Firm-Level, Macroeconomic, and Institutional Determinants of Firm Growth: Evidence From Europe

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Firm-Level, Macroeconomic, and Institutional Determinants of Firm Growth: Evidence From Europe

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Abstract

To examine the main drivers of firm growth, we estimated a model integrating firm-level, industry-specific as well as country-level determinants, aiming at a comprehensive explanation of firm growth. We used a large dataset of European firms for the 2005–2017 period and combined Amadeus firm-level data with macroeconomic variables and multidimensional measures of institutional framework, based on a range of sources. Using different panel regression model specifications, we found the most consistent relationships for firm-level determinants. Among country-level determinants, infrastructure quality, inward FDI, natural resources, and inequality show a consistently positive and significant relation with firm growth.

Introduction

After the Great Recession of 2008, EU countries experienced large differences in firm growth. For example, the average employment growth of EU enterprises over the 2008–2014 period ranged from a negative 3.9 percent in Spain to 2.2 percent in Lithuania (Hallak & Harasztosi, 2019). What are the factors behind these differences? Finding an answer to this question is crucial for policy makers that aim at creating favourable conditions for firm performance.

According to the resource-based theory of a firm, firm growth depends primarily on factors internal to the firm, such as technology, skilled personnel, efficient procedures, brand names, trade contacts, and so forth, and their efficient combination (Coad, 2007). However, the optimum firm size theory posits that

firm growth also depends on a number of exogenous variables, such as the country's macroeconomic environment, institutional setting, and business environment (Geroski, 2000). The extensive empirical literature on firm growth suggests a long list of growth determinants (see Coad, 2009 for an overview). Significant firm-specific factors include firm size, age, export propensity, intangible capital (as an indicator of the firm's innovation capacity), ownership of the firm, the firm's financial sources (indicating financial constraints), and firm productivity. Apart from these, empirical literature also points to the importance of the industry in which the firm operates as well as the macroeconomic factors and institutional environment in the country, suggesting that firm growth is to a certain extent determined by factors external to the firm. However, as Ipinnaiye et al. (2017) argue

in their study of drivers of SME growth, not enough is known about the role of external growth determinants, leaving a gap in the extant firm growth literature. In addition, instead of testing the effects predicted by a particular theory, integrative models are needed to determine to what extent firms' growth depends on industry and country specifics as well as their own firm-level characteristics. Our study seeks to contribute to this debate. The objective of the paper is to identify the factors on the firm, industry, and macro levels that stimulate or impede the growth of EU enterprises.

Based on the applied theoretical framework and empirical literature, we estimated a comprehensive model of firm growth that integrates firm-level, industry-specific, as well as macroeconomic and institutional determinants, aiming at an explanation, as complete as possible, of the phenomenon of firm growth. The study utilized a large dataset of European firms for the 2005–2017 period. To analyse the main factors that drive firm growth (measured as revenue and employment growth), we used different panel regression model specifications. All the relevant firm-level determinants of growth identified in the literature and available in the Amadeus database were taken into account. Apart from these, two other sets of factors were included in the model, the industry in which the firm operates and country-specific factors. To include the latter, we followed the approach of D'Olio et al. (2013); in modelling the factors of productivity growth in Europe, they combined Amadeus firm-level data on productivity and firm characteristics with various country-level data (business environment, FDI, infrastructure quality, credit availability). By way of applying a multidimensional measure of the institutional framework, we tested to what extent the differences in firm growth were due to the home country of the firm. A number of macroeconomic variables were tested, together with a set of composite indicators constructed to measure more specific differences in the institutional environment such as bureaucracy and regulation, including labour market regulation, tax systems, healthcare and education, political environment, rule of law, and security, as well as measuring the overall development of the infrastructure and financial system.

Our paper contributes to the literature on firm growth by integrating three sets of determinants in explaining growth: 1) firm-level, 2) industry-specific, and 3) macroeconomic and institutional factors. To the best of our knowledge, this is the first attempt at investigating such a comprehensive set of determinants of firm growth that also includes institutional drivers. Whereas the study by Ipinnaiye et al. (2017) uses a similar approach of integrating macroeconomic

determinants with internal drivers and provides evidence that the macroeconomic environment affects SME growth (both directly and indirectly), it does not include the institutional environment in the analysis. We provide evidence on the extent to which the growth of EU enterprises depends on this wide range of determinants, identifying those that are more important than others and thus more deserving of the attention of policy makers and managers.

Our results reveal a significant role of firm-, industry-, and country-level determinants of firm growth. The most consistent relationships were found for firm-level determinants, while macroeconomic and institutional determinants show lower consistency and require more detailed examination. Positive and statistically significant relation with firm growth among firm-level determinants was identified for labour productivity and the share of intangible capital, while age and level of debt have a negative relation with firm growth. Among macroeconomic determinants, we found that inward FDI, presence of natural resources, and inequality correlate positively with firm growth. The significance, size, and direction of the relation varies the most among institutional determinants, with the exception of infrastructure, which shows the highest and consistently positive and significant relation with firm growth.

The rest of the paper is organized as follows. We review the theory and the empirical evidence on determinants of firm growth in Section 1. Section 2 describes the data and the methodological approach. Section 3 presents the results and discusses the main findings of the study. We conclude with Section 4.

1 Theoretical considerations and empirical evidence

The extensive literature on firm growth attributes firm heterogeneity to a number of sources, depending on an underlying theory. In his review of the main theories of firm growth, Geroski (2000) classifies them into models of optimum firm size, predicting that firms will tend to grow to their optimum size (see, e.g., Viner, 1952), stage theories where firms evolve through several phases of growth (see, e.g., Greiner, 1998), and models based on Penrose's (1959) theory of the growth of the firm. Penrose's theory contains two types of arguments. The first is the "managerial limits to growth" hypothesis, stating that "firm growth is led by an internal momentum generated by learning-by-doing" (Coad, 2009, p. 32). Managerial limits refer to one of the two types of firm-specific capabilities that Penrose identifies, where managerial capabilities are associated with

execution of ideas and entrepreneurial capabilities with subjective evaluations of market conditions, perceiving the opportunities, and being willing to act on them (Penrose, 1959, p. 36). The second type of argument links to 'resource-based view' of the firm where "firms are composed of idiosyncratic configurations of resources" (Coad, 2007, p. 33), the use of which generates firm growth (for more see Coad, 2007; Geroski, 2000).

The purpose of our research can best be summarized by a combination of optimum size and resource-based theories of firm growth. The model of optimum firm size suggests that optimum size depends on a number of exogenous variables (Geroski, 2000). On the other hand, resource-based theory attributes firm growth to inherent factors within the firm, such as technology, skilled personnel, efficient procedures, brand names, trade contacts, and so forth (Coad, 2007; Wernerfelt, 1984) and their efficient combination. Whereas extensive literature exists on firm-specific characteristics as a source of heterogeneity in firm growth, little is known about the role of external determinants, such as macroeconomic conditions, and of the combined effects of internal and external drivers in firm growth (Ipinnaiye et al., 2017). Available empirical studies show low explanatory power of individual theories of firm growth and a strong stochastic element in explaining it. Coad (2009) claims that the main result of empirical work on firm growth is that it is the stochastic element that is predominant, in other words, that "firm growth appears to be an idiosyncratic and fundamentally random process" (p. 58). In such circumstances, "it is meaningful to follow Penrose and suppose that growth is not just a means to obtain a certain size, but rather it is an end in itself, a constructive application of spare resources. Indeed, in the presence of learning-by-doing and dynamic increasing returns, a lack of growth would be akin to stagnation" (p. 59). Consequently, he proposes that the way forward is through empirical analysis and quotes Starbuck (1971, p. 126), saying that the subject needs "solid, systematic empirical research directed toward explicit hypotheses and utilizing sophisticated statistical methods" (Coad, 2007, pp. 59–60). Our approach is motivated by a need to contribute to this debate and to aim at an explanation of the phenomenon of firm growth that is as complete as possible, instead of testing effects predicted by a particular theory. Based on the theoretical perspectives and empirical literature, we have built an integrative model of firm growth that includes internal as well as external determinants.

In selecting firm-level determinants of firm growth, we drew on empirical studies that focus on variables such as firm size, age, R&D and innovation activity and human capital, export-related variables, nationality of ownership, as well as the firm's financial sources to capture the impact of financial constraints, productivity, and the dynamics of the firm's growth in the previous period. As external drivers of firm growth, we included industry-specific, macroeconomic, and institutional factors. What follows is a brief look at the main findings of the literature on the scope and direction of these determinants of firm growth.

Firm size is one of the basic variables included in empirical analyses of firm growth. Conventional wisdom has claimed that expected firm growth rates are independent of size (Gibrat's Law); however, more recent analyses tend to demonstrate a negative relationship between a firm's size and growth (Almus, 2000; Bottazzi & Secchi, 2003; Cabral & Mata, 2003; Calvo, 2006; Dunne & Hughes, 1994; Goddard et al., 2002; McPherson, 1996; Reichstein & Jensen, 2005; Yasuda, 2005; Zhou & De Wit, 2009). Smaller firms grow faster; if for no other reason, this is because they have to reach the size of minimal efficiency (Audretsch et al., 2004).

The predominant finding on *firm age* is that there is a negative relationship between firm age and growth (Dunne et al., 1989; Evans, 1987; Geroski & Gugler, 2004; Glancey, 1998), although some analyses do not confirm this (Barron et al., 1994; Das, 1995). Fort et al. (2013, p. 27), who specifically analyse the role of a firm's age and size in business cycles, find that young/small businesses are more cyclically sensitive, so that the relative decline in employment during recession is greater for young and small businesses than for large and mature businesses.

