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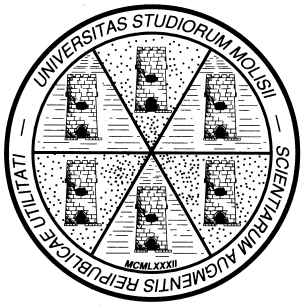

ECONOMICS & STATISTICS DISCUSSION PAPER
No. 54/09

Investment decisions, price-earnings ratios and finance. Evidence from firm-level data

by

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Abstract

Economic theory suggests that firm's investment depend on future growth opportunities, measured for example by price-earnings ratios, but might be dampened by inefficient financial markets. This paper tests these hypotheses using an unbalanced panel of 9,000 listed firms from 41 developed and developing markets, from 1990 to 2006. The empirical results confirm that managers use the information contained in the price-earnings ratios to make investment decisions. Moreover, stock market development and the specialization of the financial system towards arm's length instead of bank financing has a positive effect on firms' investment decisions. Taken together, these results suggest that firms with higher growth opportunities accumulate more capital and that the stock market has a key role in channelling funds toward investment projects.

JEL classification: G20; G21; G30

Keywords: Investment decisions, Price-earnings ratios, Financial development, Financial structure, Panel data

* I would like to thank Alberto Pozzolo for his supervision and support. I would also like to acknowledge the valuable comments of the members of my thesis committee, Giovanni Ferri, Sergio Ginebri and Francesco Nucci, the suggestions of participants at the Workshop for Italian PhD Students in Economics (University of Salerno) and at the seminar at University of Molise. A special thank to Dario Focarelli and Paolo Zanghieri of ANIA for their helpful advices on the Worldscope Database. Remaining errors are my own. Address for correspondence: Università degli Studi del Molise, Dipartimento di Scienze Economiche, Gestionali e Sociali (SEGeS), via De Sanctis, 86100 Campobasso, Italy. E-mail: filomena.pietrovito@unimol.it.

1. Introduction

Assessing the impact of growth opportunities on investment decisions and therefore, on economic growth, has been the focus of several contributions in the corporate finance literature (Fazzari et al. 1988; Chen, Goldstein and Jiang, 2006) as well as in the finance and growth literature (Rajan and Zingales, 1998; Wurgler, 2000; Fisman and Love, 2004 a,b; Bekaert et al., 2007). Moreover, two natural questions about the impact of financial institutions on investment have been addressed in the finance and growth literature. The first question is whether more efficient financial systems are likely to encourage investment decisions (Wurgler, 2000; Love, 2003; Ndikumana, 2005; Bekaert et al., 2007), while the second question is whether the financial specialization of a country toward the stock market or the banking activity plays a key role in investment decisions (Demirguc-Kunt and Maksimovic, 2002; Ndikumana, 2005; Ergungor, 2008).

Even though the literature on corporate finance has focused on different price-based measures of firms' growth opportunities, such as the Tobin's Q, there is no evidence on the sensitivity of investment to the price-earnings ratios. On the other hand, the literature on finance and growth documents the existence of a positive influence going from growth opportunities to investment and therefore, to growth, but only using aggregate industry-level and country-level data. For instance, the contribution by Bekaert et al. (2007) uses data on the price-earnings ratios at industry-level to assess the link between country's growth opportunities and aggregate investment growth. Similarly, almost all contributions documenting the existence of a causal relationship between financial development, financial structure and investment use aggregate data (Wurgler, 2000; Ndikumana, 2005; Bekaert et al., 2007).

The present work aims to contribute to this literature by testing three main hypotheses through a model that uses firm-level panel data obtained from a high-quality source: the Worldscope Database. The first hypothesis is that firm's future growth opportunities, measured by the price-earnings ratios, positively influence investment decisions, even after controlling for other standard determinants of investment. The second hypothesis is that the deepening of financial intermediaries as well as financial markets activity encourages entrepreneur's investment behaviour and helps private firms to take

advantage of growth opportunities[1]. The third hypothesis is that a country's financial structure, characterized by the relative importance of financial markets over financial intermediaries, promotes firm-level investment.

This paper is based on firm-level panel data that have several important advantages in studying the determinants of investment[2]. First of all, they allow to take into account unobservable firm-specific fixed effects, that is, unobservable characteristics of a firm that cannot be included as controls in the empirical specification but are likely to influence investment decisions. Hence, including the specific-firm fixed effects allows to control for heterogeneity across firms, not otherwise observed, and to eliminate the bias due to omitted variables. Furthermore, using panel data implies an increase in the variability of data by taking into account both the cross-section and the time series variation, thereby allowing to observe how the effect of growth opportunities and financial development on investment changes both between and within firms, over time.

The advantage of using the price-earnings ratio as an indicator of growth opportunities relies on the fact that it reflects the expected value of firm's future profits[3]. This implies that when prices are high relative to earnings, investors are willing to pay a large multiple of today's earnings to buy firm's shares because they expect profits to raise in the future. In this case, the market's prices are anticipating the firm's future growth opportunities and the stock market is capitalizing their present value; in this sense the price-earnings ratio can be considered a forward-looking measure. Consequently, as also emphasized in the corporate finance literature, managers can look at the stock prices to extract information about the future growth perspectives of a firm and make corporate decisions, such as investment decisions (Morck et al., 1990; Chen, Goldstein and Jiang, 2006).

In order to test the above hypotheses, this work conducts an econometric analysis based on an unbalanced panel of more than 9,000 firms listed in 41 developed and developing countries, for the period 1990-2006.

[1] This hypothesis relies on the financial services view arguing that the overall level of financial development matters for firm expansion, new investment, and capital allocation.
[2] Bond and Van Reenen (2007, p. 4420) provide a detailed description of the most important advantages of using firm-level data.
[3] The price-earnings ratio is given by the ratio of the price investors are willing to pay to buy a firm's share and the earnings per share.

The first key finding of the analysis is that information about firm's growth opportunities, anticipated by the price-earnings ratios, influences managers in taking corporate investment decisions. This result is consistent both with the corporate finance and with the finance and growth literature documenting a positive relationship between growth opportunities and investment. Moreover, as in the most important contributions on finance and growth (Wurgler, 2000; Bekaert et al., 2007), this paper finds that the stock market development matters for investment. By contrast, the banking development does not seem to matter for investment decisions. The last result is probably due to the fact that the analysis is conducted on a database that includes only publicly listed so that, even the small firms are relatively large. Indeed, large firms are more likely to substitute bank finance with other sources of external finance, such as the stock market. The empirical analysis also suggests that the overall financial development does not exert any accelerator effect on growth opportunities in the sense that it does not help firms with higher growth opportunities to experience higher levels of investment in the future. Finally, an additional and innovative finding of this paper with respect to the existing literature (Beck and Levine, 2002; Demirguc-Kunt and Maksimovic, 2002; Ndikumana, 2005) is that it shows one channel through which the structure of the financial system has an independent effect on growth in the sense that it enhances the response of firm's investment to the relative importance of financial markets over banks, in a model that accounts for financial development and for other determinants of investment. This result is consistent with the finding of Ergungor (2008) showing that the market-based financial systems are more likely to promote growth than the bank-based systems.

The remaining part of this work is organized as follows. Section 2 outlines the existing literature to which the present work is closely related. Section 3 describes the firm-level and the country-level data used to conduct the empirical analysis and their sources. Section 4 provides some descriptive statistics and the correlation coefficients of the variables used in the empirical specification. Section 5 describes the empirical model and the methodology used for the estimation. Section 6 reports and discusses the econometric results. Section 7 concludes.

2. Previous literature

A large body of the empirical research in corporate finance deals with the implications of shifts in growth opportunities for the level of investment[4]. This literature relies on the idea that the location of the demand curve for firm's investment is determined by its investment opportunities, which are defined as the expected present value of future profits from additional capital expenditures. Therefore, all else being equal, an improvement in investment opportunities shifts the demand curve to the right, thereby increasing the desired level of capital stock (Hubbard, 1998). Since the value of growth opportunities is not directly observable, the corporate finance literature adopts different measures that attempt to approximate it.

