Are Large Firms Born or Made? Evidence from Developing Countries

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Abstract

We compare the role of institutions versus firm characteristics at the time of creation of the firm in explaining size, growth, and productivity over firm lifecycle using data from 118 developing countries. Initial firm characteristics, specifically, size at birth plays a key role in predicting variation in firm size and growth over the firm lifecycle whereas country factors dominate in predicting variation in productivity. Older firms are larger and this is partly due to the selection of more efficient firms as evidenced by the Olley-Pakes size-productivity covariance. Our findings highlight the importance of initial founding conditions in shaping firm lifecycles.

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Introduction

The state of institutions, particularly financial institutions influences firm and industry performance and growth. Rajan and Zingales (1998) show that financial development leads to comparatively faster growth rates in industries normally dependent on external finance; Demirguc-Kunt and Maksimovic (1998) and Beck et al. (2005) show that financial development promotes growth of individual firms. More recently, attention has begun to focus on how institutions affect a firm's growth rate at different points of its life cycle.

Do developing country firms grow as they age? We do know that in developed countries such as the U.S., new businesses start small and, if they survive, grow fast as they age.[1] But it is not clear whether firms in developing countries face a similar size-age profile as in the US given that they face entirely different business environments and operating conditions.[2] In this paper, we examine lifecycle effects in firm size, growth, and productivity across 120 developing economies. We are interested in three questions: Do firms grow over their life cycle? Are differences in the size and growth of firms better explained by the differences in institutions across countries, as a voluminous literature suggests, or by the differences in firm level characteristics, in particular initial size at birth? How does firm productivity change over the life-cycle and what explains this variation?

A body of research in finance has established the importance of life-cycle explanations for many fundamental corporate finance policies, including dividends (Fama and French (2001), Grullon et al. (2002), DeAngelo, DeAngelo, and Stulz (2006), Denis and Osobov (2008)), financing (Berger and Udell, 1990), stock valuations (Pastor and Veronesi (2003)) and acquisitions (Maksimovic and Philips (2008), Arikan and Stulz (2011)). We also know that size

[1] See, for example, Evans (1987) and Davis, Haltiwanger, and Schuh (1996).
[2] An exception is Hsieh and Klenow (2014) who contrast growth trajectories in India and Mexico with those in the USA.

and age are closely related and are the best predictor of financing constraints (Hadlock and Pierce (2010)). However, much less is known about if there is a lifecycle of firm size and what factors explain the evolution of firm size and productivity with age.

We start by examining whether older firms are larger, grow faster, and are more productive than younger firms and whether these relationships vary across different countries and industries. We then assess the extent to which the observed variation in average size, growth since birth, and productivity at different points in the firms' life-cycle in different countries can be explained by two explanatory factors: First, we explore how much country-level institutional factors affect firm size, growth, and productivity at different ages since founding. Here we quantify the explanatory power of these country-level institutional factors on firm indicators. However, we recognize that institutions also affect the initial size distribution of firms and that their influence through this latter channel may be very significant.

Second, we estimate the extent to which these post-birth variables can be explained by the firm's initial size at founding. As the Lucas (1978) and Rauch (1991) models suggest, and Klepper (2001) shows empirically, more capable entrepreneurs are expected to form larger firms.[3] Given that entrepreneurial talent is a likely predictor of firm performance, we condition on initial firm size when predicting the role of institutions on subsequent growth. Furthermore, as discussed in Klapper, Laeven, and Rajan (2006), Kerr and Nanda (2009), and Ayyagari, Demirguc-Kunt, and Maksimovic (2014b), initial firm size is influenced by institutions within each country by affecting the financing of entrepreneurial firms and the pool of potential educated entrepreneurs. Thus, the explanatory power of initial size in the performance regressions also places an upper bound on the effect of institutions through this channel.

[3] Maksimovic, Phillips, and Yang (2013) show initial size and productivity are predictors of future public firm status in the US, and hence growth and productivity.

Using a variance decomposition approach, we examine differences between countries as well as differences between different types of firms, and their interaction.[4] We focus on the effect of country level institutions and initial firm size, but extend the analysis to consider other firm-level characteristics, such as ownership and the firm's legal organization, which while not exogenous to the firm's outcomes, nevertheless provide descriptive evidence of the association between performance and firm characteristics. Finally, we examine the within-country covariance between firm size and productivity at different points along the lifecycle to get a sense of the extent of misallocation in developing countries.

We use data from the World Bank Enterprise Surveys (ES) database, consisting of 44,870 formal firms[5] in 118 countries, surveyed over the period 2006-2012. The surveys use standardized survey instruments and a uniform sampling methodology to minimize measurement error and to yield data that are comparable across countries. The strength of our data is that we cover most of the developing countries in the world. We have the following main findings:

First, our analysis shows that in developing countries, older firms are substantially larger than younger firms. The average firm that is 40 years and older employs 5 times as many workers as the average firm under the age of five. Our results are robust to considering only manufacturing firms and taking into account survey sampling weights. We obtain similar patterns when we look across country income groups. Our results are also robust to excluding firms with government ownership, former Socialist economies where they may be a discrepancy

[4] To examine the relative influence of firm effects compared with country effects, we use variance decomposition analysis. Similar methods have been used in finance to examine the importance of country vs. firm level effects in explaining property rights protection (Ayyagari, Demirguc-Kunt, and Maksimovic (2008)). The method is also well established in corporate strategy studies in the context of decomposing profitability into corporate and industry effects (e.g. Schmalensee (1985), Rumelt (1991), McGahan and Porter (1997, 2002), Khanna and Rivkin (2001)). By using this method, we can focus directly on the general importance of these effects in explaining firm size and growth over lifecycle without any assumptions on structural analysis.

[5] While the Enterprise Survey data surveys establishments, we use the terms firm and establishment interchangeably since we restrict our analysis to single establishment firms.

in age reported due to large-scale privatization,[6]and firms that started operations before countries' independence. This finding also holds controlling for industry and country fixed effects in a multivariate analysis. The significantly upward sloping age-size profile is pervasive in the vast majority of countries. In only less than 10% of the countries is the average 40+ year firm not as big as firms younger than 5 years.[7]

Second, we find that as firms age, they not only grow and employ more workers but are also much more productive. This is consistent with the literature (e.g. Pagano and Schivardi, (2003)) suggesting that larger firms are more productive.

Third, our analysis shows that firm-level characteristics dominate country-level characteristics in predicting variation in size and growth over the lifecycle since birth. The firm-level factors together explain between 34.6% of the variation in firm size in the case of mature firms (20-39 years) to 51.1% of the variation in firm size in the case of young firms (<5 years). Of the firm-level characteristics, size at birth dominates other factors such as location, industry, ownership, and legal organization. In particular, size at birth has the largest explanatory power explaining 52.2% of the variation in firm size for young firms, 37.3.3% for firms aged 5-19 years and 27.2% for mature firms aged 20-39 years. In comparison, institutional factors matter less than size at birth for explaining variation in size over the lifecycle. The total variation in size at different points along the lifecycle that can be explained by country dummies ranges between 9% (for firms in the 5-19 and 20-39 age bins) to 12.5% for young firms (<5 years).[8]

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[6] The establishments in the survey were explicitly told that if the establishment was privatized, then the establishment year provided should refer to when the original government-owned establishment began operations.
[7] However we also find a great deal of variation in the size-age gap across countries. In about 22% of the sample (27 countries), the size-age ratio is as large or larger than in the U.S. where Hseih and Klenow (2014) show that the average 40 year old firm employs over seven times as many workers as the average firm five years or younger.
[8] Of the explainable variation in size at the country level, 24%-37% can be explained by using historical institutional variables proposed in the literature such as legal origin (La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998)), ethnic fractionalization (Easterly and Levine (1997), Alesina et al. (2003)) and latitude (Engerman and Sokoloff (1997)). In smaller sub-samples where we also include settler mortality (Acemoglu, Johnson, and Robinson (2001)),

We see similar patterns when we look at the variation in growth since birth. Size at birth explains 3.2% of the variation in growth since birth for young firms, 3.8% for firms aged 5-19 years, and 4.8% of the variation for mature firms. Country dummies by contrast explain between 1.2% (young) - 2.9% (mature firms) of the variation in firm growth over the lifecycle.

Fourth, country-level characteristics are more important than firm-level characteristics in predicting variation in labor productivity along different points in the lifecycle. Country dummies explain 55.9% of the variation in labor productivity for young firms, and 52% for firms aged 5-19 years and mature firms aged 20-39 years. Historical institutional variables proposed in the literature such as legal origin (La Porta, Lopez-de-Silanes, Shleifer, and Vishny, 1998), ethnic fractionalization (Easterly and Levine (1997), Alesina et al. (2003)) and latitude (Engerman and Sokoloff (1997)) explain more of this explainable variation for young firms (21%) than for mature firms (15%). In comparison, all the firm-level characteristics (industry, location, ownership, legal organization, and size at birth) explain only up to 10.5% of the variation in labor productivity at different points along the lifecycle. Likewise, the interaction between firm-level characteristics and country dummies or country-level institutional variables also does not contribute much explanatory power.

The fact that that we do find that institutional variables explain productivity comparatively well suggests that we would have enough power to detect a strong effect of institutional variables on firm size and growth post founding, were such an effect to exist.

Finally, we try to understand to what extent selection processes may be driving our results by studying the variation in the size-productivity covariance across countries. Bartelsman,

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a proxy for the disease environment during European colonization that shaped property rights protection, the historical institutional variables together explain 71% of the explainable variation in size for firms in the 5-19 age bin. Similar results hold for growth, suggesting that the literature has been looking at first-order institutional factors.

Haltiwanger, and Scarpetta (2013) show that the size-productivity covariance captures the extent of resource mis-allocation and selection forces operating in an economy. Our results show that there is a great deal of resource misallocation in developing countries since the covariance term is largely negative. We also find that the average and median size-productivity covariance appears to increase with age suggesting that on average the unproductive firms exit so older firms are more productive.

Our results contribute to the large literature on firm size and age (Dunne, Roberts, and Samuelson (1989), Davis, Haltiwanger, and Schuh (1996), Cabral and Matta(2003), Foster, Haltiwanger, and Syverson (2012)) and advance the findings in Ayyagari, Demirguc-Kunt, and Maksimovic (2014a) who find that mature firms have the largest share of employment in developing countries. Overall our results suggest that across the world, firms start small and grow as they age and this is consistent with the studies of lifecycle of firms in developed countries.