Two other determinants with a positive impact on firms' growth that are regularly put forward by the literature are *R&D and innovation activity* (Coad, 2009; Dugal & Morbey, 1995; Freel, 2000; Geroski & Machin, 1992; Geroski & Toker, 1996; Hall & Mairesse, 2006; Mansfield, 1962; Rauch et al., 2005; Roper, 1997), as well as the level of *human capital* (Hamilton et al., 2003; Iranzo et al., 2008; Navon, 2010; Parrotta et al., 2014; Unger et al., 2011). An alternative aspect of this research relates to *intangible capital*. The role of the accumulation of intangible capital as a source of SME growth has attracted increased attention. It has been shown (Corrado et al., 2009; Haskel et al., 2018; Piekkola, 2011; Van Ark et al., 2009) that intangible capital contributes up to one third of overall productivity growth in the US, EU, and Japan. Research linking intangible capital to growth and productivity of SMEs is rare and fragmented, focusing primarily on human capital, competencies, or R&D.

As far as *export propensity* is concerned, the dominant conclusion of the literature is that export-oriented firms are more productive and generally more successful than local-market-oriented firms

(Aw-Roberts et al., 1997, 1998; Bernard et al., 2005; Bernard & Wagner, 1997; Burger et al., 2008; Clerides et al., 1998; Criscuolo et al., 2005; Hahn, 2004; Hallward-Driemeier et al., 2002; Head & Ries, 2003; Van Biesebroeck, 2005); therefore, one expects that they will be, in principle, more successful in terms of growth.

The literature suggests that firms with *lower levels of indebtedness* and those that are *less dependent on external sources of financing* have better capacity to grow. This is especially important in periods of economic recession, when financial limitations are one of the main factors that restrain firm growth (Braun & Larrain, 2005; Bricongne et al., 2012; Desai et al., 2004; Fagiolo & Luzzi, 2006; Kroszner et al., 2007; Manova et al., 2015). Any model of firm growth must also contain *productivity* as a control variable (see Alvarez & Görg, 2009). According to Coad (2009, p. 25), it is logical to expect that more productive firms grow while less productive ones stagnate or reduce in size. Still, empirical analyses do not always confirm this (Bottazzi et al., 2006). One possible explanation is that firms may increase their productivity with increasing (or decreasing) extent of their operations (Haltiwanger et al., 1998).

The *industrial sector* in which a firm operates importantly codetermines its growth dynamics (see Audretsch, 1995; Audretsch & Mahmood, 1994; Coad, 2009; Gabe & Kraybill, 2002; Geroski & Toker, 1996). This is all the more relevant in times of economic recession (see Bricongne et al., 2012; Chor & Manova, 2012; Eaton et al., 2011; Jiang et al., 2009; Levchenko et al., 2010; Roubinchtein & Ayala, 2009). Coad (2009) also puts forward the importance of *macroeconomic factors* for firm growth. *Income inequality* is a country-specific macroeconomic variable that deserves special attention. Some of the recent empirical work addresses the debate on whether inequality has a positive or negative effect on growth, and the conclusion is still open (Ferreira et al., 2022). Theoretical work has identified a number of channels through which inequality can affect economic growth, and most of them predict a negative effect. These transmission channels include (Neves & Silva, 2014): the credit market imperfection channel (with the core idea that inequality is detrimental to growth as it prevents the poor from carrying out investments in human and physical capital, in the presence of borrowing constraints); the fiscal policy channel (where taxation and redistributive government expenditure increase when inequality increases, leading to negative effects on investment incentives and thus growth); sociopolitical instability channel (where inequality leads to political instability and social unrest, negatively influencing investments and growth); and savings channel (which predicts a positive effect as inequality directs resources towards the rich, who have a higher marginal propensity to save than the poor, leading to greater aggregate savings and higher investment and growth). However, these theoretical transmission channels are likely to operate differently over different time horizons, as shown by Halter et al. (2014). More specifically, the positive effects of inequality on growth associated with higher savings and investment tend to be based on economic mechanisms and are therefore likely to operate in the shorter run, while the negative effects tend to operate in the long run as they often involve political economy channels. In addition, the results will be different in developed and developing countries, as the transmission channels are not the same in both types of economies (Topuz, 2022). In developed countries, income inequality can have a beneficial effect, through an increase in available savings and investment, and indeed the impact of inequality on growth has been shown to be positive in high-income OECD and European economies (Castelló-Climent, 2010). The conclusion that inequality can be growth-enhancing in some circumstances and growth-inhibiting in others is corroborated by a meta-analysis of the empirical literature of recent decades, which shows that the effect of inequality on growth is negative and more pronounced in less developed countries than in rich countries and that the relationship works differently in the short and long run (Neves et al., 2016).

Empirical evidence is building up on the importance of *institutional factors*. Institutions are the rules of the game, composed of formal and informal constraints, in which organizations and entrepreneurs are the players (North, 1994). The institutional environment creates a socio-economic ecosystem in which firms operate and which influences the allocation and use of resources as well as the returns and risks of investing firms (Sobel, 2008; Xu, 2010). The business and institutional environment encompasses a wide range of factors relevant for firm-level growth, from the availability of infrastructure, the supply of human capital, access to finance, and the basic functions of government (such as containing corruption) to barriers to entry and exit, tax environment for firms, as well as labour regulations (Reyes et al., 2021). The quality of such an environment has been shown to explain cross-country differences in productivity (Hall & Jones, 1999). For a long time, only country-level data on the business environment was available, but the multicollinearity of its various aspects is severe at this level, and some of the important measures can only be obtained through firm-level data (Xu, 2010). This has been resolved by the abundance of firm-level data since 2000, which has led to

an extensive literature on the impact of the business environment on firm performance, largely, but not exclusively, focused on developing countries (Ganau & Rodríguez-Pose, 2019; Nichter & Goldmark, 2009; Pereira & Temouri, 2018; Xu, 2010).

This literature is quite fragmented and usually deals with the effects of specific elements of the business environment. One of the exceptions is a study by Reyes et al. (2021), which examines a comprehensive list of business and institutional environment variables to explain growth at the firm level. They conclude that modern infrastructure, access to finance, and basic government protection together with the presence of a strong agglomeration environment are important determinants of firm growth, while labour regulations, taxes, and access to land are not. They also show that the effects of the environment depend on firm size (small firms need a stronger business environment than larger firms) and age (younger firms show faster growth due to infrastructure, labour flexibility and ease of entry) as well as the country's level of development (Reyes et al., 2021).

Turning to the results for specific elements of the business environment, our first consideration is the *infrastructure*. Physical infrastructure is an important factor in explaining firm performance in developing countries, especially in countries with a low stock of infrastructure (Xu, 2010). However, modern infrastructure has also been shown to be important for the productivity of firms in developed countries. Evidence of the positive productivity effects of information and communication technology (ICT) is accumulating (Cardona et al., 2013; Stanley et al., 2018; Vu et al., 2020), bringing the importance of ICT infrastructure to the fore. The same applies to transport infrastructure such as roads, railways, airports, and ports, which enable connectivity and ensure better connections between companies, customers, and suppliers with the help of a logistics system (Bergantino et al., 2023). Recent empirical studies confirm that such infrastructure determines firm-level productivity (Bergantino et al., 2023; Branco et al., 2023; Khanna & Sharma, 2021; Wan et al., 2024).

The importance of the *educational system* as an element of the business environment that has a positive impact on firm productivity is supported by numerous studies (see for example Backman, 2014; Gennaioli et al., 2012). Firm-level studies on the productivity impact of *bureaucratic burden* are rare, however. Some conclusions can be drawn from a study that analysed the impact of regional institutional quality on firms in Western Europe and found government effectiveness to be the most important institutional dimension benefiting firm productivity (Ganau & Rodríguez-Pose, 2019). Government effec-

tiveness was measured as a variable that captures the perception of the quality of public services and could be interpreted as a proxy for bureaucratic quality. The same study found no evidence for control of *corruption and rule of law* as two of the elements of institutional quality, although control of corruption shows a positive effect when considered individually in the model (Ganau & Rodríguez-Pose, 2019). However, Reyes et al. (2021) confirm that containing corruption, together with basic safety provided by the government, is an important determinant of firm growth.

Gemmell et al. (2018) claim that in countries with higher statutory *tax rates*, productivity catch-up of small firms is slower. According to Fernández-Villaverde and Ohanian (2018), the lagging of European productivity growth behind the US since the mid-1970s is due to higher tax rates and increased regulatory barriers that have reduced competition and new business formation. Lack of or slow *structural reforms* are another factor with a negative impact on firm growth (de Almeida & Balasundharam, 2018; Kouamé & Tapsoba, 2019; Masuch et al., 2018). A number of authors point to the importance of a flexible enough setting that allows the *entry and exit* of firms (Acemoglu et al., 2019; Foster et al., 2018; Lewrick et al., 2018; Storz et al., 2017), where the exit of less productive firms frees up skilled labour for newly entering firms (Acemoglu et al., 2018).

Lastly, the *financial system* should be considered as an element of the institutional environment. Financial intermediaries and markets play an important role in mobilizing savings and ensuring that resources are channelled into productive sectors. However, the empirical literature on the role of financial development in economic growth has only developed since the 1990s, mostly focusing on cross-country evidence (Ang, 2008). This literature has produced consistent results showing that there is a positive relationship between financial development indicators and economic growth (Ang, 2008; Levine, 2003; Valickova et al., 2015). For example, a seminal study by Demirgüç-Kunt and Maksimovic (1998) used firm-level data to test whether financial development affects the degree to which firms' investment in profitable growth opportunities is constrained and showed that well-developed financial systems are important in facilitating firm growth. However, since the global economic crisis of 2007–2008, these conclusions have been reconsidered. Some studies argue that there is such a thing as too much finance (Law & Singh, 2014). Over the last decades, financial sectors have grown rapidly, and empirical evidence is accumulating showing that the level of financial development is only beneficial up to a certain point, after

which the relationship between finance and growth becomes negative (Arcand et al., 2015; Law & Singh, 2014; Samargandi et al., 2015). Thus, the traditional view that finance and growth present a linear relationship is challenged by evidence suggesting that it is non-linear (with an inverted U-shape) and that there is a finance threshold in the finance–growth nexus. Arcand et al. (2015) find that this threshold is reached when credit to the private sector reaches 80–100 percent of GDP. Above this threshold, more finance is associated with less growth (Arcand et al., 2015). The question of the finance–growth nexus still appears to be unresolved. This is not only due to the issues of endogeneity and the weaknesses of cross-country studies (Berger et al., 2020), but also due to the question of appropriate measurement of financial development (Levine, 2003; Valickova et al., 2015).