The more extensively used proxy in the corporate finance literature is the Tobin's Q which is a price-based measure. It is defined as the ratio of the "maximized value of the firm in period *t* to the replacement cost value in period *t* of the capital stock that the firm inherits from the previous period" (Bond and Van Reenen, 2007) and can be measured by the ratio of the market value of firm's securities to the sum of the replacement cost of property, plant and equipment and the replacement cost of inventory. This indicator proxies for corporate growth opportunity since the market value captures the market's anticipation of future growth opportunities within the firm.

This measure has been adopted by Fazzari et al. (1988) who empirically analyze the differences in investment in firms classified according to their dividend behaviour. They find that "if financing constraints are important, the investment of firms with good investment opportunities that retain all or nearly all of their earnings will likely to be more sensitive to cash flow than that for high-payout firms with a large dividend cushion of funds to finance investment" (Fazzari et al., 1988). Another relevant contribution that adopts the Tobin's Q to measure firm's investment opportunities is the one by Chen, Goldstein and Jiang (2006) who explain the role of stock prices information in guiding managers in making decisions on corporate investment[5].

[4] It should be noted that the corporate finance literature focuses mainly on the effect of shifts in growth opportunities on investment decisions in the short-run, while the present work refers to the long-run effects.

[5] The reasoning is that stock prices reflect both public and private information about firm's fundamentals and the private information is captured by prices through speculators' trading activity. If managers decide on the level of investment, they will use all the available information that includes the information contained in stock prices and other information that they have but that have not been incorporated in the prices yet. In this environment, Chen, Goldstein and Jiang (2006) find that investment will be more sensitive to stock prices, expressed through the Tobin's Q, when the price provides more information that is new to managers.

On the other hand, the literature on finance and growth provides evidence on the existence of a relationship between growth opportunities and investment by adopting industry and country-level data and different proxies for the latent growth opportunities. One widely used proxy turns out to be an indicator that reflects global industry growth opportunities that could arise as a consequence of technological innovation or price shocks. Given that the United States have well developed financial institutions, they are likely to take advantage of global shocks. For this reason, several contributions in the finance and growth literature rely on the United States data to proxy for global shocks affecting some industries in different countries. For instance, the influential contribution by Rajan and Zingales (1998), in testing the hypothesis that industries that are more financially dependent from external source can benefit more from financial development, assumes that the dependence of some industries from external finance, due to some technological shocks that rise the industry's investment opportunities beyond what internal funds can support, persists across countries. Under these assumptions, Rajan and Zingales (1998) use an industry's financial dependence measure referred to the United States as an indicator of industry's dependence in other countries. Another attempt to measure country's growth opportunities by using the United States data is made by Fisman and Love (2004b) who test whether countries with high levels of financial development grow faster in industries with global growth opportunities. Under the hypothesis described above, the global growth opportunities are likely to be proxied by the United States' sales growth. Fisman and Love (2004b) document that industries with global growth opportunities grow faster in well financially developed countries.

Nevertheless, when a proxy is based only on data from a particular country, apart from the well known measurement error[6], there is an additional measurement error in approximating the growth opportunities due to the fact that it is partly reflecting country specific opportunities, such as the productivity and the demand shifts that are typical of developed countries (Ciccone and Papaioannou, 2006). An improvement upon the proxies based on the United States' growth opportunities is given by the measure adopted by Bekaert et al. (2007). In examining whether countries with higher growth opportunities are likely to experience faster aggregate output and investment growth, Bekaert et al. (2007) express growth opportunities by the weighted average of industry's price-earnings ratios,

[6] The measurement error is due to the fact that we are using an imprecise measure of growth opportunities (which are not observable) in the regression model.

where the weights are the relative capitalizations of industries within a country. The intuition behind such a measure is that if countries have a high specialization in high price-earnings industries, they should grow faster than the average. Bekaert et al. (2007) find that they do.

The present work is also closely related to the literature on finance and growth assessing the impact of financial intermediation on economic growth. Empirical research has addressed this question quite extensively, thereby assessing that the deepening of both financial intermediaries and stock market activity accelerates growth. Indeed, following the seminal contributions by King and Levine (1993a, b), subsequent empirical studies provided evidence that an improvement in the financial system is likely to affect investment (Love, 2003; Bekaert et al., 2007), productivity and long-run economic growth (Levine and Zervos, 1998; Rajan and Zingales, 1998; Levine, Loayza and Beck, 2000; Beck, Levine and Loayza, 2000; Wurgler, 2000). However, even though the present work is related to this literature to the extent that it assesses a positive influence going from financial development to economic growth, it is more closely related to the strand of this literature which adopts firm-level data. For instance, Demirguc-Kunt and Maksimovic (2002) investigate whether underdevelopment of legal and financial systems prevents firms from capturing growth opportunities. More specifically, they assess that the more developed the financial markets, the greater the proportion of firms that grow at a rate which is higher than the one that can be attained by relying only on internal funds or on short term borrowing. Moreover, Love (2003) empirically tests a model in which the internal financial constraints interfere with efficient intertemporal investment in the sense that they cause firms to substitute investment tomorrow for investment today. Love (2003) provides evidence that financial development is likely to allow easier access to external funds for firms with good investment opportunities by reducing internal financing constraints.

The present contribution also complements the strand of the literature on finance and growth addressing the question of whether the specific financial structure of a country is likely to influence entrepreneur's investment behaviour. While the relationship between financial development and economic growth has been widely analyzed, there is less empirical evidence on the relevance of the financial structure. Moreover, at the firm level, Demirguc-Kunt and Maksimovic (2002) find that there is no evidence that the relative ratio

of market activity to the size of the banking sector affects the proportion of firms that obtain external finance. At the country level, Ndikumana (2005) also provides evidence that it is the overall degree of financial development that matters for aggregate investment, not the financial structure. In contrast, Ergungor (2008) empirically suggests that, in inflexible judicial environments, countries will experience higher growth rates if they have well-developed banking systems because relationship are essential for reputation building. On the other hand, in flexible judicial environments, countries will grow faster when they have well-developed stock markets because entrepreneurs invest more when they do not have to pay holdup rents to investors.

From a theoretical point of view, Fecht, Huang and Martin (2008) construct an overlapping generation model predicting that bank-oriented economies can grow more slowly than market-oriented economies because of a trade-off between risk-sharing provided by banks and growth. On one side, competitive banks increase risk-sharing that implies less investment in productive assets and less growth, because a high degree of risk-sharing is associated with larger liquidity. Therefore, since banks have to maximize the expected utility of depositors alive at each date, they do not take into account the benefits to future generations of an increase in capital stock. On the other side, financial markets are likely to promote investment in capital by constraining the amount of risk-sharing banks can offer.

3. Data and sources

In order to conduct the empirical analysis, both firm-level and country-level data are required. Table 1 provides a description of all the variables adopted in the analysis as well as their sources.

3.1 Description and sources of firm-level data

Firm-level data are drawn from the Worldscope Database that includes financial statement of about 29,000 active companies listed in developed and emerging markets, representing approximately 95% of the global market capitalization. The base year for the Worldscope Database is 1980, although data are best represented from January 1985 to December 2007. This database contains both qualitative and quantitative information on each listed firm. The qualitative information refers to a variety of characteristics that help to define the firms' profile and includes the company's header information and the SIC classifications, among others. On the other hand, the quantitative information include the financial statements, such as the balance sheets, the income statements and the cash flow statements, the valuation ratios, such as the profitability, the liquidity and the leverage ratios, and the security and market data that include, among others, the stock prices and the stock performances.

For the purpose of the analysis, this paper uses data on investment, total assets and price-earnings ratios for more than 9,000 companies listed in 41 developed and emerging markets, for the period 1990-2006[7]. Therefore, the original sample consists of an unbalanced panel of more than 52,000 observations[8].

In order to measure firm-level investment, the empirical analysis uses data on capital expenditures that represent the funds used to acquire fixed assets, other than those associated with acquisitions. This indicator includes, among others, additions to property, plant and equipment and investment in machinery and equipment, thereby measuring the ongoing firm's increase in fixed capital. Capital expenditures are included in the regression scaled by the total assets at the beginning of the year, as in the more recent literature (Love, 2003; Chen, Goldstein and Jiang, 2006).