The importance of initial size in our paper also relates to studies documenting the importance of initial size for survival in the US (Aggarwal and Audretsch (2001), Cetorelli (2004), Kerr and Nanda (2009)). More generally, the importance of founding conditions in our paper relates to the growing literature documenting the importance of firm-level intrinsic factors for corporate behavior. For instance, papers such as Bloom and Van Reenen (2007, 2010), posit that the variations in management practices, seen as a measure of organizational capital, have broader implications for firm growth and productivity differences across countries. Other studies define organizational capital using accounting measures to show that this influences financial performance (e.g. Chan, Lakonishok, and Sougiannis (2001), Lev and Radhakrishnan (2005), Edmans (2011), and Eisfeldt and Papanikolaou (2013)), managerial pay (e.g. Lustig et al. (2011),

Carlin, Chowdhury, and Garmaise (2012)) and firm M&A decisions (e.g. Li, Qiu, and Shen (2015)). A vast literature also emphasizes the importance of managerial traits and human capital in general for different corporate policies (see Malmendier and Nagel (2011), Malmendier, Tate, and Yan (2011), Carlin and Gervais (2009), Berk, Stanton, and Zechner (2010))[9]. All these papers focus on managerial characteristics of continuing firms and not on characteristics at the time of startup. One exception is work by Bena and Molina (2013) who study the creation of new firms and find that pyramidal ownership structures facilitate the financing of entrepreneurial activity. Their focus is on understanding the role of ownership structure and while they find that start-up size of firms set up by parent companies is larger than stand-alone firms, they do not explore the life-cycle implications of start-up size or its role vis-à-vis the role of institutions.

This article is also related to recent work investigating the importance of country versus firm-level factors in explaining firm perceptions and behaviors. Ayyagari, Demirguc-Kunt, and Maksimovic (2008) find that firm-level characteristics, such as legal organization and ownership structure, are comparable with institutional factors in explaining variations in perceptions of property rights protection. Doidge, Karolyi, and Stulz (2007) on the other hand find that most of the variation in governance ratings across firms is explained by country characteristics rather than by firm characteristics. They attribute this finding to the increased incentives of firms in better legal environments to adopt better governance structures. Our results suggest that while institutional variation across countries is important in understanding the size-age gap, firm-specific factors are as equally important if not more important in explaining the variation in size and growth at different points in the firm life-cycle.

[9] See, for instance, Bertrand and Schoar (2003), Pérez-González (2006), Bennedsen, Nielsen, Pérez-González, and Wolfenzon (2007), Kaplan, Klebanov, and Sorensen, (2012), Cronqvist, Makhika and Yonker (2012), Graham, Li, and Qiu (2012), and Benmelech and Frydman (2015) among others.

A number of caveats exist. Our results cover only the formal sector, that is, firms that are formally registered and operating as legal entities. We also do not have data on micro enterprises (less than 5 employees) in our sample. The *dual economy* view in development economics (originally associated with Harris and Todaro (1970)) predicts that informal firms should look very different from formal firms in terms of size, productivity, wages paid and the industries/markets they operate in. Recent studies such as La Porta and Shleifer (2008) also show that while informal firms account for a large portion of economic activity in developing countries, growth and development comes from the creation of highly productive formal firms. Second, our data is only on the continuing/surviving firms and hence we have no data on firm exit rates. On a related note, the surveys are stratified only by industry, firm size, and geographical location and so we may not have a completely representative sample of firm ages, though the firms within the strata are randomly sampled. Finally, the ES data is based on survey data rather than individual country census. However, our enquiries with the survey implementation team reveal that mean response rates across our sample of countries is 70%[10] which suggests that we have a representative sample of firms across economies. Overall, our analysis provides an important first step in exploring cross-country differences in firm lifecycle.

[10] The 70% mean response rate across our sample of countries is superior to most other survey based studies. For instance, Campello, Giambona, Graham, and Harvey (2011) report response rates of 3 to 7% in their survey of how companies use credit lines during a financial crisis. Other studies in corporate finance report response rates between 7%-9% including Graham and Harvey (2001), Brav, Graham, Harvey and Michaely (2005), and Lins, Servaes, and Tufano (2010).

II. Data

We use the World Bank Enterprise Surveys (ES), an on-going initiative of the World Bank to benchmark the investment climate in different countries across the world and to analyze firm behavior and performance (see www.enterpriseseurveys.org for more details). This is the only multi-country survey of its size and scope and has been used in numerous prior studies.[11]

The ES survey from the universe of eligible firms obtained from the country's statistical office[12] using stratified random sampling with replacement to generate a sample representative of the whole non-agricultural private economy (so fully government owned firms are excluded from the sampling universe) in the country. The surveys are stratified according to three criteria: *Sector of activity* (population of industries include manufacturing sectors, construction, services, transport, storage, communications, and computer and related activities), *Firm size* (the strata include small firms (5-19 employees),[13] medium firms (20-99 employees), and large firms (100 or more employees)), and *Location* (based on centers of economic activity in the country).

While the ES have been produced since 2002, we restrict our sample to surveys administered during 2006-2012 since these provide sampling weights that address the varying probabilities of selection across different strata and are thus indispensable to making assertions

[11] The Enterprise Surveys and their precursor, the World Business Environment Survey (WBES) have been used to investigate a series of questions in finance and economics including the relation between property rights and contracting institutions (e.g. Acemoglu and Johnson (2005)), investment climate and business environment obstacles to growth (e.g. Beck et al. (2005) and Ayyagari et al. (2008)), firm financing patterns (e.g. Beck et al. (2008), Cull and Xu (2005) and Ayyagari et al. (2010)), dispute resolution via courts (e.g. Djankov et al. (2003)), corruption (e.g. Barth et al. (2009)) and tax evasion (Beck, Lin, and Ma, 2014).

[12] The master list of firms is sometimes obtained from other government agencies such as tax or business licensing authorities. In some cases, the sampling universe is generated from lists maintained by the Chamber of Commerce and business associations or marketing databases where registration is voluntary. In a few cases, the sample frame is created via block enumeration.

[13] We have a few firms in the sample that report having less than 5 employees. All our results are robust to dropping these firms. Our results are also robust to dropping firms that started out as informal enterprises and were formally registered after starting operations.

about the whole population.[14] For countries that were surveyed twice during this period, we retain the most recent survey data for each country. Our results are also robust to retaining data for the year with the largest number of firms surveyed.

While the sampling unit in ES is the establishment,[15] we restrict out analysis to single establishment firms that comprise over 85% of the sample.[16] Hence we use the terms firm and establishment interchangeably. We drop missing observations on size and age, drop observations where the date the firm began operations is before 1800 and obvious data errors (such as one observation where date the firm began operations is reported to be 2205). This leaves us with a final sample of 44,696 firms across 118 countries.[17] The key variables used in our analysis are the following:

Firm Size is the number of permanent, full-time employees in the firm where permanent, full-time employees are defined as all paid employees that are contracted for a term of one or more fiscal years and/or have a guaranteed renewal of their employment contract and that work 8 or more hours per day. The survey asks firms to report the employment numbers at the end of the last fiscal year.

Size at Birth is the size of the firm when it first started operations. ***Size Ratio*** is the ratio of current firm size to the size of the firm when it first started operations.

[14] Most surveys contain three sets of weights – strict, median, and weak weights depending on the eligibility criteria used to construct the sample universe. The survey implementation manual recommends the use of median weights for cross-country comparisons which is what we use in this paper.

[15] In the Enterprise Surveys, the establishment is defined as a physical location where business is carried out and where industrial operations take place or services are provided. In addition, an establishment must make its own financial decisions, have its own financial statements separate from those of the firm, and have its own management and control over its payroll.

[16] When we focus on multi-establishment firms, we find that they have similar size-age profiles as single-establishment firms. The average 40+ multi-establishment firm is 4.5 times larger than the average multi-establishment firm that is <5 years of age.

[17] The Enterprise Survey database was downloaded in Dec 2012.

Labor Productivity is the logarithm of the ratio of total annual sales (in USD) to number of permanent, full time employees. While the ES report annual sales in local currency units (LCU), we use end of period USD/LCU exchange rates from the International Financial Statistics (IFS) to obtain sales in USD.

Firm Age is defined as the number of years since the firm began operations in the country. We compute age at the end of the last fiscal year to be consistent with the employment question.

We winsorize the top and bottom 1% of firm size, size at birth, and labor productivity (before taking logs) to minimize the effect of outliers.

Insert table 1 here

Table1 presents the summary statistics and correlations between the main variables. Panel A of Table 1 shows that the mean firm size in our sample is 59 employees. The mean firm size ratio is 5.64. Thus, the average firm in our sample is 5.6 times its size when it started operations. The ratio extends from a very small number to 860. The firms with ratios in excess of 100 are spread out across countries and industries. [18] For instance, there are two firms with a size ratio of 860, one is a Columbian firm surveyed in 2010 in the industry sector *Metals and Machinery* which is privately held and started operations in 1940 with 1 employee and had 860 employees in 2009 and the other is a publicly listed company in Mauritius in *Non-metallic and Plastic Materials* surveyed in 2009 which started operations in 1953 with 1 employee. 55% of our sample is composed of manufacturing firms and while the average log labor productivity is 10.08, there is wide heterogeneity as seen by the range between 5.81 and 17.2. Panel B shows that older firms in our sample are larger and more productive. Firm Size Ratio and Age are also positively correlated suggesting that firms grow as they age.

[18] Our results are robust to using median regressions rather than OLS for the specifications with size ratios.

In the next two sub-sections, we describe the institutional and firm-level characteristics we use for our variance decomposition analysis and the underlying motivation behind the choice of these variables.

A. Country-level Institutional Determinants

In this sub-section, we describe the different country-level variables we use in the variance decomposition analysis to capture the contribution of country factors in explaining firm size and growth over the lifecycle. We begin with four exogenous institutional variables - Legal Origin, Latitude, Ethnic Fractionalization, and Settler Mortality - that have been widely considered in the literature to be determinants of property rights protections and with long-lasting economic consequences. Here, we consider whether these historical institutions have a significant explanatory power in predicting the size, growth, and productivity of firms over their lifecycle. Below we first describe the hypotheses behind each of these institutional theories and the variables we use to capture them.

La Porta et al. (1998) argue that countries' legal systems differ in how much they protect the rights of private investors vis-à-vis the state and minority shareholders. La Porta et al. (1998) maintain that legal systems that evolve from common law traditions tend to support private property rights. By contrast, countries established civil law systems as acts of policy. Such systems tend to be designed to state administration, are more predictable, and are less likely to favor individuals over the state, or to tailor decisions in ways that safeguard individual claimants in specific instances. Subsequent research showed that legal origin has consequences not just for the legal and regulatory framework of society but also for economic outcomes such as government ownership of banks (La Porta et al. 2002), entry regulations (Djankov et al., 2002),

regulation of labor (Botero et al. 2004), and financial development (La Porta et al. 1998, Claessens and Laeven (2003), and Beck et al. (2005)).

