# Real effect of bank efficiency: Evidence from disaggregated manufacturing sectors

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## Abstract

In this paper, we investigate the real effect of bank efficiency for the growth and market structure of 23 manufacturing sectors in a two-dimensional panel framework. We use the cost and profit efficiency scores that are estimated based on the stochastic frontier model for 5850 banks. The robust finding is that industries that rely heavily on external finance, grow faster and are enhanced by the creation of new enterprises in countries with efficient banking systems. Further evidence, however, reveals that the efficiency effect is mainly derived from the cost side during the financial crisis period.



**Key words:** Industry growth; Industry market structure; Bank efficiency

**JEL:** D4, G21, L11

## 1. Introduction

As far as the role of banks on growth is concerned, the drawback in many empirical works is the measure of financial development. The common measures, which have been, so far, analysed are the quantity-based measures such as the size of banking systems, the amount of credit allocated for productive use, or liquid liabilities (King and Levine 1993). These quantity-based indicators have been used extensively by many empirical studies (e.g. Alan Gelb 1989, Gertler and Rose 1991, Roubini and Sala-i-Martin 1992, King and Levine 1993, Easterly 1993 and Cetorelli and Gambera 2001). These studies tend to observe the role of banks as a stimulator of capital accumulation, and often find a significant and positive relationship between an indicator of financial development and economic growth. It is argued that these measures only partially capture the role played by banks in economic growth, and the interpretation is criticised (Lucchetti et al. 2001): The growth of credit disbursed is, *inter alia*, more likely to be influenced by the level of economic activities rather than banks' independent behaviour. In other words, banks release loans on demand by firms, (though they may adjust lending rates in order to constrain or relax the volume of loans.) Hence, as Rajan and Zingales (1998) point out, the quantity-based financial development may play a leading indicator of economic growth rather than of a causal factor.

Lucchetti et al. (2001) investigate the impact of bank efficiency on economic growth. They argue that departure from the quantity-side of finance may address the well-known issue of the endogeneity problem in the finance-growth relationship. Lucchetti et al. further point out that bank efficiency shows the allocative function, which has been neglected if using only quantitative indicators of financial development. Using cost efficiency for Italian regions, they find that bank efficiency has, indeed, an independent effect on real growth. Using a sample of 100 countries over 1996-2005, Hasan et al. (2009a) also find that cost inefficiency associated with the banking sector has a negative effect on economic growth. Hasan et al. (2009b) argue that banks promote growth through three channels of quantity-based variables (e.g. credit), quality-based variables (e.g. efficient intermediates), and the interaction of both. Using data for 7000 banks in 11 European countries over the period 1996-2004, the impact of bank efficiency on regional growth is found to be almost three times as large as that of the quantity channel.

In finance-growth literature, there are a number of empirical papers on the relationship between finance and *industry growth*. Although earlier studies tend to employ

the volume measures of finance, a new strand of empirical studies has attempted to investigate the impact of quality-based variables such as banking market structure and bank competition on industry performance.

The role of banking market structure in promoting industry growth is initiated by Boot (2000) in an indirect way by analysing lending relationships. It is argued that lending relationships mitigate asymmetries of information arising in the context of relationships between banks and their clients. In this scenario, banks are able to screen and monitor their clients more efficiently. The study of the role of banking market-structure on firms' growth in a direct way is proposed by Rajan and Zingales (1998). Cetorelli and Gambera (2001), for example, find that banking concentration has a depressing effect on overall industry growth. Claessens and Laeven (2005) find that financially dependent industries grow faster in countries with greater banking system competition. On the other hand, Maudos and Fernandez de Guevara (2006) find that the exercise of market power (less competition) enhances growth. Bonaccorsi di Patti and Dell'Ariccia (2004) also find that there is a positive relationship between banking system concentration and the firms' growth. Deidda and Fattough (2005) reveal a negative relationship found in only low-income countries, whilst there is no banking concentration-growth nexus found in high-income countries. The investigation of the impact of banking market structure on firms' market structure is also of interest. For example, Cetorelli (2001) find that in sectors that rely heavily on external finance, banking concentration leads to industry concentration (measured as an average firm size)[1]. This effect is found to be stronger for countries with under-developed financial systems. Cetorelli (2003) also find evidence that less competition in a banking sector is associated with less entry of new firms. In Cetorelli (2004), using a panel of manufacturing industries in 29 OECD countries, the process of enhanced competition in EU banking markets is found to be associated with a lower average firm size.

Indeed, available empirical evidence shows the valid effect of bank operations on industry growth and market structure, and motivates us further to examine the real effect of bank efficiency.

In this paper, we investigate the effect of bank efficiency on the major component of economic growth, i.e. industrial growth in manufacturing sectors together with their market structure. This relationship, to the best of our knowledge, has received little attention. We

[1] See also Cetorelli and Gambera (2001).

attempt to address two important questions, i) do industries that depend more on external finance grow faster in countries with more efficient banking systems? and ii) are new firms in these industries more likely to be created as a result of an efficient banking system? The latter attempts to test whether bank efficiency contributes to the formation of non-financial industries by enhancing industry entry. The study is conducted based on a two-step approach. In the first stage, we estimate the cost and profit efficiency for 5850 banks in 49 economies using Stochastic Frontier Analysis (SFA). Then, in the second stage using the estimated efficiency, we analyse the cross section linear relationship between banking efficiency and growth and market structure in 23 non-financial industrial sectors.

We derive a measure for intermediation quality at the individual bank level and test banks' relative ability to convert resources into industry performance. To approximate this quality aspect of financial intermediation, we estimate bank-specific cost and profit efficiency as the non-random deviation from optimal costs and profit using SFA. The deviation may be due to excessive employment of scarce resources or reflect a sub-optimal input mix at given factor prices. By using Rajan and Zingales' (1998) method, we then test the effect of such bank efficiency on industry performance. The Rajan and Zingales method allows us to assess the relationship between financial development and growth in the value-added of industrial sectors that vary in their external financial dependence. This methodology has been widely applied to test the effect of banking-system concentration (competition), the development of trade finance and the strength of property rights on growth of non-financial firms (e.g. Cetorelli and Gambera, 2001, Fisman and Love 2004, and Claessens and Laeven 2003 and 2005). This paper further develops this methodology by applying it to bank efficiency.

**[Figure 1 about here]**

Figure 1 shows the growth of establishments and fixed capital formation for 23 industries by distinguishing between industries that are heavily dependent on external finance, and those which are less dependent on external finance[2]. The distinctive feature between the two types of industries is shown in Figures 1a and 1b. The growth of those industries, being less dependent on external finance, is relatively constant over the period. On the other hand, a decline in growth is evident during the period 2007-2009 for the external-finance dependent industries, demonstrating the fragility of the industries during the

[2] In drawing the graph, we selected all reporting 75 countries for industry growth in UNIDO industry database, including 49 countries which we investigate in this paper.

financial crisis period 2007-2009. Thus, as far as the relationship between the finance and industry growth nexus is concerned, industries that rely heavily on external finance need to be isolated from those that rely less on external finance. Exploiting this industry-specific information, we may be able to obtain a clearer picture of the effect of bank efficiency on heterogeneous industrial sectors.

Efficiency seems to capture the allocative function of banks other than measures such as the amount of credit granted to the private sector, in that the ability to use the available technology and to combine the inputs optimally into the production process can be considered a necessary condition for the correct allocation of resources. This implies that industries and firms that rely heavily on external financing should grow disproportionately faster in countries with well-developed banks than in countries with poorly developed banking systems in terms of efficiency. Another important aspect is that industry market-structure may be related to the degree of efficiency in banks. We test whether bank efficiency causes financially dependent industries to become concentrated or de-concentrated. Banks may act as a barrier to entry by favouring incumbents, with whom they have already established relationships, over new entrants. In this instance, bank efficiency may allow firms to earn monopoly profits, and contribute to the formation of concentrated industries. On the other hand, bank inefficiency may induce industry concentration due to its sluggish operation by focusing on large firms, and thus help to raise industry monopoly profits. If this effect is strong, then bank efficiency may give rise to the de-concentration of industry.

Empirical evidence reveals that sectors that rely heavily on external finance grow faster in countries with efficient banking systems. Furthermore, efficient banking system tends to lead to un-concentrated industrial sectors. Our results also suggest that the quality-based variable of bank efficiency supersedes quantity-based variables in influencing industry performance. At least, maintaining the focus on the effects on industrial growth and market structure, banking efficiency performs an important role. If bank efficiency is enhanced, industries that are dependent on external finance should benefit disproportionately more than industries that are not heavy users of external finance. These results remain robust to the use of different empirical specifications of bank efficiency, instrumental variables, sample periods and sample selections. A further investigation, however, indicates that the efficiency effect mainly derives from the cost side rather than the profit side during the financial crisis period.

The rest of the paper is organized as follows. Section 2 contains the illustration of the models including the estimation of efficiency measures and industry performance. The data set is also described in this section. The empirical results are presented in Section 3. In Section 4 several robustness tests are reported, and Section 5 concludes.

## 2. Model specification and data

### 2.1. Model specification

We adopt a two-step approach to study the impact of financial sector efficiency on industry performance. In the first step, we measure the cost and profit efficiency of banking sectors for 49 countries. In the second step, we estimate a linear equation linking bank efficiency to industry performance.

#### 2.1.1. Cost and profit efficiency

To estimate an indicator for the quality of finance in the banking sector, we follow Lucchetti et al. (2001) and Hasan et al. (2009b) and measure a bank's relative efficiency in converting inputs into a production set, whilst minimizing (maximizing) its costs (profits). We expect that given risk, more an efficient banking sector would select profitable projects at the lowest cost of lending.

