,c,t} - \alpha_{Ki} k_{i,c,t} - (1 - \alpha_{Ki}) l_{i,c,t} \quad (10)$$

Thus, this measure of TFP is very similar to the previous one, with the added benefit that the technological coefficients vary across industries. For all of the aforementioned reasons, our preferred estimate of TFP is *ltfp2.* Despite this, it is worth noting that the correlation between the three measures is very high, especially in growth rates which is the basis of the empirical analysis that we perform in this paper (see Table 1). Thus, in the regressions below we use *ltfp* and *ltfp1* as robustness checks.

In order to get an intuitive grasp of the TFP data and its evolution over time, in Figure 1 we plot the weighted average[12] level of TFP for Latin America[13] and for Emerging Asia[14] relative to industrial countries in the sample.[15] The average level for every year is taken across all 26 industries in all the countries of the corresponding region. The graph shows an interesting pattern: average TFP levels in Latin America (relative to industrial countries) were considerably higher that in emerging Asia in the late 1960's and early 1970's. This pattern persisted until the 1980's when Latin America began a secular decline around the time of the debt crises that beset the region in the early years of that decade. The process was temporarily reversed in the 1990's, a period of major market-oriented reforms across the region, until the late part of the decade when a new wave of financial crises –starting with Asia and Russia in 1997 and 1998 respectively—hit with full force and TFP collapsed. Instead, emerging Asia suffered stagnation, an even a small decline in the early years of the 1980's, that washed out part of the gains achieved in the previous decade. But in the mid 1980's it began a process of rapid catch-up that persisted until the financial crises of 1997. This impressive process of growth is probably behind the motto of "Asian Tigers" that the region earned for its impressive economic performance during this period.[16] By the end of the sample period,

[12] We apply a double weight procedure. Within country, we weight every sector by its relative size in the national economy. And between countries, we weight by the country's relative size (in terms of value added) in the regional aggregate. The figures with the unweighted mean and median levels show similar results.

[13] In our sample the Latin American region corresponds to Bolivia, Chile, Colombia, Ecuador, Guatemala, Mexico, Panama, Peru, Uruguay, and Venezuela.

[14] In our sample Emerging Asia is Indonesia, Korea, Malaysia, Philippines, and Singapore.

[15] Following Cerra and Saxena (2008), in our sample Industrial Countries refers to Australia, Austria, Belgium, Canada, Denmark, Finland, France, Greece, Ireland, Italy, Japan, Luxemburg, Malta, Netherlands, New Zealand, Norway, Portugal, South Africa, Spain, Sweden, Turkey, United Kingdom, and United States of America.

[16] Earlier studies suggested that the East Asian growth came mainly from a capital surge, but Hsieh (2002) shows that productivity growth was an important factor behind the surge.

relative TFP levels in both regions where approximately 85% of the levels in industrial countries.

4. Methodology

In order to evaluate the effects of financial development on industry level TFP growth, we estimate variants of the following equation:

$$\Delta ltfp_{i,c,t} = \alpha Share_{i,c,t} + \beta\left(RZ_i \times FD_{c,t}\right) + \eta_{i,t} + \lambda_{c,t} + \varepsilon_{i,c,t} \qquad (11)$$

As it is now standard in the growth literature, we transform all variables in our database into five-year averages to eliminate business cycle fluctuations and focus on long term growth. Thus, $\Delta ltfp_{i,c,t}$ designates the average growth rate in TFP in sector *i*, country *c,* for one of those five year averages in the period between 1963 and 2003. As explained in the previous section, we use three different measures of industry level TFP, but the baseline is *ltfp2*.

Equation (11) includes industry-time ($\eta_{i,t}$) and country-time ($\lambda_{c,t}$) fixed-effects. This limits the amount of controls that need to be introduced in the regression to variables that vary simultaneous over the industry, country and time dimensions. One of these variables is $Share_{i,c,t}$ which, following Rajan and Zingales (1998), is defined as the industry *i's* share in country *c* of total value added in manufacturing at the beginning of the 5-year period.

The other is the primary variable of interest, which is constructed as the interaction between RZ_i –Rajan and Zingales's measure of industry *i's* dependence on external finance— and $FD_{c,t}$ –a proxy for country level financial development that varies over time—. The inclusion of this interactive term allows us to identify if financial development, measured as the economy wide availability of private credit as a ratio of GDP, affects more the industries that for technical reasons rely more on credit. In other words it allows us to pin point if in fact credit is having a significant impact on the economic sectors where it is needed most. As in Rajan and Zingales's paper, the sign of the estimated coefficient β provides evidence of the average effect of financial development on industry level TFP growth.

Following Levine et al (2000), our preferred proxy for financial development is the ratio of private credit to GDP. The numerator of the ratio is equal to the value of credit by financial intermediaries to private firms only as opposed to credit issued to governmental entities. Furthermore, it excludes credit issued by the central banks. We interpret higher levels of this proxy as indicating higher levels of financial services and therefore greater financial intermediary development. The source of the private credit data is the World Development Indicators dataset (WDI), which contains annual information for all the countries included in our sample for the entire sample period.[17] In terms of Rajan and Zingales's proxy for industry *i's* dependence on external finance RZ_i, it is computed using two key assumptions: (i) there is a technological reason why some industries depend more on external finance than others; (ii) these technological differences persist across countries and over time, so that we can use an industry's dependence on external funds as identified in the United States as a measure of its dependence in other countries. This measure captures dependence on credit related to the use –in equilibrium—of external funds (as opposed to firm savings) in asset acquisition. In the appendix, we present a table with the list of 26 manufacturing sectors and their corresponding level of external dependence ranked from the lowest to the highest.

Our working hypothesis is that industries that are more dependent on external funds will have relatively higher TFP growth rates in countries that have more developed financial systems. Suggestive evidence for this relationship is reported in Figure 2, which traces the evolution of the mean levels of our proxy for financial development in Latin America and in Emerging Asia vis-à-vis the industrial countries in our sample. The patterns are consistent with Figure 1 which traces of evolution of average relative TFP

[17] We also run the regressions using other proxies for financial development used elsewhere in the literature such as the ratio of liquid liabilities to GDP, or the stock market capitalization of listed companies as a ratio of GDP. While the results we obtain are consistent with the baseline, our preferred indicator is the ratio of private credit to GDP because it is the most direct measure of financial intermediation to the private sector.

growth rates across industrial sectors in our sample: during the period of high relative TFP growth rates in Emerging Asia, particularly in the early 1990's, financial development also increased to levels that even surpassed the average for industrial countries prior to the financial crises of 1997. The pattern changed after the crisis, when both TFP growth and financial development collapsed in the region. In Latin America, the average levels of relative financial development show a declining trend over time beginning in the early 1980's (with a short-lived lapse in the early 1990's), similar to the trend of the average levels of relative TFP growth rates depicted in Figure 1.