Through these different channels, we expect legal origin should also have an impact on firm size and growth over the lifecycle. For our sample of countries, we use ***Legal Origin***, a set of three dummy variables from La Porta et al. (1998, 1999) to capture the differences between three influential legal traditions - British common law, French civil law, and Socialist law.[19]

Acemoglu, Johnson, and Robinson (2001) argue that many countries, especially former colonies, did not design the legal system to protect property rights. Instead, its purpose was to facilitate the extraction of resources from the indigenous population. Thus, two systems with the same legal origin may in practice offer very different protections. Acemoglu et al. (2001, 2002) and Engerman and Sokoloff (1997) contend that European colonization offers a natural experiment to test this hypothesis. Europeans set up extractive systems in colonies that were not attractive for colonial settlement, either because of high settler mortality due to natural causes at the time of colonization, or because the indigenous population was relatively large. In colonies where settlement was feasible, countries set up the judicial systems to protect the property rights of the settlers. This theory emphasizes the role of geography (latitude and natural endowments) and disease environment (which affected the settler mortality) in shaping property rights.

To measure geographical endowments, we use ***Latitude,*** which is the absolute value of the latitude of the country scaled between zero and one, from La Porta et al. (1998). Countries closer to the equator have a more tropical climate that is inhospitable to European settlers, and therefore these countries fostered "extractive" institutions. We use data on settler mortality from Acemoglu, Johnson, and Robinson (2001). We define ***Settler Mortality*** as a measure of the death

[19] Three countries – Ethiopia, Iran, and Yemen – were re-classified from French Civil law in La Porta, Lopez-de-Silanes, and Shleifer (2008) to English Common Law in Djankov, McLiesh, and Shleifer (2007). We retain the original classification but our results are not significantly different with the change.

rates for European settlers in former colonies and calculate it by the logarithm of annualized deaths per thousand Europeans. Since we have data on Settler Mortality for a smaller sample, we use Latitude for our main results and present the results on Settler Mortality as a robustness test.

Easterly and Levine (1997) show that Ethnic Fractionalization is also an important determinant of rent seeking and social polarization that affects property rights and social institutions. Empirically, we use ***Ethnic Fractionalization***, a measure of ethnic fractionalization of the country compiled by Alesina et al. (2003).

The explanatory power of the different variables may be affected due to nonlinearities arising from the way we construct these variables as shown by Ayyagari, Demirguc-Kunt, and Maksimovic (2008). Following Ayyagari et al. (2008), we rescale the variables by constructing a four-point scale for Latitude, Settler Mortality, and Ethnic Fractionalization based on their quantiles. We perform variance component analysis using this four-point scale. In the regression, we enter dummies for each unique value of the rescaled variables.

B. Firm-level Characteristics

For the variance decomposition analysis, we consider the following firm-level characteristics:

First, we look at the initial conditions of the firm by looking at the size of the firm when it first started operations, ***Size at birth.*** Theoretical models on entrepreneurial ability such as Lucas (1978) and Rauch (1991) suggest that entrepreneurs of higher ability set up larger firms or correspondingly managers with more ability run larger firms and employ more capital. Entry size has also been shown to be important for survival based on the rationale that the relative efficiency of the entrant is discovered subsequent to entry through the process of learning from actual market experience (e.g. Ericson and Pakes (1998), Jovanovic (1982), Geroski (1995), and

Sutton (1997)). Agarwal and Audretsch (2001) show that large entry size for survival matters particularly in the formative stages of the industry life-cycle. Hence we look at the role of size at birth though the focus in our paper is not on survival but relative size, growth, and productivity over the lifecycle.

Second, we look at the importance of firm location for lifecycle effects. Firm location has been a much researched issue since Marshall (1890). Studies in economic geography have shown that firms in urban clusters are more likely to outsource (Ono (2003)), vertically disintegrate (Holmes (1999)), innovate (Glaeser et al. (1992)). More recently a large finance literature has used location as a proxy for growth opportunities (e.g. Almazan, De Motta, Titman, and Uysal, (2010)) and shown the importance of location for acquisition behavior (Uysal, Kedia, and Panchapagesan (2008); Kang and Kim (2008)) and corporate payout policies (John, Knyazeva, and Knyazeva (2011)). Urban firms have also been shown to use more equity financing and higher quality underwriters (Loughran and Schultz (2006)). In our context we apply this framework to examine to what extent the firm location and its ensuing growth opportunities influence size, growth, and productivity over the lifecycle. ***Location*** consists of five dummy variables for Capital city, city with population over 1 million, population over 250,000 to 1 million, population over 50,000 to 250,000, and less than 50,000 population.

Third, we look at the importance of ownership structure. Theories on the politics of state ownership argue that state owned firms are less efficient and less profitable than privately owned firms because of governments' deliberate policy to transfer resources to supporters and weak managerial incentives to reduce costs and (Shleifer and Vishny (1994); Shleifer (1998)). Empirically too, a large literature has shown that state owned firms under-perform private firms (e.g. Boubakri and Cosset (1998); Dewenter and Malatesta (2001); Megginson and Netter

(2001); La Porta and Lopez-de-Silanes (1999); and Gupta (2005)), are less innovative (Ayyagari, Demirguc-Kunt, and Maksimovic (2012)), and that investments of state owned firms are subject to political interference (Dinc and Gupta (2011)).[20] We would also expect the average size of state owned firms to be larger than private and foreign firms both because of their social goals and their inefficiencies. To capture ***Ownership***, we use four dummy variables to classify firms into State owned, Domestic owned, Foreign Owned, and Other ownership. The dummy variables take the value 1 if the government, private domestic individuals/companies, private foreign individuals/companies, or other ownership categories owned 50% or more of the company respectively and 0 otherwise.

Fourth we look at the role of legal organization structure. Recent corporate finance research has shown that public firms differ from private firms in very fundamental ways. These two categories of firms invest differently in response to demand shocks (Brav (2009); Sheen (2009); Asker, Farre-Mena, and Ljunqvist (2010)), have different cash policies (e.g. Gao, Harford, and Li (2012); Farre-Mensa (2012)), smooth dividends differently (Michaely and Roberts (2012)) and listed firms take much more advantage of financial booms to grow by acquisition (Maksimovic, Phillips, and Yang (2013)) while private acquirers pay significantly less for targets than public acquirers (Bargeron, Schlingemann, Stulz, and Zutter (2008)). We would thus expect public and private firms to have very different size, growth and productivity profiles with age. More generally, Demirguc-Kunt, Love, and Maksimovic (2006) show a significant interaction of institutions and incorporation status - incorporated firms grow comparatively faster in countries with strong financial and legal institutions than in countries with weak institutions. To examine these issues, we use ***Legal Organization***, consisting of three

[20] A parallel literature has established the costs associated with government ownership in financial markets (Khwaja and Mian (2005); Dinc (2005); Cole (2009); Sapienza (2004); Carvalho (2014))

dummies for Publicly listed company, Privately held limited liability company, and an Other category which includes Sole proprietorship, Partnerships, and Other legal status.

Finally, we look at how the industry classification contributes to size, growth since birth, and productivity over the lifecycle. Rajan and Zingales (1998) and Beck and Levine (2002) show that differences in legal and financial systems affect the availability of external finance and the growth of different industries in the manufacturing sector. We expect these differences to matter as much or more when we look across different sectors. Hence, we also examine if belonging to a particular Industrial Sector impacts the size, growth and productivity of firms over their lifecycle. We use ***Sector,*** which consists of dummy variables for the following industrial sectors: Manufacturing that includes Textiles, Leather, Garments, Food, Metals and machinery, Electronics, Chemicals and Pharmaceuticals, Wood and furniture, Non-metallic and plastic materials, Auto and auto components, and Other manufacturing; Retail and wholesale trade; Hotels and restaurants; Other services; and Construction, Transportation and other industries.

Among the firm-level characteristics we consider, our focus is on size at birth since it is the most exogenous variable. Other variables like sector and location are likely to be sticky at the establishment level. Ownership structure and legal form are most likely to be influenced directly by institutions as suggested by La Porta, Lopez-de-Silanes, and Shleifer (1999) and Demirguc-kunt, Love, and Maksimovic (2006) respectively.

III. *Size, Growth since birth, and Lifecycle in Developing Countries*

In this section we explore the age effects associated with firm size, firm growth since birth, and labor productivity. We begin by first looking at summary statistics on the relationship between average firm employment in surviving plants and age in the cross-section in Figure 1.

We compute the mean employment in each country in each of the following 9 age bins: <5, 5-9, 10-14, 15-19, 20-24, 25-29, 30-34, 35-39, and 40+. We then compute an index for each country where the index takes the value 1 for firms less than five years old. For all other age bins, the index is the ratio of the mean employment in that age bin to the mean employment for firms under five years of age. Figure 1 shows that in developing countries firms grow as they age.[21]

The findings in Figure 1 are very robust. First, Figure 2 shows similar results when we take sampling weights into account and compute average firm size as Total Employment/Total # of firms. Second, the upward sloping size-age profile is pervasive in our sample of countries. In only less than 10% of the countries are is the average firm aged 40 years or older not at least as big as the average firm that is younger than five years old.[22] In Appendix A1, we present the summary statistics of the firm size-age gap across different country income groups and geographic regions. Across different classifications we find that firms grow as they age though there is a great deal of variation in the size-age gap across countries.[23] Third, we find similar results when we look at just manufacturing firms in Figure 3 as well as in Figure 4, where we undertake additional robustness tests, including dropping countries with Socialist legal tradition [24], dropping firms with any government ownership and dropping firms that were established before the countries' independence.

[21]Figure 1 shows that the firm that is 40+ years on average employs nearly 5 times as many people as the firm that is less than five years old. The 95% confidence intervals show that this number could vary between 4.17 and 5.64.

[22] In 10% of the sample (12 countries), the size-age ratio for the firm that is 40 years or older is 10 or over and in 20% of the sample, the size-age ratio is over 7, which is the number by which the average 40 year old firm in the US is larger than the average firm that is five years or younger in the US (Hsieh and Klenow (2014)).

[23] The first column in panel A presents the underlying data in Figure 2. Across income groups, we find the size-age gap ranges from 4.8 times in the case of low income countries to 7.8 times in the case of high income countries. Across regions in panel B, we find that the size-age gap for firms 40 years and older ranges from 1.56 in Middle East and North Africa to 7.41 in Europe and Central Asia.

