Financial Dependence, Financial Markets, and Economic Growth

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Abstract

This study attempts to provide some arguments in the debate on the connection between a country's level of financial development and economic growth in the context of the endogenous growth theory. Specifically, we develop a theoretical model that introduces implicitly the financial sector and identifies channels through which it affects the equilibrium rate of growth. Next, we test whether the proposed specification can be supported by the data.

1 Introduction

There are a number of reasons why the financial sector and its activities may influence the rate of economic growth. Financial intermediaries channel the resources to the most profitable sectors of an economy. They monitor managers and exert corporate control ameliorating moral hazard risk. In particular, by providing liquidity, financial institutions permit risk averse savers to hold deposits rather than liquid but unproductive assets. Moreover, this mobilization of savings allows to increase the amount of resources available to entrepreneurs.

According to the endogenous growth theory all these functions of financial sector can effectively increase the rate of the economic growth. By increasing the quality and probability of success of the undertaken innovation, they positively affect the level and progress of technology available in the economy. Additionally, since technology plays pivotal role in "new" growth models, financial system can substantially influence economic performance. By mobilizing saving, banks and equity markets increase capital accumulation and again exert positive impact on the equilibrium growth rate.

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Schumpeter (1912) was the first who emphasized the positive influence of the development of a country's financial sector on the level and the rate of growth of its per capita income. The formalization of his idea, however, was only possible with the emergence of endogenous growth literature.

King and Levine (1993) construct an endogenous growth model in which a financial system influences decisions to invest in the activities that enhance productivity most and find that financial sector distortions can reduce the rate of economic growth.

In Bencivenga and Smith (1991), banks provide liquidity to the depositors, increases the savings, and, thus, increases economic growth [1].

The model developed in this study differs from the previous attempts to develop the theoretical link between financial system and rate of growth. We extend the endogenous growth model of Aghion and Howitt (1992, 1998) to present the theoretical foundations for empirically observed positive influence of banks and stock market development on the rate of economic growth.

Next, with the theoretical model as a background, the empirical analysis of the relationship between selected measures of financial development and growth is performed. Using the data set and empirical specifications proposed by Rajan and Zingales (1998) and Beck and Levine (2002), this study investigates if financial system development is robustly correlated with economic growth at the industry level using data for 36 industries and 44 countries for the 1980-1990 time period. Using the cross-sectional cross-industry data we test whether higher level of financial development can account for faster growth of more financially dependent industries. We also examine whether stock market, banks, and other financial institutions serve as one or separate channels for growth. Finally, the robustness analysis is performed.

The obtained results indicate a strong connection between considered financial development measures, financial dependence, and economic growth at the industry level. The industry level analysis on the determinants of economic growth indicates that in countries with more developed financial system industries that rely heavily upon external finance grow disproportionately faster. We obtain these results for both contemporaneous and initial financial development relationship with rate of growth.

[1] Other recent theoretical studies on financial development and growth include Boyd and Smith (1992), Chen, Chiang and Wang (2007), Greenwood and Jovanovic (1990), Greenwood and Smith (1997) Saint-Paul (1992). For the detailed survey see Levine (1997).

2 The Theoretical Model

We use the Aghion and Howitt's (1992) "creative destruction" framework of endogenous growth. In this section we follow closely the specification of Barro and Sala-i-Martin (1995, chapter 7). By using the same notation we can show how the introduction of a financial development variable alters the original framework and how it influences the results.

The economy produces a final good output according to the following production function:

$$Y = AH^{1-\alpha}K^{\alpha}, \tag{1}$$

with A being the state of "environment", H denoting human capital, and K representing physical capital formed as composite of N intermediate,quality–adjusted goods, with Spence-Dixit-Stiglitz form

$$K = \{\sum_{j=1}^{N} \tilde{X}_{j,k_j}^{\alpha}\}^{1/\alpha} = \{\sum_{j=1}^{N} (q^{k_j} X_{j,k_j})^{\alpha}\}^{1/\alpha}. \tag{2}$$

Each type of intermediate good has a "quality ladder" along which the improvements can occur. These improvements[2] build on the currently best technology and take the form of a sequential increase in the productivity level by the factor q. Therefore, the parameter k_j in Eq. (2) describes how many improvements in quality have occurred in sector j.

Bellow only the departure from the original model and its consequences are presented.