We measure the average cost and profit efficiency of a country's banking sector, using the stochastic frontier analysis developed by Meeusen and van den Broeck (1977), Aigner et al. (1977) and Kumbakhar and Lovel (2000)[3]. Note that for profit efficiency we estimate the alternative type[4], which ignores output price data by assuming imperfect competition (see Berger and Mester, 1997 for more discussion). We use the Battese and Coelli (1995) model, which allows us to estimate time-varying efficiency scores. The estimation of banks' relative

[3] The non-parametric technique of Data Envelopment analysis (DEA) is also employed in the analysis of the efficiency. The advantage of the stochastic frontier, which is a parametric technique includes the followings: Firstly, this allows one to check the *a priori* hypotheses on the technology and its evolution over the time, and secondly it is possible to construct unbiased estimators at the level of the individual bank (Wheelock and Wilson 1999).

[4] According to the literature, there are two types of profit efficiency: standard and alternative. While the standard profit efficiency assumes that markets for both output and inputs are perfectly competitive, the alternative profit efficiency concept assumes that banks are price-takers in input market only and can set output prices (Maudos et al., 2002). The alternative profit efficiency measures how close a bank comes to earning maximum profits given its output levels rather than its output prices.

efficiency using panel data is performed by estimating a cost (profit) function of the general stochastic frontier form:

$$Ln\, Y_{it} = f(Q_{it}, Z_{it}; \beta) + \varepsilon_{it} \qquad i = 1,2,3 \dots N; t = 1,2,3 \dots T$$

where $Y_{it}$ is either the total costs (for cost-efficiency) or profits before tax (for profit-efficiency)[5] of bank $i$ at time $t$; $Q_{it}$ is a vector of outputs; $Z_{it}$ denotes a vector of values of input prices associated with a suitable functional form; and $\beta$ is a vector of unknown scalar parameters to be estimated. We assume $\varepsilon_{it} = v_{it} + u_{it}$ for the cost frontier and $\varepsilon_{it} = v_{it} - u_{it}$ for the profit frontier. $u_{it}$ is the non-negative inefficiency effects in the model, which is assumed to be independently distributed with mean $\mu$ and variance $\sigma_u^2$. $v_{it}$ is random errors, assumed to be i.i.d. and $N(0, \sigma_v^2)$. We assume that banks possess some local market power, and hence both minimizing costs and maximizing profits depend on output quantity $(Q)$ and input prices $(Z)$.

The parameters of this equation are estimated using maximum likelihood for each country separately, assuming heterogeneous cost- and profit-functions across countries. Furthermore, $u_{it}$ is modelled as a function of time in the following way:

$$u_{it} = u_i\{\exp[-\eta(t - T_i)]\}$$

where $T_i$ is the last time period in the $i$th panel and $\eta$ is the decay parameter[6]. Since $t = T_i$ in the last period, the last period for firm $i$ contains the base level of inefficiency for that firm. Hence, if $\eta > 0$, the level of inefficiency decays toward the base level (or decreases over time). If $\eta < 0$, the level of inefficiency increases toward the base level (or increases over time). When $\eta = 0$, the time-varying decay model is reduced to be the time-invariant model.

[5] In the profit frontier we have to deal with banks incurring losses during the period under consideration. Researchers have proposed several methods to overcome this issue (see Bos and Koetter, 2011 for investigating the methods). In this paper, we follow Maudos et al. (2002), Kasman and Yildrim (2006) and Lozano-Vivas and Pasiouras (2010) by rescaling profits. In fact, the dependent variable in the profit model is transformed to ln $(\pi + |\pi^{min}| + 1)$, where $\pi$ is profit before tax and $|\pi^{min}|$ is the minimum absolute value of $\pi$ over all banks in the sample of each country.

[6] We had two choices in estimating cost and profit efficiency: a time-variant efficiency and time-invariant efficiency (assuming η=0). We preliminary estimated both versions. Although the results were not significantly different from each other, we found that the time-variant version, in general, produced a better empirical performance.

The inefficiency score of bank $i$ at time $t$ in each country is defined as $exp(-\hat{u}_{it})$ where $\hat{u}_{it}$ is the estimated value of $u_{it}$, taking a value between one and infinity. To make our results comparable, however, we calculate the index of cost- and profit-efficiency as $1/exp(u_i)$. Hence, each individual bank in each country has a score between 0 and 1 with values closer to 1 indicating a higher level of efficiency.

With respect to the specification of the efficiency frontier, following prior studies (e.g. Angelini and Cetorelli 2003, Hasan et al. 2009b and Coccorese and Pellecchia 2010, Mirzaei and Moore 2014, among others), we choose one output: total assets ($Q$), and three input prices: cost of loanable funds ($Z_1$) computed by dividing financial costs (interest paid) by their corresponding liabilities[7], cost of labour ($Z_2$), calculated by dividing personnel costs by total assets[8], and cost of physical capital ($Z_3$), calculated as the ratio between expenditures on plant and equipment (other non-interest expenses) and the book value of physical capital (fixed assets). By aggregating outputs into one category, i.e. total assets, we assume that there is only one cost or profit structure underlying the production of all classes of assets. Furthermore, in order to take account of changes in technology over time, we include trend variables ($Trend$) in the frontier[9]. The dependent variable ($Y$) is either the bank's total cost calculated as the summation of operating and financial costs (i.e. interest and non-interest expenses) for the estimation of cost efficiency, or profit before tax for the estimation of profit efficiency. The specific form used for the cost- and profit-function is the translog specification[10], which can be written as

[7] We follow an intermediation approach where we include the price of borrowed fund as a factor price in the cost- and profit-functions, and accordingly we include interest expenses in total cost for cost function.

[8] The number of employees is not available for most banks in the database BankScope, hence we proxy it by total assets.

[9] Since we estimate cost- and profit-efficiency models country by country we do not include any country-specific factors such as macroeconomic and/or regulatory variables.

[10] An alternative function specification would be the Fourier flexible functional form. This form best fits the underlying cost and profit structure of cross-country studies with a homogeneous function, and this specification can be shown to dominate the conventional translog functional form (Berger et al. 1997). However, since we assume heterogeneous cost and profit functions across countries, we estimate cost and profit efficiency country by country using the translog form.

$$ln(Y_{it}) = \alpha_0 + \alpha_1 lnQ_{it} + \frac{1}{2}\alpha_2 (lnQ_{it})^2 + \sum_{j=1}^{3} \beta_j lnZ_{j,it} + \frac{1}{2}\sum_{j=1}^{3}\sum_{k=1}^{3} \beta_{jk}\, lnZ_{j,it} lnZ_{k,it}$$
$$+ \sum_{j=1}^{3} \gamma_j lnQlnZ_{j,it} + \mu_1 Trend + \frac{1}{2}\mu_2 Trend^2 + \mu_q Trend.\, lnQ_{it}$$
$$+ \sum_{j=1}^{3} \mu_{zj} Trend.\, lnZ_{j,it} + lnu_{it} + lnv_{it} \qquad (1)$$

where $i = 1, 2, \ldots, N$ and $t = 1,2, \ldots, T$ index banks and time, respectively. Note that by symmetry of the Hessian in the translog function we have $\beta_{jk} = \beta_{kj}$, where $k \neq j$. In order to correspond to a well-behaved production technology, the cost- and profit-function needs to be linearly homogeneous, non-decreasing and concave in factor prices, and non-decreasing in output (Coccorese and Pellecchia, 2010). With the symmetry restriction imposed, necessary and sufficient conditions for our translog specification to be linearly homogeneous (duality theorem) in input prices are as follows:

$$\sum_{j=1}^{3} \beta_j = 1, \qquad \sum_{k=1}^{3} \beta_{jk} = 0 \; (j = 1, 2, 3), \qquad \sum_{j=1}^{3} \gamma_j = 0, \qquad \sum_{j=1}^{3} \mu_{zj} = 0.$$

### 2.1.2. Bank efficiency and industry performance nexus

Rajan and Zingales (1998) suggest that industries that are severely dependent on external finance benefit disproportionately more from well-developed financial sectors than industries that are not heavy users of external finance. It is argued that development in finance helps to mitigate asymmetric information and market frictions that drive a wedge between the price of external and internal finance. We apply the methodology developed by Rajan and Zingales (1998) to an index of bank efficiency, and the model is specified as follows[11]:

[11] The model is based on a two-dimensional panel of industries and countries excluding a time dimension on the following grounds: In econometrics software, there are two choices for estimating efficiency using Frontier Analysis: the time-invariant model and the time-varying decay model. The use of the first option implies that efficiency scores are constant over time. The second option also has the drawback that it is a decay model that the efficiency scores will either increase or decrease over time, which is not realistic as efficiency may fluctuate over time. Moreover, if we use a time dimension, then we cannot test for whether initial efficiency improves future growth, as we did for our two-dimensional approach in the robustness test presented in Table 5. In addition, one important impact of time is, perhaps, the impact of the recent global financial crisis. We have

$$
\begin{aligned}
&Industry\ Performance_{ic} \\
&\quad = Constant + \alpha_1 Share\ in\ value\ added_{ic} \\
&\quad + \alpha_2 External\ Dependence_i \times Banking\ Efficiency_c \\
&\quad + \alpha_3 External\ Dependence_i \times Additional\ variables_c \\
&\quad + \alpha_4 Sector\ Dummies_i + \alpha_5 Country\ Dummies_c + \varepsilon_{ic} \qquad (2)
\end{aligned}
$$