[24] We exclude countries with Socialist legal tradition because Ayyagari, Demirguc-Kunt, and Maksimovic (2008) argue that these countries are fundamentally different from others in their perceptions of property rights protection. One of the other concerns with the former Socialist economies might be that the data on firm year is noisy because of mass privatizations though the firms were queried on when the firm first started operations even if it was under

In Table 2, we examine the empirical relationship between firm size and age in the above figures in a regression setting. In Table 2, in col. 1, we regress Firm Size on age dummies and find all the age coefficients to be positive and significant suggesting that older firms are larger than younger firms. For ease of comparison with youngest firms, we add the constant (which presents the average mean size for firms younger than 5 years old) to each of the age coefficients and divide the sum by the constant. These ratios are reported in bold in square brackets below the coefficient and standard errors. Thus we see that the average 40+ year old firm is 5.502 times the size of the average firm that is younger than five years old. In col. 2, we repeat the analysis in Col. 1 using industry dummies and country dummies to control for any time-invariant unobserved heterogeneity across countries and industries. Once again we find that all the age coefficients are positive and significant. Cols. 3 and 4 present results for manufacturing and non-manufacturing sub-samples where we find a similar increase in firm size with age. Table 2 thus shows that firms in developing countries grow as they age.[25]

Insert Tables 2 -4 here

In Table 2, we are comparing the mean size of firms that are 40+ years old with the mean size of firms that are younger than 5 years old. However, young firms could be varying in size across years due to different macroeconomic factors, entry regulations, capital market openness, etc as well as across countries. In order to see if firms indeed grow as they age over their lifecycle, we would want to compare the size of older firms at any given point in time with their size when they were born. The Enterprise Surveys ask firms to report the number of full-time employees when the firm started operations. In Figure 5, we normalize the average size of each age cohort by the average size of that cohort at birth. We once again find an upward sloping

state ownership. However in Figure 4 we find consistent results with our main finding when we drop former Socialist economies.

[25] As shown in Appendix A2, we get very similar results if we were to repeat this analysis in terms of Log(size).

curve, consistent with our main finding that older firms in developing countries are larger than their younger counterparts. To investigate this in a regression setting, we construct Size Ratio, which is the ratio of each firm's current employment level to the number of employees when it started operations.

Col. 1 of Table 3 presents a regression of Size Ratio on age dummies and shows that older firms are much larger compared to their size when they first started operations.[26] In Col.2 we add in controls for industry and country and in Cols. 3 and 4 we look at sub-samples of manufacturing and non-manufacturing industries. In all cases the age coefficients are positive and significant.

Overall, Table 2 shows that the average older firm is larger than the average firm that is less than five years old and Table 3 shows that the average older firm is larger than its size when it first started operations. Together, Tables 2 and 3 and figures 1-5 show no evidence of a declining life-cycle in our sample of firms.

We next conduct the same analysis for labor productivity (in levels) instead of size. Figure 6 plots the mean and 95% confidence intervals of the index of productivity for each age bin. Figure 6 shows that labor productivity index increases from 1 to 2 between the <5 and 5-9 age bin (i.e. a 100% increase), declines thereafter and remains mostly flat but is still above 1, and then again increases significantly in the last age bin of 40+ firms. Given the large confidence intervals on this graph at all ages, we do not emphasize these results much. In Table 4, we repeat the regression analysis in Table 2 but with log labor productivity as our dependent variable. All the age coefficients are positive and significant suggesting that older firms have higher labor productivity than younger firms. Each of the age dummy coefficients represent the % increase in

[26] The constant shows that the average firm that is less than 5 years old is 2.92 times its size when it first started operations whereas the coefficient of the 40+ age bin shows that the average 40+ year old firm is 9.64 times its size when it first started operations.

labor productivity relative to the reference category. The exact percentage changes are given by the formula 100 * (exp(coefficient)-1) and are reported in bold in square brackets below the coefficient and standard errors. Col. 1 of Table 4 shows that the labor productivity of the average 40+ firm is approximately double that of the average firm that is younger than five years old.

To summarize, the findings in this section show that firms in developing countries grow larger and are more efficient as they age. The yet unanswered question is whether the increase in firm size with age is a function of institutions in the country or if it is determined by factors intrinsic to the firm? In the next section we attempt to answer this by analyzing what firm and country level factors are key in determining the size, growth, and productivity over the lifecycle.

IV. Size, Growth since Birth, and Firm Lifecycle – Analysis of Variance

We use variance decomposition analysis to compare the relative importance of country and firm effects in explaining variation in firm size, growth, and productivity over different points in the lifecycle.

To fix ideas, we start with a simple model of firm size evolution over the firm life-cycle. If S_{ict} is the size of firm *i*, in country *c*, at point *t*, we have:

$$S_{ict} = A_c S_{ic0}^{g_c t} \quad (1)$$

where S_{ic0} is size of the firm at birth, A_c is country effect, and for simplicity, the growth rate g_{ic} is

$$g_c = g_0 + g_{1c} \quad (2)$$

In terms of logs

$$\log S_{it} = \log A_c + (g_0 + g_{1c})t \text{ x } \log S_{i0} \quad (3)$$

$$\log S_{it} = \log A_c + g_0 \text{ x } (t \log S_{i0}) + g_{1c} \text{ x } (t \log S_{i0}) \quad (4)$$

That is, the size of a firm at point *t* can be decomposed into the scaling effect of initial size in that country ($log\ A_c$), the universal growth adjusted effect of initial size ($g_0\ x\ (t\ log\ S_{i0})$) , and the country specific universal effect of size ($g_{1c}\ x\ (t\ log\ S_{i0})$).

To compare the relative importance of initial size versus country factors, we first estimate equation (4) for the full sample of firms. We analyze this model using a regression-based, simultaneous ANOVA approach that uses the standard assumptions of ordinary least squares. We begin by estimating a restricted version of equation (4) where we include only the country effect. The R-square of this regression provides an estimate of the proportion of the variation in firm size, which is explained by the country-level institutional variable alone. That is, it provides an upper bound for the amount that can be explained by that variable directly, and by other variables that the institutional variable predicts. We next add initial size and compute the R-square to obtain an estimate of the proportion of the variation in firm size that is explained by both the institutional variable and initial size together. We note that the difference in the R-square between the new regression and the restricted regression does not provide an estimate of the variation explained by the firm-specific variable by itself. Instead, it estimates the marginal increment of explanatory power that we gain by adding the firm-specific variable. Finally, we add an interaction term to provide for the possibility that initial firm characteristics may affect firm size for some values of the institutional variable, but not for other values.

In equation (4), for the country effect, apart from the base regression that uses country dummies, we use the following four institutional variables – legal origin, latitude, settler mortality, and ethnic fractionalization that are described in detail in the previous section. To better understand life-cycle effects, we estimate equation (4) for different age buckets – young firms (<5 years), mid-age (5-19 years), and mature firms (20-39 years). We also examine the

following firm characteristics in addition to initial size in specifications analogous to equation (4) - age, ownership, legal organization, industry sector, and city location.

Finally, we use alternate dependent variables including labor productivity and growth since birth. Overall, our empirical model takes as given the classification of firms into firm categories and countries and is essentially descriptive. In particular, although it posits the existence of differences in responses across firms and countries, it offers no causal or structural explanation for these differences.

Tables 5-7 present the results of our ANOVA on Equation (4). In Table 5 we study how country- and firm-level factors explain the variation in log firm size. In col. 1 we examine the effect of age in the full sample and in cols. 2-7 we examine the effect of different factors in different age bins. In the interest of clarity, we aggregate the nine age bins examined in Table 2 into 3 age groups – young firms (<5), mid-age (5-19), and mature firms (20-39). We obtain similar results if we were to classify mature firms as those that are 20+ years old rather than as 20-39 years old.

Insert Table 5 here

We begin with a benchmark specification in which we use country dummies to model institutional variation at the country level. This specification provides us with the upper bound for the variation that can be explained at the country level. In alternate specifications, we replace the country dummy with an institutional variable. In each case, we calculate the increment to adjusted R-square with effects introduced in the following order: country, firm, and country-firm interactions. Table 5 presents the contribution to the adjusted R-square when we enter each of the institutional variables one at a time.

When we look at the full sample in Col. 1, we see that country dummies explain 9.2% of the variation in log firm size. Of the institutional variables we examine, Ethnic fractionalization explains 2.3% of the variation in firm size and Legal Origin and Latitude each explain less than 1%. Together, the four institutional variables explain 2.9% of the variation in log firm size which is 31.52% (=2.9/9.2) of the explainable variation at the country level. When we look across age bins in cols. 2-4, we see that the explanatory power of country dummies ranges from 8.9% of the variation in log firm size in the mid-age firms to 12.5% of the variation in log firm size in young firms. The high explanatory power of ethnic fractionalization in the full sample seems to be restricted to the sample with young firms (3.7%) and mid-age firms (2.1%). When entered together, legal origin, ethnic fractionalization, and latitude explain 36% (=0.045/0.125) of the explainable variation in log size among young firms, 37.08% of the explainable variation in log size among mid-age firms and 23.91% of the variation in log size among mature firms. In cols. 4-6 we include settler mortality as one of the explanatory variables which reduces our sample size. Here again we see that ethnic fractionalization has the largest explanatory power in the young firm (9.7%) and mid-age samples (4.1%). In the reduced sample, the institutional variables together explain 67.91% of the explainable variation in log firm size in the <5 age bin, 71.43% of the explainable variation in log size among the mid-age firms and 62.71% of the explainable variation in log size among the mature firms.

At the firm-level, in the overall sample, age explains 6.8% of the variation in log size, sector dummies explain 4.6%, location dummies explain 0.5%, ownership dummies explain 3.9%, legal organization dummies explain 10.1%, and log size at birth explains 35.7% of the variation in log firm size at any point in time. Thus, size at birth explains the largest variation in firm size at any given point in the lifecycle, far greater than any other country or firm-level

characteristics. Cols. 2-4 confirm this finding across different age groups - the size at the time the firm started operations explains between 27.2% (for mature firms) to 52.2% (for the <5 age bin) of the variation in log firm size. This also holds true in a reduced sample of firms in cols. 5-7 where we have data on settler mortality at the country-level.

When we look at the other firm-level factors, in the <5 age bin, we find ownership dummies, sector dummies, and legal organization dummies to be similar in their explanatory power (5%). In the 5-19 and 20-39 age bins, legal organization dummies have the largest explanatory power after size at birth, explaining 8.6% and 15.4% of the variation in log size.