Following Barro and Sala-i-Martin (1995, Chapter 7), innovations, which will increase productivity in the economy, are assumed to arrive randomly with a Poisson arrival rate p_{j,k_j}, which depends primarily on the flow of resources to R&D in sector j. Specifically, we assume that:

$$p_{j,k_j} = Z_{j,k_j} \cdot \phi(k_j), \tag{3}$$

where Z_{j,k_j} denotes the resources effectively employed in research and development process (R&D) in sector j, and $\phi(k_j)$ describes the productivity of used inputs.

The probability of success in the innovation process determines for how long the monopolist enjoys the stream of profit. The expected present value of the profit from the k_jth innovation in sector j is given by:

$$E(V_{j,k_j}) = \frac{\pi_{j,k_j}}{r + p_{j,k_j}}, \tag{4}$$

Equation (4) shows the expected reward form making the k_jth innovation in sector j. This value confronted with the R&D costs allows the investor to decide whether or not engage in the innovation process.

[2]Which are the results of successful innovations.

Now, we extend their original approach to allow for credit market imperfections and to introduce the financial system.

Firms decide to engage into R&D activity if the expected profits are at least as high as cost of improving the existing intermediate good j.

The costs of entry are equal to the value of the resources devoted to the innovation process. In this model we assume that most of the firms cannot finance the R&D expenditures from their contemporaneous activities. Hence, in order to engage in innovation activity they have to acquire some externally funded resources. Following Romer (1995), Hubbard (1995), and Bernanke, Gertler and Gilchrist (1996), we assume that the acquiring of this external funding is costly. The literature on the financial market imperfection has offered several theories basing on the asymmetry of information between insiders and outsiders that can explain this assumption. For example, Jensen and Meckling (1976) suggest that external funds are generally costlier because outsiders have less control over the borrower's action. Simultaneously, Stiglitz and Weiss (1981) and Myers and Majluf (1984) stress the problem of moral hazard and emphasize that outsiders know less about what the borrowers will do with the funds. Therefore, the higher price for capital is charged to compensate risk the outside investors face. The wedge between internal and external finance can also arise from agency and monitoring costs.

Additionally, we assume that the extent to which firms need external financing depends on the sector they operate in. This is consistent with findings in Rajan and Zingales (1998). Specifically, the external dependence takes form of the mark-up on R&D expenditures, that is:

$$Z^*_{j,k_j} = Z_{j,k_j} \cdot (1 + f_j), \tag{5}$$

where Z_{j,k_j} equal the effective expenditures on the research process and f_j is the parameter of the external funding dependence of sector j. The higher f_j is the more resources must be devoted to keep the effective expenses constant across sectors. Costs associated with relying on external funding are assumed to be proportional to the total expenditures on R&D. In this paper, we do not assume any specific functional form of f_j. All we say is that some time-varying industry-specific amount of resources must be devoted to cover external funds costs. We assume that financial system development will reduce the wedge between the costs of internal and external funds and as it will be shown enhance growth, especially for firms that are most reliant on external financing.

The expected reward per unit of time for pursuing the $(k_j + 1)$th innovation is $p_{jk_j} \cdot E(V_{j,k_j+1})$.

Hence, the expected flow of net profit from research in a sector j at quality rung k_j is given by:

$$\Pi_{j,k_j} = p_{j,k_j} \cdot E(V_{j,k_j+1}) - Z^*_{j,k_j} \tag{6}$$

For the free entry case, the equilibrium is achieved only if costs are equal to the reward for innovation; that is there is no "extra" profit from inventing higher quality of capital good. In that case $\Pi_{j,k_j} = 0$, that is:

$$Z_{j,k_j} \cdot \{\phi(k_j) \cdot E(V_{j,k_j+1}) - (1 + f_j)\} = 0. \tag{7}$$

This condition is to be satisfied for every sector j at every quality level k_j.

Taking the above expression and expression for $\phi(j)$, the probability of successful innovation per unit of time is given by the following equation:

$$p_j = \phi(k_j)\pi_{j,k_j} \cdot (1 + f_j)^{-1} - r. \tag{8}$$

This equation completes the description of innovation process in the economy. It is interesting to analyze implications of Eq. (8). The an industry j relays on the external financing, (higher f_j), the lower the probability of successful innovation in that industry, and hence lower the growth of that industry. Similarly, changes in f_j being the result in financial development will affect the probability of successful innovation and, in turn, the rate of evolution of industries. The bigger the f_j is, the bigger impact on the p_j from the changes in f_j.