[7] Original data on firm's investment and total assets are expressed in the national currency. In order to be able to compare data across firms in different countries, they have been converted in US dollars by using the exchange rate at the end of each year, obtained from the Bank of Italy's *Ufficio Italiano Cambi*.

[8] The reported number of observations refers to the size of the sample after excluding influential observations (see appendix A for a detailed description of the sample selection and appendix B for sample composition).

To test the first hypothesis of this paper, a measure of firm-level growth opportunities is needed. As highlighted in section 2, firm's growth opportunities are not directly measured by econometricians and therefore, each proxy adopted to approximate them is affected by measurement errors. This paper adopts the price-earnings ratio which is defined as the ratio of the market stock price and the earnings per share at the end of the year. The empirical specification adopts the price-earnings ratios in levels as in Bekaert et al. (2007).

Even though the first hypothesis is mainly interested in studying the effect of price-earnings ratios on investment, it also includes in the empirical specification another standard determinant of investment, namely the firm's size. As in Love (2003), it is measured by the natural logarithm of total assets that represent the sum of total current assets, long term receivables, investment in unconsolidated subsidiaries, other investments and net property plant and equipment.

3.2 Indicators of financial development

To examine whether financial development matters for firm's investment decisions, standard measures of the degree to which the national financial system assesses firms, monitors managers, facilitates risk management and mobilizes savings have been used.

The literature on finance and growth shows that alternative indicators can be used to measure both financial intermediaries and stock market development (Levine and Zervos, 1998; Levine, Loayza and Beck, 2000; Beck and Levine, 2002; Beck and Levine, 2004; Beck, Demirguc-Kunt and Maksimovic, 2008). Since there is no widely accepted empirical definition of financial development, this paper uses different indicators that are drawn from the World Bank Database on Financial Development and Financial Structure and refer to the period 1990-2006.

More specifically, to measure the financial intermediaries development, as in the more recent literature (Levine, Loayza and Beck, 2000; Beck, Demirguc-Kunt and Maksimovic, 2008), this paper adopts the *private credit* that indicates the financial resources provided to the private sector by deposit money banks and other financial institutions, over GDP. This indicator expresses the ability of financial intermediaries in providing credit to the private sector and in channelling funds to finance private investment. Moreover, it has the advantage of excluding the credit issued to governments

and public agencies and the credit issued by the central bank. Higher private credit issued by banks and other financial institutions indicates higher levels of financial services, greater financial intermediary activities and more financial resources channelled to the private sector.

On the other hand, to approximate the stock market development, this paper adopts the *market capitalization* which is the value of listed shares over GDP and is a measure of the stock market's size relative to the economy. This study also tests the robustness of the results by considering a second indicator of stock market development, that is the *value traded,* which is defined as the value of total shares traded on the stock market exchange, divided by GDP. Since the value traded is the product of quantity and prices, this indicator can rise if prices rise, without an increase in the number of transactions[9]. To deal with this shortcoming, this paper uses, in the robustness checks, the *turnover ratio* which is defined as the ratio of the value of total shares traded and market capitalization. The turnover ratio does not suffer from the previous weakness since both numerator and denominator contain prices. Moreover, it can be high if both are low and the denominator is lower than the numerator.

Other than including the above indicators which account separately for financial intermediaries and stock markets development, the empirical analysis also considers an aggregate index that controls for the overall level of financial development. Following Beck and Levine (2002), this paper uses the principal component analysis to construct an indicator of the overall financial development[10,11]. For the purpose of the analysis, the principal component is based on two indicators: the first one is the private credit provided by banks and other financial institutions, while the second one is the stock market

[9] Levine and Zervos (1998) highlight this potential pitfall arguing that if forward-looking stock markets anticipate large corporate profits and, as a consequence, higher economic growth, this will increase prices and value traded.

[10] Beck and Levine (2002) use the first principal component of two underlying measures of financial development. The first one (Finance-Activity) is a measure of the overall activity of financial intermediaries and markets. It equals the log of the product of Private Credit (the value of credits by financial intermediaries to the private sector divided by GDP) and Value Traded (the value of total shares traded on the stock market exchange divided by GDP). The second one (Finance-Size) is a measure of the overall size of the financial sector and equals the log of the sum of Private Credit and Market Capitalization.

[11] Basically, the principal component analysis takes N specific indicators of financial development and finds linear combinations of these to produce N new indices (namely, the principal components) that are uncorrelated among them. The lack of correlation is an important property since it means that the indices are measuring different "dimensions" in the data. Moreover, the indices are sorted so that the first one explains the larger amount of variation, the second one explains the second larger amount of variation, and so on.

capitalization[12]. From the original indicators, the first principal component accounting for about the 72% of variation is retained[13].

3.3 Indicators of financial structure

As emphasized in the introduction, apart from studying the effect of financial development on investment decisions, the empirical analysis also examines the impact of the financial structure of a country on capital allocation toward firms. In particular, it tests whether the country's financial specialization toward stock markets is likely to exert a positive impact on the level of investment. In other words, it aims to verify the market-based view that stresses the comparative advantage of financial markets over banks in efficiently allocating capital among firms.

Following Demirguc-Kunt and Maksimovic (2002), it has been constructed an indicator of the financial structure so that higher values imply larger and more active financial markets relative to the financial intermediaries and therefore, more market-based financial systems. The indicator of the financial structure is the ratio of the stock market capitalization to the private credit issued by banks and other financial institutions. This indicator measures the comparative size of stock markets and financial intermediaries. High values of this index can be interpreted as a prevalence of the resources channelled through the stock market rather than through financial intermediaries. The financial structure indicator allows to evaluate the relative merits of stock markets and banks and other financial intermediaries in allocating savings and therefore, in financing firm's investment.

[12] In the present work the principal component analysis works well to measure the overall degree of financial development since the original variables are positively correlated, as it can be inferred from table 3.

[13] The coefficients resulting from the principal component analysis are 0.7 both for the financial intermediaries and for the stock market development, while the weights are 27% for private credit and 73% for stock market development.

Table 1.
Variables descriptions and sources
Description and sources of all the variables used in the empirical analysis.

Variable	Definition and source
Firm-level variables:	
Capital expenditures	Funds used to acquire fixed assets other than those associated with acquisitions. It includes additions to property, plant and equipment and investments in machinery and equipment. *Source*: Worldscope
Total assets	Sum of total current assets, long term receivables, investment in unconsolidated subsidiaries, other investments and net property plant and equipment. *Source*: Worldscope
Price-Earnings ratio	Ratio of market price to earnings per-share /100. *Source*: Worldscope
Measures computed on the original firm-level variables:	
Average (Capital expenditures/Total assets)	Average capital expenditures scaled by the beginning of year total assets, over five overlapping years.
Log (Total assets)	Natural logarithm of total assets.
Financial development indicators:	
Private credit	Private credit issued by deposit money banks and other financial institutions divided by GDP. *Source*: World Bank Database on Financial Development and Financial Structure
Market capitalization	Value of listed shares on the stock market exchange divided by GDP. *Source*: World Bank Database on Financial Development and Financial Structure
Value traded	Value of shares traded on the stock market exchange divided by GDP. *Source*: World Bank Database on Financial Development and Financial Structure
Turnover ratio	Ratio of the value of total shares traded and market capitalization. *Source*: World Bank Database on Financial Development and Financial Structure

Table 1. (continued)

Variable	Definition and source
Measures computed on the original financial development indicators:	
Financial development	Financial development indicator calculated as the principal component of stock market capitalization and private credit by banks and other financial institutions.
Financial specialization	Financial specialization indicator calculated as the ratio of stock market capitalization to the private credit by banks and other financial institutions.

4. Summary statistics and correlations

Table 2 reports the summary statistics showing that there are large variations in investment, price-earnings ratios, total assets and financial indicators. The summary statistics are computed after excluding observations with a high average investment ratio (higher than 0.173) and those with a high price-earnings ratio (higher than 0.86), other than firms operating in the financial and service sectors. From table 2 it can be inferred that the dependent variable has an average value of 0.059 and a standard deviation of 0.037 with values ranging from 0 to 0.173. On the other hand, the price-earnings ratio shows an average of 0.198, meaning that investors are willing to pay, on average, 20 times the earnings per share to buy a firm's share. Moreover, the standard deviation reveals a high variability in the price-earnings ratio which ranges from 0 to 0.858. Firms with high price-earnings ratios show a high volatility of prices which derives from forecasting future profits growth.