In summary, our main hypothesis is that firm growth depends not only on firm-level factors, but also on the industry in which the firm operates and on macroeconomic and institutional characteristics of the country concerned. In modelling firm growth, we thus took into account all those determinants which had been identified as important by the empirical literature and which we were able to test with the available data. We measured firm growth by two indicators: growth of employment and growth of revenue. The following firm-level determinants of growth were tested: a firm's initial size, age, intangible capital, structure of the firm's financial sources, productivity, skill intensity, and the industry in which the firm operated. To test the extent to which differences in firm growth are due to country specific factors, we followed the approach of D'Olio et al. (2013). In modelling the factors of productivity growth in Europe, they combined Amadeus firm-level data on productivity and other firm characteristics with various country-level data (business environment, FDI, infrastructure quality, credit availability). The macroeconomic variables tested are the size of the domestic market, tariff barriers, income inequality, inward FDI, as well as dependence on natural resources. In addition, a set of composite indicators were constructed, to measure more specific differences in the institutional framework including tax systems, educational and health sectors, regulatory framework (overall and labour-market-specific), political environment, rule of law, and security, as well as measuring overall development of infrastructure and financial system. Year-specific effects were added.

2 Data and methodological approach

2.1 Data

2.1.1 Firm-level data

The data on firm growth and firm-specific factors, including the data on the industry, was taken from the Bureau van Dijk's Amadeus database. Amadeus is a comprehensive firm-level database on European companies containing annual account items on approximately 21 million companies across Europe. Different historical waves of Amadeus were used so that non-surviving firms were included.[1] A database of financial and other relevant data was thus built for firms from all available European countries. Consolidated and unconsolidated accounting data are available in Amadeus, and we used unconsolidated accounts. We restricted the analysis to the period 2005–2017.

2.1.2 Country-specific data

Sources of data for country-specific macroeconomic and institutional variables include the World Bank's ease of doing business indicators, world development indicators, education indicators, health and population statistics, and worldwide governance indicators, data from the World Justice Project, Global Competitiveness Index indicators by the World Economic Forum, and Centre for Business Research's Labour Regulation Index. The following set of variables is included in the model: size of the domestic market, tariff rate, rate of unemployment, share of inward FDI in GDP, natural resources abundance, and income inequality. In addition, we used a multidimensional measure of the business/entrepreneurial environment to identify how differences in institutional arrangements across countries influence firm growth in a country.

We constructed a series of 12 synthetic indicators that are country–year-specific, each being calculated from a series of subindicators that are listed in the *Supplemental material* (Appendix, Table A1). All subindicators were first normalized to the interval [0, 1]. When choices of synthetic indicators were made, some of the indicators were inversed, so that values between 0 and 1 offered the same meaningful interpretation in all sets of subindicators within each synthetic index (e.g., murder rates were used inversely within the safety synthetic indicator). An aggregate synthetic index, normalized to the interval [0, 1], was then calculated as a simple average of all selected subindicators.

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[1] We used the following Amadeus data vintages: 2017, 2015, 2012, 2009, and 2006.

The first institutional index is *Bureaucracy*, which measures the ease of enforcing contracts, obtaining building permits, paying taxes, starting a business, trading across borders, and so forth. The higher the value, the more efficient the bureaucracy is. The second is *Financial system*, which measures the development of the financial sector, protection of minority investments, ease of getting credit, quality of insurance and financial services, and so forth. A higher value of this indicator corresponds to a more developed and more stable financial sector. Next is *Regulation*, which rates the quality of regulation, efficiency of regulatory enforcement, and burden of government regulation. A higher index implies higher overall regulatory quality and lower regulatory burdens for firms. The fourth index is *Labour market* regulation, which quantifies the degree of labour rights, such as the right to unionization, right to strike, severance pay, length of notice period, procedural constraints on dismissal, and the like. A higher value of this indicator corresponds to more labour rights.

The fifth index is *Infrastructure* and measures the quality of infrastructure such as roads, railroads, ports, air transport, telecommunication, and electricity. A higher infrastructure index represents a more developed infrastructure. The sixth indicator is *Healthcare*, which rates the quality and accessibility of healthcare services, health expenditures, immunization, mortality rates, and so forth. A higher index corresponds to a more developed, successful, and accessible healthcare. Next is *Taxes*, which measures the level of different types of taxation, from value-added taxes to corporate and profit taxes, as well as compulsory social contributions. A higher index represents higher overall taxation. *Macroeconomic stability*, the eighth indicator, measures the strength of the macroeconomic aggregates and lack of excessive imbalances such as trade deficit, income inequality, old age dependency, and so forth. A higher value corresponds to more stable overall macroeconomic and broad social conditions required for economic development. The ninth index is *Political environment*, capturing the political stability, accountability, government power limits, trust in political institutions, and absence of corruption. A higher index corresponds to a more stable political environment and larger share of democratic control.

Rule of law is the tenth synthetic index and measures the freedoms enjoyed by individuals and businesses, absence of discrimination and violence, effectiveness and timeliness of the judiciary, and the protection of property rights. A higher index corresponds to a more effective and indiscriminatory justice system. The indicator that follows is *Security*, measuring the absence of crime, civil conflict, terrorism, and organized crime

and the reliability of police services. A higher value corresponds to a safer environment. The twelfth synthetic indicator is *Education*, quantifying the quality of the education system, abundance of human capital, enrolment rates to different levels of education, internationally comparable test scores, and aggregate expenditures on education and R&D. A higher education index implies higher quality, accessibility, and success of the educational system.

2.2 Methodological approach

To analyse the firm-, industry-, and country-level factors that drive firm growth, we used the dynamic panel regression model which is traditionally used in empirical verification of the growth theory of the firm. The expanded dynamic specification of such an autoregressive distributed lag model can be written as follows:

$$y_{it} = \alpha y_{it-1} + \beta X_{it} + \gamma C_{it} + \eta_i + \delta_c + \lambda_j + \tau_t + \nu_{it}$$
$$i = 1, 2, \ldots, N; \quad t = 2, 3, \ldots, T \quad (1)$$

where y_{it} represents the selected performance indicator, that is, revenue and employment of firm i in year t, y_{it-1} is a lagged value of the dependent variable, X_{it} is a vector of firm-level control variables, C_{it} denotes a vector of country-specific determinants, η_i is the unobserved firm-specific fixed effect, δ_c is a vector of country dummies that capture the time-invariant country-specific effect, λ_j denotes a set of industry dummies to control for industry-specific growth trends, τ_t are time dummies to control for region-wide common year shocks, and ν_{it} is an error term. Revenue/employment at time t thus depends on revenue/employment in the previous period and is correlated with other control variables. Control variables X_{it} include firm age, size, productivity, average wage, indebtedness, share of intangibles in total assets, and other firm-level characteristics that the theory and past empirical studies suggest as factors of firm growth. Where appropriate, these variables entered specification with a lag of one year to avoid the problem of simultaneity. The time period studied was 2005–2017, encompassing the entire business cycle.

Apart from FE estimation of the above model, we also report results of the between estimator (BE). The reasoning behind using BE is our expectation that the long-term average values of revenue and employment (conditional on their lagged values) as well as long-term average growth of revenue and employment might be correlated to the long-term average differences in values of X and C between countries and firms. This is especially relevant for interpreting institutional and other country-specific parameters

since their effect on the dependent variable is mostly observed in cross-section. If we expect (i) the time average of revenue and employment (conditional on their lagged values) to be reflected by the long term average differences in X and C between countries and firms as well as (ii) current values of revenue and employment (conditional on their lagged values) to react differently to temporary departures from the individual firm average values of X and C, we can rewrite our model as follows:

$$y_{it} = \alpha y_{it-1} + \beta_1 \bar{X}_i + \beta_2 (X_{it} - \bar{X}_i) + \gamma_1 \bar{C}_i + \gamma_2 (C_{it} - \bar{C}_i) + \eta_i + \delta_c + \lambda_j + \tau_t + \nu_{it}$$

where $\bar{X}_i \equiv \sum_t X_{it}/T_i$ and analogously for $\bar{C}_i$. In this model, β_1 and γ_1 reveal how cross-country and cross-firm differences in the average values of X and C affect a firm's size (conditioned on its past size). Parameters β_2 and γ_2, on the other hand, show how temporary departures from the average values of X and C affect firm size. The BE estimates β_1 and γ_1, while the within estimator FE estimates β_2 and γ_2, and neither estimates the other. Thus, even when estimating equations such as (1), it is worth comparing the within and between estimators.

We complement the above AR(1) specification in Equation (1) with a more direct modelling of employment and revenue growth rate:

$$\dot{y}_{it} = \alpha y_{it-1} + \beta X_{it} + \gamma C_{it} + \eta_i + \delta_c + \lambda_j + \tau_t + \nu_{it}$$
$$i = 1, 2, \ldots, N; \quad t = 2, 3, \ldots, T \qquad (2)$$

where $\dot{y}_{it} \equiv \frac{2(Y_{it} - Y_{it-1})}{Y_{it} + Y_{it-1}}$ and Y_{it} (y_{it}) denotes (log of) revenue or employment of firm i in year t. Growth rate $\dot{y}_{it}$ is defined as a relative change with respect to the two-year average, and is by construction bound between -2 and 2 to limit the effect of potential outliers, that is, firms that increase employment or revenue from a very low base or those that decrease them to close to zero. Despite such a definition of growth rate, most of the growth rates are very close to the values defined either by ($y_{it} - y_{it-1}$) or $\frac{Y_{it} - Y_{it-1}}{Y_{it-1}}$.