2.1 Equilibrium

Assuming H and N are constant, the growth in Y can be tied to growth in overall quality (rate of innovations). Having solved the whole model, we obtain the following steady-state values for γ:

$$\gamma = \frac{\delta(\beta \sum_{j=1}^{N} \psi(j)(1 + f_j)^{-1} - \rho)}{\theta\delta + 1}, \tag{9}$$

where δ and β are functions of parameters and constants in the model and ψ is the distribution of industries in the economy.

This equation ends derivation of theoretical model.

2.2 Finance and Growth

The Eq. (9) indicates that changes in f_j affects the GDP growth rate. It implies that costs associated with external financing negatively influence the rate of economy growth. It is also interesting to note that expression in Eq. (9) is analogous to the one in Barro and Sala-i-Martin (1995, Chapter 7), where

costs of external dependence, f_j, are assumed to be equal zero. Therefore, the model developed in this section should be considered as an extension of standard "creative destruction" approach. The extension that implicitly introduces financial markets and allows us to explain the relationship between finance and growth in a very simple setting.

The model developed in this section recognizes the influence of financial system on costs associated with external financing as responsible for this relationship. The better quality of financial intermediaries, the lower the cost of acquiring some additional finance and, hence, the faster growth of the economy.

The model also predicts that industries that depend heavily on external finance grow disproportionately faster in the countries with better financial systems. In terms of model's parameters, the lower value for f_j results in higher effective expenditures, Z_j, and greater probability of success in innovation activity. Therefore, the model indicates that the composition of industrial structure is influenced by the development of financial system.

These predictions concerning the relationship between finance and growth at the industry-level are subjected to empirical verification in Section 4. Two propositions derived from the theoretical specification are tested. First, we examine whether the higher level of financial system can be associated with the faster rate of growth. Second, we test whether the more external–dependent industries grow faster in economies with better developed financial systems.

We use Rajan and Zingales (1998) data set on external finance and growth at the industry-level, and Levine, Loayza and Beck (2000) data set on financial system. The results coincide with model's predictions that financial system can influence the economic growth rate, and external dependence plays significant role in composition of industries in the economy.

3 Data and Methodology of the Empirical Analysis

3.1 Methodology

This subsection describes the two model specifications that we use to examine whether the financial sector development affects the economic growth at the industry level. To evaluate the hypothesis of faster growth of financially dependent industries in countries with well-developed financial sectors we follow the method proposed by Rajan and Zingales (1998). The general form of the equation that is to be estimated is following

$$\begin{aligned} Growth_{j,k} &= Constant + \psi_1 \cdot Industry\ share\ of\ manufacturing_{j,k} \\ &+ \Psi_2' \cdot Industry\ \ Controls_j \\ &+ \Psi_3' \cdot Country\ \ Controls_k \\ &+ \Psi_4' \cdot (External\ Financial\ Dependence_j \cdot Financial\ Development_k) \\ &+ Error_{j,k}, \end{aligned} \tag{10}$$

where j denotes industry and k country specific variable. Uppercase coefficients indicates vectors.

The dependent variable—$Growth_{j,k}$—is the average annual real growth rate of value added in industry j in country k over the period 1980-1990.

In all empirical specifications used in this study, *Industry Control* is simply the vector of industry dummies that correct for every possible industry-specific effect. *Country Controls* represents a vector of conditioning information that control for factors associated with economic growth at the country level. The set of variables that can possibly explain the economy-wide rate of growth is very extensive.[3] The choice of adequate variables is important since we want to reduce the possibility of model misspecification due to omission of important variables. Detailed specification of *Country Controls* is presented in the next subsection.

The remaining two terms in equation (10) varies with industry and country. *Industry share of manufacturing* is industry j's share in country k of total value added in manufacturing in 1980. Cetorelli and Gambera (2001) suggest this variable captures an industry-specific convergence effect. Industries that have grown substantially in the past are less likely to grow at a high rate in the future.