Table 2 reports also the descriptive statistics for financial development and financial structure indicators. As shown by the standard deviation of these indicators, there is a high variability of financial development and financial specialization in the sample of countries considered. More specifically, from Appendix D, it can be inferred that private credit ranges from 0.108 in Venezuela to 1.659 in Japan. Countries with the lowest stock market capitalization are Venezuela (0.110), Poland (0.126) and Pakistan (0.136), whereas countries with the highest stock market capitalization are Switzerland (1.805), Malaysia (1.690) and Singapore (1.541).

Table 2.
Descriptive statistics
Summary statistics of all the variables used in the empirical analysis. See table 1 for variables description. For firm-level data the number of observations refers to firm-year units after excluding influential observations (see Appendix A for details on sample selection). Summary statistics for financial indicators are calculated on country averages.

Variables	Mean	Median	Std. Dev.	Min	Max	N. obs.
Average (Capital expenditures/Total assets)	0.059	0.053	0.037	0	0.173	52,420
Price-earnings ratio	0.198	0.153	0.151	0	0.858	52,420
Log (Total assets)	12.817	12.681	1.924	2.398	20.170	52,420
Private credit	0.662	0.607	0.385	0.108	1.659	41
Market capitalization	0.637	0.447	0.473	0.110	1.805	41
Value traded	0.364	0.246	0.363	0.012	1.488	41
Turnover ratio	0.581	0.497	0.473	0.025	2.479	41
Financial development	0	-1.090	1	-2.581	1.829	41
Financial specialization	0.898	0.762	0.460	0.142	2.112	41

By looking at the overall degree of financial development, it should be noted that Switzerland, Malaysia and Singapore are the most financially developed countries, while Venezuela, Poland and Pakistan show the lowest value of this indicator. Moreover, the financial specialization indicator can be used to classify country in bank-based and market-based showing that countries with a high specialization in stock market activity include Finland, Greece, Luxembourg, United States and United Kingdom, while bank-based countries include Austria, Germany, Japan, Italy and France.

Table 3 reports the correlations among the variables used to estimate the empirical model. Many correlation coefficients have not the expected sign. For example, it seems that the price-earnings ratio has no impact on the level of investment. Moreover, the financial intermediaries as well as the stock market development seems to exert a negative impact on investment decisions. The sign and the significativity of these coefficients may depend on the fact that in the correlation matrix it is included one explanatory variable at a time, while in the regression model more controls are included, other than firm-specific fixed effects and year dummies.

Table 3.
Correlation matrix
Correlations among the variables used in the empirical analysis. Correlations are computed after excluding influential observations (see Appendix A for details on sample selection). * indicates that the correlation coefficient is significantly different from zero at the 1% level.

	Average(Capital expenditures/ Total assets)	Price-earnings ratio	Log (Total assets)	Private credit	Market capitalization	Value traded	Turnover ratio	Financial development	Financial specialization
Average (Capital expenditures/Total assets)	1								
Price-earnings ratio	-0.008	1							
Log (Total assets)	0.032*	0.157*	1						
Private credit	-0.174*	0.202*	0.134*	1					
Market capitalization	-0.090*	0.032*	-0.007	0.449*	1				
Value traded	-0.101*	-0.007	0.020*	0.452*	0.659*	1			
Turnover ratio	-0.036*	-0.077*	-0.024*	0.154*	0.082*	0.677*	1		
Financial development	-0.150*	0.133*	0.079*	0.848*	0.855*	0.651*	0.140*	1	
Financial specialization	0.039*	-0.081*	-0.102*	-0.311*	0.594*	0.233*	-0.076*	0.172*	1

Similarly, from table 3 it can be inferred that financial specialization, accounting for the relative importance of stock markets over financial intermediaries, has a positive impact on investment decisions. This means that firms in countries with well developed financial markets over banks and other financial institutions are more likely to accumulate fixed capital in the future.

By looking at the correlations between the price-earnings ratio and other explanatory variables, it can be seen that larger firms, that is the ones with a high level of total assets, show high growth opportunities, since the correlation between the price-earnings ratio and the log of total assets is positive (0.157) and different from zero at 1% level. Moreover, the development of the financial system seems to be positively correlated to the price-earnings ratio. In particular, firms operating in more financially developed countries are more likely to experience high growth opportunities.

The correlations between all the financial development indicators are positive and significantly different form zero at 1% level. In particular it should be noted that stock market capitalization and value traded are highly and positively correlated with a coefficient of 0.659. The same is true for the correlation between value traded and turnover ratio. Therefore, it is expected that the inclusion of these indicators in the empirical specifications should evidence similar impacts on investment decisions.

The indicator of the overall financial development is strongly correlated, as expected, with both private credit and stock market capitalization since it is the principal component of the two indicators. On the other hand, financial specialization is negatively correlated to private credit and positively correlated to stock market capitalization[14].

[14] This is due to the fact that, in constructing this indicator, stock market development is in the numerator and private credit is in the denominator.

5. The empirical framework

The econometric analysis tests, on one side, whether the managers of a firm extract, from the price-earnings ratios, information about the firm's future growth opportunities to make investment decisions and, on the other side, whether the exogenous component of financial development and financial structure have an impact on the entrepreneur's investment behaviour.

The test of whether the firm's growth opportunities, anticipated by the price-earnings ratios, and the exogenous component of financial intermediaries and financial markets development have an influence on investment decisions is based on the following equation:

$$\frac{1}{5}\sum_{k=0}^{4}\frac{CapitalExpenditures_{i,c,t-k}}{TotalAssets_{i,c,t-k-1}} = \alpha PER_{i,c,t-5} + \beta \log(TotalAssets)_{i,c,t-5} + \gamma FD_{c,t-5} + \lambda_i + \varepsilon_t + \mu_{i,t} \quad (1)$$

where, *i* indexes firm, *c* indexes country and *t* indexes year, $\frac{1}{5}\sum_{k=0}^{4}\frac{CapitalExpenditures_{i,c,t-k}}{TotalAssets_{i,c,t-k-1}}$ is the average level of investment scaled by the beginning of year total assets, in five overlapping years, $PER_{i,c,t-5}$ is the price-earnings ratio, $\log(TotalAssets)_{i,c,t-5}$ is the natural logarithm of total assets controlling for firm's size, $FD_{c,t-5}$ is the degree of financial development measured, alternatively, by the *private credit*, the *market capitalization* and the principal component of them, λ_i is a time-invariant firm-specific intercept that captures unobservable firm characteristics, ε_t is a year dummy accounting for global shocks and $\mu_{i,t}$ is the idiosyncratic error term which is supposed to have mean zero and variance σ^2. All the explanatory variables are at the beginning of the five-years period considered.

To analyze the hypothesis that a country's financial structure characterized by the relative importance of financial markets over financial intermediaries is likely to promote firm-level investment, another control variable has been added in the previous equation:

$$\frac{1}{5}\sum_{k=0}^{4}\frac{CapitalExp\ enditures_{i,c,t-k}}{TotalAsset\ s_{i,c,t-k-1}} = \alpha PER_{i,c,t-5} + \beta \log(TotalAsset\ s)_{i,c,t-5} + \gamma FD_{c,t-5} + \nu FS_{c,t-5} + \lambda_i + \varepsilon_t + \mu_{i,t} \quad (2)$$

where, $FD_{c,t-5}$ and $FS_{c,t-5}$ are, respectively, the principal component and the ratio of *market capitalization* and *private credit*.

Finally, in analyzing the accelerator effect of financial development on growth opportunities, the empirical analysis includes an interaction term between the degree of financial development and the price-earnings ratios. Consequently, the estimating equation becomes:

$$\frac{1}{5}\sum_{k=0}^{4}\frac{CapitalExpenditures_{i,c,t-k}}{TotalAssets_{i,c,t-k-1}} = \alpha PER_{i,c,t-5} + \beta \log(TotalAssets)_{i,c,t-5} + \gamma FD_{c,t-5} + \eta FD_{c,t-5} * PER_{i,c,t-5} + \lambda_i + \varepsilon_t + \mu_{i,t} \quad (3)$$

where, $FD_{c,t-5}$ is the principal component of *private credit* and *market capitalization* and $FD_{c,t-5} * PER_{i,c,t-5}$ is the interaction term between the degree of financial development and the price-earnings ratios, accounting for the accelerator effect .