Overall, Table 5 shows that in explaining firm size over the lifecycle the variable with the highest explanatory power is a firm-level factor – size at birth – rather than a country level institutional variable.

Insert Table 6 here

In Table 6, we study how country- and firm-level factors explain the variation in size ratio i.e. how large the firms have grown since birth. Here we find that country dummies explain much less of the variation in growth than they do for log size. In the full sample in col.1, country dummies explain only 2.3% of the variation in firm size and when we look across age groups this ranges between 1.2% for the <5 age bin in col.2 to 2.9% for the mature firms in col. 4. When we replace the country dummies with institutional variables, individually and together, they explain less than 1% of the variation in size ratio. Together the institutional variables explain between 31-39% of the explainable variation in growth at different points along the life-cycle. In the reduced sample with settler mortality, again the country dummies and institutional variables by themselves do not have very high explanatory power. As a percentage of explainable variation at the country-level, legal origin, ethnic fractionalization, latitude, and settle mortality together

explain 22% (=0.4/1.8) of the explainable variation in size ratio for young firms, 67% of the explainable variation in size ratio for mid-age firms, and 62% of the explainable variation in size ratio for mature firms.

At the firm-level, again log size at birth is the most dominant factor in explaining variation in size ratios over the life-cycle, explaining between 3.2% (<5 age bin) to 4.8% (20-39 age bin) of the variation. The other firm-level characteristics explain less than 1% of the variation in size ratios for young, mid-age, and mature firms. When put together, firm characteristics explain 4.6% of the variation in size ratio for young firms, 5.9% of the variation in size ratio for mid-age firms and 7.5% of the variation in size ratio for mature firms. In a reduced sample of firms in cols. 4-6, firm characteristics explain 5.6% of the variation in size ratio for young firms, 5.8% of the variation in size ratio for mid-age firms and 8.6% of the variation in size ratio for mature firms. Thus Table 6 shows that while size at birth is still the dominant factor in explaining variation in firm growth in comparison to other characteristics, in absolute terms, the explanatory power is less than 4% in the full sample suggesting that neither firm-level nor country-level factors explain much of the variation in firm growth since birth.

Insert Table 7 here

In Table 7, we repeat the analysis in Tables 5 and 6 but look at variation in (log) labor productivity. Country dummies explain 52.4% of the variation in labor productivity overall. Across age groups, we see that the explanatory power of country dummies ranges from 52% for mid-age and mature firms to 55.1% for young firms. Thus the maximum variation that can be explained at the country-level is much higher for labor productivity than for size or growth.

When we replace the country dummies with institutional factors, legal origin has the largest explanatory power over latitude and ethnic fractionalization explaining 4.8% of the

variation in labor productivity in the full sample, 8.6% of the variation in labor productivity for young firms, 5.1% of the variation in labor productivity for mid-age firms and 3.2% for mature firms. Together the institutional factors explain 6.9% of the variation in labor productivity in the full sample which is only 13% (=6.9/52.4) of the maximum explainable variation at the country-level. We also see that the institutional factors explain a larger variation in labor productivity for young firms (11.8%) than for mature firms (7.6%). We see similar patterns in a reduced sample with settler mortality where the institutional factors explain between 25.1% of the variation in labor productivity for young firms, 20.6% for mid-age firms and 12.4% for mature firms. Legal origin is again the dominant factor for young and mid-age firms whereas settler mortality is the dominant factor for mature firms. These results show that institutional differences really matter for explaining variations in labor productivity especially for young firms.

At the firm level, size at birth, which had the largest explanatory power in explaining size and growth since birth, explains less than 1% of the variation in labor productivity at different points along the lifecycle. For young firms, legal organization explains 4.5% of the variation in labor productivity followed by location (3.6%) and industry sector (3.1%). For mid-age and mature firms, legal organization again has the highest explanatory power – 1.6% and 2.7% respectively – whereas all other firm characteristics explain less than 1% in these two age bins. Together, the firm-level characteristics explain 10.5% of the variation in labor productivity in young firms, 5.5% of the variation in labor productivity in mid-age firms, and 6% of the variation in labor productivity in mature firms.

Overall Tables 5-7 show that firm-level factors dominate country-level institutional factors in explaining firm size and growth since birth over the life-cycle whereas country-level factors are more important in explaining variation in labor productivity over the life-cycle. The

ability of institutional variables to explain productivity suggests that we would have had enough power to detect an effect on firm size and growth had it been economically significant. The most dominant firm-level factor in explaining size and growth since birth is size at birth, highlighting the importance of founding conditions in studying size and growth over firm lifecycle. Size at birth plays a minor role in explaining variation in labor productivity.

In unreported tests we explore the importance of country-size at birth interaction effects. We find that this interaction explains 2.3% of the variation in size for young firms and decreases with age explaining less than 1% of the variation in firm size for old firms. Thus size at birth is an important explanatory variable across all countries.[27]

V. Size-Productivity Covariance across Firm Lifecycle

The previous two sections have shown that across developing countries, older firms are larger and grow as they age, but are not much more productive than younger firms. We also find that initial starting conditions specifically size at birth, plays a significant role in explaining the variation in size and growth since birth. However, country-level institutional factors dominate firm-level factors in explaining variations in labor productivity.

In this section, we try to understand to what extent our results may be driven by selection processes. A recent literature in economics has argued that the large differences in productivity between rich and poor countries can be explained by heterogeneity in firm-level productivity which can, in turn, be attributed to the resource mis-allocation in developing countries (Bartelsman, Haltiwanger, Scarpetta (2004), Hsieh and Klenow (2009), Alfaro, Charlton, and

[27] The interaction of country dummies and size at birth dummies explains 3.7% of the variation in size ratios for young firms, 0.4% of the variation in size ratios for mid-age firms, and 1.3% of the variation in size ratios for mature firms. When we look at labor productivity, country dummies x size at birth dummies explain 1.9% of the variation in labor productivity for young firms, 0.9% of the variation in labor productivity for mid-age firms and 0.4% of the variation in labor productivity for mature firms.

Kanczuk (2008), and Midrigan and Xu (2014)). Bartelsman, Haltiwanger, and Scarpetta (2013) show, that the within-industry covariance between size and productivity is a robust measure of this mis-allocation. The underlying logic behind this measure is as follows: In the absence of any distortions, the traditional models of firm size distribution (e.g. Lucas, 1978 and Melitz, 2003) predict a positive correlation between size and productivity so that larger firms are more productive. However distortions in developing countries affect both resource misallocation (too many resources are devoted to small unproductive firms) and selection processes (highly productive firms may exit and low productivity firms may be allowed to operate) which lead to a great deal of variation in the size-productivity relation across countries. This variation is then captured by the cross country variation in the covariance between size and productivity.

We examine how the strength of this covariance varies with firm lifecycle and which institutional and policy variables explain the variation in this covariance. We supplement this measure with a standard deviation of labor productivity to assess the role of misallocation. We focus on labor productivity because Bartelsman et al. show that the within-industry dispersion of labor productivity is much larger than the within-industry dispersion of total factor productivity.

In constructing the covariance term, we follow Bartelsman et al. (2013) who exploit the cross-sectional decomposition of productivity developed by Olley and Pakes (1996). Specifically, Olley and Pakes (1996) decompose total industry productivity (weighted average of firm-level productivity with shares of industry output as weights) into the unweighted average of plant level productivities and the sample covariance between productivity and output share. We implement the Olley-Pakes (OP) decomposition at the country-age bin level. That is, for firm *i* belonging to age bin *a*, if firm-level productivity is LP_{ia}, and w_{ia} is firm i's share of employment in age bin *a*, then total productivity in that age-bin is given by:

$$LP_a = \sum_{i=1}^{N_a} w_{ia} LP_{ia}$$

This can be decomposed into two terms as:

$$LP_a = \sum_{i=1}^{N_a} (\overline{w}_a + \Delta w_{ia})(\overline{LP}_a + \Delta LP_{ia})$$

$$= N_a \overline{w}_a \overline{LP}_a + \sum_{i=1}^{N_a} \Delta w_{ia} \Delta LP_{ia}$$

$$= \overline{LP}_a + \sum_{i=1}^{N_a} (w_{ia} - \overline{w}_a)(LP_{ia} - \overline{LP}_a)$$

where $\overline{w}_a$ and $\overline{LP}_a$ represent unweighted mean share and unweighted mean productivity respectively. The second term is the OP covariance measure.

In our data, we construct the covariance measure in each country-age bin as the difference between the weighted average labor productivity in the country-age bin and the unweighted average labor productivity.

Table 8 presents the summary statistics for the standard deviation of labor productivity and for the covariance term. The summary statistics show that the mean and median standard deviation in log labor productivity increase with age suggesting that the heterogeneity in labor productivity increases with firm age. When we look at the size-productivity covariance term, we find that the mean and median across countries and ages is negative suggestive of resource misallocation and selection issues.[28] For instance, the median covariance term of -0.858 for young firms suggests that the labor productivity in the median country in the average young firm is 86% lower than it would be if employment shares were randomly allocated. However, the mean and median values of the OP covariance term also seem to become less negative with age

[28] For comparison sake, the OP covariance term for labor productivity reported by Bartelsman et al. (2013) for the United States is 0.51 which implies that the industry index of labor productivity in the average US manufacturing industry is 50% higher than it would be if employment shares were randomly allocated within industries.

indicating that the older firms in our sample are more efficient.[29] For instance, the median covariance term of -0.263 for mature firms suggests that the labor productivity in the median country in the average mature firm is 26% lower than it would be if employment shares were randomly allocated. The increase in the size-productivity covariance over the life-cycle provides suggestive evidence that the size-age profiles established in sections A and B are partly driven by the selection of more efficient firms.

VI. Conclusion

The role of size and age in influencing firm dynamics is crucial to understanding productivity differences across firms and countries. In this paper, we use unique survey data across 118 developing countries to examine the relationship between firm size and age in the formal sector. We find that the average 40 year old firm in developing countries is about 5 times larger than the average firm less than 5 years of age. Our results are robust to a number of checks in smaller samples including looking at just the manufacturing sector, dropping former Socialist economies, dropping firms with any government ownership and dropping firms that started operations before the countries' year of independence.

We then try to understand the factors that explain firm size, growth, and productivity over the firm lifecycle using a variance decomposition analysis which allows us to compare country versus firm-level factors without positing a structural or causal explanation. Our results show that while country institutional factors are important in explaining labor productivity, firm-level factors are comparable and even dominate country-level variables in explaining size and growth

[29] For comparison sake, the OP covariance term for labor productivity reported by Bartelsman et al. (2013) for the United States is 0.51 which implies that the industry index of labor productivity in the average US manufacturing industry is 50% higher than it would be if employment shares were randomly allocated within industries.

over the life-cycle. In particular, initial size at birth has significant explanatory power in explaining variation in firm size and firm size ratios of firms.