[3]Sala-i-Martin (1997b) reports a total of 63 variables presented in the literature that were found significant in at least one empirical study on the determinants of economic growth. The problem is that growth theories are not explicit enough with regard to the specific variables belonging to the "true" regression. As Sala-i Martin (1997a) notes, "a good theorist could make almost (...) any variable look like important theoretical determinant of the rate of economic growth."(p.2) . However, Levine and Renelt (1992) find no variables that are robustly correlated with GDP growth. For other evidence on robustness of determinants of economic growth see Doppelhofer, Miller and Sala-i-Martin (2000).

The last term in the equation (10) is of primary interest for us, the interaction between industry j's dependence on external financing and financial development in country k. The exact definitions of external dependence and measures of financial sector development used in the empirical analysis in this study is presented in next subsection. The coefficient of this variable allows us to verify whether the hypothesis derived in theoretical section of this study can be corroborated by the data and empirical analysis. The positive signs for this term will indicate that industries that require more external financing grow disproportionately faster in countries with well-developed financial sector.

Two specification of Equation (10) are considered. The first one allows us to evaluate the effect of financial development on economic growth at the both country and industry level. The second specification examines only the industry level effect of financial system. Although the former specification provides richer insight, the latter is robust to some specification errors that can undermine the validity of derived conclusions.

3.2 Data

3.2.1 Financial Dependence

The main assumption in the theoretical model derived in Section 2 is that there are technological and institutional reasons why some industries depend more on external finance than others. This assumption can be justified on the ground that the initial project scale, gestation period, the "cash harvest" period, and the need for subsequent investment differ substantially between industries. If we additionally assume that the variance of the reliance on external finance across industries persists across countries the actual external dependence of industries can be used. If pharmaceuticals require a larger initial scale investment than the apparel industry in the United States, it also requires a larger scale in Korea. Taking the size of external dependence observed for large firms in a country with a relatively well developed financial system we can obtain proxy for the "natural" dependence of industries on external finance in other countries. Following Rajan and Zingales (1998), we use a sample of publicly listed firms in the U.S. to compute the natural external dependence of industries.

Rajan and Zingales (1998) employ data from Standard and Poor's *Compustat* for U.S. firms in 36 industries. They use the amount of external finance used by U.S. firms in industry as a proxy for the required size of external financing in this sector. This implies that foreign firms in the same industry would like to raise the amount of external finance to the U.S. firms' level if their financial markets have been more developed. A firm's dependence on external finance is defined as the share of investment that cannot be financed through internal cash flows. Therefore, it is computed as as

capital expenditures minus cash flow from operations divided by capital expenditures. In order to smooth temporal fluctuations and reduce the effects of outliers both numerator and denominator are averaged over the 1980s.

3.2.2 Industry Growth Rate

The purpose of this paper is to see whether financially dependent industries grow faster in countries with well-developed financial sectors. Therefore, the dependent variable is the average annual growth rate of value added. The data we use are from Rajan and Zingales (1998). They employed the Industrial Statistical Yearbook database prepared by the United Nations Statistical Division (1993) to obtain data on value added for each industry in each country. In order to reduce the dependence on country-specific factors like natural resources, their data set, and hence our analysis, is confined to manufacturing firms (U.S. SIC 2000-3999).

In the sensitivity analysis we also use alternative measures of industry development. An industry can grow because new establishments are added to the industry or because existing establishments grow in size. Therefore, we use a decomposition of the industry growth rate on the number of new establishments and the average size of already existing establishments.

3.2.3 Financial Indicators

To test the hypothesis we need appropriate indicators of financial development. Ideally, they should measure the efficiency with which financial sector reveals information, secures the legal and regulatory environment assuring performance, assesses new projects and firms, exerts corporate control, and, therefore, channels external resources to industries that need them most. Unfortunately, there is little agreement on how these indicators should be constructed and critical data are not available for a broad cross-section of countries. However, the recent literature has developed a number of indicators that may proxy adequately for development of financial intermediaries and stock market across countries.[4]

The primary measure of financial intermediary development is *Private Credit*, which equals the value of loans made by deposit money banks and other financial institutions to the private sector divided by GDP. This indicator has been used in a number of previous empirical studies on the relationship between financial development and economic growth at the industry level, e.g. Rajan and Zingales (1998) or Cetorelli and Gambera (2001). *Private Credit* isolates credit issued by banks as opposed to credit issued by the central bank. Moreover, it identifies credit issued to the private sector, as opposed to credit issued to governments and public enterprises. *Private Credit* is the measure of

[4]They do not, however, consider many important financial system components, like consulting, auditing, etc.

the activity of financial intermediaries in one of its main function: channelling savings to investors. Recent empirical studies have shown a robust link between this measure of financial intermediary development and economic growth, see Levine et al. (2000), Beck, Levine and Loayza (2000).