While these graphs are suggestive, they depict only simple correlations. In order to establish causal effects, we need more formal regression analysis. The identification strategy used in this paper has one advantage that is shared with Rajan and Zingales (1998):[18] since we make predictions about within country differences among industries based on an interaction term between country-time and industry characteristics, we can simultaneously correct, through suitable fixed-effects, for country-time and industry-time characteristics in ways that would be very difficult to do otherwise. At the same time, the identification assumption we need is that any determinant of financial development at the country level not to be systematically correlated with the sector level characteristics that determine the sensitivity of that sector to credit availability, which in our case is RZ_i. Since this variable is constructed based on US data and it intends to capture technological reasons why sectors differs in terms of their reliance on external funds, we believe this condition to be relatively weak and likely to hold in our sample.

5. Results

The results for the baseline regressions in equation (11) are reported in Table 2. The upper panel shows the results for the full sample. The lower panel shows the results for the subsample of developing countries only (list of countries in each category in the

[18] Although it is worth pointing out that Rajan and Zingales (1998) is purely cross-sectional, thus they do not exploit the time dimension as we do here.

appendix). Columns (1) and (2) are the results for the cases when the LHS variable is value-added growth and capital stock growth (i.e., investment) respectively, while columns (3)-(5) are the results for the growth rate of TFP –our main variable of interest—using the three alternative measures of TFP that were discussed in the previous section. The standard errors reported in these regressions are robust to clustered heteroskedasticity (clusters by country-industry).

The results in column (1) are akin to Rajan and Zingales (1998) –financial development enables industrial sectors that are relatively more in need of external finance to grow disproportionally faster—. The only difference here is that we confirm these results using the temporal dimension of data, something that Rajan and Zingales could not do with their dataset. The results in column (2) provide evidence that (at least part) of the growth enhancing effect works through the capital accumulation channel: the positive coefficient for the interaction term shows that investment rates grow disproportionally faster in sectors that are more dependent on credit in countries with more financial development.

The novel results are those in columns (3)-(5). We find a positive and significant effect for the coefficient β which suggests that part of the effect of financial development on value added growth also works through TFP growth, and not entirely through the capital accumulation channel. In other words, industries that are more dependent on external funds will have relatively higher TFP growth rates in countries with more developed financial systems. These results suggest that the availability of credit fosters the adoption of better technologies, not simply more investment.

These results hold for both the full sample, and the developing country subsample. Interestingly, the estimated effects are bigger in the latter, suggesting that FD plays a particularly important role in developing countries, which by definition are more credit constrained.

Next, we discuss the quantitative implications of these results. In particular, we are interested in evaluating what is the estimated marginal effect on industry level TFP growth of an increase of a certain magnitude in financial development. In Figure 3 we plot the estimated marginal effect for the growth rate of *ltfp2* for a 1 standard deviation increase in financial development for different levels of RZ_i. In our sample, this increase in financial development is equivalent to a 36 percentage point shift in the private credit to GDP coefficient. This is roughly what it would take to bring the level of financial development in Bolivia to the one prevailing in Portugal.

The results are that for industrial sectors with low levels of financial dependence (i.e., Leather products or Footwear) the marginal effect is not statistically different from zero (the min and max lines are the 95% confidence interval for the estimate of the marginal effect). As the requirement of external capital increases, so does the importance of financial development in explaining productivity growth. The higher the level of RZ_i, the higher the marginal impact of financial markets on productivity. For example, for an industry with a level of RZ_i around the median level of 0.53 (i.e., the glass industry), the estimated effect of a one standard deviation increase in financial development is an acceleration of TFP growth of approximately 0.29% per year on average (over a five-year window). In our sample, the average TFP growth in that sector is 1.2% per year. Thus, the estimated increase is equivalent to accelerating TFP growth rate in this particular sector by approximately 25% with respect to the prevailing level. In other words, such an increase in financial development would bring significant impacts for this industry in a country where achieving such an increase in financial development is possible. For industries with external financial requirements equal to the maximum (for example, Plastic Products), then the estimated increase in TFP growth for a one standard deviation increase in financial development is approximately 0.6% per year.

In summary, the impact of a one standard deviation increase in financial development on TFP growth ranges from 0 to 0.6% per year, depending on the external finance requirement of industries. Considering that the average growth of TFP in the sample is only 0.3% per year, these results are economically significant.

6. Robustness Checks and Extensions

In our base line estimations we have followed a two-step approach to estimate the impact of financial development on TFP growth. The first step of the procedure follows two different alternatives. In one approach we estimate TFP using the residuals of an OLS estimation of a production function and in the other two, we estimate TFP as a Solow residual using different ways to compute cost shares. In the second step we estimate regressions of TFP growth on the relevant regressors (the interaction of financial development and the finance dependence variable, the initial share of the industry in the country, and the country time and country industry fixed effects) to assess how financial development affects productivity growth. Our first robustness exercise addresses possible problems in the two-step procedure when using the OLS estimate of TFP (first column of the results tables presented up to now).

A potential problem faced in this estimation is that financial development and its interaction with the external dependence measure are correlated with capital and labor growth. If such is the case our estimator of TFP growth obtained in the OLS estimation of equation (4) may be inconsistent and biased. We can mitigate this problem by estimating a variation of equation (4) and (11) in one single step. Instead of estimating TFP and regressing the estimate on the relevant independent variables, we can include the regressors directly in a regression in which the change in value added is the dependent variable, and in which the first difference of the capital stock and of labor are also included. We estimate the following equation:

$$\Delta y_{i,,c,t} = \alpha \Delta k_{i,c,t} + \beta \Delta l_{i,c,t} + \gamma Share_{i,c,t} + \delta (RZ_i \times FD_{c,t}) + \eta_{i,t} + \lambda_{c,t} + \varepsilon_{i,c,t} \quad (12)$$

In an alternative specification we allow the coefficients attached to the capital stock and to labor to vary across industries. Namely, we also estimate:

$$\Delta y_{i,c,t} = \sum_{i=1}^{26} \alpha_i \Delta k_{i,c,t} + \sum_{i=1}^{26} \beta_i \Delta l_{i,c,t} + \gamma\, Share_{i,c,t} + \delta \left(RZ_i \times FD_{c,t} \right) + \eta_{i,t} + \lambda_{c,t} + \varepsilon_{i.c.t} \quad (13)$$

In table 3 we report the results of estimating (12) and (13) both for the full sample as well as for the sample of developing countries. The impact of financial development on total factor productivity growth estimated using this methodology remains significant, and the point size of the estimators is very similar to that estimated in table 2.