To understand the selection forces at play and the extent of resource mis-allocation in developing countries, we study the size-productivity covariance at different ages. We find that the resource mis-allocation is the worst for young firms and decreases with age.

Our findings have important policy implications. We show that across the world, on average, formal new firms start small and grow as they age. We find no evidence of declining life-cycles in the formal sector suggesting that older firms are important contributors to economies in developing countries in terms of employment. We also find that initial conditions of a firm, specifically its size at birth, play an important role in explaining variation in size and growth over firm lifecycle. This suggests that institutions that affect the composition of firm entry rather than those that affect the growth trajectories of mature firms may have a more significant effect on industry evolution and should be the focus of government policies.

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Figure 1: Firm Employment by Age – Sample Estimates in 120 Developing Countries

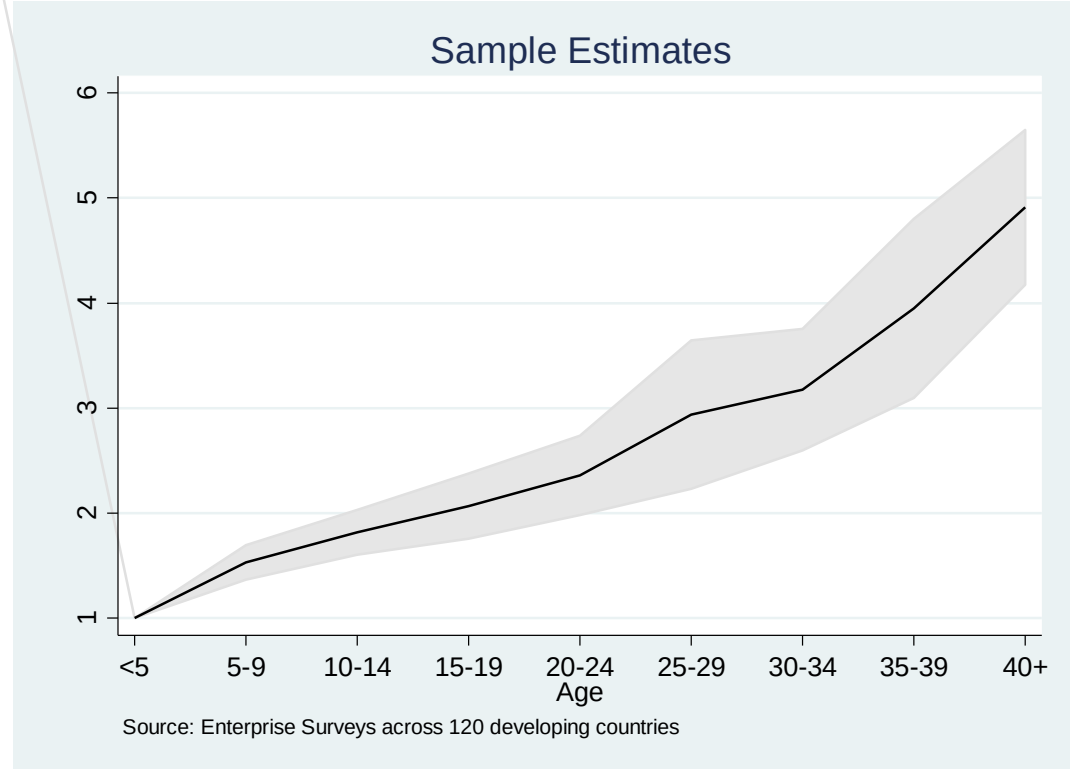

Figure 2: Firm Employment by Age - Population Estimates in 120 Developing Countries