Given that it is of interest to estimate the long-run effect of the information contained in stock prices and of the improvement in the financial system on investment decisions, the empirical specifications include the average level of investment, scaled by the beginning of year total assets, for all the periods of five years between 1990 and 2006. To maximize the time-series content, overlapping five-years periods have been used as in Bekaert et al. (2007). On the other side, all the control variables have been lagged one year respect to the five-years period to which investment are referred. This strategy allows to examine the effect of the current stock price information, degree of financial development and financial specialization on future investment decisions, thereby making it easy to capture the relationship of interest. Moreover, the inclusion of the first lag of the financial indicators allows to deal with the potential endogeneity of both financial development and financial specialization, arising from a possible two-way relationship between the financial system and investment, and allows to establish, with more confidence, the relationship between

the exogenous component of the financial development and the financial structure and the firm's investment process.

The inclusion of the term λ_i accounts for time-invariant unobservable characteristics of a firm that cannot be included as controls in the empirical specification, but are likely to influence investment decisions. Accounting for the "individuality" of each firm implies to let the intercept vary across companies even though the slope coefficients are constant. The differences in the intercepts may be due to special features of each company, such as the managerial style, the managerial philosophy or the structure. Just as the dummy variables have been used to account for company effect, the time effects, ε_t, have been included to control for global shocks. This allows to control for the potential shifts over time that firm's investment can experience because of factors such as technological changes, changes in regulatory and tax policies and external effects, namely wars or other conflicts. In sum, by including both firm and time fixed effects, the intercepts are allowed to vary not only between firms, but also over time. The advantage of including both firm-specific fixed effects and time-specific effects is that they control for the heterogeneity across firms, not otherwise observed, and eliminate the bias due to omitted variables.

To estimate the above econometric specifications an unbalanced panel of about 9,000 firms listed in developed and developing countries, for the period 1990-2006, have been used[15]. Even though panel data have several advantages, as emphasized in the introduction, they show some weaknesses due to the fact that, for the econometric estimation, we cannot assume that the observations are independently distributed across time (Wooldridge, 2002a, chapter 13). For example, unobserved firm's characteristics, λ_i, that do not change over time, are likely to affect investment decisions in 1990 as well as in 1991, and so on. Moreover, in panel data the unobserved fixed-effects are also likely to be correlated with the firm-level explanatory variables. For instance, in the specific case, the unobserved firm's characteristics affecting the level of investment are also likely to affect the price-earnings ratios and the firm's size[16]. For these reasons, two special methods have been

[15] Since each cross-sectional unit (i.e. each firm) has not the same number of time series observations, this panel is *unbalanced*.

[16] If we were able to assume the fixed-effect being uncorrelated with each explanatory variable, then the fixed-effect could be considered an unobserved factor, affecting the dependent variable, that is not systematically related to the observable explanatory variables, whose coefficients are of interest. In this case, we could apply the pooled OLS to estimate the regression coefficients. On the contrary, if the covariance between the unobserved fixed-effects and the observed explanatory variables is different from zero, then

developed to eliminate from the equation model the fixed-effect prior to estimation: the first-difference and the mean-difference.

The first-difference method consists in transforming the original equation by differencing observations for two adjacent periods, across all periods. For instance, if T = 3 one could subtract observations in period 1 from observations in period 2 and observations in period 2 from observations in period 3. By using this method, the fixed-effect, that remains the same across years, will be cancelled out and the time-constant unobserved heterogeneity will be no longer a problem for estimation. Therefore, the resulting equation is just a linear model in the differences of all variables (although the intercept is dropped out) which can be estimated by OLS, thereby obtaining unbiased and consistent coefficients on the explanatory variables of interest[17]. This method shows some inefficiency due to the fact that one could also subtract observations in period 1 from observations in period 3 and therefore, information is partially lost.

On the other hand, the fixed-effect estimator uses a different transformation to remove the unobserved effect prior to estimation that consists in expressing the original observations as deviations from the individual means of all the variables included in the specification. The result is that, since the mean of the time-invariant fixed effect is itself, these individuals effects are removed from the transformed equation and the OLS can still be used to estimate the transformed equation. In this case, since the transformation consists in subtracting the individual mean, all the information is used and therefore, this method turns out to be more efficient than the previous one. For this reason, the above investment equations have been estimated as fixed-effects models that also assume robust standard errors to account for the overlapping nature of data.

putting the fixed-effects in the error term and estimating the regression with pooled OLS would produce biased and inconsistent coefficients (Wooldridge, 2002b, chapter 10)

[17] After the transformation, the orthogonality condition between the error term and the explanatory variables is still valid since the error term does not contain the fixed-effect anymore.

6. Results

6.1 Sensitivity of investment to price-earnings ratios and financial development

The empirical analysis starts by testing the hypothesis that firm's managers are likely to extract information about future growth opportunities from the price-earnings ratios to make investment decisions and that financial intermediaries and financial markets play some role in allocating capital toward firms. The empirical analysis begins with this hypothesis in order to (i) illustrate the methodology adopted and (ii) set the basic model for further test the role of financial specialization in resource allocation.

Empirically, to test the sensitivity of firm-level investments to growth opportunities and to the degree of financial development the model described in equation (1) has been adopted. The results are shown in table 4.

Column (1) presents the estimates of the effect of firm's growth opportunities and that of firm's size on the average level of investment ratios. As expected, the coefficient on the price-earnings ratios enters this regression positively and significant at the 1% level. The intuition behind this result is that when prices are high relative to earnings, investors are willing to pay a large multiple of today's earnings to buy firm's shares because they expect profits to raise in the future and therefore, the firm can rely upon more financing resources to make investment.

Moreover, the coefficient on the firm's size is equal to -0.017 and is significantly different from zero at the 1% level. This implies that an increase of one standard deviation in the firm's size, that is an increase of 1.924, determines a decrease in the future average level of investment ratios of about 0.033. This means that larger firms, i.e. the ones with high total assets at the beginning of the period, are likely to make less investment than smaller firms.

Furthermore, the coefficient on the price-earnings ratio remains positive and significantly different from zero at the 1% level in all the specifications considered. On the other hand, the coefficient on the firm's size remains negative and significantly different from zero at 1% level in all the specifications.

Table 4.
Sensitivity of investment to price-earnings ratio and financial development

The dependent variable is the average level of investment scaled by the beginning of year total assets, over five overlapping years. All the regressions include a time-invariant firm-specific fixed effect, year dummies and a constant (not reported). All the independent variables are referred to the beginning of each period of five years. In specification (1) the independent variables are: the price-earnings ratio and the logarithm of total assets. In specification (2) the independent variables are: the price-earnings ratio, the logarithm of total assets and the private credit issued by banks and other financial institutions over GDP. In specification (3) the independent variables are: the price-earnings ratio, the logarithm of total assets and the stock market capitalization over GDP. In specification (4) the independent variables are: the price-earnings ratio, the logarithm of total assets, and both the private credit issued by banks and other financial institutions and the stock market capitalization over GDP. In specification (5) the independent variables are: the price-earnings ratio, the logarithm of total assets and the principal component of the private credit issued by banks and other financial institutions and the stock market capitalization over GDP. Robust standard errors are computed. The t-statistics are reported in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively. R-Square refers to the R^2 within panel observations.