While the identification strategy used in the previous section has the advantage of reducing the risk of omitted variable bias and model misspecification due to the inclusion of country-time and industry-time fixed effects, it has the disadvantage of not allowing us to identify the direct country-level effect –if any—that financial development might have on industry level TFP growth irrespective of the industry's dependence on external finance. This effect is absorbed by the fixed-effects in the regression. Here, we explore if our results are robust to an alternative model that allows estimating the direct effect, albeit at the cost of possible model misspecification.

In order to address this problem, we report the regression results for the following alternative model:

$$\Delta ltfp_{i,c,t} = \alpha_1 Share_{i,c,t} + \beta_1 \left(RZ_i \times FD_{c,t} \right) + \beta_2 FD_{c,t} + X_{c,t} + \eta_{i,t} + \varepsilon_{i,c,t} \quad (14)$$

The difference between equations (11) and (14) is that in the latter we identify β_2 –the direct effect of financial development on the dependant variable—.[19] In order to do so, we need to replace the country-time fixed effects with observable variables that vary along these dimensions ($X_{c,t}$). Following the growth literature,[20] we choose the following control variables: inflation rate ($\pi_{c,t}$), the growth rate of real GDP per capita ($y_{c,t}$), and the government fiscal balance as a share of GDP ($s_{c,t}$). The results are reported in table 4. For concreteness, we only report the results for the growth rate of TFP which is our main variable of interest.

The results for β_1, the coefficient of the interaction term between the measure of external dependence (RZ_i) and financial development (FD_{ct}), is positive and significant, while the estimated effect β_2 –the direct effect of financial development on

[19] The inclusion of country-time fixed effects in model (11) accounts for all possible observable and unobservable determinants of TFP growth that vary at the country-time dimensions. In model (12), we forgo the fixed effect in order to be able to identify β_2. To the extent that all the other determinants of industry level TFP growth that vary across country and time are either not observable, or may be missing from $X_{c,t}$, then equation (12) is possibly misspecified due to omitted variable bias.

[20] See, for example, Barro (1997)

the dependant variable— is typically insignificant. This is true for the whole sample (left panel) and developing countries sub-sample (right panel).

Interestingly, since β_2 turns out not to be significant, this suggests –if model (12) is correctly specified—that country level financial development affects industry level TFP growth only through the channel of its interaction with the industry's level of dependence on external sources of finance. This provides further evidence in favor of our baseline model.

Extensions:

One potential concern with our results is that there might be other country-level variables that have an effect on TFP growth through the level of industry dependence on external finance. One such variable is macroeconomic volatility which is naturally connected to financial development.[21] Thus, in our regressions we might be inputting to financial development effects on TFP growth that might be really capturing the effect of some omitted variables. In order to contemplate this possibility, we augment model (11) with an additional term: the interaction between external dependence (RZ_i) and macroeconomic volatility (Vol_{ct}), which we proxy with inflation volatility.[22] Therefore, we estimate the following model:

$$\Delta ltfp_{i,c,t} = \alpha Share_{i,c,t} + \beta\left(RZ_i \times FD_{c,t}\right) + \delta(RZ_i \times Vol_{c,t}) + \eta_{i,t} + \lambda_{c,t} + \varepsilon_{i,c,t} \quad (15)$$

The results are reported in Table 5. They suggest that the new interaction term is not statistically significant in either sample, while the coefficient estimates for the effect of financial development remain positive and statistically significant in all the

[21] See, for example, Ranciere, Tornell and Westermann (2005) and Cerra and Saxena (2008).

[22] We compute inflation volatility as the absolute value of the coefficient of variation in inflation for each country over a five year period. We also try other measures of macroeconomic volatility, such as real exchange rate volatility, terms of trade volatility and the volatility of capital flows. The results are qualitatively similar. We opt to report the results based on the inflation measure because it is the one with the largest data availability for our sample of countries.

regressions. Thus, there does not seem to be an omitted bias variable associated to our estimation.

Finally, we look at the joint effect of financial development and macroeconomic volatility on industry level TFP growth. In the previous table we have shown that macroeconomic volatility does not appear to have a direct effect on industry level TFP growth. Despite this, the main focus in this paper is on the effect of financial development on TFP growth. Thus, a key concern for us is whether macroeconomic volatility affects this relationship. In other words: is financial development less effective as a trigger for industry level TFP growth in more volatile macroeconomic environments? In order to explore this question we augment model (13) with a triple interaction between external dependence (RZ_i), financial development (FD_{ct}) and macroeconomic volatility (Vol_{ct}):

$$\begin{aligned}\Delta ltfp_{i,c,t} &= \alpha Share_{i,c,t} + \beta\left(RZ_i \times FD_{c,t}\right) + \delta(RZ_i \times Vol_{c,t}) + \\ &\gamma\left(RZ_i \times FD_{c,t} \times Vol_{c,t}\right) + \eta_{i,t} + \lambda_{c,t} + \varepsilon_{i,c,t}\end{aligned} \quad (16)$$

The results are reported in Table 6. They suggest that macroeconomic volatility plays a role in mediating in the relationship between country-level financial development and industry-level TFP growth. Despite the seemingly different results for the regressions of whole sample vis-à-vis the sub sample of developing countries only (see columns (1)-(3) vis-à-vis columns (4)-(6) respectively), once we account for the joint significance of all the coefficients, the results are very similar. In particular, the results in Table 5 show that the positive effect of financial development on industry-level TFP growth is only estimated with precision at low levels of macroeconomic volatility. This is true in full sample and also in the developing country sub sample.