3 Results

Empirical analysis highlighted the interplay of a number of firm-, industry-, and country-level determinants. For most of the institutional determinants and country-specific factors, we have not found any consistent statistical evidence of their effect on firm growth, while internal factors have a significant correspondence with firm performance. Table 1 shows the results for autoregressive distributed (AR 1) lag model separately for revenue (columns 1, 2, and 3 for OLS, FE, and BE estimates) and employment growth (columns 4, 5, and 6 for OLS, FE, and BE estimates).

Table 2 further shows the results for a more direct modelling of employment and revenue growth rate. In the growth specification model, the selected determinants explain much less variation of revenue and employment growth than in the previous case. R^2 in these regressions (Table 2) are much lower and range between 3% and 13% across different specifications, while the autoregressive distributed lag model explains between 19% and 95% of variation. The large number of variables in all specifications used is normally related also to their statistical significance; therefore, we also considered adjusted p-values with the simple Bonferroni correction.

The most consistent relations were found for firm-level determinants, especially age, skills, and productivity. A positive and highly statistically significant (with one of the highest t-values) relation to firm growth was confirmed for labour productivity, while age and firm growth are related negatively (older firms will grow less likely). Skills correlate positively to revenue growth, but negatively to employment growth, and the correspondence is consistent regardless of whether we consider the autoregressive distributed lag model or growth specification model. However, any interpretation of this result is limited by the fact that skills are measured by the firm average wages, which have a high correlation with the dependent variable, that is, firms with higher employment have lower average wages and firms with higher revenue have potential for higher wages, which might explain the observed correspondence. The share of intangible capital exhibits a positive relation to both, revenue and employment growth, across all specifications. As predicted in theory, level of debt is consistently negatively related to both, revenue and employment growth, across all specifications.

Among country-level determinants, unemployment turned out as the most significant. Measuring the effects on the growth of each firm separately with the FE regression exhibits a negative correlation between unemployment and revenue and employment growth. This means that higher aggregate unemployment negatively influences firm growth. While this represents the effects of an endogenous economic cycle, long-term cross-country differences in unemployment have the opposite effect (as obtained by the BE regression). The long-term relationship between growth and unemployment is also related to the long-standing macroeconomic question of whether there is a trade-off between high growth rates and low unemployment (Aghion & Howitt, 1994; Bean & Pissarides, 1993; Caballero & Hammour, 1996; Eriksson, 1997). Technological innovations may not only improve growth but also increase unemployment in the short term because automation makes some workers

Table 1. Revenue and employment growth determinants (AR(1) specification), 2005–2017.

	Revenue growth equations			Employment growth equations		
	(1) OLS	(2) FE	(3) BE	(4) OLS	(5) FE	(6) BE
$\ln(\text{revenue})_{t-1}$	0.671***	0.187***	0.727***	0.0597***	0.0684***	0.0266***
	(0.000202)	(0.000301)	(0.000405)	(9.07e−05)	(0.000138)	(0.000151)
$\ln(\text{emp})_{t-1}$	0.276***	0.305***	0.237***	0.899***	0.485***	0.948***
	(0.000265)	(0.000522)	(0.000548)	(0.000119)	(0.000240)	(0.000205)
age_t	−0.00198***	0.0100***	−0.00268***	−0.000686***	0.0129***	−0.00124***
	(1.86e−05)	(0.000495)	(4.09e−05)	(8.33e−06)	(0.000227)	(1.53e−05)
$\ln(\text{avg.wage})_{t-1}$	0.190***	0.208***	0.165***	−0.0964***	−0.264***	−0.0275***
	(0.000332)	(0.000486)	(0.000622)	(0.000149)	(0.000223)	(0.000232)
debtleverage_t	−0.000663***	−0.00169***	−0.000334**	−0.000279***	−0.000334***	−9.38e−05*
	(0.000102)	(0.000131)	(0.000139)	(4.57e−05)	(6.01e−05)	(5.20e−05)
$\ln(\text{lab.prod.})_{t-1}$	0.0528***	0.0574***	0.0528***	0.00596***	0.00763***	0.00564***
	(5.98e−05)	(6.59e−05)	(0.000132)	(2.68e−05)	(3.02e−05)	(4.95e−05)
intang.share_t	0.0344***	0.0642***	0.0279***	0.0334***	0.0530***	0.0156***
	(0.00105)	(0.00177)	(0.00211)	(0.000472)	(0.000811)	(0.000788)
Country-level determinants:						
GDP PPP_t	0.00713	0.551***	−1.273***	0.709***	0.468***	−0.284***
	(0.0437)	(0.0452)	(0.0250)	(0.0196)	(0.0207)	(0.00932)
inwardFDI_t	−0.0723*	−0.283***	4.533***	−0.209***	−0.181***	0.739***
	(0.0420)	(0.0378)	(0.0910)	(0.0188)	(0.0173)	(0.0340)
natur.resources_t	0.327***	−0.234***	0.722***	0.0996***	0.0412***	0.105***
	(0.0231)	(0.0240)	(0.0194)	(0.0103)	(0.0110)	(0.00726)
unemployment_t	−0.768***	−0.725***	0.287***	−0.351***	−0.412***	0.107***
	(0.0126)	(0.0116)	(0.0126)	(0.00566)	(0.00533)	(0.00470)
Equality - GINI coef$_t$[a]	−0.213***	−0.169***	0.280***	−0.107***	−0.0946***	−0.0386***
	(0.00748)	(0.00724)	(0.00813)	(0.00335)	(0.00332)	(0.00304)
avg.tariff_t	−0.469***	−1.021***	0.590***	−0.105***	−0.231***	0.00513
	(0.0265)	(0.0245)	(0.0158)	(0.0118)	(0.0112)	(0.00591)
Synthetic institutional indices:						
Education_t	−0.122***	−0.190***	0.0212***	−0.0445***	−0.191***	0.0284***
	(0.0105)	(0.0105)	(0.00782)	(0.00469)	(0.00481)	(0.00292)
Taxes_t	0.171***	0.184***	0.155***	0.108***	0.144***	−0.0210***
	(0.00567)	(0.00498)	(0.0119)	(0.00254)	(0.00228)	(0.00444)
Healthcare_t	−0.113***	0.281***	0.478***	−0.241***	0.0111	−0.0122
	(0.0202)	(0.0199)	(0.0245)	(0.00904)	(0.00915)	(0.00916)
Bureaucracy_t	−0.103***	−0.491***	0.335***	−0.0528***	−0.306***	0.0855***
	(0.0109)	(0.0110)	(0.0139)	(0.00490)	(0.00504)	(0.00520)
Infrastructure_t	2.150***	2.933***	0.320***	0.896***	0.787***	0.219***
	(0.0481)	(0.0495)	(0.0191)	(0.0215)	(0.0227)	(0.00713)
$\text{Financial system}_t$	−0.194***	0.160***	0.0171	−0.314***	−0.107***	−0.0287***
	(0.0128)	(0.0127)	(0.0128)	(0.00575)	(0.00582)	(0.00478)
Political envir_t	0.969***	−0.839***	0.257***	0.724***	0.0480*	−0.134***
	(0.0662)	(0.0617)	(0.0235)	(0.0297)	(0.0283)	(0.00877)
Rule of law_t	−1.490***	1.547***	0.550***	−1.522***	5.362***	0.171***
	(0.280)	(0.256)	(0.0262)	(0.125)	(0.117)	(0.00978)
Regulation_t	0.408***	0.602***	−0.237***	−0.201***	0.0608***	0.115***
	(0.0404)	(0.0390)	(0.0154)	(0.0181)	(0.0179)	(0.00577)
Security_t	−1.535***	−6.128***	−0.236***	−2.582***	−4.742***	0.00778**
	(0.257)	(0.245)	(0.00886)	(0.115)	(0.113)	(0.00331)
Labour market_t	−0.273***	0.225***	−0.107***	−0.0616***	0.375***	0.00956***
	(0.0161)	(0.0156)	(0.00611)	(0.00720)	(0.00714)	(0.00228)
Macro stability_t	1.750***	2.375***	−1.449***	0.912***	0.982***	−0.290***
	(0.0267)	(0.0249)	(0.0293)	(0.0119)	(0.0114)	(0.0109)
Constant	2.028***	12.04***	−0.160***	2.630***	3.420***	−0.244***
	(0.268)	(0.462)	(0.0238)	(0.120)	(0.212)	(0.00890)
Country effects	yes	yes	no	yes	yes	no
Year effects	yes	yes	yes	yes	yes	yes
Industry effects	yes	yes	yes	yes	yes	yes
Observations	15,487,532	15,487,532	15,487,532	15,487,532	15,487,532	15,487,532
R^2	.823	.189	.837	.929	.383	.951
Number of id		3,328,871	3,328,871		3,328,871	3,328,871

Notes: Dependent variable is log of revenue for (1)–(3) and log of employment for (4)–(5). Standard errors are in parentheses. ***$p < .01$, **$p < .05$, *$p < .1$.
[a]The interpretation for GINI coef. is reversed: a higher value of the indicator reflects higher equality.

Table 2. Revenue and employment growth determinants (growth rate specification), 2005–2017.