Variables	(1)		(2)		(3)		(4)		(5)	
Price-earnings ratio	0.004	***	0.004	***	0.003	***	0.003	***	0.003	***
	(4.28)		(4.31)		(3.34)		(3.38)		(3.74)	
Log (Total assets)	-0.017	***	-0.017	***	-0.017	***	-0.017	***	-0.017	***
	(-45.78)		(-44.82)		(-45.94)		(-45.00)		(-45.17)	
Private credit			-0.001				-0.001			
			(-1.25)				(-1.70)			
Market capitalization					0.003	***	0.003	***		
					(6.90)		(6.98)			
Financial development									0.001	***
									(4.42)	
No. of Observations	47,131		47,131		47,131		47,131		47,131	
R-Square	0.1970		0.1970		0.1983		0.1984		0.1975	

Column (2) also includes an indicator of financial intermediaries development that measures the resources allocated to the private sector by banks and other financial institutions, over GDP. This indicator has been commonly used in the literature to estimate the effect of financial intermediaries development on growth and has been found to exert a positive impact on it (King and Levine, 1993a,b; Levine and Zervos, 1998; Beck, Levine and Loayza, 2000; Beck, Demirguc-Kunt and Levine, 2000). In the sample considered, *private credit* does not seem to influence firm-level investment decisions since its

coefficient is not significantly different from zero at the common levels. This means that the fact that a firm operates in a country with a well developed activity of banks and other financial intermediaries does not have any effect on capital allocation. Even though this result is not consistent with the past existing literature on finance and growth, it is in line with contributions using more recent data on financial development (see, for instance, Rousseau and Wachtel, 2007)[18]. As highlighted in the introduction, this result is probably due to the fact that the analysis is conducted on a database that includes only publicly listed so that, even the small firms are relatively large. Indeed, large firms substitute to bank finance other sources of external finance, such as the stock market.

Given that it is of interest to analyze not only the effect of the financial intermediaries deepening, but also the effect of stock market development on investment decisions, column (3) adds to the firm's characteristics the stock market capitalization as a percentage of the GDP. Consistent with the existent literature, the coefficient on stock market development (0.003) is positive and significantly different from zero at the 1% level. This result is relevant for the purpose of this analysis since it documents the existence of a positive influence going from the deepening in the stock market activity and the capital accumulation process. According to the existing literature, the stock market may influence investment through different channels. First of all, the stock market provides information about the profitability of investment and, therefore it can identify fundable projects that otherwise may not be undertaken. Second, an expansion in the stock market activity may increase the opportunities for risk sharing which lowers the cost of equity finance and, through this route, increase investment. Third, the stock market may have a positive impact on investment by exerting pressure on corporate managements, especially through effective takeover or threat of takeover (Jensen and Meckling, 1976). The positive effect of stock market development, taken together with the positive impact of growth opportunities, is predictive of the fact that the stock market valuation of a firm is a useful guide for managers to take corporate decisions and, in the specific case, investment decisions.

Up to now the empirical analysis has considered the effect of financial intermediaries and stock market development on the level of investment, separately. Nevertheless, the sign and the significativity of the coefficients on both private credit and stock market capitalization are not altered if both indicators are included in the same regression (see

[18] Indeed, Rousseau and Wachtel (2007) show that the impact of financial intermediaries deepening on growth is not as strong in more recent data (1990-2003).

column (4) in table 4). This means that the effect of financial intermediaries development on firm-level investment is independent on the degree of stock market development and vice-versa, and that the stock market development has a robust effect on investment in the sample while, the development of financial intermediaries does not.

Finally, column (5) includes the principal component of private credit and stock market capitalization to estimate the effect of the overall financial development on capital allocation. Therefore, this indicator accounts both for financial intermediaries and for stock market development and summarizes the overall degree of financial efficiency in only one index. The effect of financial development on investment is positive and significantly different from zero at the 1% level. More specifically, an increase of one standard deviation in the level of financial development implies a potential increase of 0.001 in the future average level of investment ratios.

6.2 Sensitivity of investment to financial specialization

This section presents the results of the second part of the econometric analysis which examines whether the exogenous component of the country's financial specialization has an impact on firm-level investment. This analysis is based on the investment equation (2) that includes an indicator of the country's financial specialization along with the set of firm's characteristics and the financial development indicator described above. Therefore, the investment equation is similar to the one adopted in the previous section apart from an additional term, $FS_{c,t-1}$, which accounts for the degree of country's financial specialization in the stock market's activity.

This model predicts that if market-based financial systems promote investment more than bank-based systems, then the estimated coefficient v is expected to be positive.

The coefficient of interest is reported in the first column of table 5 in which the financial specialization indicator is included along with the price-earnings ratio and the logarithm of total assets. The results of this specification indicate a positive and significant effect of financial specialization on firm-level investment since the coefficient is positive and significantly different from zero at the 1% level. More specifically, an increase of one standard deviation (that is an increase of 0.460) in the relative importance of financial markets over intermediaries increases average investment ratios by 0.003.

Furthermore, the specification in column (1) is extended to investigate the effect of financial specialization in a model that includes also an indicator of the overall level of financial development. Indeed, as it can be inferred from column (2), the coefficient on financial specialization remains positive and significant even after including the principal component of the stock market capitalization and the private credit provided by banks and other financial institutions.

These results suggest that, in the sample considered, the relative importance of stock market activity over that of financial intermediaries is relevant for investment decisions in a model that accounts for firm's characteristics and for the overall financial development. Hence, these results indicate that it is both the level of financial development and the degree of financial specialization toward stock markets that matters for investment decisions, and by this route, for economic growth.

This is an innovative finding in the finance and growth literature given that previous contributions have shown that it is the overall level of financial development, not the financial structure, that accounts for growth (Beck and Levine, 2002; Demirguc-Kunt and Maksimovic, 2002; Ndikumana, 2005). Nevertheless, the results provided in the present contribution are consistent with some recent theoretical and empirical literature. From an empirical point of view, the relative importance of market-based systems over bank-based systems has been documented by a recent work by Ergungor (2008) who shows that market-based systems promote growth compared with bank-based systems in countries with flexible legal systems.

Table 5.
Sensitivity of investment to financial specialization

The dependent variable is the average level of investment scaled by the beginning of year total assets, over five overlapping years. All the regressions include a time-invariant firm-specific fixed effect, year dummies and a constant (not reported). All the independent variables are referred to the beginning of each period of five years. In specification (1) the independent variables are: the price-earnings ratio, the logarithm of total assets and the financial specialization defined as the ratio of stock market capitalization and private credit issued by banks and other financial institutions. In specification (2) the independent variables are: the price-earnings ratio, the logarithm of total assets, the financial specialization defined as the ratio of stock market capitalization and the private credit issued by banks and other financial institutions and the financial development defined as the principal component of private credit issued by banks and other financial institutions and stock market capitalization. Robust standard errors are computed. The t-statistics are reported in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively. R-Square refers to the R^2 within panel observations.

Variables	(1)	(2)
Price-earnings ratio	0.003 ***	0.003 ***
	(3.84)	(3.54)
Log (Total assets)	-0.017 ***	-0.017 ***
	(-45.74)	(-44.84)
Financial specialization	0.002 ***	0.001 ***
	(4.28)	(3.23)
Financial development		0.001 ***
		(3.18)
No. of Observations	47,131	47,131
R-Square	0.1975	0.1978

6.3 The accelerator effect

The accelerator effect of stock market development consists in the fact that the deepening in the stock market activity could make firm-level investment more responsive to the growth opportunities, measured by the price-earnings ratios. More specifically, this analysis consists in attempting to answer the following question: does the deepening in the stock market activity enhance the responsiveness of investment to an increase of firm-specific growth opportunities, as measured by the price-earnings ratios? The accelerator effect is based on the intuition that the ability of firms to accumulate more fixed capital depends, not only on the future growth opportunities, but also on the availability of finance that allows to take advantage from them. In other words, the idea behind the accelerator

effect is that a firm may not grow either because it does not experience growth opportunities or because it has high growth opportunities but has no funds to take advantage of them.

In analyzing the accelerator effect, regression (3) is estimated and predicts a positive coefficient, so that firms with higher growth perspectives are likely to increase investment in the next period if the country's stock market is well developed.

The coefficient resulting from the estimation of regression (3) is reported in column (3) of table 6. It can be inferred that, even though the stock market development has an independent effect on investment, it does not play any role in helping firms to take advantage of growth opportunities. The coefficient on the interaction term is, indeed, equal to zero. Therefore, more efficient financial systems are likely to mobilize more financial resources to promote investment projects but are not likely to mobilize resources to those firms with high growth perspectives in the sample considered.

6.4 Robustness checks

Up to now, the results obtained by estimating the empirical model can be summarized as follows: (i) the stock market development, measured by the market capitalization over GDP, has a positive impact on investment; (ii) the financial specialization toward stock markets matters for capital accumulation even in a model that accounts for standard determinants of investment and for the overall level of financial development; (iii) the stock market development does not seem to exert an accelerator effect on growth opportunities in the sample considered.