To see this, consider the marginal effect of financial development on industry level TFP growth. This is derived directly from equation (16):

$$\frac{\partial(\Delta ltfp_{i,c,t})}{\partial(FD_{c,t})} = \beta RZ_i + \gamma(RZ_i \times Vol_{c,t}) \quad (17)$$

The coefficient estimates for the full sample, as reported in Table 6, columns (1)-(3), are that $\beta > 0$, while $\gamma \cong 0$. The coefficient estimates for the sub sample of developing country, as reported in Table 6, columns (4)-(6), are that $\beta \cong 0$, while $\gamma > 0$. This suggests that higher levels of macroeconomic volatility have a positive effect on the marginal effect of financial development on industry level TFP growth. While this is true, it does not take into account the standard errors associated to the marginal effect as defined in (15). In particular, the standard deviation of (15) is:

$$std\left(\frac{\partial(\Delta ltfp_{i,c,t})}{\partial(FD_{c,t})}\right) = \sqrt{(RZ_i)^2 \operatorname{var}(\beta) + (Vol_{c,t})^2 (RZ_i)^2 \operatorname{var}(\gamma) + 2(Vol_{c,t})(RZ_i)^2 \operatorname{cov}(\beta,\gamma)} \quad (18)$$

Equation (18) reveals that the standard deviation of the marginal effect is an increasing function of ($Vol_{c,t}$) –unambiguously so if and only if $\operatorname{cov}(\beta,\gamma) > 0$.[23] This implies that the marginal effect is more imprecisely estimated at higher levels of volatility.

In Figure 4 we plot the marginal effect (16) –y-axis— against different levels of $Vol_{c,t}$ –x-axis—setting the level of (RZ_i) at the median value.[24] We use the coefficient estimates from Table 6, column (3) –full sample—. In Figure 5 we plot the same thing for the developing country sub sample only, using the coefficient estimates from Table 5, column (6). We also include the 95% confidence intervals computed using the standard errors in (16).

The results reveal that the marginal effect of financial development on industry level TFP growth is positive and statistically significant only for low levels of macroeconomic volatility. This is true for the full sample and for the developing country sub sample, although in the latter case, the relationship is more imprecisely estimated. At higher levels of volatility the estimate is no longer significant, despite the positive

[23] In our sample, $Cov(\beta,\gamma) < 0$, but it is sufficiently small in absolute value such that the RHS of equation (16) is still an increasing function of $Vol_{c,t}$.

[24] The results are qualitatively the same for any other levels of RZ_i

slope of the marginal effect. Thus, at higher levels of volatility, the relationship between financial development and TFP growth may be zero.[25]

This suggests that pursuing macroeconomic stabilization policies in high volatility economies (as it is the case in many developing countries), is crucial since volatility *may* wash out the positive effect that greater financial intermediation has on industry level TFP growth.[26] This might, for example, explain why financial development may not have been effective in fostering TFP growth in the LAC region, which is characterized by very high macroeconomic and financial volatility.[27]

7. Conclusions

Financial development impacts productivity by allowing resources to flow towards their more productive uses. In this paper we use a cross sector cross country dataset that allows us to overcome endogeneity issues faced by the empirical cross country literature, to test this claim. We find that in countries with deeper credit markets, sectors that rely more on external finance have a higher productivity growth than those in countries with shallower markets. Our results suggest that this impact is stronger in developing than in developed countries. We interpret this as a result that financial constraints may be tighter in developing ones, and also as a consequence that firms in developed countries rely more strongly on capital markets as opposed to their counterparts in emerging economies.

The link between credit and productivity growth varies across macroeconomic setups. We find evidence of macroeconomic instability weakening the ability of the financial sectors to allocate resources efficiently. While financial development can ease part of the negative impact of volatility, it is very difficult to estimate precisely the way volatility affects the relationship between financial development and TFP growth. Our

[25] While the positive slope suggests that financial development is relatively more important in a volatile environment, the effect is imprecisely estimated.

[26] The emphasis in added in the word "may" as we can not rule out the possibility that the widening of the standard errors at higher levels of volatility in Figure 4 is a purely statistical phenomenon.

[27] For a discussion on the relatively high incidence of macroeconomic and financial volatility in Latin America and the Caribbean, see Hausmann and Gavin (1996), de Ferranti et al (2000) and IDB (2005).

estimates suggest that the impact of financial development on TFP growth is larger as volatility increases, but at high levels of volatility our estimates are imprecise and in fact suggest that the impact of financial development can be dampened. In countries with high inflation volatility financial development may be less effective in promoting TFP growth. In fact, macroeconomic volatility reduces the capacity of agents to identify the most profitable sectors or the most profitable activities. According to our results, an increase in the volatility of inflation may reduce the effectiveness of financial development as a motor of industry-level TFP growth.

8. References

Acemoglu, Aghion and Zilibotti (2002) “Distance to Frontier, Selection and Economic Growth”NBER Working Paper No. 9066.

Aghion, P., Angeletos, G., Banerjee,A. and K. Manova (2005) “Volatility and Growth: Credit Constraints and Productivity-Enhancing Investment” NBER Working Paper 11349

Bagehot, W. (1873) Lombard Street: A Description of the Money Market. Irwin, Homewood, IL.

Barro R. Determinants of economic growth: A cross-country empirical study. Cambridge: MIT Press; 1997.

Beck, T., Demirguc-Kunt, A., Laeven, L., and R. Levine (2004) “Finance, Firm Size and Growth”. NBER Working Paper No. 10983.

Beck,T., R. Levine, and N. Loayza (2000), “ Finance and the Sources of Growth”, *Journal Financial Economics, 58*, 261-300.

Behr, P. and S. Lee (2005) “Credit Risk Transfer, Real Sector Productivity, and Financial Deepening”

Bekaert, G., Harvey, C. , Lundbald, C. and S. Siegel (2007) “Global Growth Opportunities and Market Integration”, Journal of Finance, Forthcoming.

Bencivenga, V., Smith, D. and R. Starr (1995) “Transactions Costs, Technological Choice, end Endogenous Growth” Journal of Economic Theory. 67:52-177

Bernanke, B., and R. Gurkaynak (2001) "Is Growth Exogenous? Taking Mankiw, Romer and Weil Seriously," NBER Working Papers 8365, National Bureau of Economic Research.

Buera, F., Kaboski,J. and Y. Shin (2008) “Finance and Development: A Tale of Two Sectors”. Mimeo. UCLA.

Buera, F. and Y. Shin (2008) “Financial Frictions and the Persistence of History: A Quantitative Exploration”. Mimeo. UCLA.

Caselli, F. (2005) “Accounting for Cross-Country Income Differences” Handbook of Economic Growth.

Cerra, V. and S. Saxena (2008) “Growth Dynamics: The Myth of Economic Recovery” American Economic Review. , 98-1, pp. 439-57, March.

Ciccione, A. and E. Papaioannou (2006) “Adjustment to Target Capital, Finance and Growth”, mimeo.