To assess the stock market development we employ two indicators that are to measure size and liquidity of markets: *Market Capitalization* and *Value Traded*, respectively[5]. The first one measures the size of the stock market and equals the value of listed domestic shares on domestic exchanges divided by GDP. The second measure of equity market development is *Value Traded*, which equals the value of the trades of domestic shares on domestic exchanges divided by GDP. *Value Traded* measures the activity of the stock market trading volume as a share of national output and should therefore positively reflect liquidity that stock market provide to economic agents on an economy-wide level.

The industry data on financial dependence, on the share of total value added in manufacturing, and on the growth of value added are from Rajan and Zingales (1998) and have been kindly provided by the authors. The data on share of Muslims and share of Catholics in country's population as well as all financial environment indicators have been kindly provided by Andrei Schleifer. The country political and economical variables are taken from Penn World Table, Mark 5.6 and from the Global Development Network Growth Database compiled in 2001 by Easterly and Sevadeh.

4 Empirical Results

4.1 Benchmark Results

Basic specification

Table 1 presents the results of regressions based on the specification without country fixed effect. We use ordinary least square estimator with robust standard errors. The evidence in this table is clearly supportive the hypothesis suggested by the theoretical model. Industries that are more dependent on external finance grow faster in countries with well-developed financial sector. The interaction between the need of external financing and financial development is significant for all measures of financial development.

We start with *Private Credit*—a measure of financial intermediary development. The results in the first column indicate that both at the country- as well as at the industry-level banks and other financial institutions contribute to economic development. Most importantly, the coefficient on the interaction term of *Private Credit* is significantly positive at 1% level. This means that in countries with a higher level of *Private Credit*, industries using external finance experience faster growth.

[5]Both measures were used by Levine and Zervos (1998).

Table 1. Basic model specification-independent effect.

Independent Variables	(1.1)	(1.2)	(1.3)	(1.4)
Industry's share of total value	-1.071	-1.037	-1.023	-0.665
added in manufacturing	(0.220)***	(0.225)***	(0.228)***	(0.204)***
Private credit	0.021			
	(0.009)**			
External dependence × Private credit	0.080 (0.023)***			
Market capitalization		-0.006 (0.010)		
External dependence × Market capitalization		0.099 (0.026)***		
Value traded			0.075 (0.027)***	
External dependence × Value traded			0.201 (0.065)***	
Accounting standards				0.035 (0.021)*
External dependence × Accounting standards				0.104 (0.037)***
Log per capita income in 1980 in USD	-0.050 (0.006)***	-0.041 (0.005)***	-0.039 (0.005)***	-0.029 (0.006)***
Government expenditures	-0.127 (0.061)**	-0.142 (0.061)**	-0.104 (0.063)*	-0.278 (0.069)***
Human Capital	0.005 (0.002)*	0.004 (0.002)**	0.003 (0.002)	0.002 (0.002)
Inflation	-0.007 (.003)**	-0.011 (0.003)***	-0.010 (0.003)***	-0.004 (0.007)
Disruptions	-0.011 (0.003)***	-0.012 (0.003)***	-0.011 (0.003)***	-0.006 (0.004)*
Trade	0.012 (0.004)***	-0.009 (0.004)**	0.009 (0.004)**	0.009 (0.004)**
R^2	0.153	0.144	0.149	0.139
Number of observations	1242	1242	1242	855

Notes: The ordinary least square estimation. The dependent variable is the annual compounded growth rate in real value added for the period 1980-1990 for each industry in each country. *External Dependence* is the fraction of capital expenditures not financed with internal funds (cash flow) for U.S. firms in the same industry. Private Credit is the average for 1980-1990 value of loans made by deposit money banks and other financial institutions to the private sector divided by GDP. *Market Capitalization* is the average value of domestic shares as a share of GDP. *Value Traded* is average value of trades of domestic shares as a share of GDP. *Human capital* is the average years of schooling attained by the population over 25 years of age in 1980. *Shakes* is an aggregate index of the average number of revolutions, coups d'etat, assassinations and purges over 1980-1990. *Trade* is the 1980 volume of trade as share of GDP. All regressions include industry fixed effects (coefficient estimates not reported). Heteroskedasticity-consistent standard errors are reported in the parentheses.
***, **, and * indicate statistical significance at the 1, 5, and 10 percent level, respectively.