	Revenue growth equations			Employment growth equations			
	(1) OLS	(2) FE	(3) BE	(4) OLS	(5) OLS	(6) FE	(7) BE
$\ln(emp)_{t-1}$	−0.00919***	−0.117***	0.000517***	−0.0327***		−0.349***	−0.0164***
	(7.52e−05)	(0.000225)	(0.000135)	(6.77e−05)		(0.000182)	(0.000112)
$\ln(revenue)_{t-1}$					0.00689***		
					(5.20e−05)		
age_t	−0.00259***	0.00341***	−0.00300***	−0.000615***	−0.00152***	0.00564***	−0.00117***
	(7.31e−06)	(0.000228)	(1.36e−05)	(6.57e−06)	(6.57e−06)	(0.000184)	(1.13e−05)
$\ln(avg.wage)_{t-1}$	0.0163***	0.0336***	0.0199***	−0.0522***	−0.0660***	−0.192***	−0.0113***
	(0.000126)	(0.000223)	(0.000200)	(0.000113)	(0.000118)	(0.000180)	(0.000166)
$debtleverage_t$	−0.000363***	−0.000427***	−0.000214***	−0.000177***	−0.000237***	−0.000269***	−7.05e−05*
	(4.02e−05)	(6.03e−05)	(4.63e−05)	(3.61e−05)	(3.64e−05)	(4.87e−05)	(3.84e−05)
$\ln(lab.prod.)_{t-1}$	0.0180***	0.0205***	0.0149***	0.00648***	0.00555***	0.00645***	0.00555***
	(2.33e−05)	(3.02e−05)	(4.34e−05)	(2.10e−05)	(2.13e−05)	(2.45e−05)	(3.60e−05)
$intang.share_t$	0.0334***	0.0679***	0.0306***	0.0203***	0.0126***	0.0370***	0.00572***
	(0.000415)	(0.000814)	(0.000701)	(0.000373)	(0.000376)	(0.000658)	(0.000581)
Country-level determinants:							
$GDP\ PPP_t$	−0.363***	−0.142***	−0.676***	0.738***	0.557***	0.523***	−0.220***
	(0.0172)	(0.0208)	(0.00830)	(0.0155)	(0.0156)	(0.0168)	(0.00689)
$inwardFDI_t$	−0.420***	−0.476***	1.653***	−0.140***	−0.150***	−0.148***	0.640***
	(0.0165)	(0.0174)	(0.0303)	(0.0149)	(0.0150)	(0.0141)	(0.0251)
$natur.resources_t$	0.142***	0.136***	0.222***	0.131***	0.132***	0.0551***	0.0708***
	(0.00908)	(0.0110)	(0.00646)	(0.00817)	(0.00823)	(0.00892)	(0.00536)
$unemployment_t$	−0.564***	−0.550***	−0.112***	−0.308***	−0.257***	−0.349***	0.0911***
	(0.00497)	(0.00535)	(0.00418)	(0.00447)	(0.00450)	(0.00433)	(0.00347)
Equality - GINI coef$_t$[a]	−0.311***	−0.348***	−0.0534***	−0.0783***	−0.103***	−0.0697***	−0.0339***
	(0.00294)	(0.00333)	(0.00270)	(0.00265)	(0.00267)	(0.00269)	(0.00224)
$avg.tariff_t$	−0.231***	−0.348***	0.171***	−0.113***	−0.104***	−0.229***	0.0210***
	(0.0104)	(0.0113)	(0.00527)	(0.00936)	(0.00943)	(0.00913)	(0.00437)
Synthetic institutional indices:							
$Education_t$	−0.104***	−0.156***	0.0419***	−0.0482***	−0.00310	−0.173***	0.0188***
	(0.00412)	(0.00482)	(0.00260)	(0.00371)	(0.00373)	(0.00390)	(0.00216)
$Taxes_t$	0.225***	0.211***	−0.00844**	0.0906***	0.103***	0.121***	0.0186***
	(0.00223)	(0.00229)	(0.00395)	(0.00201)	(0.00202)	(0.00185)	(0.00328)
$Healthcare_t$	−0.385***	−0.380***	0.00337	−0.217***	−0.255***	−0.0358***	0.0145**
	(0.00794)	(0.00918)	(0.00816)	(0.00715)	(0.00720)	(0.00742)	(0.00677)
$Bureaucracy_t$	−0.0841***	−0.333***	0.292***	−0.0358***	0.0148***	−0.234***	0.101***
	(0.00431)	(0.00505)	(0.00463)	(0.00388)	(0.00390)	(0.00409)	(0.00384)
$Infrastructure_t$	1.021***	1.444***	0.0653***	0.958***	0.839***	0.825***	0.182***
	(0.0189)	(0.0228)	(0.00635)	(0.0170)	(0.0171)	(0.0184)	(0.00526)
$Financial\ system_t$	−0.491***	−0.452***	−0.230***	−0.237***	−0.295***	−0.0796***	−0.0581***
	(0.00505)	(0.00584)	(0.00426)	(0.00454)	(0.00457)	(0.00472)	(0.00353)
$Political\ envir_t$	1.425***	0.176***	−0.103***	0.599***	0.879***	0.138***	−0.102***
	(0.0260)	(0.0284)	(0.00781)	(0.0234)	(0.0236)	(0.0230)	(0.00648)
$Rule\ of\ law_t$	−0.643***	−0.683***	0.407***	−1.531***	−1.883***	3.942***	0.0985***
	(0.110)	(0.118)	(0.00871)	(0.0989)	(0.0996)	(0.0952)	(0.00722)
$Regulation_t$	0.147***	0.361***	0.0210***	−0.185***	−0.194***	0.0184	0.109***
	(0.0159)	(0.0179)	(0.00514)	(0.0143)	(0.0144)	(0.0145)	(0.00426)
$Security_t$	−0.404***	−2.315***	−0.0572***	−2.481***	−2.604***	−4.342***	0.0131***
	(0.101)	(0.113)	(0.00295)	(0.0909)	(0.0915)	(0.0913)	(0.00244)
$Labour\ market_t$	0.00576	−0.0163**	−0.00874***	−0.0633***	0.0357***	0.318***	−0.0147***
	(0.00633)	(0.00717)	(0.00203)	(0.00569)	(0.00573)	(0.00580)	(0.00169)
$Macro\ stability_t$	1.545***	1.757***	−0.235***	0.817***	0.807***	0.891***	−0.239***
	(0.0105)	(0.0114)	(0.00974)	(0.00943)	(0.00950)	(0.00925)	(0.00808)
Constant	−0.587***	1.674***	−0.508***	2.713***	2.885***	2.069***	−0.108***
	(0.105)	(0.213)	(0.00790)	(0.0949)	(0.0955)	(0.172)	(0.00655)
Country effects	yes	yes	yes	yes	yes	yes	yes
Year effects	yes	yes	yes	yes	yes	yes	yes
Industry effects	yes	yes	yes	yes	yes	yes	yes
Observations	15,487,532	15,487,532	15,487,532	15,487,532	15,487,532	15,487,532	15,487,532
R^2	.080	.096	.138	.049	.036	.298	.054
Number of id		3,328,871	3,328,871			3,328,871	3,328,871

Notes: The dependent variable is growth rate of revenue for (1)–(3) and growth rate of employment for (4)–(7). Standard errors are in parentheses. ***$p < .01$, **$p < .05$, *$p < .1$.
[a]The interpretation for GINI coef. is reversed: a higher value of the indicator reflects higher equality.

redundant or unemployable due to inadequate skills and education. In addition, innovations may force some less successful firms to downsize or even go bankrupt (Eriksson, 1997). In a more recent approach, Schubert and Turnovsky (2018) augment the standard endogenous growth model by introducing search unemployment and wage bargaining, where unemployment arises due to the time-consuming and costly process of matching job vacancies with job-seeking agents. In their model, as in our long-run results, there is a weak positive correlation between growth and unemployment in the long run. This is also consistent with the endogenous dynamic growth cycle model (Goodwin, 1967), where employment determines the wage pressures (high employment upward pressure, high unemployment downward pressure).

Following a similar business cycle mechanism, temporal changes in GDP per capita are positively correlated with firm revenue and employment growth. On the other hand, BE estimations suggest that the differences in the cross-country dimension in the overall development have a negative relation with firm growth rates (more developed countries' firms grow slower on average). For most of the institutional and other country-specific factors, the results of the FE regression bear no interpretational value. Since FE regression measures the effect within each firm separately, only variables that have a potentially endogenous effect on the cyclical nature of the economic growth can have a meaningful interpretation (unemployment rate and GDP per capita). The time variance of most institutional indicators is very small, and even where it is not small, it is impossible to conceptually link it with the growth pattern of each individual firm. Due to this fact, we only interpreted the results of the BE regression, which measures the effect of the long-term differences in the institutional framework.

The inward FDI and presence of natural resources both have a long-term positive relation with firm growth, whereas the results for the effects of tariffs are inconclusive. The positive association between FDI and growth is consistent with review studies, most of which conclude that FDI has a positive impact on economic growth (Almfraji & Almsafir, 2014; Iamsiraroj & Ulubaşoğlu, 2015; Lasbrey et al., 2018). However, the evidence is far from clear. Iamsiraroj and Ulubaşoğlu (2015) report that less than half of the studies analysed found a positive and statistically significant effect, while almost a third reported a negative effect of FDI on growth. The reasons proposed in the literature for a significant proportion of negative FDI-growth associations emphasize the importance of absorptive capacity, especially trade openness (Iamsiraroj & Ulubaşoğlu, 2015), financial development (Alfaro et al., 2004; Durham, 2004),

skilled labour (Borensztein et al., 1998; Li & Liu, 2005), domestic endowments, trade restrictions and friendly investment climate (Iamsiraroj, 2016), as well as a bridgeable technology gap (Li & Liu, 2005). Other studies suggest that FDI can reduce economic growth due to the mediating mechanisms of dependence (Amin, 1974; Frank, 1979) and decapitalization, that is, the crowding out of host country savings or diversion of domestic capital from other more productive sectors (Bornschier, 1980).