David De Ferranti, Indermit S. Gill, Guillermo E. Perry, Luis Serven (2000). “Securing Our Future in a Global Economy.” World Bank Latin American and Caribbean Studies.

Easterly, W., R. Islam and J. Stiglitz (2001) “Shaken and Stirred: Explaining Growth Volatility.” In: B. Plesokovic and N. Stern, editors. Annual World Bank Conference on Development Economics. Washington, DC, United States: World Bank.

Fink,G., Haiss, P. and H.C.Mantler (2005) “The Finance Growth Nexus: Market Economies vs. Transition Economies”. EUROPAINSTITUT. Working Paper No 64.

Fisman, R. and I. Love (2003) “Trade Credit, Financial Intermediary Development, and Industry Growth”, Journal of Finance, 58:353-374

Fisman, R. and I. Love (2004) “Financial Development and Growth in the Short and Long Run”NBER Working Paper No.10236.

Greenwald, B. , Kohn, M. and J. Stiglitz (1990) “Financial Market Imperfections and Productivity Growth” Journal of Economic Behavior & Organization, Elsevier, vol. 13(3): 321-345,

Hartmann, P. Heider, F., Papaioannou,E. and M. Lo Duca (2007) “The Role of Financial Markets and Innovation in Productivity and Growth in Europe” European Central Bank. Occasional Paper Series. No 72.

Hausmann, R., and M. Gavin. 1996. “Securing Stability and Growth in a Shock Prone Region: The Policy Challenge for Latin America.” Research Department Working Paper # 315. Washington, DC, United States: Inter-American Development Bank.

Honohan, P. (2004) “Financial Development, Growth and Poverty: How Close are the Links?” World Bank Policy Research Working Paper 3203.

Hsieh, Chang-Tai (2002). "What Explains the Industrial Revolution in East Asia? Evidence From the Factor Markets ." American Economic Review, 92(3): 502–526.

Hsieh, C. and P. Klenow (2007) “Misallocation and Manufacturing TFP in China and India” NBER Working Paper 13290.

Inter-American Development Bank (2005). “Unlocking Credit: The Quest for Deep and Stable Bank Lending.” Economic and Social Progress in Latin America Report. Washington DC.

King, R. and Levine, R. (1993a) "Finance, Entrepreneurship and Growth: Theory and Evidence". Journal of Monetary Economics, 32, pp.513-542.

King, R. and Levine, R. (1993b), “Finance and Growth: Schumpeter May Be Right”, Quarterly Journal of Economics, 108, pp. 717-737.

Lee, J.(1996) “Financial Development by Learning”. Journal of Development Economics. 50(1):147-164

Levine, R. (1997) “Financial Development and Economic Growth: Views and Agenda”. Journal of Economic Literature. XXXV:688-726

Levine, R. (2004) “Finance and Growth: Theory and Evidence” NBER Working Paper 10766.

Levine, R., Loayza, N. and T.Beck(2000), "Financial Intermediation and Growth: Causality and Causes". Journal of Monetary Economics, 46, pp. 31-77.

Levine, R. (1997), “Financial Development and Economic Growth: Views and Agenda”, Journal of Economic Literature, June 1997, pp. 688-726.

Levine, R. and S. Zervos. (1998) “Stock market , Banks, and economic Growth”, American Economic Review, 88, pp. 537-558.

Papaioannou, E. (2007) “Finance and Growth. A Macroeconomic Assessment of the Evidence From a European Angle”. European Central Bank. Working Paper Series No. 787.

Rancière, R., A. Tornell, and Frank Westermann. 2005. “Systemic Crises and Growth.” NBER Working Paper 11076. Cambridge, United States: National Bureau of Economic Research.

Rajan, R. and L. Zingales (1998) “Financial Develoment and Growth”. American Economic Review. 88(3):559-586.

Restuccia,D. and R. Rogerson (2007) “Policy Distortions and Aggregate Productivity with Heterogeneous Plants” NBER Working Paper 13018.

Rioja, F. and N. Valev (2003) “Finance and the Sources of Growth at Variou Stages of Economic Development” Mimeo http://ssrn.com/abstract=438261

Schumpeter, J. (1912) The Theory of Economic Development: An inquiry into profits, capital, credit, interest and the business cycle

Wurgler, J. (2000) “Financial Markets and the Allocation of Capital” Journal of Financial Economics, 58:187-214

9. Tables

Table 1: Correlation Matrix TFP

Growth Rates			
	□ltfp	□ltfp1	□ltfp2
□ltfp	1		
□ltfp1	0.997	1	
□ltfp2	0.996	0.995	1
Levels			
	ltfp	ltfp1	ltfp2
ltfp	1		
ltfp1	0.568	1	
ltfp2	0.358	0.556	1

Notes: ltfp is estimated by OLS, ltfp1 using fixed input shares for the whole sample, and ltfp2 allows input shares to vary per industry.

Table 2: Baseline Results

Full Sample					
	(1)	(2)	(3)	(4)	(5)
Dependent Variable:	□log(VA)	□log(K)	□ltfp	□ltfp1	□ltfp2
(Rajan & Zingales) * FD	0.050***	0.048***	0.011**	0.012**	0.015***
	[0.012]	[0.011]	[0.005]	[0.006]	[0.006]
Industry Share	-0.266***	-0.218***	-0.077**	-0.082**	-0.102**
	[0.056]	[0.067]	[0.039]	[0.041]	[0.040]
Observations	7721	7721	7721	7721	7405
R-squared	0.467	0.394	0.494	0.486	0.491
Developing Countries					
	(1)	(2)	(3)	(4)	(5)
Dependent Variable:	□log(VA)	□log(K)	□ltfp	□ltfp1	□ltfp2
(Rajan & Zingales) * FD	0.070***	0.063***	0.015*	0.017*	0.022**
	[0.021]	[0.019]	[0.009]	[0.009]	[0.009]
Industry Share	-0.291***	-0.240***	-0.061	-0.067	-0.090*
	[0.070]	[0.089]	[0.050]	[0.053]	[0.054]
Observations	4624	4624	4624	4624	4431
R-squared	0.423	0.382	0.422	0.417	0.421

Notes: Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1. All specifications include country-time and industry-time fixed effects.