$Industry\ Performance_{ic}$ is either the average (compounded) growth rate of value added, or the average firms size, in industry *i* and country *c* over the period 1995-2007. The former allows us to examine whether industries grow faster in countries with efficient banking sectors, whereas the latter allows us to assess the impact of banking efficiency on industry market structure. Note that the market structure is captured by taking the average firm size that is computed as the natural logarithm of the ratio of total value added and the number of establishments of sector *i* in country *c*. A possible caveat is in place: such a synthetic measure does not provide information regarding the distribution of market shares within the sector. However, it is argued that this may be the best measure of industry market structure available at a sufficiently disaggregated level for a significant cross section of countries (Cetorelli 2001). In order to check on the reliability of the measure of average firm size computed using number of establishments, Cetorelli (2001) has calculated the ranking of average firm size across sectors. For industry specific reasons e.g. economies of scale, one would expect a natural ordering in firm size across countries. This is confirmed by observing the matrix of pairwise rank correlations, which are found to be very large and highly significant[12]. It is also argued that the reliability of our measure of average firm size comes from a comparison with a measure of industrial mark-ups estimated for manufacturing sectors in a number of countries (Martins et. al. 1996). One should expect to find a positive correlation between the two measures of firm size and mark-ups: a larger firm should be associated with a higher market concentration, and hence greater potential for higher margin. Martins et. al. (1996) find that a regression of mark-up on average firm size, controlling for industry- and country-

modelled the crisis period by extending the sample period to 2008-2010 and the results are reported in Table 8. Note that the methodology with the two-dimensions of industry and country is developed by Rajan and Zingales (1998) and has been adopted and expanded by a number of studies to analyse the effect of market structure and competition in the banking sectors on economic growth (e.g. Cetorelli and Gamberra 2001, Beck and Levine 2002 and Claessens and Laeven 2005).

[12] Cetorelli (2001) explores the effect of banking market structure on the market structure of industrial sectors in 17 OECD countries, using firm size as a proxy of the market structure of industry *i*. See also Cetorelli (2004).

fixed effects, produced a positive and significant coefficient for the average firm size variable. The results of these tests should confirm that our measure of average firm size is a plausible indicator of industry market structure.[13]

$Share\ in\ value\ added_{ic}$ is the share of industry $i$ in total manufacturing in country $c$ in 1995. It is the beginning-of-period sector share in value added. We expect that sectors, which have grown considerably in their life cycle in the past, are unlikely to continue to grow at a high rate in the future (Rajan and Zingales 1998, Cetorelli and Gambera 2001 and Cetorelli 2004). Hence, a negative sign is predicted for its coefficient. $External\ Dependence_i$ is the measure of dependence on external finance for industry $i$ as measured for a sample of US companies over the period 1990-1999, which has been used as a benchmark for other countries. $Banking\ Efficiency_c$ is the average cost or profit efficiency score for country $c$ over the period 2001-2010, estimated from the equation (1). $Sector\ Dummies$ and $Country\ Dummies$ are industry and country dummies, respectively. Following previous studies (e.g. Maskus et al., 2012), we do not specify the direct effect of external financial dependence, since it is captured by the industry dummies. The country dummies capture any time-invariant country characteristics.

Furthermore, $Additional\ variables_c$ is a vector of other control variables that may have influence on industry performance. In particular, we include two indicators. One is an indicator of stock market efficiency proxied by the stock market turnover ratio[14]. This allows us to examine whether banking sector efficiency has an independent effect, if any, on industry performance by distinguishing the contribution from equity market efficiency. Since stock market finance applies to large and listed companies, it is expected that the efficiency of equity markets can contribute to the growth and formation of a more concentrated market structure of non-financial sectors through financing large firms. The other indicator used is an institutional variable. It has been reported by some studies (e.g. Beck et al. 2003) that the degree to which property rights are enforced in a country matter for growth. We specify an indicator of property rights, which ranges from 0 to 100 with a higher score denoting greater protection of property.

[13] As a robustness test, we also modelled using the ratio of total employment and the number of establishments, and the results are similar to those of the ratio of value added to number of establishments.

[14] Demirguc-Kunt and Maksimovic (1996) argue that market activity measured as stock market turnover ratio seems to relax financing constraints more than market capitalization does.

## 2.2. Data and summary statistics

The source of data on the banks' balance sheets and income statements used to estimate bank efficiency is the BankScope database. We include all commercial, cooperative and savings banks with the total assets greater than 1 million USD over the period 2001 and 2010. We select data of the international accounting standard, when banks report both local and international accounting standards. In order to ensure that each bank is included only once in the dataset, unconsolidated statements are used when they are available. Merged banks are considered as separate entities before the merger and as one entity afterwards. In order to mitigate the impact of outliers, the observations for which the output and/or factor prices are lower than the 1$^{st}$ centile or larger than the 99$^{th}$ centile are removed. After these data selection procedures, we have a micro panel data consists 5850 banks from 49 emerging and advanced countries. These data are used to estimate bank efficiency and the averages are computed for each country over time.

Next, we constitute a macro panel data set with the two dimensions of industry and country. The industry data for the industry performance, i.e. dependent variables as well as the share of total manufacturing value added for each sector are taken from the UNIDO Database (United Nations Database on Industrial Statistics) for 23 manufacturing sectors (based on ISIC classification, Rev. 3) for 49 countries. The database contains information necessary to compute growth rate of real value added, and the natural log of ratio between value added and number of establishments for each sector in each country for the period 1995 and 2007.

Each industry's degree of financial dependence is taken from Klapper et al. (2006) at two digit levels[15].

With respect to country data, the stock market turnover ratio (as a proxy of market efficiency) is retrieved from the World Development Indicators database averaged for the

[15] Following Rajan and Zingales (1998), Klapper et al. (2006) developed external financial dependence as the industry-level median (across firms) of the ratio of capital expenditure minus cash flow from operations divided by capital expenditures. Higher cash flow allows a firm to utilize the internal financial resources, indicating that the firm is less dependent on external finance. Using Standard and Poor's compustat database for US firms over the period 1990-1999, Klapper et al. calculated this proxy for each industry. This has been used as a benchmark for industrial sectors of other countries, for instance, see Maskus et al. (2012). Our empirical results also remain when we use the old version of data on the degree of external finance taken from Rajan and Zingales (1998), who estimated for U.S. firms over the period 1980 to 1989

period 1995-2007. The indicator of property rights is taken from the Heritage Foundation averaged for the period 1995-2007.

The definition and sources of the variables are found in Table 1. The average bank-level data used for the first stage and the average country-industry-data used for the second stage are available upon request from the authors.

**[Table 1 about here]**

Before proceeding, we point out that our measure of bank efficiency is estimated over the period 2001-2010, a period for which more individual bank data are available from our database of BankScope[16]. This period does not, however, coincide fully with the period, for which we estimate the industry growth, 1995-2007. See Table 1 which lists the variables with the varying sample periods. These data mismatch does not, however, constitute an important issue. Firstly, the efficiency of a banking sector at a country level does not vary noticeably during the sample period. Secondly, as a robustness test, we computed the industry variables for the subsample period of 2001-2007, which is fully covered by the sample period of banking data, and we find consistent results as detailed in Section 4. Moreover, previous studies also use different time spans. For example, Cetorelli and Gambera (2001) use bank data for 1989-1996, while their industry data are for 1980-1990. Similarly, Cetorelli (2004) use bank data for 1990-1997, whereas their industry data are for 1980-1997. Claessens and Laeven (2005) use bank-level data of 1994-2001 with their industry data period of 1980-1990 that is completely outside of the bank sample period (for more discussion see Cetorelli and Gambera, 2001).

Appendix A1, and A2 present summary statistics and a correlation matrix of main variables, respectively.

## 3. Empirical results

We first present the results from the stochastic frontier analysis. We, then, turn to the industry performance regression results.

### 3.1. Estimation of bank efficiency

[16] The banking data in BankScope is limited before 2001 for most emerging countries.

Since we assume the heterogeneous cost and profit functions across countries, we estimate the level of efficiency using the stochastic frontier of Equation (1) for each country separately using the maximum likelihood methodology. In order to save space, the regression results for 49 individual countries are not presented.

**[Table 2 about here]**

Table 2 reports bank cost and profit efficiency averaged for each of the 49 countries in the sample over the period 2001-2010. Since all banks (greater than $1million) operating in each country were taken into account, a weight based on assets is given, respectively[17]. The measure of efficiency takes a maximum value of 100 percent (or value 1 in absolute terms) with a higher (lower) value indicating more (less) efficiency. We report on two types of efficiency: cost efficiency and profit efficiency by distinguishing emerging from advanced economies. For advanced economies, all except for Korea exceed 80% in terms of efficiency, and as expected, the average efficiency score for advanced economies is higher than that for emerging economies. This is perhaps due to the fact that information asymmetries between lenders and borrowers are, in general, lower in developed financial systems because of a better selection of investment projects, improved monitoring of borrowing, and a reduction in the cost of the intermediation process (Pagano, 1993 and Bertocco, 2007). The coefficient of variation also indicates that the dispersion in the cost and profit efficiency is much larger for emerging economies. This appears to characterise heterogeneous emerging banking systems with a lack of uniform regulations and institutional arrangements across this group of countries. Such distinguishing features between the two types of economies are also observed in Panel B, where the degree of efficiency is broadly constant for advanced economies over the time period, whereas a declining trend is evident for emerging economies.

### 3.2. Effect of bank efficiency on industry performance

#### 3.2.1. Effect of bank efficiency on industry growth

**[Table 3 about here]**

[17] The weight is based on each bank's market share, calculated as total assets of each bank divided by total assets of all banks in a country.