Some of the strongest pieces of microeconomic evidence for the positive impact of FDI on growth come from studies of firm-level productivity spillovers, a process by which FDI catalyses productivity improvements in other domestic firms. It has been shown that vertical spillovers are more likely than horizontal, intra-industry spillovers (Rojec & Knell, 2018). As at the aggregate level, the effectiveness of FDI also depends on preexisting conditions (Batten & Vo, 2009). Determinants such as the country of origin of the FDI (Gorodnichenko et al., 2014), the ownership structure of domestic firms (Branstetter, 2006; Iršová & Havránek, 2013; Monastiriotis & Alegria, 2011; Smarzynska Javorcik, 2004), a moderate technology gap (Iršová & Havránek, 2013; Todo, 2006), and previous experience with foreign firms (Iršová & Havránek, 2013) have been shown to have a significant impact on the strength of productivity spillovers. Görg and Greenaway (2001, 2004) suggest five main reasons for the possible absence of positive effects in empirical studies. First, MNCs often ensure that their technological advantages and other firm-specific assets and advantages are not leaked to domestic competitors (Baltagi et al., 2015; Perri & Andersson, 2014); second, MNCs may draw demand away from domestic firms through increased competition (Aitken & Harrison, 1999; Gorg & Strobl, 2001; Konings, 2001); thirdly, positive spillovers may only affect a small number of domestic firms due to geographical distance, absorptive capacity, firm size, industry characteristics, and technology gap (Aitken & Harrison, 1999; Keller & Yeaple, 2009; Kokko et al., 1996); fourth, spillovers may only occur through FDI-induced vertical integration and not horizontally; and fifth, the strength of FDI spillovers depends on a number of characteristics of the host country, such as the rule of law, well-functioning markets, and an undistorted trade and foreign investment regime.

Higher inequality was found in our study to be linked positively with growth rates. This result is consistent with some recent empirical work showing that inequality has a different effect on growth in the shorter run, when positive effects are expected to prevail, compared to the long run, when the effects of higher inequality tend to be negative (Halter et al.,

2014). The result is also consistent with previous evidence that the effects are different in developed and developing countries (Neves et al., 2016) and become positive in high-income economies (Castelló-Climent, 2010). When interpreting our results on inequality and growth, we therefore have to bear in mind that we were looking at developed countries and measuring short- to medium-term effects.

Tests for institutional determinants also require deeper inquiry. The size and direction of the impact varies the most among institutional determinants. Only the development of infrastructure shows a consistently positive and significant relation with firm growth in all specifications, which is consistent with recent findings on the importance of ICT and transport infrastructure (Bergantino et al., 2023; Cardona et al., 2013). A lower bureaucratic burden and better educational system exhibit positive correlation to firm growth in cross-country BE specifications, which is also in line with existing empirical evidence. The financial system, on the other hand, shows a statistically significant negative relation to firm growth in most of the specifications. This finding corroborates empirical evidence that began to accumulate after the global economic crisis of 2007–2008, showing that the relationship between finance and growth is nonlinear and turns negative for high-income countries (Arcand et al., 2015; Law & Singh, 2014). Arcand et al. (2015) find that financial depth starts having a negative effect on growth when credit to the private sector reaches 80–100 per cent of GDP. For the European Union countries, the value of domestic credit to the private sector did not fall below 89 per cent in the period 2005–2017 (World Bank, n.d.), suggesting that the countries in our sample have reached a threshold above which financial deepening can become a drag on economic growth. Another possible explanation for our result on the financial system is the issue of measurement. How to adequately measure financial development remains an important challenge (Valickova et al., 2015). Our synthetic indicator includes some elements of financial activity but may be inadequate for capturing effective financial intermediation. Further research on this topic is needed. Results of BE regressions also indicate that countries with better rule of law garner firms with higher revenue and employment growth, while in countries with better macroeconomic stability, firms exhibit lower growth rates on average.

Most other institutional variables, including healthcare, regulation, security, taxes, political environment, and labour market regulation have lower t-values, and their direction of effect varied based on whether we predicted employment or revenue growth or used AR revenue and employment regression models. For

these institutional indicators, we have not found enough statistical evidence to consistently prove that cross-country differences in these institutional fields have any effect on firm growth.

The study has some limitations. Some of the data we used in our analysis, such as the World Bank's Doing Business data, are subject to criticism. The World Bank's Doing Business indicators have been reviewed several times as their methodology and reliability have been questioned (Arslan, 2020; Berg & Cazes, 2007). The data limitations associated with these indicators are due to several factors. Firstly, the reliance on interviews, which are often conducted with a limited number of respondents, leads to a bias in the results, as demonstrated by the significant fluctuations in indicators such as innovativeness, which cannot change drastically on an annual basis. Secondly, the methodology for selecting representative cases lacks transparency, leading to a potential selection bias and ignoring the diversity of solutions offered by different national jurisdictions. Thirdly, enforcement procedures are not taken into account, so crucial aspects of labour market dynamics are neglected. In addition, the aggregation and weighting system used in the creation of the indicators may overlook important variables and adjustment channels, while subjective interpretations and biases in the formulation of the questionnaire further undermine the reliability of the data. However, given the limitations and increasing use of secondary data in economics and business studies over the past fifty years (Nielsen et al., 2020) and the declining share of primary research in firm growth (Cerar et al., 2021), the integration of multi-level secondary sources (including survey-based data) can partially compensate for the shortcomings of data sources.

4 Conclusions

Our results implicate that explaining firm-level growth outcomes requires the inclusion of explanatory variables from multiple levels since firm, industry, and country determinants interplay in the process of firm growth. We have produced new empirical evidence on growth determinants of European firms in the period from 2005 to 2017. The empirical evidence is in line with theoretical predictions; firm-level factors have been identified as the most important. Productivity and skills, reflecting managerial and resource limits, have been identified as the most relevant and significant determinants of firm growth.

The role of unemployment as a determinant is found to be dual in character. On the one hand, the between effects support the theory of the endogenous

economic growth cycle (Goodwin, 1967), where unemployment levels are inversely related with upward wage pressures, linking higher unemployment with the lowest point in terms of output in the economic cycle, thus positively correlating unemployment with individual firm growth. On the other hand, the short-term changes in unemployment have a procyclical effect on firm growth rates, where a fall of aggregate unemployment is associated with higher firm growth.

Inward FDI, natural resources, the development of infrastructure, educational system, rule of law, and a better-functioning bureaucracy are shown to have a positive long-term relation with firm growth. Our results suggest that at a higher level of a country's financial development, more finance is related to less growth. We have also found that higher inequality has a positive relation with firm growth. On the other hand, we have not found statistical evidence of the relevance of long-term differences in labour market regulation, overall taxation, security, the political environment, healthcare system, and regulation for firm growth.

The results of our study have managerial and policy implications. In a complex interplay of many determinants at different levels, we have been able to identify those that unambiguously stimulate firm growth. These should be supported through managerial and policy incentives. The findings suggest that firm-level growth strategies should include striving for productivity, high skill levels, and the creation of intangible resources. Managers and entrepreneurs should also consider the quality of the institutional environment when deciding where to locate their operations, focusing on the factors that our study has identified as relevant for firm growth. In the case of the environment in which they already operate, they might consider these findings when assessing how to overcome the environment's limitations or capitalize on its strengths.

While managers can focus on the factors that have an impact on firm capabilities, policy makers can help create an environment that provides business opportunities and lowers the risks associated with investment. As governments have limited resources, they need to factor into decision making which challenges are the most important and should be addressed first. The results of our study suggest that the quality of the institutional environment plays an important role in addressing the productivity challenge in Europe. Governments and policy makers should support the development of modern infrastructure, invest in a high-quality education system, encourage foreign direct investment, promote the rule of law, and improve the efficiency of bureaucracy.

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Appendix

Table A1. 12 synthetic indicators of business environment and their corresponding components.

I. Bureaucracy	Source
1 Cost of building permits (inverse)	DB
2 Number of building permit procedures (inverse)	DB
3 Duration of building permit procedures (inverse)	DB
4 Cost of enforcing contracts (inverse)	DB
5 Number of procedures for enforcing contracts (inverse)	DB
6 Duration of enforcing contracts (inverse)	DB
7 Paying taxes: payments (number per year) (inverse)	DB
8 Paying taxes: time (inverse)	DB
9 Registering property: cost (% of property value)—score	DB
10 Registering property: procedures (number)—score	DB
11 Registering property: Time (days)—score	DB
12 Starting a business: cost—men (% of income per capita)—score	DB
13 Starting a business: procedures required—men (number)—score	DB
14 Starting a business: time—men (days)—score	DB
15 Bureaucracy to trade across borders—score	DB
16 Cost of business start-up procedures (% of GNI per capita) (inverse)	WDI

II. Financial system	Source
1 Getting credit total score	DB
2 Protecting minority investment	DB
3 Account ownership at a financial institution or with a mobile-money-service provider (% of population ages 15+)	WDI
4 Automated teller machines (ATMs) (per 100,000 adults)	WDI
5 Commercial bank branches (per 100,000 adults)	WDI
6 Bank capital to assets ratio (%)	WDI
7 Bank nonperforming loans to total gross loans (%) (inverse)	WDI
8 Domestic credit provided by financial sector (% of GDP)	WDI
9 Insurance and financial services (% of commercial service exports)	WDI
10 Insurance and financial services (% of commercial service imports as a share of commercial service exports) (inverse)	WDI
11 Net foreign assets (current LCU) per capita	WDI
12 Strength of legal rights index (0 = weak to 12 = strong)	WDI
13 Protection of minority shareholders' interests	WEFGCI

III. Regulation	Source
1 Regulatory quality	WGI
2 Resolving insolvency score	DB
3 Starting a business: paid-in minimum capital (% of income per capita)—score	DB
4 Factor 6: Regulatory enforcement	DB
5 Government regulations are effectively enforced	DB
6 Government regulations are applied and enforced without improper influence	DB
7 Administrative proceedings are conducted without unreasonable delay	DB
8 Due process is respected in administrative proceedings	DB
9 The government does not expropriate without lawful process and adequate compensation	DB
10 Burden of government regulation	GCIWEF
11 Efficiency of legal framework in settling disputes	GCIWEF
12 Efficiency of legal framework in challenging regulations	GCIWEF
13 Strength of auditing and reporting standards	GCIWEF