Table 3: Baseline Results – One Step Estimation

	Full Sample		Developing Countries	
	(1)	(2)	(3)	(4)
	□log(VA)	□log(VA)	□log(VA)	□log(VA)
(Rajan & Zingales)*FD	0.014**	0.014**	0.020**	0.018**
	[0.006]	[0.006]	[0.009]	[0.009]
Industry share	-0.110***	-0.088**	-0.098**	-0.094*
	[0.039]	[0.038]	[0.050]	[0.052]
Observations	7721	7721	4624	4624
R-squared	0.734	0.743	0.712	0.724

Notes: Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. All specifications include country-time and industry-time fixed effects. Due to space limitations the coefficientes on □k and □l are not reported.

Table 4: Alternative model

	Full Sample			**Developing Countries**		
	(1)	(2)	(3)	(4)	(5)	(6)
	□ltfp	□ltfp1	□ltfp2	□ltfp	□ltfp1	□ltfp2
(Rajan & Zingales) * FD	0.015**	0.015**	0.019***	0.020*	0.021*	0.028***
	[0.007]	[0.007]	[0.007]	[0.011]	[0.011]	[0.011]
Financial Development	-0.001	-0.002	-0.003	-0.009	-0.01	-0.013**
	[0.004]	[0.004]	[0.004]	[0.006]	[0.006]	[0.006]
Industry Share	-0.102**	-0.109**	-0.129***	-0.105*	-0.111**	-0.144**
	[0.042]	[0.042]	[0.045]	[0.054]	[0.055]	[0.057]
Inflation Rate	0.002	0.001	0.004	0.009	0.007	0.010*
	[0.005]	[0.005]	[0.005]	[0.006]	[0.006]	[0.006]
Growth rate of GDP per capita	0.433***	0.428***	0.443***	0.399***	0.392***	0.405***
	[0.047]	[0.048]	[0.048]	[0.055]	[0.057]	[0.056]
General Government Consumption / GDP	-0.041**	-0.042**	-0.047***	-0.048**	-0.049**	-0.053**
	[0.017]	[0.017]	[0.017]	[0.021]	[0.021]	[0.022]
Observations	7045	7045	6758	4170	4170	3997
R-squared	0.193	0.192	0.196	0.125	0.124	0.13

Notes: Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1. All specifications include industry-time fixed effects.

Table 5: Additional Controls

	Full Sample			Developing Countries		
	(1)	(2)	(3)	(4)	(5)	(6)
	□ltfp	□ltfp1	□ltfp2	□ltfp	□ltfp1	□ltfp2
(Rajan & Zingales) * FD	0.013**	0.014**	0.017***	0.015	0.016*	0.021**
	[0.006]	[0.006]	[0.006]	[0.009]	[0.009]	[0.009]
(Rajan & Zingales) * Inflation Volatility	0.001	0.001	0.001	0.004	0.003	0.003
	[0.001]	[0.001]	[0.001]	[0.008]	[0.008]	[0.009]
Industry Share	-0.104***	-0.111***	-0.129***	-0.087*	-0.096*	-0.119**
	[0.038]	[0.039]	[0.040]	[0.051]	[0.053]	[0.055]
Observations	6818	6818	6543	4116	4116	3947
R-squared	0.504	0.497	0.504	0.434	0.429	0.436

Notes: Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1. All specifications include country-time and industry-time fixed effects.

Table 6: The Effects of Macro Volatility

	Full Sample			Developing Countries		
	(1)	(2)	(3)	(4)	(5)	(6)
	0 ltfp	0 ltfp1	0 ltfp2	0 ltfp	0 ltfp1	0 ltfp2
(Rajan & Zingales) * FD	0.012*	0.012**	0.016***	-0.014	-0.01	-0.01
	[0.006]	[0.006]	[0.006]	[0.016]	[0.017]	[0.017]
(Rajan & Zingales) * Inflation Volatility	-0.001	-0.001	-0.001	-0.03	-0.027	-0.034
	[0.001]	[0.001]	[0.001]	[0.020]	[0.021]	[0.021]
(Rajan & Zingales) * (Inflation Volatility) * FD	0.002	0.002	0.002	0.063**	0.058*	0.070**
	[0.002]	[0.002]	[0.002]	[0.031]	[0.033]	[0.034]
Industry Share	-0.106***	-0.113***	-0.130***	-0.094*	-0.103*	-0.128**
	[0.038]	[0.040]	[0.040]	[0.052]	[0.054]	[0.056]
Observations	6746	6746	6474	4044	4044	3878
R-squared	0.509	0.501	0.508	0.44	0.434	0.441

Notes: Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1. All specifications include country-time and industry-time fixed effects.