Table 3 shows the results of the impact on bank efficiency on industry growth based on Eq. (2). The industry growth is the average growth rate of value added in a particular sector in a particular country over the period 1995-2007. The model is estimated in eight regressions by altering the specifications with OLS. The industry and country dummies are also specified, but not reported to save space. The results seem to be consistent for the key independent variables across these regressions. *Inter alia*, in line with the previous studies (e.g. Rajan and Zingales 1998), the coefficient of the share in value added is negative and statistically significant in all regressions, indicating convergence across industries.

The regressions (1) and (2) show that industrial sectors that rely more on external finance tend to grow disproportionately faster in countries with more cost- and/or profit-efficient banking sectors, since the coefficients for the interactive variables (cost- and profit-efficiency times external financial dependence) is positive and significant at least at the 10% level. This accords with the prior studies by Rajan and Zingales (1998), Cetorelli and Gambera (2001), and Claessens and Laeven (2005), who find that financial development facilitates economic growth through greater availability of external financing. Our finding is also complementary to those studies that suggest more competition in banking sectors promotes economic growth (e.g. Classens and Laeven, 2005).

The results remain to be robust in the alternative specifications in (3) and (4), where the interaction of the external financial dependence with stock market efficiency is included. We find no evidence that efficient stock markets facilitate industry growth, and this contrasts with Levine (1991), who find that measures of more market liquidity are strongly related to growth. Regressions (5) and (6) also suggest that the impact of banking efficiency on industrial sector growth remains to be robust in the presence of an institutional variable, i.e. property rights. These results are confirmed in (7) and (8). The robust evidence is that a more efficient banking sector facilitates the growth of those industries, which are more dependent on external financing.

To interpret these results and measure the economic relevance of the banking system efficiency variables, we perform a standard comparative dynamics exercise (see Cetorelli and Gamberra 2001). We use the regression estimates to infer the differential impact of banking efficiency on growth of a financially dependent industry in two countries that differ in their level of efficiency. See 'differential in real growth rate' in Table 3. For instance, if we take one industry at the $75^{th}$ percentile of external financial dependence (e.g. Chemicals and Chemical Products) and another industry that is at the $25^{th}$ percentile (e.g. Printing and

Publishing), then the total impact on growth based on the estimated cost coefficiency in regression (2) is 0.449 percentage point higher in a country at the 75$^{th}$ percentile (e.g. Germany) of the distribution of banking sector efficiency than in a country at the 25$^{th}$ percentile of (e.g. Turkey). In other words, in terms of growth, moving from Turkey to Germany with a more efficient banking sector, benefits highly financially dependent industries. Similarly, the total impact on growth based on the estimated coefficient in regression (1) for profit efficiency is 0.485 percentage point higher in a country at the 75$^{th}$ percentile (e.g. the UK) of the distribution of banking sector efficiency than in a country at the 25$^{th}$ percentile of (e.g. Egypt). In short, since the average growth in value added is 8 percent, these effects are economically not trivial.

### 3.2.2. Effect of bank efficiency on industry market structure

Table 4 presents the regression results where the dependent variable is the logarithm of value added over the number of establishments. Regressions are estimated using OLS with industry and country dummies (the dummy variables are not reported to save spaces). In all regressions, the share of value added variables is consistently positive and significant, and this again indicates the convergence effect (Cetorelli, 2004).

**[Table 4 about here]**

As reported in the first two columns, i.e. (1) and (2) regressions, bank efficiency appears to have a negative and significant effect on the concentrated market structure of industry. This implies that the average firm size by sector, where firms rely more on external finance, is smaller in countries that are characterized by an efficient banking sector. This indicate that banking efficiency contributes to de-concentration of industry sectors.

Regressions (3) and (4) present estimation results where the interaction term with a proxy for stock market efficiency is specified. While the effect of bank efficiency continues to be negative and significant, the average firm size is larger in countries with more efficient stock markets. A possible explanation for this phenomenon is that larger listed firms have more access to stock markets, and hence efficient stock markets can help these large firms to finance their investment opportunities. This is consequently leading to more concentrated industrial sectors. The finding of the significant effect from property rights in (6) (7) and (8) regressions indicates that a well-functioned institutional environment make it easier for the formation and establishment of smaller and younger firms.

The economic significance of such bank efficiency impact on industry market structure is indicated in 'differential in firm size' in Table 4. For instance, with models (2) and (1), a sector heavily dependent on external finance (at 75$^{th}$ percentile) will have an average firm size about 2.4% and 5.4%, respectively, smaller than a sector relatively less dependent on external finance (at 25$^{th}$ percentile), if bank cost and profit efficiency were to increase from the first to the third quintile of its distribution. Considering that the unconditional absolute difference in firm size between high- and low-dependence sectors is about 3%, such an impact determined by a change in bank cost and profit efficiency is economically significant.

## 4 Robustness tests

### 4.1 Robustness tests for the effect of bank efficiency on industry growth

**[Table 5 about here]**

Table 5 shows the consolidated results of the 4 alternative robustness tests together with the initial results in Table 3. The specification of the regressions from (1) to (8) are analogous to those in Table 3. In order to save space we only present the coefficients of bank efficiency that are the primal concern of this paper. Other coefficients are very close to the original results in terms of sign and significance.

Firstly, we use three instrument variables (IV) of total population and total GDP (measured in US dollars) of a country to proxy for market size, and indicators for the legal origin of a country in order to determine a country's institutional characteristics.[18] These types of instrumental variables are often used by a number of studies (see e.g. Cetorelli and Gambera, 2001) on industry performance[19]. See Table 5 in 'Instrument variables' for the results, where the coefficients are broadly consistent with those of Table 3 in terms of sign, statistical significance and the order of magnitude. This confirms our previous findings that financially dependent firms grow faster in more efficient banking environments.

[18] The data of GDP and population are collected from WDI, World Bank. Both variables are transformed into logarithms for estimation. The variable of legal origin is retrieved from World Bank (2004). See Table 1 for the respective sample periods.

[19] In order to check the over-identifying restriction for each of the IV regressions, we performed a Durbin-Wu-Hausman (DWH) F-test.

Secondly, we test whether our findings are robust when we use the initial values rather than the average values. It is argued that the effect of financial development and hence banking efficiency on economic growth may not be contemporaneous but affects future growth. We use the year 2001, the earliest year, for the efficiency scores. For stock market efficiency and property rights, we specify the initial year 1995. See the results in 'Initial values of bank efficiency' in Table 5. The positive and significant effect of the interaction terms remains, and the magnitude gauged by the coefficients is again close to the initial values in Table 3. This indicates the persistence of the shock derived from bank efficiency and demonstrates a long term influence of the efficiency. This robustness test may also eradicate any remaining doubt of an endogeneity problem, if there is, between bank efficiency and industry growth.

The third test of robustness refers to the alternative indicators of bank efficiency. We use the product efficiency scores based on equation (1) for each country separately. We assume that bank output is a function of inputs, where total loans (i.e. *product*) proxy for output and the input variables are similar to those used for cost efficiency. The product efficiency indicates that no more output can be achieved from the given inputs, and it is expected that industries should benefit more if a banking system is more productively efficient. Another alternative indicator is *cost to income ratio* taken from financial statements. See 'Alternative indicators of bank efficiency' in Table 5. Although the effect of cost to income variable is not well-determined, the coefficient for product efficiency is significantly positive across all specifications. The results again prove the validity of the efficiency hypothesis in terms of producing maximum output given inputs.

As for the forth robustness test, we use a different sample period. In the main estimation in Table 3, the period of 1995-2007 was used to gauge the growth of value added, whereas the data for the banking efficiency scores covered the period of 2001-2010. We match the sample period for dependent and efficiency variables together with other explanatory variables with the period of 2001-2007. The results are reported in 'Sample period 2001-2007' and are again supportive to the original results. It is noteworthy that the size of the coefficients has become much larger, indicating the strength of the association with the matched sample period. Greater efficiency in a banking sector exerts a positive effect on growth of those industries that are more dependent on external finance, and such effects are proved to be robust to the sample period.

**[Table 6 about here]**

Next, we augment the model with the proxies of other financial development variables, which are found to be strong indicators of growth in much literature including quantity-based development. We specify domestic credit to private sector, domestic credit provided by the banking sector, banking freedom and stock market capitalization[20]. All these variables are interacted with financial dependence. See Table 6. We find little evidence that these proxies of financial development have any impact on growth of non-financial sectors, except for market capitalization, whereas bank efficiency continues to exert a significant effect. This result sheds an additional light on the debate over quality- versus quantity-finance, favouring the former. The weakening effect of the quantity side of financial development is also exposed in Hasan et al. (2009a). One may wonder if this is due to the 'reverse causality', as Lucchetti et al. (2001) point out, that the growth of credit is more influenced by the economic activities of industry rather than the other way round. This result proves an important channel of the influence on industry growth exerted by a financial variable through banking efficiency, and may not necessarily be through the provision of credits.

### 4.2 Robustness tests for the effect of bank efficiency on industry market structure

We present some robustness with respect to the effect of bank efficiency on industry market structure. Using the same instrumental variables of total population and total GDP (measured in US dollars) of a country as for growth in Table 5, we report the regression results in Panel A of Table 7. As observed, the results confirm our previous findings that the average firm size of financially dependent firms is smaller in countries with more efficient banking sectors.

**[Table 7 about here]**

We also check the results by using the initial year of the financial development with the year 1995 for stock market efficiency and property rights and the year 2001 for bank efficiency. See Panel B of Table 7. The result again confirms that an efficient banking sector contributes to the formation of un-concentrated firms, and, indeed, indicates the persistent effect on market structure. Note that, in contrast to banking efficiency, more efficient stock

[20] We take the ratio with GDP for these variables (except banking freedom). See Table 1 for the data sources.

markets enhance the average size of those sectors that are heavily dependent on external finance, and this seems to exert a long term effect, too.