To illustrate the economic significance of financial intermediary development in explaining industry-growth pattern we will present Rajan and Zingales-style example. Consider beverages and machinery, the industries at the 25th percentile (low external dependence) and 75th percentile (high external dependence), respectively. The regression results predict that an one-standard-deviation higher level of *Private Credit* may result in about 0.9% faster annual growth of beverages and 1.84-percentage point of machinery.[6] These numbers clearly indicate the presence of positive relationship between financial development. Moreover, we observe that the industry growth increases in the external dependence of the industry. Substantially more financially dependent machinery would have grown over 0.9% faster each year than Beverages if *Private Credit* had increased an one-standard-deviation[7].

The next two columns indicate that also stock market development is important determinant of economic growth. In column 2, we use *Market Capitalization*, whereas in column 3 *Value Traded* is employed as the measure of equity market. Although the coefficient on the economy-wide effect of *Market Capitalization* is negative and statistically insignificant, *Value Traded* is significantly positive

at the one-percent level. These results are consistent with earlier studies on stock market development and economic growth.[8] If the interaction terms are considered, the evidence in Table 1 suggests that the higher stock market development, proxied by *Market Capitalization* or *Value Traded*, the faster the growth rates of industries that need external financing. Both coefficients on the interaction of external dependence and stock market development are positive and statistically significant at the one-percent level. Economically, an one-standard-deviation increase in *Value Traded* raises the Machinery rate of growth for 0.7-percentage point more than the Beverages rate of growth due to the relatively larger influence of the equity market development on industry growth rate[9].

All country control variables that we have employed in these specification have predicted sign and most of them are statistically significant.

The results in Table 1 suggest that both financial intermediation and stock market development play important roles in explaining the differences in industry distributions across countries.

Country Dummies Specification

[6]This numbers include both economy-wide and industry specific effect of financial development on growth. Specifically, the change in the machinery growth rate is computed as follows:
$0.021 \cdot \Delta$*Private Credit* (economy-wide effect) + $0.080 \cdot$ External financial dependence of machinery$\cdot\Delta$ *Private Credit* (industry specific effect), that is: $0.021 \cdot 0.323 + 0.080 \cdot 0.45 \cdot 0.323 = 0.0184$. All other terms cancel out. For beverages we use analogue formula.

[7]We do not consider how to increase *Private Credit* nor we state the direction of causality.

[8]In their study on the relationship between stock market development and economic growth, Levine and Zervos (1998) note that *Market Capitalization* is not a robust determinant of economic growth.

[9]We compute this difference as follows: $0.201 \cdot (0.45-0.08)$ [difference in External financial dependence between Machinery and Beverages] $\cdot$ 0.089 [standard deviation of *Value Traded*].

Now, we consider the estimation of the country dummies model based on alternative specification . Table 2 reports the results of the regression, in which beside the industry dummies we include country dummies, one for each country, instead of the set of country controls. This specification reduces the threat of misspecification or omission of the important variables.

In Table 2 we consider a single measure of financial sector development in each regression. All four financial indicators interacted with *External financial dependence* are statistically significant at the one-percent level. Also the goodness-of-fit measure, $R^2 - adjusted$, has improved in all equations and is now almost two times bigger than in the basic model. The coefficients for *Private Credit*, *Market Capitalization*, *Value Traded*, and *Accounting Standards* remain positive and comparing to those in Table 1 their magnitude has slightly increased. Therefore, the higher level of financial intermediary and/or stock market development leads to relatively faster growth of the industries that are more in need of external financing.

Table 2. Country dummies specification-independent effect.