The last part of the econometric analysis attempts to provide some robustness checks to the analysis of the effect of stock market development on the average level of investment ratios by adopting different indicators. Moreover, it provides estimation based on a framework that considers as dependent variable the level of investment, scaled by total assets, averaged over three non-overlapping five-year periods[19]. The results of both robustness checks are reported in table 6 (Panel A and B).

[19] The same methodology has been adopted by several contributions analyzing the effect of financial development on economic growth by using country-level data, such as Levine, Loayza and Beck (2000) and Beck and Levine (2004).

In particular, the regression reported in column (1) of panel A adopts as an indicator of stock market development the *value traded* defined as the value of shares traded on the stock market exchange divided by GDP whereas, the regression reported in column (2) of panel A adopts the *turnover ratio* computed as the ratio of the value of total shares traded and market capitalization, both at the beginning of the five-years period. As it can be inferred from the table, the effect of stock market development is unaffected by the measure adopted since the coefficients remain positive and significantly different from zero at the 1% level. Nevertheless, the favourite measure of stock market development remains the stock market capitalization since, by comparing column (4) of table 4 and the first and second columns of table 6 (panel A), it can be inferred that the stock market capitalization exerts the highest effect on investment decisions with a coefficient of 0.003. Moreover, the coefficient on private credit becomes negative and significantly different from zero at 5% and 10% levels after measuring the stock market development with the new indicators.

The results of the estimations computed on non-overlapping data are reported in panel B. This table shows that the effect of price-earnings ratios on capital allocation does not change. In particular, the coefficient remains positive and significantly different form zero at the 1% level in all specifications. Moreover, the impact of price-earnings ratios on investment increases after considering non-overlapping data. In fact, the coefficients range from 0.012 to 0.024 meaning that an increase of one standard deviation (that is an increase of 0.151) in the price-earnings ratios determines an increase in the average level of the investment ratios that ranges from 0.002 to 0.004, depending on specification and sample. The intuition behind this result is that the information about future growth opportunities are captured by the price-earnings ratios and are used by managers to make investment decisions.

From the same panel, it can be inferred that the impact of stock market development on the capital allocation remains positive and significantly different from zero at standard levels after considering non-overlapping data. In fact, the deepening of the stock market activity helps firms to accumulate more capital even though it does not help firms with higher growth opportunities to invest more. Also the relative importance of the stock market activity over that of financial intermediaries in a country seems to exert a strong

and positive effect on capital accumulation and, therefore on growth, in the sample considered.

Table 6.
Robustness checks and the accelerator effect

Panel A.

The dependent variable is the average level of investment scaled by the beginning of year total assets, over five overlapping years. All the regressions include a time-invariant firm-specific fixed effect, year dummies and a constant (not reported). All the independent variables are referred to the beginning of each period of five years. In specification (1) the independent variables are: the price-earnings ratio, the logarithm of total assets, the private credit issued by banks and other financial institutions over GDP and the stock market value traded over GDP. In specification (2) the independent variables are: the price-earnings ratio, the logarithm of total assets, the private credit issued by banks and other financial institutions over GDP and the stock market turnover ratio. In specification (3) the independent variables are: the price-earnings ratio, the logarithm of total assets, the stock market capitalization over GDP and an interaction term between stock market capitalization and the price-earnings ratio. Robust standard errors are computed. The t-statistics are reported in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively. R-Square refers to the R^2 within panel observations.

Panel A

Variables	(1)	(2)	(3)
Price-earnings ratio	0.003 ***	0.004 ***	0.002
	(3.86)	(4.23)	(1.15)
Log (Total assets)	-0.017 ***	-0.017 ***	-0.018 ***
	(-44.41)	(-44.86)	(-45.98)
Private credit	-0.001 ***	-0.001 **	
	(-2.72)	(-2.21)	
Value traded	0.001 ***		
	(4.91)		
Turnover ratio		0.002 ***	
		(4.58)	
Market capitalization			0.003 ***
			(5.90)
Market capitalization * PER			0.000
			(0.54)
No. of Observations	47,038	47,038	47,038
R-Square	0.1970	0.1971	0.1980

Panel B.
The dependent variable is the level of investment, scaled by total assets, averaged over three non-overlapping five-year periods. All the regressions include a time-invariant firm-specific fixed effect, year dummies and a constant (not reported). All the independent variables are referred to the beginning of each period of five years. In specification (1) the independent variables are the price-earnings ratio and the logarithm of total assets. In specification (2) the independent variables are the price-earnings ratio, the logarithm of total assets and the stock market capitalization over GDP. In specification (3) the independent variables are the price-earnings ratio, the logarithm of total assets, the stock market capitalization over GDP and an interaction term between stock market capitalization and the price-earnings ratio. In specification (4) the independent variables are the price-earnings ratio, the logarithm of total assets, the financial specialization defined as the ratio of stock market capitalization and the private credit issued by banks and other financial institutions and the financial development defined as the principal component of private credit issued by banks and other financial institutions and stock market capitalization. The t-statistics are reported in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively. R-Square refers to the R^2 within panel observations.

Panel B

Variables	(1)		(2)		(3)		(4)	
Price-earnings ratio	0.014	***	0.012	***	0.024	***	0.012	***
	(3.39)		(2.74)		(2.99)		(2.77)	
Log (Total assets)	-0.015	***	-0.015	***	-0.015	***	-0.015	***
	(-18.75)		(-18.13)		(-18.26)		(-18.02)	
Market capitalization			0.004	*	0.007	**		
			(1.85)		(2.60)			
Private credit			0.000					
			(0.06)					
Market capitalization * PER					-0.017	*		
					(-1.82)			
Financial specialization							0.002	**
							(1.91)	
Financial development							0.001	
							(1.28)	
No. of Observations	13,712		13,522		13,522		13,522	
R-Square	0.1485		0.1494		0.1499		0.1496	

7. Concluding remarks

This study has examined three different but related questions about the relationship between growth opportunities, financial institutions and firm-level investment decisions. The first question is whether the information about future growth opportunities, contained in the price-earnings ratios, is likely to influence managers in taking corporate decisions, such as the decisions on investment. The second question is whether the development of financial intermediaries and financial markets are likely to encourage entrepreneur's investment behaviour and help private firms to take advantage from growth opportunities. The third question is whether a country's financial structure, characterized by the relative importance of stock markets over financial intermediaries, is likely to promote firm-level investment.

The empirical analysis conducted on an unbalanced panel of 9,000 listed firms over the period 1990-2006 is informative with regard to the three questions. Indeed, the evidence shows that the information contained in the price-earnings ratios about the future growth perspectives is likely to affect investment decisions. Moreover, the results show that different indicators of stock market development are positively and strongly related to firm's investment. This suggests that the stock market development facilitates private investment to the extent that it is accompanied by an increase of funds to investors and by a decrease in the cost of equity finance. Therefore, as a country's financial market becomes more sophisticated, capital becomes more available and cheaper and it is allocated more efficiently among firms. By contrast, the credit provided by banks and other financial institutions to the private sector does not seem to exert a positive impact on investment. This result is also documented in the more recent literature (Rousseau and Wachtel, 2007) and is probably due to the fact that the analysis is conducted on a database that includes only publicly listed so that, even the small firms are relatively large. As expected, large firms substitute bank finance with other sources of external finance, such as the stock markets. Moreover, the results indicate that, even though the stock market enhances investment in the private sector, it does not make it easier for firms to obtain the funds required to capture growth opportunities, by further increasing investment.

The empirical analysis also shows a positive effect of the overall financial development on investment. Finally, the results of the empirical analysis are informative about the existence of a positive relationship between the financial specialization on the

stock market activity, relative to that of financial intermediaries, and investment. These results are not only consistent with the view that it is the overall level of financial development that matters for growth, but also with claims that market-based systems are better at promoting investment than bank-based systems.

Taken together, these findings suggest that firms with higher growth opportunities accumulate more capital and that the stock market has a key role in channelling funds toward investment projects.