IV. Labour market	Source
1 Vulnerable employment, total (% of total employment) (modelled ILO estimate) (inverse)	WDI
2 Wage and salaried workers, total (% of total employment) (modelled ILO estimate)	WDI
3 Subindicator "Valid grounds for dismissals"	ILO
4 Subindicator "Prohibited grounds for dismissals"	ILO
5 Subindicator "Maximum probationary (trial) period"	ILO
6 Subindicator "Procedural requirements for dismissals"	ILO
7 Subindicator "Notice periods"	ILO
8 Subindicator "Severance pay"	ILO
9 Subindicator "Redundancy pay"	ILO
10 Subindicator "Redress"	ILO

Table A1. (continued)

11	Maximum probationary (trial) period, in months	ILO
12	Average notice period	ILO
13	Average redundancy pay	ILO
14	Average severance pay	ILO
15	The law, as opposed to the contracting parties, determines the legal status of the worker	CCBR
16	Part-time workers have the right to equal treatment with full-time workers	CCBR
17	Part-time workers have equal or proportionate dismissal rights to full-time workers	CCBR
18	Fixed-term contracts are allowed only for work of limited duration	CCBR
19	Fixed-term workers have the right to equal treatment with permanent workers	CCBR
20	Maximum duration of fixed-term contracts	CCBR
21	Agency work is prohibited or strictly controlled	CCBR
22	Agency workers have the right to equal treatment with permanent workers of the user undertaking	CCBR
23	Annual leave entitlements	CCBR
24	Public holiday entitlements	CCBR
25	Overtime premia	CCBR
26	Weekend working	CCBR
27	Limits to overtime working	CCBR
28	Duration of the normal working week	CCBR
29	Maximum daily working time	CCBR
30	Legally mandated notice period	CCBR
31	Legally mandated redundancy compensation	CCBR
32	Minimum qualifying period of service for normal case of unjust dismissal	CCBR
33	Law imposes procedural constraints on dismissal	CCBR
34	Law imposes substantive constraints on dismissal	CCBR
35	Reinstatement normal remedy for unfair dismissal	CCBR
36	Notification of dismissal	CCBR
37	Redundancy selection	CCBR
38	Priority in reemployment	CCBR
39	Right to unionization	CCBR
40	Right to collective bargaining	CCBR
41	Duty to bargain	CCBR
42	Extension of collective agreements	CCBR
43	Closed shops	CCBR
44	Codetermination: board membership	CCBR
45	Codetermination and information/consultation of workers	CCBR
46	Unofficial industrial action (the legality of industrial action does not depend on trade union involvement or authorization)	CCBR
47	Political industrial action (political strikes are regarded as contra bonos mores under the general criminal and civil law, and hence prohibited. Strikes must be directed against the primary employer)	CCBR
48	Secondary industrial action (secondary and solidarity strikes are viewed as unlawful for the same reason as political strikes)	CCBR
49	Lockouts (prohibition)	CCBR
50	Right to industrial action	CCBR
51	Waiting period prior to industrial action	CCBR
52	Peace obligation (strikes may not be called while a collective agreement, which generally implies a contractual peace obligation, is in force)	CCBR
53	Compulsory conciliation or arbitration (there is no requirement of compulsory conciliation or arbitration although a strike is unlawful if its object is subject to compulsory arbitration under codetermination law)	CCBR
54	Replacement of striking workers	CCBR

V. Infrastructure

1	Getting electricity score	DB
2	Air transport, freight (million ton-km) per capita	WDI
3	Air transport, passengers carried per capita	WDI
4	Air transport, registered carrier departures worldwide per capita	WDI
5	Fixed telephone subscriptions (per 100 people)	WID
6	Mobile cellular subscriptions (per 100 people)	WID
7	Internet users (per 100 people)	EI
8	Personal computers (per 100 people)	EI
9	Mortality rate attributed to unsafe water, unsafe sanitation, and lack of hygiene (per 100,000 population) (inverse)	HPS
10	People practicing open defecation (% of population) (inverse)	HPS
11	People practicing open defecation, rural (% of rural population) (inverse)	HPS

Table A1. (continued)

12	People practicing open defecation, urban (% of urban population) (inverse)	HPS
13	People using at least basic drinking water services (% of population)	HPS
14	People using at least basic drinking water services, rural (% of rural population)	HPS
15	People using at least basic drinking water services, urban (% of urban population)	HPS
16	People using at least basic sanitation services (% of population)	HPS
17	People using at least basic sanitation services, rural (% of rural population)	HPS
18	People using at least basic sanitation services, urban (% of urban population)	HPS
19	People using safely managed drinking water services (% of population)	HPS
20	People using safely managed sanitation services (% of population)	HPS
21	Electric power consumption (kWh per capita)	WDI
22	Electric power transmission and distribution losses (% of output) (inverse)	WDI
23	Electricity production from coal sources (% of total)	WDI
24	Electricity production from hydroelectric sources (% of total)	WDI
25	Electricity production from natural gas sources (% of total)	WDI
26	Electricity production from nuclear sources (% of total)	WDI
27	Electricity production from oil sources (% of total)	WDI
28	Electricity production from oil, gas and coal sources (% of total)	WDI
29	Fixed broadband subscriptions (per 100 people)	WDI
30	Logistics performance index: Ability to track and trace consignments (1 = low to 5 = high)	WDI
31	Logistics performance index: Competence and quality of logistics services (1 = low to 5 = high)	WDI
32	Logistics performance index: Ease of arranging competitively priced shipments (1 = low to 5 = high)	WDI
33	Logistics performance index: Efficiency of customs clearance process (1 = low to 5 = high)	WDI
34	Logistics performance index: Frequency with which shipments reach consignee within scheduled or expected time (1 = low to 5 = high)	WDI
35	Logistics performance index: Overall (1 = low to 5 = high)	WDI
36	Logistics performance index: Quality of trade and transport-related infrastructure (1 = low to 5 = high)	WDI
37	Quality of port infrastructure, WEF (1 = extremely underdeveloped to 7 = well developed and efficient by international standards)	WDI
38	Rail lines (total route-km) per capita	WDI
39	Railways, goods transported (million ton-km) per capita	WDI
40	Railways, passengers carried (million passenger-km) per capita	WDI
41	Water productivity, total (constant 2010 US$ GDP per cubic meter of total freshwater withdrawal)	WDI
42	Quality of overall infrastructure	GCIWEF
43	Quality of roads	GCIWEF
44	Quality of railroad infrastructure	GCIWEF
45	Quality of port infrastructure	GCIWEF
46	Quality of air transport infrastructure	GCIWEF

VI. Healthcare

1	Specialist surgical workforce (per 100,000 population)	WDI
2	Adolescent fertility rate (births per 1,000 women ages 15-19) (inverse)	HPS
3	Completeness of birth registration (%)	HPS
4	Completeness of death registration with cause-of-death information (%)	HPS
5	Current health expenditure per capita, PPP (current international $)	HPS
6	Current health expenditure (% of GDP)	HPS
7	Domestic general government health expenditure (% of current health expenditure)	HPS
8	Domestic general government health expenditure (% of GDP)	HPS
9	Domestic general government health expenditure (% of general government expenditure)	HPS
10	Domestic general government health expenditure per capita (current US$)	HPS
11	Domestic general government health expenditure per capita, PPP (current international $)	HPS
12	Hospital beds (per 1,000 people)	HPS
13	Immunization, DPT (% of children ages 12-23 months)	HPS
14	Immunization, Hib3 (% of children ages 12-23 months)	HPS
15	Immunization, measles (% of children ages 12-23 months)	
16	Immunization, Pol3 (% of one-year-old children)	HPS
17	Incidence of tuberculosis (per 100,000 people) (inverse)	HPS
18	Lifetime risk of maternal death (%) (inverse)	
19	Maternal mortality ratio (modelled estimate, per 100,000 live births) (inverse)	HPS
20	Mortality from CVD, cancer, diabetes or CRD between exact ages 30 and 70 (%) (inverse)	HPS
21	Number of deaths ages 5-14 years per capita (inverse)	HPS
22	Number of infant deaths per capita (inverse)	HPS
23	Nurses and midwives (per 1,000 people)	HPS

Table A1. (continued)

24	Out-of-pocket expenditure (% of current health expenditure) (inverse)	HPS
25	Out-of-pocket expenditure per capita (current US$) (inverse)	HPS
26	Out-of-pocket expenditure per capita, PPP (current international $) (inverse)	HPS
27	Physicians (per 1,000 people)	HPS
28	Maternal leave benefits (% of wages paid in covered period)	HPS
29	Number of weeks of maternity leave	HPS
30	Risk of catastrophic expenditure for surgical care (% of people at risk) (inverse)	HPS
31	Risk of impoverishing expenditure for surgical care (% of people at risk) (inverse)	HPS

VII. Taxes

1	Other taxes (% of profit)	DB
2	Paying taxes: Labour tax and contributions (% of commercial profits)	DB
3	Profit tax	DB
4	Social contributions (% of revenue)	WDI
5	Tax revenue (% of GDP)	WDI
6	Taxes on goods and services (% of revenue)	WDI
7	Taxes on goods and services (% value added of industry and services)	WDI
8	Taxes on income, profits and capital gains (% of revenue)	WDI
9	Taxes on income, profits and capital gains (% of total taxes)	WDI