Independent Variables	(3.1)	(3.2)	(3.3)	(3.4)
Industry's share of total value added in manufacturing	-1.056 (0.248)***	-1.041 (0.247)***	-1.033 (0.248)***	-0.587 (0.223)***
External dependence × Private credit	0.079 (0.023)***			
External dependence × Market capitalization		0.095 (0.025)***		
External dependence × Value traded			0.201 (0.062)***	
External dependence × Accounting standards				0.099 (0.036)***
R^2	0.268	0.267	0.264	0.239
Number of observations	1242	1242	1242	855

Notes: The ordinary least square estimation with country dummies. The dependent variable is the annual compounded growth rate in real value added for the period 1980-1990 for each industry in each country. *External Dependence* is the fraction of capital expenditures not financed with internal funds (cash flow) for U.S. firms in the same industry. *Private Credit* is the average for 1980-1990 value of loans made by deposit money banks and other financial institutions to the private sector divided by GDP. *Market Capitalization* is the average for 1980-1990 value of domestic shares as a share of GDP. *Value Traded* is average for 1980-1990 value of trades of domestic shares as a share of GDP. All regressions include both country industry fixed effects (coefficient estimates not reported). Heteroskedasticity-consistent standard errors are reported in the parentheses.
***, **, and * indicate statistical significance at the 1, 5, and 10 percent level, respectively.

To see the economic interpretation of these results, consider again the two industries, beverages

and machinery. The coefficient estimate for *Accounting Standard*, given in the fourth column, predicts that the former of these industries would grow 0.4-percentage point faster each year than the latter if a country it is located in would experience a 10-point increase in *AccountingStandard*. Note that this example does not consider the problem of causality, nor how to increase *AccountingStandards*. To conclude, the development of financial sector exerts positive impact on financially dependent industries.

The results in Tables 1 and 2 allow us to check whether this study is consistent with the earlier attempts to establish the connection between financial dependence and industry growth. The point estimates in the former table are similar to those obtained by Cetorelli and Gambera (2001) in a similar specification. In their paper, Cetorelli and Gambera (2001) also used financial development indicator at both country- and industry-level. Although the number of observation they have is a bit smaller and they consider a different set of country control variables, the qualitative and quantitative results are almost the same.[10] The specification in Table 2 compares with the original Rajan and Zingales (1998) paper, where among the financial development measures were *Private Credit*, *Market Capitalization*, and *Accounting Standards*. The coefficients for the interaction terms in Rajan and Zingales (1998) are quite similar to these in Table 2, although in this study we use more accurately computed measures of financial development.

4.2 Robustness analysis—Endogeneity

It should be noticed that the cross-country cross-industry regressions presented in the previous subsection may be subject to endogeneity problems. Although the results obtained from regressing country dummies specification model control for omitted variables, we have not accounted for the issue of reverse causality. The correlation between financial sector development and industry growth rate could arise from an endogenous determination of the level of financial development, that is, financial system may be influenced by innovations in the process governing growth rates. It was Robinson (1952), who first suggested that "where enterprise leads finance follows" (p.86). If this declaration is valid, there would exist a correlation between financial sector development and the industry growth rate but the interpretation of the results we proposed would not be correct. This endogeneity problem can be solved by applying instrumental variable technique.

Ideally, we would use instruments that are exogenous to economic development and, simultaneously, highly correlated with financial system. Recent theoretical and empirical studies on the determinants of financial sector development offer some indication on the proper choice of the instruments.

[10] See Table V, column (e) in Cetorelli and Gambera (2001).

Financial environment indicators

An influential insight on the determinants of financial development and, hence, on the choice of instruments for our regressions is presented in Rajan and Zingales (2001). In their study on the theory of financial development, Rajan and Zingales (2001) notice an important caveat of legal origin-based theories, so extensively promoted in La Porta, Lopez-de Silanes, Shleifer and Vishny (1997, 1998, 2000), Levine (1998, 1999), or Beck, Demirgüç-Kunt and Levine (2001).The indicators of the development of financial sector do not improve monotonically over time. Instead, in the 20^{th} century they have fluctuated substantially. This behavior cannot be explained by the structural theories that attribute cross-country differences in financial development to time-invariant factors, such as a country's legal origin or religion.[11] Therefore, in the second set of instrumental variable regressions we employ indicators that comprise time-variant legal environment measures describing the depositor-investor relations.

Table 3 summarizes the instrumental variable results from five regressions. This time, however, we use financial indicators of legal system: *Creditor*, *Anti-Director*, and *Enforcement* as the instruments. The results indicate a very strong connection between the exogenous components of financial intermediary and stock market development and the rate of growth at the industry level.

We perform an augmented regression Durbin-Wu-Hausman test of overidentyfing restrictions proposed by Davidson and MacKinnon (1993). The test verifies the hypothesis that the introduction of instrumental variables has no effect on the estimates of the regression's coefficients. The null hypothesis is that a set of least squares estimates is consistent.