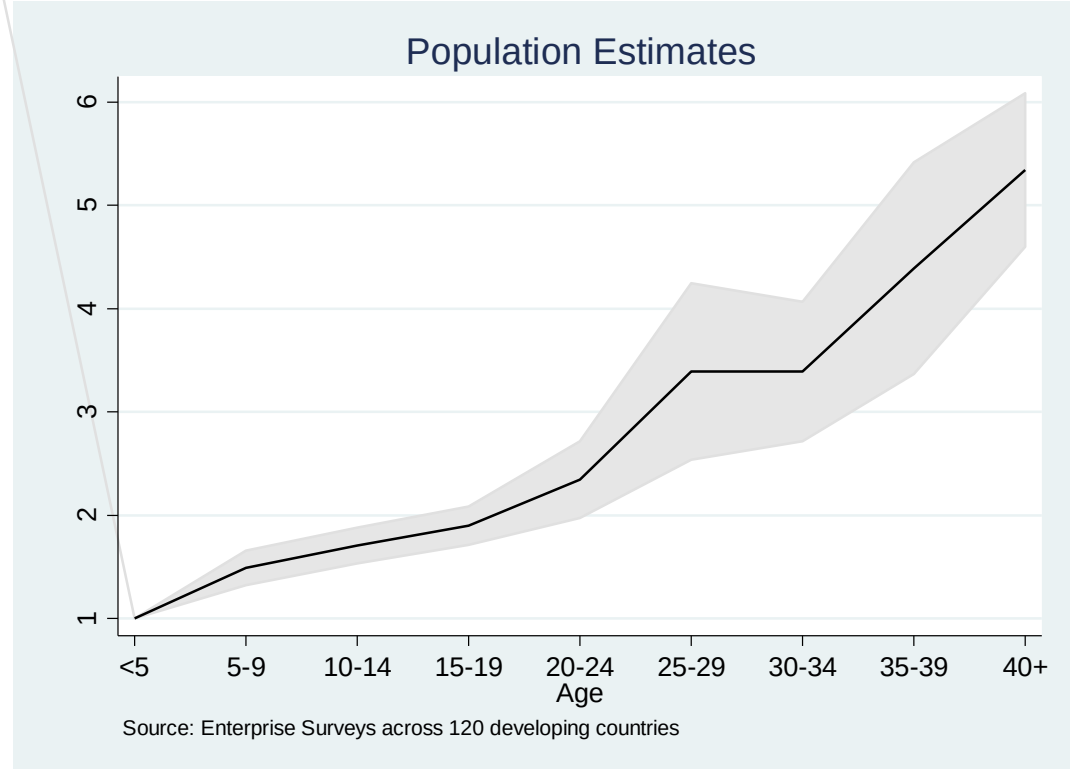

Figure 3: Firm Employment by Age – Manufacturing in 120 developing countries

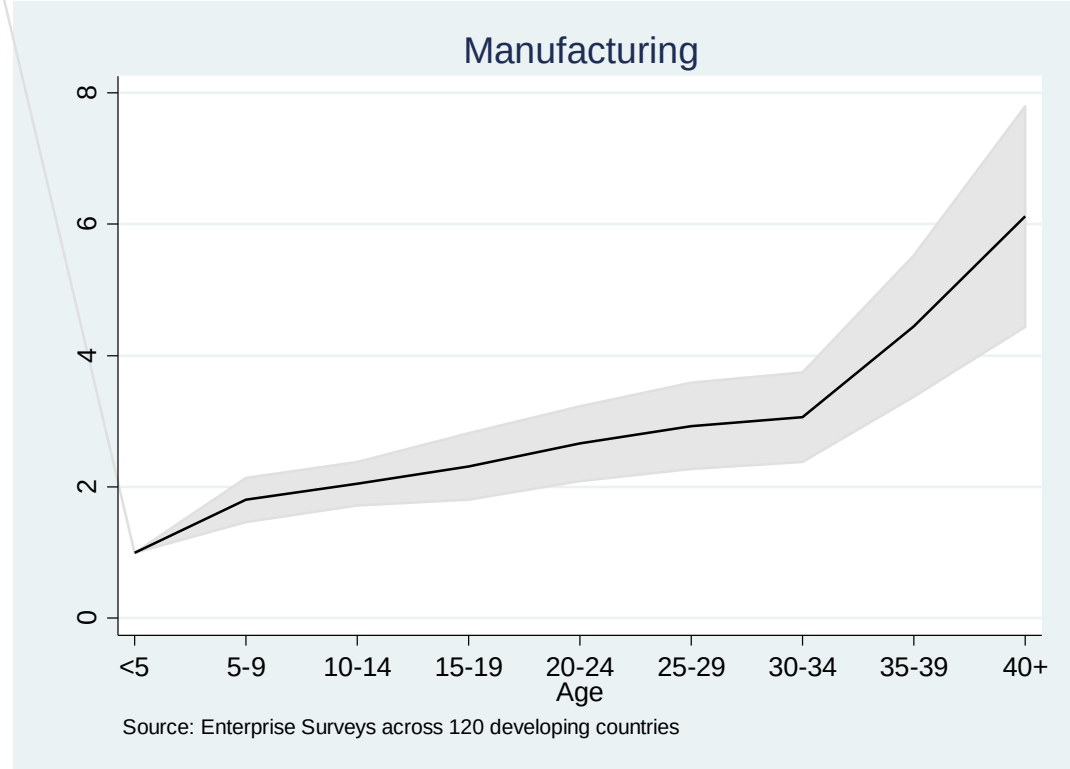

Figure 4: Firm Employment by Age – Robustness Tests

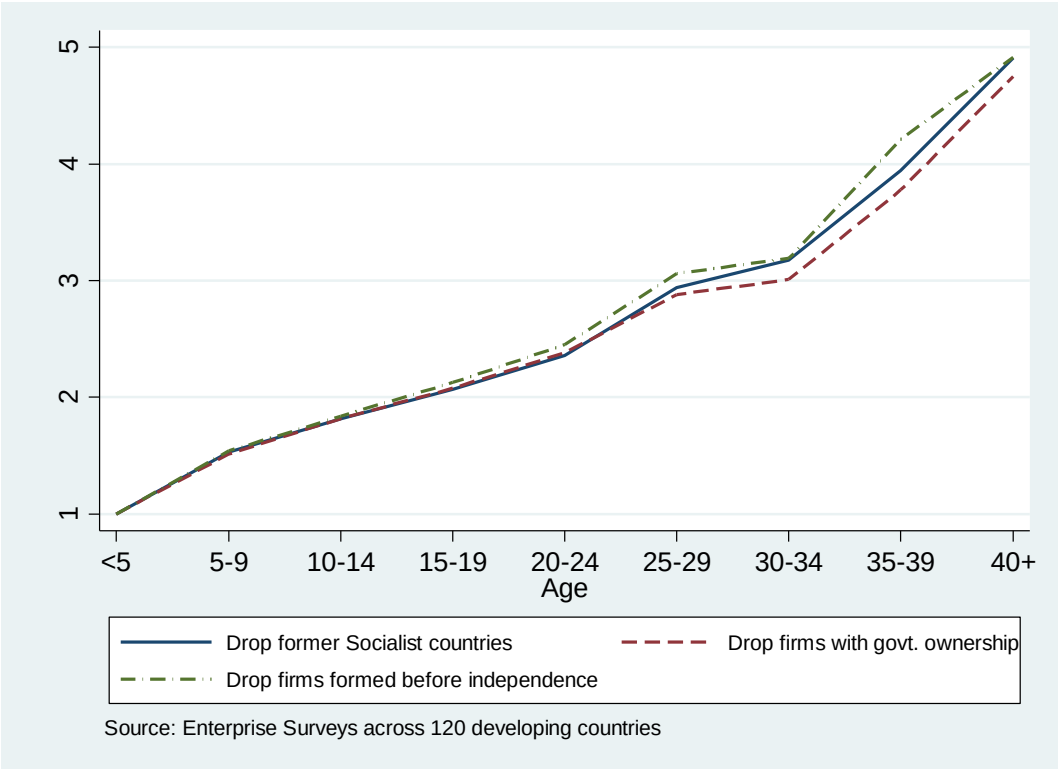

Figure 5: Firm Employment by Age - Normalize by Average Employment at Birth

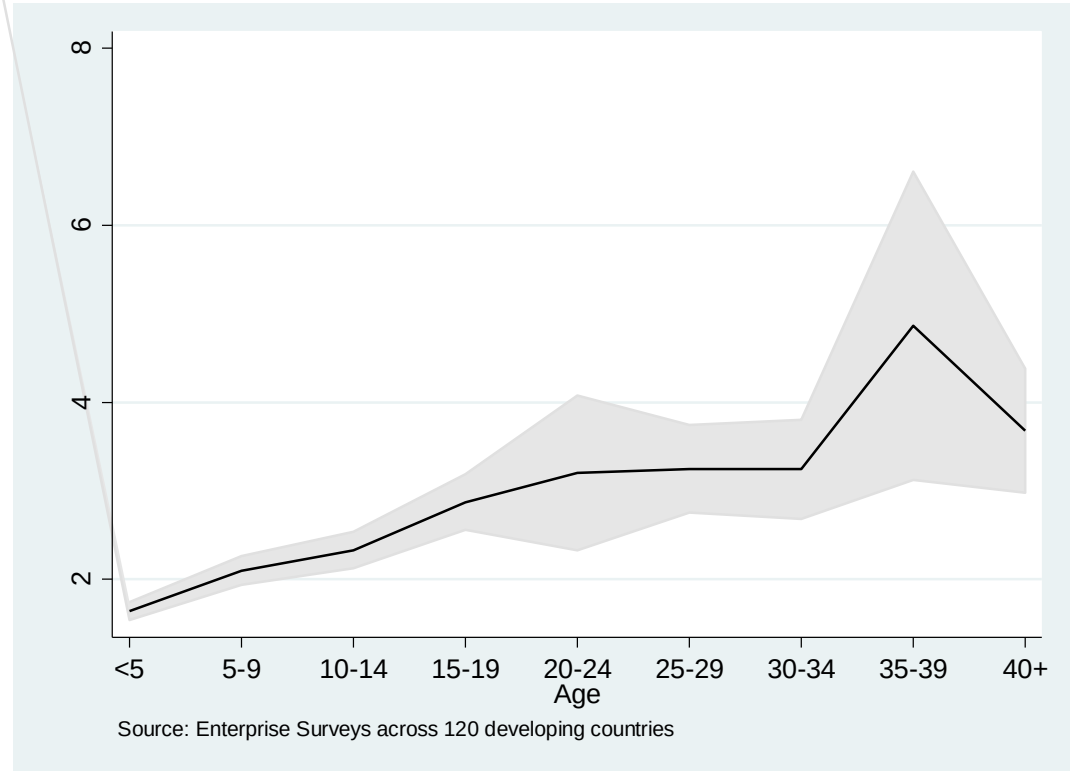

Figure 6: Labor Productivity by Age

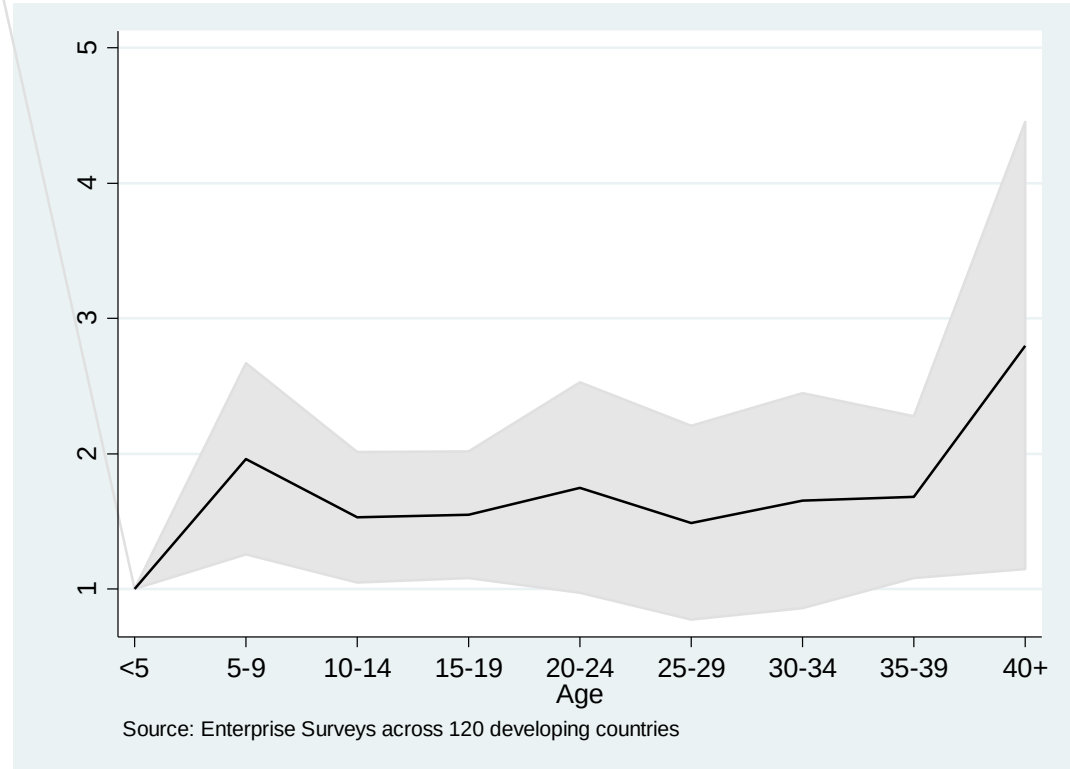

Table 1: Summary Statistics and Correlations – Cross-country Sample

The variables are defined as follows: Firm Size is the number of permanent, full-time employees in the firm where permanent, full-time employees are defined as all paid employees that are contracted for a term of one or more fiscal years and/or have a guaranteed renewal of their employment contract and that work 8 or more hours per day. Firm Size Ratio is the firm size of each firm scaled by the number of full-time employees when it started operations. Firm Age is defined as the number of years since the firm began operations in the country. Manufacturing is a dummy variable that takes the value 1 for firms in the manufacturing sector and 0 otherwise. Labor Productivity (Log) is the logarithm of the ratio of total annual sales (in USD) to number of permanent, full time employees.

Panel A: Summary Statistics

Variable	**N**	**Mean**	**Std. Dev.**	**Min**	**Max**
Firm Size	44696	59.35	125.02	3	860
Log (Firm Size)	44696	3.09	1.27	1.10	6.76
Firm Size Ratio	38932	5.64	18.15	0.006	860
Firm Age	44696	15.73	15.37	0	209
Manufacturing	44676	0.55	0.50	0	1
Labor Productivity (Log)	31020	10.08	1.95	5.81	17.36

Panel B: Correlations

	Firm Size	Log (Firm Size)	Firm Size Ratio	Firm Age	Manufacturing
Log (Firm Size)	0.760***				
Firm Size Ratio	0.351***	0.312***			
Firm Age	0.259***	0.309***	0.134***		
Manufacturing	0.103***	0.162***	0.007	0.141***	
Labor Productivity(Log)	0.084***	0.146***	0.046***	0.090***	-0.031***

*, **, and *** represent significance at 10%, 5%, and 1% levels respectively

Table 2: Firm Size and Age

This table shows results from the following regression: Firm Size = $\alpha + \beta_1$ Age Dummies + β_2 Industry Dummies + β_3Country Dummies + β_4Year Dummies + e. Firm Size is the number of permanent, full-time employees in the firm where permanent, full-time employees are defined as all paid employees that are contracted for a term of one or more fiscal years and/or have a guaranteed renewal of their employment contract and that work 8 or more hours per day. Age Dummies consist of 9 age dummies for the following age bins: <5(reference category), 5-9, 10-14, 15-19, 20-24, 25-29, 30-34, 35-39, and 40+. Manufacturing is a dummy variable that takes the value 1 for firms in the manufacturing sector and 0 otherwise. Year Dummies consist of dummies for each of the years in which the Enterprise Survey is conducted. All regressions are estimated by ordinary least squares. Robust standard errors are reported in parentheses. The square brackets in col. 1 contains a ratio of the mean size of the particular age bin to the mean size in the age bin with youngest (<5) firms.

	1	2	3	4
	Firm Size	Firm Size	Firm Size	Firm Size
			Manufacturing	Non-Manufacturing
5-9	12.805***	11.081***	14.584***	6.626***
	(1.178)	(1.178)	(1.948)	(1.389)
	[1.452]			
10-14	28.611***	22.272***	30.422***	12.945***
	(1.453)	(1.464)	(2.356)	(1.751)
	[2.010]			
15-19	35.393***	28.656***	32.279***	24.981***
	(1.782)	(1.832)	(2.687)	(2.504)
	[2.250]			
20-24	35.030***	32.225***	38.536***	25.506***
	(2.412)	(2.488)	(3.302)	(3.824)
	[2.237]			
25-29	42.667***	41.593***	46.368***	36.210***
	(2.969)	(3.049)	(3.927)	(5.029)
	[2.507]			
30-34	60.010***	55.428***	61.000***	49.566***
	(4.148)	(4.147)	(5.358)	(6.383)
	[3.119]			
35-39	65.241***	63.114***	73.153***	48.247***
	(4.808)	(4.811)	(6.395)	(7.076)
	[3.304]			
40+	127.496***	120.580***	135.790***	94.946***
	(3.852)	(3.895)	(5.004)	(6.324)
	[5.502]			
Constant	28.318***	27.983***	53.847***	1.734
	(0.758)	(4.703)	(17.833)	(2.987)
Fixed Effects	None	Country, Industry, Year	|---------- Country, Year ----------|	
N	44696	44676	24564	20112
Adjusted R-square	0.064	0.115	0.108	0.094

*, **, and *** represent significance at 10%, 5%, and 1% levels respectively.