### 4.3 Financial crisis period

The statistics for our sample countries shows that average industry growth in the pre-crisis period (2005-2007) is 9% whilst it is significantly contracted to -2% during the crisis period (2008-2010), indicating a shift in the industry growth. Moore and Mirzaei (2014) also document significant decline in industry growth when the global financial crisis hit . It is, hence, worthwhile to analyse the impact of bank efficiency on industry growth and average firm size by taking the crisis sample period. The sample period of 2008-2010 is used for the dataset of industry growth, industry firm size, bank efficiency, stock market efficiency and property rights[21]. For the variable of Share in value added, the pre-crisis year of 2007 is used. The results are reported in Table 8.

**[Table 8 about here]**

The effects of cost efficiency continue to exert a positive effect on the industry growth, though to a lesser degree, since the coefficient is significant at the 10% level. In the case of firm size, in contrast to our previous findings for the economically normal period, evidence reveals that more bank (cost) efficiency leads to more concentrated industrial sectors. One of the adverse phenomena during the crisis period was the constrained supply of credit, hence those firms that had capacity to offer more collateral and/or had established relationships with banks were likely to secure funds. Young and new firms are perceived as being risky, and hence they may have found it difficult to obtain bank loans during the crisis period. If banks behave prudently, this is likely to lead to a contraction of growth or the bankruptcy for these vulnerable firms. This means that while bank efficiency alleviates financial constraints for these firms, leading to less concentration of industries during normal periods, only well established incumbents' firms can benefit from the efficient banks during the crises periods. This may have contributed to increasing industries' average firm size.

Moreover, such bank efficiency is mainly driven through the cost side, as there is absence of statistical significance on the coefficient of profit efficiency. Banks appear to

[21] Note that since the UNIDO reports industry data with a multi-year lag we cannot extend the data beyond 2010.

focus on the cost side rather than on the profit side. This is plausible given the fact that the stance of the banking sector is more defensive during the crisis period.

### 4.4 Efficiency model with country specific variables

**[Table 9 about here]**

In this section, we re-estimate the efficiency scores by pooling all countries with country specific variables in translog equation (1). Specifically, following Lozano-Vivas and Pasiouras (2010) we control for variation in risk-taking strategies among banks by including bank equity to total assets ratio. The variables of domestic credit to private sector (% of GDP) and stock market capitalization (% of GDP) are included as proxies for differences in financial development across countries. We also specify proxies of political and institutional quality indexes, KKZ index and property rights across countries[22]. The KKZ index measures different dimensions of governance, which include government effectiveness, political stability, regulatory quality, rule of law, voice and accountability and control of corruption. We expect that banks are likely to be more efficient if they are in countries with higher quality institutions. A dummy variable for countries with British common law is also included, as it is often argued that legal origins of countries can affect the development of financial sectors. The country dummy variables are also specified to capture any remaining country-fixed effects. The sample period for these datasets is 2001-2010. Note that the number of observations are reduced to 43 countries, as such country-specific variables are not available for all countries. The efficiency score is re-computed based on the pooled translog model with these country-specific variables.

We then estimate the linear model using the new dataset of efficiency scores. The results are shown in Table 9, where not only the cost and profit efficiency, but also the average efficiency score (cost and profit) are specified. The results for the effect of cost efficiency remains robust with a positive effect on growth and a negative effect on the firm size. The profit efficiency is not significant, whereas the average efficiency is significant, but only at the 10% level. The results appears to verify that efficiency indeed matters for industry performance, however this may be largely driven by the effect of cost efficiency.

[22] The KKZ index is collected from World Governance Indicator.

## 5. Conclusion

This research agenda involves delving deeper into the details governing the functioning of the quality-finance and industry performance nexus. Banking efficiency appears to be one such attribute, since the empirical results in this paper support that efficiency in the banking sector offers a qualifying impact on the finance-growth relationship. We first measured the relative bank efficiency of a sample of 5850 banks in 49 countries, using a stochastic frontier methodology. We then related industry performance of 23 manufacturing sectors to this indicator of banking system efficiency.

This paper provides new empirical evidence on the question of the channels through which the banking system affects the real sector. The main insight of this study is that at least maintaining the focus on the effects on industrial performance, banking efficiency plays an important role. Industries that depend heavily on external finance grow faster in countries with more efficient banking systems. Furthermore, when industries are more in need of external finance, firms are of a disproportionately smaller size, if they are in countries with efficient banking sectors. These results suggest that in efficient banking markets, banks can offer better conditions of financing and improve profitability in industries in the long run. The evidence also seems to imply that efficient banking systems may relax financial barriers to entry, leading to less concentrated markets in non-financial industries. The results have been shown to be robust when we control for the effects of stock market efficiency, property rights, the instrument variables, the initial values of financial development and the different sample periods. Although, we find no evidence that efficient stock markets contribute to the growth of non-financial firms, it affects the average firm size of those sectors in favour of more concentrated firms. This suggests that large public firms benefit more from liquid equity markets and become disproportionately larger.

In the extended models with the financial crisis dummy and revised efficiency score, respectively, we have observed that the efficiency effect is mainly derived from the cost side in the banking sector.

Firms in sectors especially dependent on external finance should suffer more, and therefore grow less than average, when faced with an inefficient banking sector. On the other hand, if bank efficiency is enhanced, then one would expect that those firms, in industries that are dependent on external finance, should benefit more. The results confirm the basic predictions of bank efficiency and growth: An inefficient banking industry may impose a

deadweight loss in the credit market as a whole, resulting in a reduction in the total quantity of loanable funds for viable projects. Moreover, because bank efficiency plays a more substantial role for growth, perhaps, by facilitating credit access of less large firms, and to the extent that investment by small and medium firms is more likely to introduce innovative technologies, banking efficiency should have an impact on the pace of technological progress. In the midst of important regulatory reforms and significant structural transformations of the banking industry that have been undertaken elsewhere in the post financial crisis period, policies that promote bank efficiency need to be re-emphasised.

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# Appendix

**Table A1:** Summary statistics

| | Mean | Med. | Max. | Min. | St. Dev. | Obs. |
|---|---|---|---|---|---|---|
| *Variables used for stage 1* | | | | | | |
| Total assets (USD m) | 12704.1 | 711.9 | 2964299.0 | 0.1 | 90228.6 | 58497 |
| Total cost (operating and financial cost-USD m) | 183.2 | 22.9 | 9992.6 | 0.5 | 703.2 | 44923 |
| Profit before tax (USD m) | 81.4 | 3.7 | 35081.1 | -27782.3 | 749.8 | 58320 |
| Price of deposits (%) (total interest expenses/ total funds) | 1.82 | 1.49 | 43.35 | 0.01 | 1.70 | 36184 |
| Price of labours (%) (total personnel expenses/ total assets) | 1.70 | 1.30 | 48.99 | 0.00 | 2.12 | 54492 |
| Price of capital (%) (other non-interest expenses/ fixed assets) | 139.73 | 76.92 | 1000.00 | 0.18 | 166.97 | 56595 |
| *Variables used for stage 2* | | | | | | |
| a) Financial sector efficiency | | | | | | |
| Cost efficiency | 0.82 | 0.86 | 0.99 | 0.31 | 0.13 | 49 |
| Profit efficiency | 0.76 | 0.80 | 0.92 | 0.34 | 0.13 | 49 |
| Stock market turnover ratio (%) | 67.84 | 54.39 | 226.99 | 1.47 | 46.77 | 48* |
| b) Industry variables | | | | | | |
| Industry growth (average compounded) | 0.08 | 0.10 | 0.34 | -0.43 | 0.11 | 1000 |
| Firm's size (log of value added to no. of establishment) | 14.03 | 13.88 | 19.89 | 9.13 | 1.61 | 1064 |
| Industry's share of total value added | 0.045 | 0.033 | 0.447 | 0.000 | 0.047 | 1057 |
| External finance dependence | 0.30 | 0.17 | 1.06 | -0.12 | 0.30 | 23 |
| c) Institutional variable | | | | | | |
| Property rights | 69.78 | 70.00 | 90.00 | 29.23 | 18.35 | 49 |

**Source:** BankScope, UNIDO Database, Klapper et al. (2006), World Bank Database, and Heritage Foundation. * indicates that the data for Taiwan is not available in our database.

| Table A2: Correlation matrix | | | | | | | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| (1)Industry growth | | | | | | | |
| (2)Average firm size I | 0.035 | | | | | | |
| (3)Share in value added | -0.046 | 0.238*** | | | | | |
| (4)Financial dependence | 0.074** | -0.087*** | -0.097*** | | | | |
| (5)Stock market turnover ratio | 0.225*** | 0.164*** | 0.014 | 0.046 | | | |
| (6)Property rights | 0.324*** | -0.177*** | 0.026 | -0.01 | 0.429*** | | |
| (7)Bank cost efficiency | 0.347*** | -0.173*** | 0.023 | -0.009 | 0.472*** | 0.619*** | |
| (8)Bank profit efficiency | 0.254*** | -0.097*** | 0.016 | 0.001 | 0.428*** | 0.426*** | 0.856*** |

**Notes:** Industry growth is the average (compounded) real growth in sectoral value added over 1995-2007. Firm size is the average natural logarithm of value added divided by the total number of establishments in each sector in each country over 1995-2007. Share in value added is the fraction of value added of each sector in each country in year 1995. Financial dependence is the external financial dependence of each sector. Bank efficiency scores obtained using Eq. (1). * Significant at 10%, ** Significant at 5% and *** Significant at 1%.