10. Figures

Figure 1: Stylized Facts about TFP

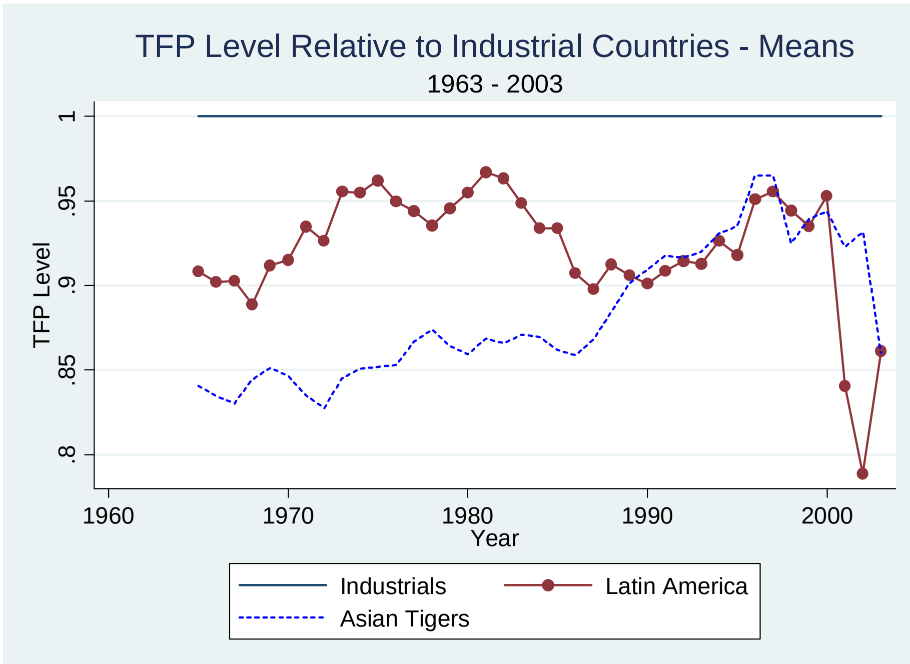


Figure 2: Stylized Facts about Financial Development

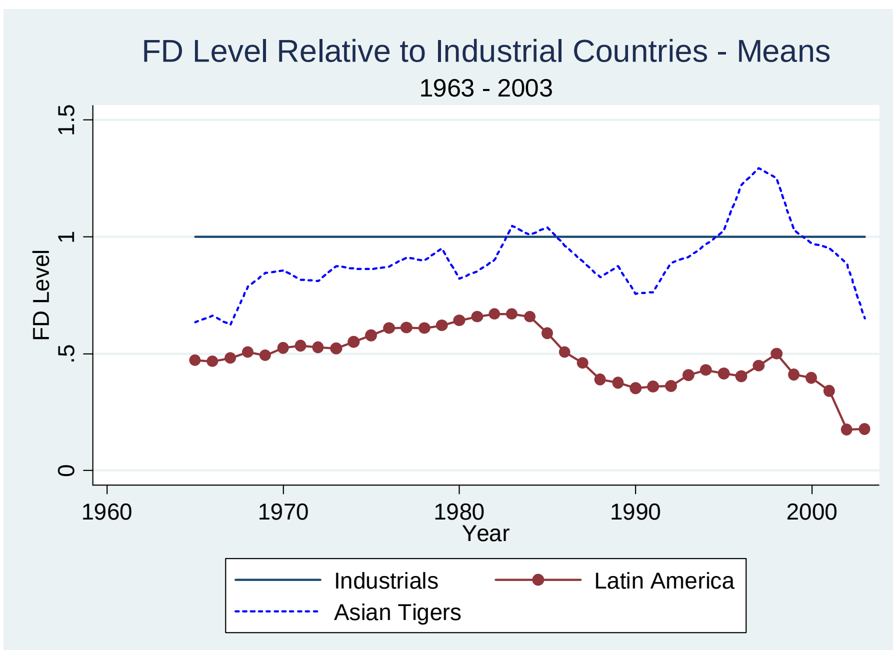


Figure 3: Marginal Effects

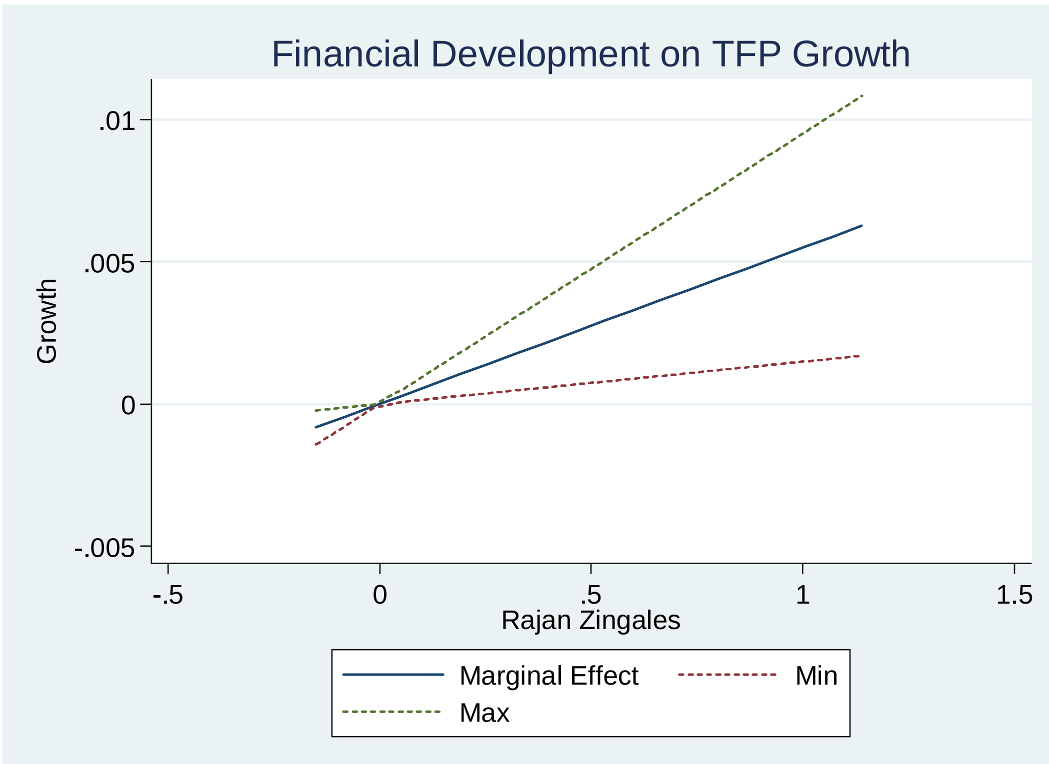


Figure 4: Marginal Effects – TFP Growth Financial Development and Volatility

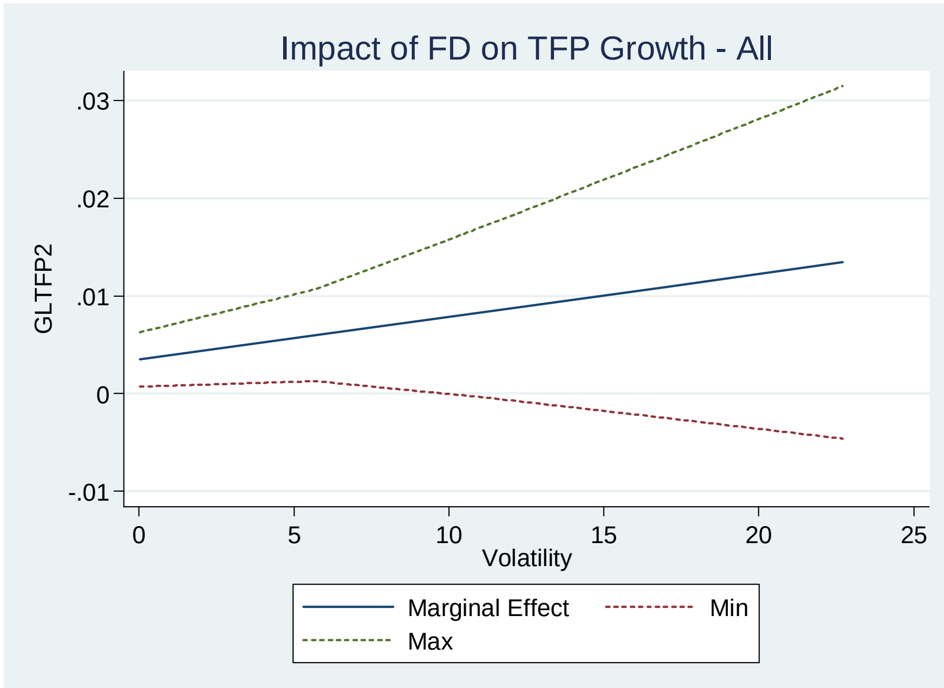
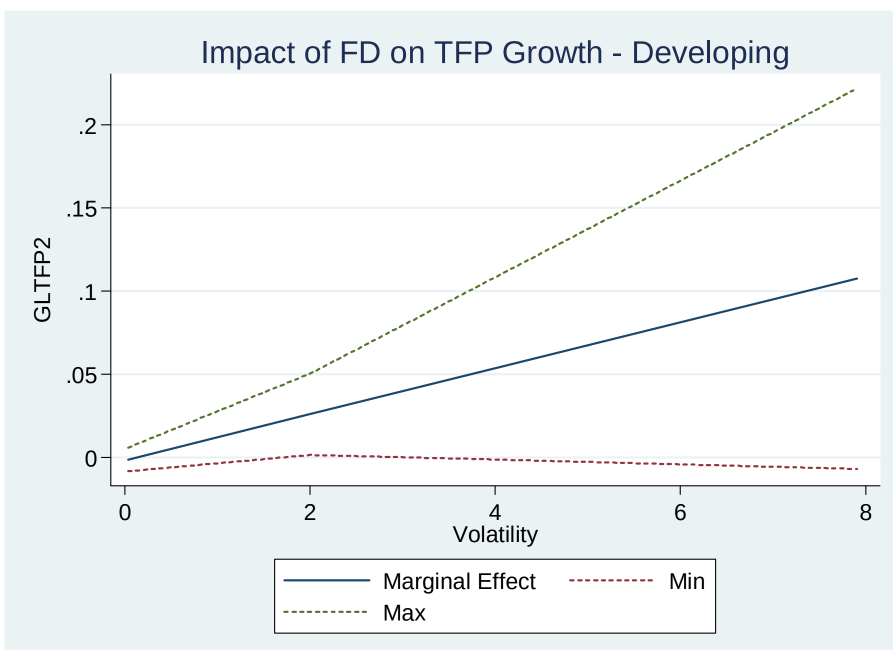


Figure 5: Marginal Effects – TFP Growth Financial Development and Volatility



Appendix

Appendix table 1: Countries and Sample

Country	Start	End
Australia	1965	1985
Austria	1969	2003
Bangladesh	1981	1998
Barbados	1970	1995
Belgium	1965	2001
Bolivia	1988	1998
Bulgaria	1980	2003
Cameroon	1989	2002
Canada	1965	1990
Central African Republic	1973	1983
Chile	1965	1998
China (Macao SAR)	1978	2003
Colombia	1965	1999
Cyprus	1971	2003
Denmark	1965	1991
Ecuador	1965	2003
Egypt	1967	1995
Eritrea	1992	2003
Ethiopia	1990	2002
Ethiopia and Eritrea	1965	1989
Fiji	1970	1994
Finland	1965	2002
France	1965	2003
Greece	1965	1998
Guatemala	1974	1988
Hungary	1965	1995
India	1977	2002
Indonesia	1970	2003
Iran, (Islamic Republic of)	1984	2003
Ireland	1965	2002
Israel	1965	2002
Italy	1967	2003
Japan	1965	2002
Jordan	1974	2003
Kenya	1993	2002
Korea, Republic of	1965	2002
Kuwait	1966	2001
Libyan Arab Jamahiriya	1965	1980
Luxembourg	1965	1992
Malawi	1979	1998
Malaysia	1983	2002
Malta	1965	2002

Country	Start	End
Mexico	1970	2000
Morocco	1985	2003
Myanmar	1989	2002
Netherlands	1965	1993
New Zealand	1965	1990
Norway	1965	2001
Oman	1993	2003
Pakistan	1981	1991
Panama	1965	2000
Peru	1982	1996
Philippines	1965	1995
Poland	1982	2002
Portugal	1971	2003
Romania	1985	1999
Senegal	1974	1990
Singapore	1965	2003
Slovenia	1987	2003
Somalia	1968	1977
South Africa	1965	1972
Spain	1965	2000
Sri Lanka	1979	2001