In table 3 *Private Credit*, *Market Capitalization*, and *Value Traded* enter regressions positively and significantly at the one-percent level. Joint influence of equity development and banking sector development is also statistically significant at the one-percent level. These results suggest that higher level of financial development results in disproportionately faster growth of financially dependent industries.

Table 3. Country dummies specification—IV: financial indicators

[11] According to Rajan and Zingales (2001), the evidence presented by the proponents of legal-based theories are specific to the second half of the 20^{th} century.

Independent Variables	(9.1)	(9.2)	(9.3)	(9.4)	(9.5)
Industry's share of total value added in manufacturing	-0.757 (0.188)***	-0.719 (0.180)***	-0.792 (0.189)***	-0.740 (0.184)***	-0.744 (0.178)***
External dependence × Private credit	0.089 (0.025)***			0.106 (0.037)***	0.098 (0.059)*
External dependence × Market capitalization		0.091 (0.034)***		-0.037 (0.050)	
External dependence × Value traded			0.388 (0.119)***		-0.055 (0.269)
R^2	0.316	0.316	0.304	0.312	0.315
Number of observations	1124	1124	1124	1124	1124
F-statistics				6.13***	6.24***
Durbin-Wu-Hausman	5.34**	4.93**	6.70***	3.59**	3.05**

Notes: The instrumental variable estimates with country dummies. The dependent variable is the annual compounded growth rate in real value added for the period 1980-1990 for each industry in each country. *External Dependence* is the fraction of capital expenditures not financed with internal funds (cash flow) for U.S. firms in the same industry. *Private Credit* is the average for 1980-1990 value of loans made by deposit money banks and other financial institutions to the private sector divided by GDP. *Market Capitalization* is the average for 1980-1990 value of domestic shares as a share of GDP. *Value Traded* is average for 1980-1990 value of trades of domestic shares as a share of GDP. All regressions include both country industry fixed effects (coefficient estimates not reported). F-statistics report the joint significance of financial development measures. Heteroskedasticity-consistent standard errors are reported in the parentheses.
Instruments for financial development indicators: Enforcement, Creditor, Anti-Director, and country and industry dummies. The Durbin-Wu-Hausman statistics test the null hypothesis that the use of instrumental variables does not change the estimation outcome.
***, **, and * indicate statistical significance at the 1, 5, and 10 percent level, respectively.

In all regressions, the Durbin-Wu-Hausman tests reject at the one- and five-percent significance level the hypothesis that the use of instrumental variables does not change the estimation results. The regressions' goodness-of-fit measures are markedly larger from these of ordinary least squares and instrumental variable regressions that used legal origins as instruments. The results of the second set of instrumental variable regressions suggest that the relationship between the firms' need of external financing, financial development, and industry growth is not due to the simultaneity bias and or reverse causality.

5 Conclusions

This study examined the impact of the level of financial system development on economic growth at the industry level.

The theoretical model was used as a background to motivate the empirical analysis of the relationship between selected measures of the financial development level and the economic growth. We employed Rajan and Zingales's (1998) data set to verify theoretical model's assumptions and conclu-

sions. The results supported the most important contribution of the model, that is, that in countries that are better financially developed the more dependent industries grow faster. Additionally, we found that financial development is robustly and significantly correlated with economic growth in the international context.

The results remained unchanged for the wide spectrum of financial development measures. Using various indicators for banking sector, equity market, overall size, activity, and efficiency of financial system we always found that financial development positively affects industry growth with the larger impact observed for more financially dependent industries.

In the sensitivity analysis, by extracting the exogenous components of financial development we were able isolate the impact of the financial system on economic growth and industry expansion. This even further corroborated the model findings.

The study leaves many important questions unanswered. In particular, no attempt was made to examine what is the exact form of external financial dependence in the theoretical model? What does it comprise? Which and how technological and institutional factors affect the financial dependence? Does structure of banking sector influence these parameters? The subsequent papers should attempt to answer these questions.[12] Both empirical and theoretical studies are required to allow us to understand fully the forces, which drive the relationship between financial development and growth.

This study, however, makes an important step in establishing the theoretical explanation for observed reality. It also allows us to take a stance and present some additional arguments in the debate on the connection between a level of financial development and the economic growth.

[12]The Cetorelli and Gambera's (2001) paper on banking concentration and industry growth goes in this direction.

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