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**Table1:** Descriptive, definition, and source of variables

| Variable | Definition and source |
|---|---|
| *Dependent variables* | |
| Growth | Average (compounded) annual growth rate of value added in a particular sector in each country over 1995-2007. Source: UNIDO database, and own calculation. |
| Industry market structure | Average natural logarithm of ratio between value added and total number of establishments over 1995-2007. Source: UNIDO database, and own calculation. |
| *Explanatory variables* | |
| Share in value added | The value added of each sector as a proportion of the total value added of an economy at the initial year (1995). Source: UNIDO database, and own calculation. |
| Financial dependence | External financial dependence of U.S. firms by 2-digit ISIC sector over the period 1990 to 1999. This is an industry-level median of the ratio of capital expenditures minus cash flow over capital expenditures. Cash flow is defined as the sum of funds from operations, decreases in inventories, decreases in receivables, and increases in payables. Capital expenditures include net acquisitions of fixed assets. This definition follows Rajan and Zingales (1998). Source: Klapper et al. (2006). |
| Cost efficiency | Average cost efficiency of a country's banking system over the period 2001-2010, derived from stochastic cost frontier estimates. Source: BankScope and own estimation. |
| Profit efficiency | Average profit efficiency of a country's banking system over the period 2001-2010, derived from stochastic relative profit frontier estimates. Source: BankScope and own estimation. |
| Stock market efficiency | Average stock market turnover ratio over the period 1995-2007, calculated as the total value of shares traded during the period divided by the average market capitalization for the period. Source: World Bank-WDI and own calculation. |
| Property rights | Average measure of property rights over the period 1995-2007. It is an indicator of the protection of private property rights and ranges from 0 to 100. A higher score denotes greater protection of property. Source: Heritage Foundation and own calculation. |
| *Others* | |
| Product efficiency | Average product efficiency of a country's banking system over the period 2001-2010, derived from stochastic product frontier estimates. It is the ability to produce a good using the fewest resources possible. Source: BankScope and own estimation. |
| Cost to income ratio | Average cost to income ratio of a country's banking sector over the period 2001-2010. It shows a bank's costs in relation to its income, calculated by dividing the operating costs by operating income. The ratio suggests how efficiently the bank is being run. Source: BankScope and own calculation. |
| Domestic credit to private sector | Average ratio of domestic credit to private sector to GDP of country over the period 1995-2007, which refers to financial resources provided to the private sector. Source: World Bank-WDI and own calculation. |
| Domestic credit provided by banking sector | Average ratio of domestic credit provided by banking sector to GDP of a country over the period 1995-2007. Source: World Bank-WDI and own calculation. |
| Banking freedom | Average measure of banking freedom over the period 1995-2007. This is an indicator that provides an overall measure of openness of the banking sector and the extent to which banks are free to operate their businesses. It ranges from 0 to 09. Higher values signify more freedom. Source: Heritage Foundation and own calculation. |
| Market capitalization | Average stock market capitalization to GDP of a country over the period 1995-2007. Source: World Bank-WDI and own calculation. |
| Legal origin | An indicator of a country's legal system. Source: World Bank (2004). We classify whether a country's legal system is based on British, French, German, or Scandinavian law. |
| Population | Average total population of a country over the period 1995-2007. Source: World Bank-WDI and own calculation. |
| GDP | Average real GDP of a country over the period 1995-2007. Source: World Bank-WDI and own calculation. |

**Table 2:** Average cost and pforit efficiency (%) levels of banks in 49 emerging and advanced countries over 2001-2010

| Emerging economies | | | Advanced economies | | |
|---|---|---|---|---|---|
| | Efficiency | | | Efficiency | |
| Country | Cost | Profit | Country | Cost | Profit |
| *Panel A: by country* | | | | | |
| Argentina | 82.05 | 75.12 | Australia | 92.02 | 88.50 |
| Brazil | 75.59 | 68.01 | Austria | 89.16 | 80.50 |
| Chile | 85.64 | 75.53 | Belgium | 93.57 | 90.54 |
| China | 81.16 | 74.70 | Canada | 86.94 | 81.53 |
| Colombia | 83.28 | 75.21 | Denmark | 84.31 | 82.13 |
| Czech Rep. | 72.25 | 68.10 | Finland | 90.53 | 87.30 |
| Egypt | 53.62 | 46.90 | France | 92.37 | 88.61 |
| Estonia | 76.29 | 71.06 | Germany | 94.09 | 90.54 |
| Hungary | 73.16 | 66.37 | Greece | 89.03 | 83.63 |
| India | 72.46 | 66.02 | Iceland | 93.24 | 88.76 |
| Indonesia | 66.38 | 66.07 | Ireland | 83.15 | 80.56 |
| Malaysia | 86.21 | 76.15 | Israel | 93.23 | 88.07 |
| Mexico | 76.62 | 75.60 | Italy | 91.19 | 84.22 |
| Morocco | 43.96 | 34.18 | Japan | 88.19 | 82.93 |
| Peru | 82.85 | 76.60 | Korea | 43.47 | 57.40 |
| Philippines | 83.59 | 74.59 | Luxembourg | 91.58 | 88.63 |
| Poland | 85.69 | 85.72 | Netherlands | 96.41 | 89.79 |
| Russia | 67.96 | 47.00 | New Zealand | 97.53 | 88.93 |
| Slovak Rep. | 72.06 | 69.30 | Norway | 90.11 | 84.73 |
| Slovenia | 79.28 | 74.24 | Portugal | 87.80 | 82.65 |
| South Africa | 85.63 | 86.00 | Spain | 88.53 | 84.19 |
| Taiwan | 81.26 | 75.69 | Sweden | 93.77 | 88.43 |
| Thailand | 63.57 | 61.65 | Switzerland | 94.53 | 88.70 |
| Turkey | 75.11 | 66.23 | United Kingdom | 92.11 | 88.92 |
| | | | United States | 91.22 | 88.71 |
| average | 75.24 | 69.00 | average | 89.12 | 85.16 |
| std.dev. | 14.69 | 19.84 | std.dev. | 8.90 | 10.91 |
| coef. of var. | 19.52 | 28.75 | coef. of var. | 9.99 | 12.81 |
| *Panel B: by year* | | | | | |
| 2001 | 78.97 | 70.86 | | 91.90 | 83.78 |
| 2002 | 79.57 | 72.50 | | 89.95 | 84.01 |
| 2003 | 80.92 | 73.07 | | 90.00 | 86.19 |
| 2004 | 78.95 | 73.56 | | 91.03 | 86.38 |
| 2005 | 77.60 | 73.97 | | 91.04 | 86.55 |
| 2006 | 76.77 | 70.28 | | 90.03 | 86.72 |
| 2007 | 77.41 | 66.50 | | 88.96 | 87.87 |
| 2008 | 68.48 | 64.63 | | 87.83 | 86.01 |
| 2009 | 67.99 | 62.67 | | 87.62 | 86.14 |
| 2010 | 65.07 | 63.63 | | 88.30 | 85.25 |
| Mean 2001-07 (s1) | 78.60 | 71.53 | | 90.42 | 85.93 |
| Mean 2008-10 (s2) | 67.18 | 63.64 | | 87.92 | 85.80 |
| S1=S2 (p-value) | 0.00 | 0.00 | | 0.08 | 0.14 |

**Table 3:** Banks efficiency and industry growth

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| Share in value added | -0.026*** | -0.026*** | -0.025*** | -0.025*** | -0.025*** | -0.025*** | -0.024*** | -0.024*** |
| | (-2.87) | (-2.87) | (-2.69) | (-2.70) | (-2.83) | (-2.82) | (-2.66) | (-2.67) |
| Stock market efficiency*FD | | | -0.007 | -0.005 | | | -0.006 | -0.004 |
| | | | (-0.93) | (-0.69) | | | (-0.80) | (-0.57) |
| Property rights*FD | | | | | -0.018 | -0.011 | -0.017 | -0.010 |
| | | | | | (-0.69) | (-0.50) | (-0.63) | (-0.42) |
| Bank efficiency | | | | | | | | |
| Cost efficiency*FD | | 0.117** | | 0.117** | | 0.127** | | 0.126** |
| | | (2.48) | | (2.48) | | (2.49) | | (2.46) |
| Profit efficiency*FD | 0.083* | | 0.091* | | 0.108* | | 0.114* | |
| | (1.68) | | (1.81) | | (1.75) | | (1.83) | |
| Industry dummies | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Country dummies | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Number of countries | 49 | 49 | 48 | 48 | 49 | 49 | 48 | 48 |
| Observations | 1000 | 1000 | 993 | 993 | 1000 | 1000 | 993 | 993 |
| R-squared | 0.526 | 0.528 | 0.524 | 0.526 | 0.526 | 0.528 | 0.524 | 0.526 |
| Adj. R-squared | 0.489 | 0.491 | 0.487 | 0.489 | 0.489 | 0.491 | 0.487 | 0.488 |
| **Differential (in %) in real growth rate** | | | | | | | | |
| Cost efficiency | | 0.449 | | 0.449 | | 0.487 | | 0.483 |
| Profit efficiency | 0.485 | | 0.531 | | 0.631 | | 0.666 | |

**Notes:** Dependent variable is the average (compounded) real growth in sectoral value added over the period 1995-2007. Share in value added is the fraction of value added of each sector in each country in year 1995. FD is the external financial dependence of each sector. Stock market efficiency is stock market turnover ratio. Bank efficiency scores obtained using Eq. (1). Regressions are estimated using OLS and include industry and country dummies (not reported). Robust t-values are in parentheses. * Significant at 10%, ** Significant at 5% and *** Significant at 1%. The sample size is reduced to 993 observations for 48 countries with the stock market efficiency, as observations for Taiwan are missing. The differential in real growth rate measures (in percentage terms) how much faster an industry at the 75th percentile level of external financial dependence grows with respect to an industry at the 25th percentile level when it is located in a country at the 75th percentile of banking efficiency rather than in one at the 25th percentile.