VIII. Macro stability

1	External balance on goods and services (% of GDP)	WDI
2	Final consumption expenditure (% of GDP)	WDI
3	Birth rate (inverse)	WDI
4	Employment	WDI
5	GDP per capita, PPP (constant 2011 international $)	WDI
6	Foreign direct investment, net inflows (% of GDP)	WDI
7	Labour force participation rate	WDI
8	Life expectancy	WDI
9	Ratio of female to male labour force participation rate (%) (national estimate)	WDI
10	Total natural resources rents (% of GDP)	WDI
11	Unemployment, total (% of total labour force) (national estimate) (inverse)	WDI
12	Age dependency ratio (% of working-age population)	HPS
13	General government final consumption expenditure (% of GDP)	WDI
14	GINI index (World Bank estimate) (inverse)	WDI
15	Gross fixed capital formation (% of GDP)	WDI
16	Refugee population by country or territory of asylum per capita (inverse)	WDI
17	Share of youth not in education, employment or training, total (% of youth population) (inverse)	WDI
18	Tariff rate, applied, simple mean, all products (%) (inverse)	WDI

IX. Political environment

1	Control of corruption: estimate	WGI
2	Government effectiveness: estimate	WGI
3	Political stability and absence of violence/terrorism: estimate	WGI
4	Voice and accountability: estimate	WGI
5	Factor 1: constraints on government powers	WJP
6	Government powers are effectively limited by the legislature	WJP
7	Government powers are effectively limited by the judiciary	WJP
8	Government powers are effectively limited by independent auditing and review	WJP
9	Government officials are sanctioned for misconduct	WJP
10	Government powers are subject to non-governmental checks	WJP
11	Transition of power is subject to the law	WJP
12	Factor 2: absence of corruption	WJP
13	Government officials in the executive branch do not use public office for private gain	WJP
14	Government officials in the judicial branch do not use public office for private gain	WJP
15	Government officials in the police and the military do not use public office for private gain	WJP
16	Government officials in the legislative branch do not use public office for private gain	WJP
17	Factor 3: open government	WJP
18	Publicized laws and government data	WJP
19	Right to information	WJP
20	Civic participation	WJP
21	Complaint mechanisms	WJP

Table A1. (continued)

22	Diversion of public funds	GCIWEF
23	Public trust in politicians	GCIWEF
24	Irregular payments and bribes	GCIWEF
25	Favouritism in decisions of government officials	GCIWEF
26	Efficiency of government spending	GCIWEF
27	Transparency of government policymaking	GCIWEF

X. Rule of law

1	Rule of law: estimate	WGI
2	Factor 4: fundamental rights	WJP
3	Equal treatment and absence of discrimination	WJP
4	The right to life and security of the person is effectively guaranteed	WJP
5	Due process of law and rights of the accused	WJP
6	Freedom of opinion and expression is effectively guaranteed	WJP
7	Freedom of belief and religion is effectively guaranteed	WJP
8	Freedom from arbitrary interference with privacy is effectively guaranteed	WJP
9	Freedom of assembly and association is effectively guaranteed	WJP
10	Fundamental labour rights are effectively guaranteed	WJP
11	Factor 7: civil justice	WJP
12	People can access and afford civil justice	WJP
13	Civil justice is free of discrimination	WJP
14	Civil justice is free of corruption	WJP
15	Civil justice is free of improper government influence	WJP
16	Civil justice is not subject to unreasonable delay	WJP
17	Civil justice is effectively enforced	WJP
18	Alternative dispute resolution mechanisms are accessible, impartial, and effective	WJP
19	Factor 8: criminal justice	WJP
20	Criminal investigation system is effective	WJP
21	Criminal adjudication system is timely and effective	WJP
22	Correctional system is effective in reducing criminal behaviour	WJP
23	Criminal system is impartial	WJP
24	Criminal system is free of corruption	WJP
25	Criminal system is free of improper government influence	WJP
26	Due process of law and the rights of the accused	WJP
27	Property rights	GCIWEF
28	Intellectual property protection	GCIWEF
29	Judicial independence	GCIWEF

XI. Security

1	Intentional homicides (per 100,000 people) (inverse)	WDI
2	Losses due to theft and vandalism (% of annual sales of affected firms) (inverse)	WDI
3	Factor 5: order and security	WJP
4	Crime is effectively controlled	WJP
5	Civil conflict is effectively limited	WJP
6	People do not resort to violence to redress personal grievances	WJP
7	Business costs of terrorism	GCIWEF
8	Business costs of crime and violence	GCIWEF
9	Organized crime	GCIWEF
10	Reliability of police services	GCIWEF

XII. Education

1	Scientific and technical journal articles per capita	WDI
2	Adjusted net enrolment rate, lower secondary, both sexes (%)	EI
3	Adjusted net enrolment rate, primary, both sexes (%)	EI
4	Barro-Lee: average years of primary schooling, age 15+, total	EI
5	Barro-Lee: average years of secondary schooling, age 15+, total	EI
6	Barro-Lee: average years of tertiary schooling, age 15+, total	EI
7	Barro-Lee: average years of total schooling, age 15+, total	EI
8	Barro-Lee: percentage of female population age 15+ with no education	EI
9	Barro-Lee: percentage of female population age 15+ with primary schooling. Completed primary	EI
10	Barro-Lee: percentage of female population age 15+ with primary schooling. Total (incomplete and completed primary)	EI
11	Barro-Lee: percentage of female population age 15+ with secondary schooling. Completed secondary	EI

Table A1. (continued)

12	Barro-Lee: percentage of female population age 15+ with secondary schooling. Total (incomplete and completed secondary)	EI
13	Barro-Lee: percentage of female population age 15+ with tertiary schooling. Completed tertiary	EI
14	Barro-Lee: percentage of female population age 15+ with tertiary schooling. Total (incomplete and completed tertiary)	EI
15	Barro-Lee: percentage of population age 15+ with no education	EI
16	Barro-Lee: percentage of population age 15+ with primary schooling. Completed primary	EI
17	Barro-Lee: percentage of population age 15+ with primary schooling. Total (incomplete and completed primary)	EI
18	Barro-Lee: percentage of population age 15+ with secondary schooling. Completed secondary	EI
19	Barro-Lee: percentage of population age 15+ with secondary schooling. Total (incomplete and completed secondary)	EI
20	Barro-Lee: percentage of population age 15+ with tertiary schooling. Completed tertiary	EI
21	Barro-Lee: percentage of population age 15+ with tertiary schooling. Total (incomplete and completed tertiary)	EI
22	Cumulative drop-out rate to the last grade of lower secondary general education, both sexes (%) (inverse)	EI
23	Cumulative drop-out rate to the last grade of primary education, both sexes (%) (inverse)	EI
24	Duration of compulsory education (years)	EI
25	Early school leavers from primary education, both sexes (number)	EI
26	Effective transition rate from primary to lower secondary general education, both sexes (%)	EI
27	Enrolment in early childhood education, both sexes per capita	EI
28	Enrolment in early childhood education, public institutions, both sexes share	EI
29	Enrolment in lower secondary education, both sexes (number) per capita	EI
30	Enrolment in lower secondary education, public institutions, both sexes share	EI
31	Enrolment in post-secondary non-tertiary education, both sexes (number) per capita	EI
32	Enrolment in post-secondary non-tertiary education, public institutions, both sexes (number) share	EI
33	Enrolment in pre-primary education, both sexes (number) per capita	EI
34	Enrolment in pre-primary education, public institutions, both sexes (number) share	
35	Enrolment in primary education, both sexes (number) per capita	EI
36	Enrolment in primary education, public institutions, both sexes (number) share	EI
37	Enrolment in secondary education, both sexes (number) per capita	EI
38	Enrolment in secondary education, public institutions, both sexes (number) share	EI
39	Enrolment in secondary vocational, both sexes (number) share	EI
40	Enrolment in tertiary education, all programmes, both sexes (number) per capita	EI
41	Enrolment in upper secondary education, both sexes (number) per capita	EI
42	Enrolment in upper secondary education, public institutions, both sexes (number) share	EI
43	Enrolment in upper secondary vocational, both sexes (number) share	EI
44	Expenditure on education as % of total government expenditure (%)	EI
45	Government expenditure on education as % of GDP (%)	EI
46	Graduates from tertiary education, both sexes (number) per capita	EI
47	Harmonized test scores, total	EI
48	Labour force with advanced education (% of total labour force)	EI
49	Labour force with basic education (% of total labour force)	EI
50	Labour force with intermediate education (% of total labour force)	EI
51	Lower secondary completion rate, both sexes (%)	EI
52	Official entrance age to compulsory education (years) (inverse)	EI
53	Out-of-school adolescents of lower secondary school age, both sexes (number) per capita (inverse)	EI
54	Out-of-school children of primary school age, both sexes (number) per capita (inverse)	EI
55–77	PISA: 15-year-olds RESULTS below Level 1	EI
78	Primary completion rate, both sexes (%)	EI
79	Pupil-teacher ratio in lower secondary education (headcount basis)	EI
80	Pupil-teacher ratio in pre-primary education (headcount basis)	EI
81	Pupil-teacher ratio in primary education (headcount basis)	EI
82	Pupil-teacher ratio in secondary education (headcount basis)	EI
83	Pupil-teacher ratio in tertiary education (headcount basis)	EI
84	Pupil-teacher ratio in upper secondary education (headcount basis)	EI
85	Rate of out-of-school children of primary school age, both sexes (%) (inverse)	EI
86	Rate of out-of-school youth of upper secondary school age, both sexes (%) (inverse)	EI
87	Expenditure on secondary education (% of government expenditure on education)	WDI
88	Expenditure on tertiary education (% of government expenditure on education)	WDI
89	Research and development expenditure (% of GDP)	WDI
90	Researchers in R&D (per million people)	WDI

Notes: DB—Doing Business; WDI—World Development Indicators by the World Bank (WB); EI—WB Education Indicators; HPS—WB Health and Population Statistics; WGI—Worldwide Governance Indicators; WJP—World Justice Project; GCIWEF—Global Competitiveness Index by World Economic Forum; CCBR - Labour Regulation Index (Cambridge: Centre for Business Research); ILO – International Labour Organization.