Swaziland	1968	1995
Sweden	1965	1987
TFYR of Macedonia	1987	1996
Togo	1974	1982
Trinidad and Tobago	1981	1995
Tunisia	1965	2003
Turkey	1965	2000
United Kingdom	1968	2000
United Republic of Tanzania	1965	1999
United States of America	1965	2002
Uruguay	1989	2001
Venezuela	1974	1998
Zambia	1965	1975
Zimbabwe	1965	1996

Appendix table 2: Descriptive Statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
Growth rate of ltfp	7721	0.002	0.098	-0.508	0.860
Growth rate of ltfp1	7721	0.000	0.099	-0.501	0.820
Growth rate of ltfp2	7405	0.003	0.099	-0.518	0.847
Financial Development	7721	0.525	0.366	0.045	2.174
Rajan & Zingales	7721	0.309	0.339	-0.150	1.140
Lindsh	7721	0.021	0.026	-0.063	0.313
General Government Consumption / GDP	7509	0.161	0.061	0.043	0.527
Inflation rate	7163	0.124	0.196	-0.068	2.001
Growth rate of GDP per capita	7617	0.024	0.028	-0.116	0.162
Inflation Volatility	6818	0.637	1.670	0.035	22.702

Appendix table 3: Manufacturing Industries and external financial dependence

Industry name	Industry	Rajan & Zingales
Pottery, china, earthenware	361	-0.15
Leather products	323	-0.14
Footwear, except rubber or plastic	324	-0.08
Non-ferrous metals	372	0.01
Wearing apparel, except footwear	322	0.03
Other non-metallic mineral products	369	0.06
Beverages	313	0.08
Iron and steel	371	0.09
Food products	311	0.14
Textiles	321	0.16
Paper and products	341	0.17
Printing and publishing	342	0.20
Industrial chemicals	351	0.21
Rubber products	355	0.23
Furniture, except metal	332	0.24
Fabricated metal products	381	0.24
Wood products, except furniture	331	0.28
Transport equipment	384	0.39
Other manufactured products	390	0.47
Glass and products	362	0.53
Machinery, except electrical	382	0.76
Other chemicals	352	0.86
Machinery, electric	383	0.91
Professional & scientific equipment	385	0.96
Plastic products	356	1.14