**Table 4:** Effect of bank effciency on average firms size

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| Share in value added | 1.232*** | 1.223*** | 1.217*** | 1.207*** | 1.240*** | 1.239*** | 1.228*** | 1.226*** |
| | (14.87) | (14.78) | (14.71) | (14.57) | (14.95) | (14.94) | (14.77) | (14.75) |
| Stock market efficiency*FD | | | 0.274*** | 0.215** | | | 0.125* | 0.121* |
| | | | (3.00) | (2.44) | | | (1.80) | (1.75) |
| Property rights*FD | | | | | -0.371 | -0.436** | -0.457* | -0.537** |
| | | | | | (-1.61) | (-2.15) | (-1.94) | (-2.55) |
| Bank efficiency | | | | | | | | |
| Cost efficiency*FD | | -0.627** | | -1.098** | | -0.241* | | -0.186* |
| | | (-1.94) | | (-2.44) | | (-1.74) | | (-1.77) |
| Profit efficiency*FD | -0.919** | | -0.624*** | | -0.422 | | -0.444* | |
| | (-2.18) | | (-3.38) | | (-0.81) | | (-1.85) | |
| Industry dummies | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Country dummies | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Number of countries | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 |
| Observations | 1049 | 1049 | 1049 | 1049 | 1049 | 1049 | 1049 | 1049 |
| R-squared | 0.812 | 0.812 | 0.812 | 0.812 | 0.812 | 0.812 | 0.813 | 0.813 |
| Adj. R-squared | 0.798 | 0.798 | 0.799 | 0.798 | 0.799 | 0.799 | 0.799 | 0.799 |
| **Differential (in %) in firm size, measured:** | | | | | | | | |
| Cost efficiency | | -2.406 | | -4.213 | | 0.925 | | -0.714 |
| Profit efficiency | -5.366 | | -3.644 | | -2.464 | | -2.593 | |

**Notes:** Dependent variable is the average natural logarithm of value added divided by the total number of establishments in each sector in each country over the period 1995-2007. Share in value added is the fraction of value added of each sector in each country in year 1995. FD is the external financial dependence of each sector. Stock market efficiency is stock market turnover ratio. Bank efficiency scores obtained using Eq. (1). Regressions are estimated using OLS and include industry and country dummies (not reported). Robust t-values are in parentheses. * Significant at 10%, ** Significant at 5% and *** Significant at 1%. 48 countries because the absence of number of establishment data of Taiwan. The differential in firm size measures (in percentage terms) how much bigger an industry at the 75th percentile level of external financial dependence is with respect to an industry at the 25th percentile level when it is located in a country at the 75th percentile of banking efficiency rather than in one at the 25th percentile.

**Table 5:** Banks efficiency and industry growth: Robustness tests

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| ***Table 3(reproduced)*** | | | | | | | | |
| Cost efficiency*FD | | 0.117** | | 0.117** | | 0.127** | | 0.126** |
| | | (2.48) | | (2.48) | | (2.49) | | (2.46) |
| Profit efficiency*FD | 0.083* | | 0.091* | | 0.108* | | 0.114* | |
| | (1.68) | | (1.81) | | (1.75) | | (1.83) | |
| ***Instrument variables*** | | | | | | | | |
| Cost efficiency*FD | | 0.119** | | 0.074* | | 0.155** | | 0.117* |
| | | (2.25) | | (1.72) | | (2.39) | | (1.72) |
| Profit efficiency*FD | 0.123*** | | 0.090* | | 0.133*** | | 0.104** | |
| | (2.64) | | (1.76) | | (2.64) | | (1.97) | |
| Durbin-Wu-Hausman | 0.67 | 0.33 | 1.19 | 0.94 | 1.33 | 1.45 | 7.19* | 4.22 |
| ***Initial values of bank efficiency*** | | | | | | | | |
| Cost efficiency(2001)*FD | | 0.110*** | | 0.104** | | 0.114*** | | 0.104** |
| | | (2.84) | | (2.55) | | (2.91) | | (2.54) |
| Profit efficiency(2001)*FD | 0.097** | | 0.093** | | 0.122*** | | 0.110** | |
| | (2.35) | | (1.97) | | (2.70) | | (2.28) | |
| ***Alternative indicators of bank efficiency*** | | | | | | | | |
| Product efficiency*FD | | 0.095** | | 0.101** | | 0.094** | | 0.099** |
| | | (2.03) | | (2.10) | | (1.99) | | (2.06) |
| Cost to income ratio*FD | -0.053 | | -0.054 | | -0.056 | | -0.057 | |
| | (-1.48) | | (-1.50) | | (-1.55) | | (-1.58) | |
| ***Sample period 2001-2007*** | | | | | | | | |
| Cost efficiency*FD | | 0.178** | | 0.175** | | 0.191** | | 0.198** |
| | | (2.54) | | (2.48) | | (2.45) | | (2.52) |
| Profit efficiency*FD | 0.169** | | 0.165** | | 0.219** | | 0.225** | |
| | (2.30) | | (2.19) | | (2.33) | | (2.38) | |

**Notes:** Dependent variable is the average (compounded) real growth in sectoral value added over the period 1995-2007. FD is the external financial dependence of each sector. Bank efficiency scores obtained using Eq. (1). Instrument variables: We use the legal origin dummy, population and GDP indicator of the country. The Durbin-Wu-Hausman statistic tests the null hypothesis that the use of instrumental variables does not change the estimation outcome. Initial values: Stock market efficiency is stock market turnover ratio in year 1995. Property right is taken from the year 1995. Bank efficiency scores are based on the average of each country in year 2001. In order to save space, the Share in value added, Stock market efficiency*FD and Property rights*FD, and also R-squared are not reported. Robust t-values are in parentheses. * Significant at 10%, ** Significant at 5% and *** Significant at 1%.

**Table 6:** Bank efficiency and industry growth: sensitivity to alternative indicators of financial development

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| Share in value added | -0.026*** | -0.026*** | -0.026*** | -0.026*** | -0.026*** | -0.026*** | -0.026*** | -0.026*** |
| | (-2.86) | (-2.85) | (-2.87) | (-2.85) | (-2.86) | (-2.87) | (-2.92) | (-2.90) |
| Bank development | | | | | | | | |
| Domestic credit to private sector*FD | 0.011 | 0.014 | | | | | | |
| | (0.99) | (1.33) | | | | | | |
| Domestic credit prov. by banking*FD | | | 0.015 | 0.017 | | | | |
| | | | (1.04) | (1.32) | | | | |
| Banking freedom*FD | | | | | -0.028 | -0.041 | | |
| | | | | | (-0.95) | (-1.39) | | |
| Market development | | | | | | | | |
| Market capitalization*FD | | | | | | | 0.027** | 0.026** |
| | | | | | | | (2.37) | (2.47) |
| Property rights*FD | -0.041* | -0.032 | -0.041* | -0.031 | -0.017 | 0.016 | -0.045 | -0.038 |
| | (-1.67) | (-1.31) | (-1.68) | (-1.28) | (-0.54) | (0.61) | (-1.18) | (-1.63) |
| Bank efficiency | | | | | | | | |
| Cost efficiency*FD | | 0.096** | | 0.096** | | 0.120*** | | 0.071* |
| | | (2.31) | | (2.29) | | (2.97) | | (1.66) |
| Profit efficiency*FD | 0.098* | | 0.098* | | 0.136*** | | 0.059* | |
| | (1.88) | | (1.90) | | (2.60) | | (1.73) | |
| Industry dummies | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Country dummies | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Number of countries | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 |
| Observations | 993 | 993 | 993 | 993 | 993 | 993 | 993 | 993 |
| R-squared | 0.527 | 0.528 | 0.527 | 0.528 | 0.529 | 0.530 | 0.529 | 0.530 |
| Adj. R-squared | 0.489 | 0.490 | 0.489 | 0.490 | 0.491 | 0.492 | 0.492 | 0.492 |

**Notes:** Dependent variable is the average (compounded) real growth in sectoral value added over the period 1995-2007. Share in value added is the fraction of value added of each sector in each country in year 2001. FD is the external financial dependence of each sector. Bank efficiency scores obtained using Eq. (1). Regressions are estimated using OLS and include industry and country dummies (not reported). Robust t-values are in parentheses. * Significant at 10%, ** Significant at 5% and *** Significant at 1%.