Appendix A. Sample selection

All countries available in the Worldscope database are included. This results in a sample of 41 countries. The sample does not include firms for which the primary industry is either financial (one-digit SIC code of 6) or services (one-digit SIC code of 7 or above).

In addition, the following observations have been dropped before estimating the coefficients of interest.

- All firms with less than six years of coverage.
- All firms with missing *Capital expenditures*, *Total assets* and *Price-earnings ratio*.
- Observations with Average (Capital expenditures/Total assets) >= 0.173
- Observations with Price-earnings ratio >= 0.86

The resulting dataset has 9,039 firms with 52,420 observations.

Appendix B. Sample composition

The appendix reports the number of firm-year observations and the number of firms in each country included in the sample. The data source is Worldscope.

Country	Number of observations	Number of Firms
Argentina	176	43
Austria	352	43
Belgium	351	48
Brazil	433	204
Canada	1,626	230
Chile	614	110
Colombia	77	12
Denmark	649	76
Finland	520	81
France	2,043	296
Germany	2,338	349
Greece	37	23
Hungary	41	10
India	2,011	412
Indonesia	723	150
Ireland	249	22
Israel	102	32
Italy	838	125
Japan	8,078	2,072
Korea, Rep.	1,803	449
Luxembourg	63	11
Malaysia	1,802	401
Morocco	15	6
Mexico	395	76
Netherlands	801	76
New Zealand	192	36
Norway	294	56
Pakistan	342	54
Peru	191	42
Philippines	399	85
Poland	105	36
Portugal	117	26
Singapore	924	228
South Africa	869	134
Spain	227	42
Sweden	816	116
Switzerland	1,019	116
Thailand	927	194
United Kingdom	4,024	456
United States	15,800	2,053
Venezuela	37	8
Total	52,420	9,039

Appendix C. Summary statistics by country for firm-level variables

The appendix reports the summary statistics by country of all the firm-level variables used in the empirical analysis. See table 1 for variables description.

Country	Average (Capital expenditures/Total assets)		Price-earnings ratio		Log (Total assets)	
	Mean	Median	Mean	Median	Mean	Median
Argentina	0.05	0.04	0.19	0.12	13.14	13.47
Austria	0.07	0.06	0.20	0.14	12.80	12.52
Belgium	0.07	0.07	0.56	0.18	12.78	12.56
Brazil	0.07	0.07	0.58	0.08	13.26	13.24
Canada	0.07	0.07	0.33	0.15	12.92	12.83
Chile	0.06	0.06	0.23	0.14	12.43	12.43
Colombia	0.04	0.04	0.19	0.12	12.94	13.03
Denmark	0.07	0.07	0.28	0.16	12.11	11.91
Finland	0.08	0.07	0.16	0.11	12.96	13.01
France	0.09	0.05	0.27	0.15	13.09	12.76
Germany	0.08	0.07	1.35	0.21	12.84	12.53
Greece	0.08	0.06	0.46	0.23	12.46	12.07
Hungary	0.12	0.13	0.15	0.11	12.28	12.03
India	0.09	0.07	0.18	0.11	11.91	11.79
Indonesia	0.07	0.05	0.21	0.10	11.68	11.43
Ireland	0.07	0.05	0.16	0.14	12.54	12.74
Israel	0.06	0.04	0.23	0.26	13.71	13.79
Italy	0.05	0.04	0.24	0.15	13.69	13.66
Japan	0.05	0.04	0.60	0.29	13.54	13.39
Korea, Rep.	0.07	0.05	0.46	0.11	12.78	12.61
Luxembourg	0.06	0.05	0.28	0.25	12.77	12.64
Malaysia	0.06	0.05	0.49	0.16	11.70	11.59
Morocco	0.11	0.08	0.20	0.16	13.16	13.00
Mexico	0.06	0.06	0.30	0.13	13.95	13.42
Netherlands	0.07	0.07	0.21	0.12	12.90	12.81
New Zealand	0.08	0.07	0.19	0.14	11.69	11.50
Norway	0.12	0.08	0.26	0.14	12.48	12.44
Pakistan	0.08	0.06	0.17	0.08	11.09	10.93
Peru	0.07	0.06	0.32	0.05	11.59	11.53
Philippines	0.07	0.06	0.47	0.14	11.99	11.92
Poland	0.08	0.08	0.56	0.12	11.67	11.33
Portugal	0.08	0.06	0.29	0.18	13.17	13.22
Singapore	0.07	0.05	0.38	0.16	11.91	11.73
South Africa	0.09	0.07	0.14	0.11	12.23	12.67
Spain	0.06	0.05	0.94	0.14	13.70	13.64
Sweden	0.06	0.06	0.43	0.14	13.26	13.15
Switzerland	0.06	0.05	0.19	0.15	13.37	13.10
Thailand	0.07	0.06	0.28	0.10	11.33	11.08
United Kingdom	0.12	0.06	0.31	0.13	12.29	12.99
United States	0.07	0.06	0.31	0.16	12.88	12.79
Venezuela	0.05	0.04	0.12	0.10	7.13	7.09

Appendix D. Summary statistics by country for financial indicators

The appendix reports the mean, by country, of all the financial indicators used in the empirical analysis. See table 1 for variables description.

Country	Private credit	Market capitalization	Value traded	Turnover ratio	Financial development	Financial specialization
Argentina	0.21	0.36	0.03	0.18	-2.14	1.64
Austria	0.91	0.14	0.06	0.49	-1.40	0.14
Belgium	0.61	0.55	0.12	0.20	-1.32	0.76
Brazil	0.30	0.35	0.14	0.41	-2.01	1.15
Canada	0.81	0.80	0.45	0.54	-0.30	0.76
Chile	0.51	0.83	0.08	0.10	-0.94	1.38
Colombia	0.17	0.15	0.01	0.08	-2.30	0.50
Denmark	0.52	0.45	0.27	0.58	-1.56	1.04
Finland	0.61	1.12	0.64	0.49	-0.54	2.11
France	0.85	0.59	0.39	0.61	-0.93	0.66
Germany	1.05	0.39	0.37	1.02	-0.83	0.38
Greece	0.48	0.86	0.46	0.48	-1.08	1.77
Hungary	0.26	0.25	0.21	0.74	-2.23	0.99
India	0.25	0.30	0.45	1.46	-2.16	1.26
Indonesia	0.40	0.25	0.10	0.40	-2.01	0.73
Ireland	0.66	0.64	0.26	0.46	-0.80	0.73
Israel	0.72	0.51	0.20	0.37	-1.20	0.72
Italy	0.59	0.34	0.26	0.64	-1.59	0.54
Japan	1.66	0.72	0.41	0.56	0.48	0.44
Korea, Rep.	0.63	0.41	1.12	2.48	-0.60	0.34
Luxembourg	0.96	1.53	0.04	0.02	0.55	1.66
Malaysia	1.22	1.69	0.80	0.42	1.12	1.41
Mexico	0.22	0.30	0.10	0.35	-2.21	1.33
Morocco	0.49	0.38	0.04	0.11	-1.70	0.75
Netherlands	1.20	0.95	0.81	0.77	1.06	0.63
New Zealand	0.98	0.43	0.15	0.35	-0.90	0.43
Norway	0.60	0.32	0.23	0.70	-1.20	0.36
Pakistan	0.23	0.14	0.21	1.92	-2.42	0.60
Peru	0.23	0.22	0.04	0.20	-2.30	0.97
Philippines	0.37	0.54	0.17	0.29	-1.60	1.33
Poland	0.22	0.13	0.06	0.51	-2.44	0.54
Portugal	0.93	0.37	0.25	0.59	-1.09	0.38
Singapore	0.97	1.54	0.77	0.50	0.86	1.32
South Africa	0.61	1.50	0.39	0.25	0.71	1.37
Spain	0.74	0.26	0.14	0.50	-1.49	0.36
Sweden	0.45	0.93	0.71	0.68	-0.23	1.05
Switzerland	1.59	1.81	1.49	0.77	1.83	1.12
Thailand	1.21	0.52	0.34	0.72	-0.48	0.44
United Kingdom	1.12	1.33	0.73	0.53	0.55	1.14
United States	0.50	1.11	1.41	1.16	0.67	0.77
Venezuela	0.11	0.11	0.02	0.18	-2.58	0.82

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