**Table 7:** Effect of bank effciency on average firms size: Robustness tests

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| *Panel A: Instrumental variables* | | | | | | | | |
| Share in value added | 1.242*** | 1.255*** | 1.231*** | 1.242*** | 1.217*** | 1.233*** | 1.117*** | 1.098*** |
| | (14.11) | (14.26) | (13.94) | (14.09) | (12.99) | (13.22) | (11.23) | (10.76) |
| Stock market efficiency*FD | | | 0.002 | 0.003** | | | 0.014 | 0.011* |
| | | | (1.39) | (2.03) | | | (1.44) | (1.77) |
| Property rights * FD | | | | | -0.143 | -0.200 | -0.166* | -0.204* |
| | | | | | (-0.87) | (-1.04) | (-1.72) | (-1.83) |
| Bank efficiency | | | | | | | | |
| Cost efficiency*FD | | -1.187*** | | -1.667*** | | -1.153** | | -0.973* |
| | | (-2.63) | | (-3.28) | | (-2.23) | | (-1.73) |
| Profit efficiency*FD | -0.663* | | -0.932** | | -0.713* | | -0.740** | |
| | (-1.69) | | (-2.05) | | (1.80) | | (-2.51) | |
| Industry dummies | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Country dummies | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Number of countries | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 |
| Observations | 1005 | 1005 | 1005 | 1005 | 1005 | 1005 | 1005 | 1005 |
| Durbin-Wu-Hausman | 7.06* | 2.93 | 1.04 | 0.99 | 0.38 | 0.77 | 0.96 | 0.81 |
| R-squared | 0.811 | 0.812 | 0.807 | 0.806 | 0.794 | 0.788 | 0.735 | 0.747 |
| *Panel B: Initial financial development* | | | | | | | | |
| Share in value added | 1.222*** | 1.216*** | 1.208*** | 1.203*** | 1.236*** | 1.236*** | 1.209*** | 1.205*** |
| | (14.73) | (14.69) | (14.59) | (14.49) | (14.90) | (14.91) | (14.78) | (14.73) |
| Stock market efficiency (1995)*FD | | | 0.258*** | 0.172* | | | 0.324*** | 0.307*** |
| | | | (2.64) | (1.94) | | | (5.37) | (5.21) |
| Property rights (1995)*FD | | | | | -0.564** | -0.510** | -0.844*** | -0.912*** |
| | | | | | (-2.44) | (-2.56) | (-4.04) | (-4.48) |
| Bank efficiency | | | | | | | | |
| Cost efficiency (2001)*FD | | -0.167*** | | -0.486** | | -0.105** | | -0.427** |
| | | (-3.48) | | (-2.27) | | (-2.29) | | (-2.43) |
| Profit efficiency (2001)*FD | -0.378* | | -1.043** | | -0.267* | | -0.705* | |
| | (-1.86) | | (-2.39) | | (-1.69) | | (-1.76) | |
| Industry dummies | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Country dummies | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Number of countries | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 |
| Observations | 1049 | 1049 | 1049 | 1049 | 1049 | 1049 | 1049 | 1049 |
| R-squared | 0.811 | 0.811 | 0.815 | 0.814 | 0.812 | 0.812 | 0.818 | 0.817 |
| Adj. R-squared | 0.798 | 0.797 | 0.801 | 0.800 | 0.798 | 0.798 | 0.804 | 0.804 |

**Notes:** Dependent variable is the average natural logarithm of value added divided by the total number of establishments in each sector in each country over the period 1995-2007. Share in value added is the fraction of value added of each sector in each country in year 1995. FD is the external financial dependence of each sector. Stock market efficiency is stock market turnover ratio. Bank efficiency scores obtained using Eq. (1). Regressions are estimated using OLS and include industry and country dummies (not reported). Robust t-values are in parentheses. * Significant at 10%, ** Significant at 5% and *** Significant at 1%.

**Table 8:** Banks efficiency and industry growth and average firm size during the crisis period 2008-2010

| | Growth | | Average firm size | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Share in value added | -0.268 | -0.246 | 9.387*** | 9.266*** |
| | (-1.09) | (-1.03) | (11.04) | (11.29) |
| Stock market efficiency*FD | -0.001 | -0.001 | 0.002 | 0.000 |
| | (-1.22) | (-1.38) | (0.71) | (0.17) |
| Property rights*FD | 0.003 | 0.001 | 0.010 | -0.002 |
| | (1.17) | (0.53) | (1.60) | (-0.27) |
| Bank efficiency | | | | |
| Cost efficiency*FD | | 0.789* | | 4.487*** |
| | | (1.80) | | (2.68) |
| Profit efficiency*FD | 0.546 | | -1.769 | |
| | (0.74) | | (-0.67) | |
| Industry dummies | Yes | Yes | Yes | Yes |
| Country dummies | Yes | Yes | Yes | Yes |
| Number of countries | 39 | 39 | 36 | 36 |
| Observations | 769 | 769 | 700 | 700 |
| R-squared | 0.394 | 0.397 | 0.819 | 0.822 |
| Adj. R-squared | 0.340 | 0.343 | 0.803 | 0.805 |

**Notes:** Dependent variable is the average (compounded) real growth in sectoral value added and the average natural logarithm of value added divided by the total number of establishments in each sector in each country over the period 2008-2010. Share in value added is the fraction of value added of each sector in each country in pre-crisis year 2007. FD is the external financial dependence of each sector. Stock market efficiency is stock market turnover ratio. Bank efficiency scores obtained from Eq. (1). Regressions are estimated using OLS and include industry and country dummies (not reported). Robust t-values are in parentheses. * Significant at 10%, ** Significant at 5% and *** Significant at 1%. The sample size is reduced to 769 observations for 39 countries due to limitation of data availability during the period.

**Table 9:** Banks efficiency and industry growth and average firm size with new efficiency scores

| | Growth | | | Average firm size | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Share in value added | -0.024** | -0.024** | -0.024** | 1.203*** | 1.209*** | 1.209*** |
| | (-2.38) | (-2.39) | (-2.40) | (8.57) | (8.48) | (8.48) |
| Stock market efficiency*FD | -0.026* | -0.025* | -0.024 | 0.208** | 0.190* | 0.185* |
| | (-1.82) | (-1.68) | (-1.62) | (2.07) | (1.90) | (1.82) |
| Property rights*FD | -0.007 | -0.020 | -0.012 | 1.527** | 1.555** | 1.503** |
| | (-0.12) | (-0.40) | (-0.25) | (2.08) | (2.26) | (2.21) |
| Bank efficiency | | | | | | |
| Cost efficiency*FD | | 0.412** | | | -2.68** | |
| | | (2.07) | | | (-2.19) | |
| Profit efficiency*FD | -0.116 | | | 4.629 | | |
| | (-0.17) | | | (0.73) | | |
| Average efficiency*FD | | | 0.675* | | | -3.887* |
| | | | (1.87) | | | (-1.74) |
| Industry dummies | Yes | Yes | Yes | Yes | Yes | Yes |
| Country dummies | Yes | Yes | Yes | Yes | Yes | Yes |
| Number of countries | 43 | 43 | 43 | 43 | 43 | 43 |
| Observations | 887 | 887 | 887 | 938 | 938 | 938 |
| R-squared | 0.510 | 0.512 | 0.512 | 0.815 | 0.816 | 0.816 |
| Adj. R-squared | 0.469 | 0.472 | 0.471 | 0.801 | 0.801 | 0.801 |

**Notes:** The efficiency is estimated with country-specific variables. Dependent variable is the average (compounded) real growth in sectoral value added and the natural logarithm of value added divided by the total number of establishments in each sector in each country over the period 1995-2007. Share in value added is the fraction of value added of each sector in each country in year 1995. FD is the external financial dependence of each sector. Stock market efficiency is stock market turnover ratio. Bank efficiency scores obtained using Eq. (1) with country-specific variables of bank equity to total assets ratio, domestic credit to private sector (% of GDP), stock market capitalization (% of GDP), KKZ index, property rights, a dummy variable for countries with British common law and country dummy variables. Regressions are estimated using OLS and include industry and country dummies (not reported). Robust t-values are in parentheses. * Significant at 10%, ** Significant at 5% and *** Significant at 1%. The sample size is 43 countries due to limitation of data availability for the country-specific variables used in the translog function for some countries.

**Figure 1a:** Growth of establishments

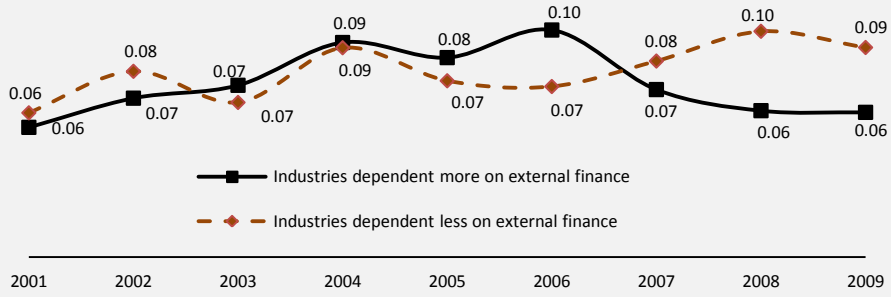
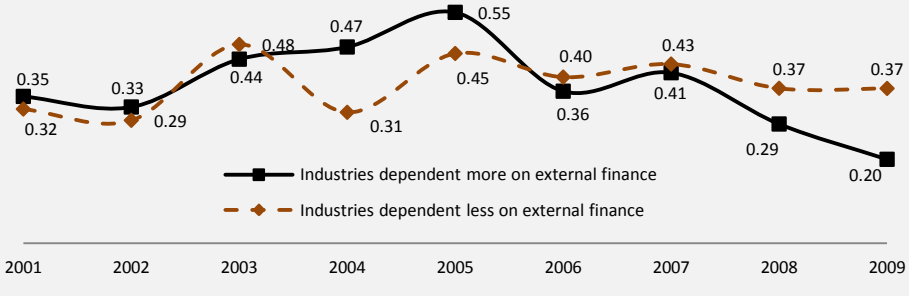



**Figure 1b:** Growth of fixed capital formation




**Note:** Data source UNIDO. The threshold differentiating between two types of industry (dependent more or less on external finance) is set at 0.30, which is the mean of all 23 industries' degree of financial dependence based on the criteria set by Klapper et al. (2006). An industry is classified as more dependent if it has a financial dependence degree above 0.30, and less dependence if it has a financial dependency degree below 0.30. Overall, 9 out of 23 industries belong to more dependent industries