Table 3: Firm Growth and Age

This table shows results from the following regression: Firm Size Ratio = $\alpha + \beta_1$ Age Dummies + β_2 Industry Dummies + β_3Country Dummies + β_4Year Dummies + e. Firm Size Ratio is the firm size of each firm scaled by the number of full-time employees when it started operations. Age Dummies consist of 9 age dummies for the following age bins: <5(reference category), 5-9, 10-14, 15-19, 20-24, 25-29, 30-34, 35-39, and 40+. Manufacturing is a dummy variable that takes the value 1 for firms in the manufacturing sector and 0 otherwise. Year Dummies consist of dummies for each of the years in which the Enterprise Survey is conducted. All regressions are estimated by ordinary least squares. Robust standard errors are reported in parentheses.

	1	2	3	4
	Firm Size Ratio	Firm Size Ratio	Firm Size Ratio	Firm Size Ratio
			Manufacturing	Non-Manufacturing
5-9	0.868***	0.686***	0.418*	0.870***
	(0.146)	(0.156)	(0.248)	(0.202)
10-14	2.690***	1.957***	1.439***	2.458***
	(0.219)	(0.227)	(0.284)	(0.359)
15-19	4.531***	3.719***	2.619***	5.035***
	(0.331)	(0.336)	(0.394)	(0.575)
20-24	4.061***	3.434***	3.387***	3.203***
	(0.399)	(0.413)	(0.576)	(0.519)
25-29	4.438***	4.026***	3.718***	4.413***
	(0.544)	(0.574)	(0.733)	(0.992)
30-34	5.031***	4.315***	3.715***	5.296***
	(0.516)	(0.519)	(0.609)	(1.006)
35-39	5.622***	5.186***	5.817***	3.681***
	(0.683)	(0.675)	(0.941)	(0.796)
40+	9.638***	8.621***	9.568***	6.238***
	(0.832)	(0.822)	(1.130)	(0.977)
Constant	2.922***	0.423	1.262***	0.898***
	(0.112)	(0.533)	(0.253)	(0.185)
Fixed Effects	None	Country, Industry, Year	|---------- Country, Year ---------|	
N	38932	38914	21342	17572
Adjusted R-square	0.018	0.039	0.037	0.041

*, **, and *** represent significance at 10%, 5%, and 1% levels respectively.

Table 4: Labor Productivity and Age

This table shows results from the following regression: Labor Productivity (Log) = $\alpha + \beta_1$ Age Dummies + β_2 Industry Dummies + β_3Country Dummies + β_4Year Dummies + e. Labor Productivity (Log) is the logarithm of the ratio of total annual sales (in USD) to number of permanent, full time employees. Age Dummies consist of 9 age dummies for the following age bins: <5(reference category), 5-9, 10-14, 15-19, 20-24, 25-29, 30-34, 35-39, and 40+. Manufacturing is a dummy variable that takes the value 1 for firms in the manufacturing sector and 0 otherwise. Year Dummies consist of dummies for each of the years in which the Enterprise Survey is conducted. All regressions are estimated by ordinary least squares. Robust standard errors are reported in parentheses. The square brackets in col. 1 is the % change in firm size given by 100 x (exp(b)-1) where b is the respective age coefficient.

	(1)	(2)	(3)	(4)
	Labor Productivity (Log)	Labor Productivity (Log)	Labor Productivity (Log)	Labor Productivity (Log)
5-9	0.212***	0.138***	0.100***	0.151***
	(0.037)	(0.025)	(0.034)	(0.037)
	[23.615%]			
10-14	0.417***	0.207***	0.151***	0.246***
	(0.037)	(0.026)	(0.035)	(0.040)
	[51.740%]			
15-19	0.460***	0.231***	0.176***	0.256***
	(0.040)	(0.028)	(0.038)	(0.044)
	[58.407%]			
20-24	0.388***	0.253***	0.220***	0.261***
	(0.049)	(0.036)	(0.045)	(0.065)
	[47.403%]			
25-29	0.411***	0.241***	0.194***	0.313***
	(0.056)	(0.041)	(0.049)	(0.086)
	[50.833%]			
30-34	0.445***	0.253***	0.204***	0.341***
	(0.064)	(0.046)	(0.055)	(0.091)
	[56.049%]			
35-39	0.538***	0.291***	0.267***	0.345***
	(0.076)	(0.054)	(0.064)	(0.106)
	[71.258%]			
40+	0.762***	0.413***	0.499***	0.261***
	(0.045)	(0.035)	(0.043)	(0.066)
	[114.256%]			
Constant	9.756***	7.353***	7.774***	8.579***
	(0.029)	(0.114)	(0.165)	(0.134)
Fixed Effects	None	Country, Industry, Year	|--------Country, Year----------|	
N	31020	31014	17638	13376
Adjusted R-sq	0.011	0.538	0.550	0.493

*, **, and *** represent significance at 10%, 5%, and 1% levels respectively.

Table 5: Firm Size and Lifecycle – Analysis of Variance

The table documents how firm level variables and country level variables contribute to the adjusted R-square of the following regression model when they are entered one at a time: Log Firm Size $= \alpha + \beta_1$ Firm Characteristic Dummies $+ \beta_2$ Country Characteristic Dummies + e. Log Firm Size is the logarithm of the number of permanent, full-time employees in the firm where permanent, full-time employees are defined as all paid employees that are contracted for a term of one or more fiscal years and/or have a guaranteed renewal of their employment contract and that work 8 or more hours per day. The country characteristic is captured by using one of the following variables at the country level: Country dummies, Legal Origin, Ethnic Fractionalization, or Latitude. Legal Origin takes the value one if Common law, two if French civil law, and three if Socialist law countries. Ethnic Fractionalization is the probability that two randomly selected individuals in a country are not from the same ethnic group. Latitude is the absolute value of the latitude of the country scaled between zero and one. The firm effect is captured by one of the following variables: Age, Sector, Location (City Size), Legal Organization, Ownership, and Size at birth. Age is the age of the firm since it started operations. Sector is 14 industrial sector dummies. Location is 5 dummies for capital city, city with population over 1 million, city with population over 250,000 to 1 million, city with population 50,000 to 250,000, and city with less than 50,000 population. Legal Organization is one of three values that reflects whether the firm is organized as a publicly listed company, privately held limited liability company or one of the following - sole proprietorship, partnership, or another alternative form. Ownership is one of four values reflecting whether the owner (>=50% ownership) is the state government; private domestic individuals, companies or organizations; private foreign individuals, companies or organizations; or another ownership form. Size at birth is the log of firm size when the firm started operations. We rescale Ethnic Fractionalization, Latitude, and Settler Mortality on a four-point scale using quantiles.

	1	2	3	4	5	6	7
Age Groups	All	Young (<5)	Mid-Age (5-19)	Old (20-39)	Young (<5)	Mid-Age (5-19)	Old (20-39)
Country characteristics							
Country Dummies	0.092	0.125	0.089	0.092	0.187	0.105	0.059
Legal Origin Dummies	0.008	0.018	0.017	0.014	0.056	0.04	0.015
Ethnic Fractionalization Dummies	0.023	0.037	0.021	0.009	0.097	0.041	0.009
Latitude Dummies	0.004	0.018	0.009	0.01	0.035	0.01	0.001
Settler Mortality Dummies					0.044	0.024	0.016
Legal Origin, Latitude, Ethnic Fractionalization Dummies	0.029	0.045	0.033	0.022			
Legal Origin, Latitude, Ethnic Fractionalization, Settler Mortality Dummies					0.127	0.075	0.037
Firm-level characteristics							
Age	0.068						
Sector Dummies	0.046	0.051	0.041	0.026	0.069	0.033	0.017
Location (City Size) Dummies	0.005	0.002	0.002	0.01	0.014	0.009	0.008
Ownership Dummies	0.039	0.05	0.044	0.026	0.084	0.052	0.038
Legal Organization Dummies	0.101	0.05	0.086	0.154	0.097	0.104	0.148
Log (Size at birth)	0.357	0.522	0.373	0.272	0.577	0.429	0.273
All firm-level characteristics together	0.423	0.511	0.389	0.346	0.62	0.487	0.37
N	33982	6119	20144	5724	2234	8352	3896

Table 6: Firm Growth and Lifecycle – Analysis of Variance

The table documents how firm level variables and country level variables contribute to the adjusted R-square of the following regression model when they are entered one at a time: Size Ratio = $\alpha + \beta_1$ Firm Characteristic Dummies + β_2 Country Characteristic Dummies + e. Firm Size Ratio is the firm size of each firm scaled by the number of full-time employees when it started operations. The country characteristic is captured by using one of the following variables at the country level: Country dummies, Legal Origin, Ethnic Fractionalization, or Latitude. Legal Origin takes the value one if Common law, two if French civil law, and three if Socialist law countries. Ethnic Fractionalization is the probability that two randomly selected individuals in a country are not from the same ethnic group. Latitude is the absolute value of the latitude of the country scaled between zero and one. The firm effect is captured by one of the following variables: Age, Sector, Location (City Size), Legal Organization, Ownership, and Size at birth. Age is the age of the firm since it started operations. Sector is 14 industrial sector dummies. Location is 5 dummies for capital city, city with population over 1 million, city with population over 250,000 to 1 million, city with population 50,000 to 250,000, and city with less than 50,000 population. Legal Organization is one of three values that reflects whether the firm is organized as a publicly listed company, privately held limited liability company or one of the following - sole proprietorship, partnership, or another alternative form. Ownership is one of four values reflecting whether the owner (>=50% ownership) is the state government; private domestic individuals, companies or organizations; private foreign individuals, companies or organizations; or another ownership form. Size at birth is the log of firm size when the firm started operations. We rescale Ethnic Fractionalization, Latitude, and Settler Mortality on a four-point scale using quantiles.

		1	**2**	**3**	**4**	**5**	**6**
Age Groups	**All**	**Young (<5)**	**Mid-Age (5-19)**	**Old (20-39)**	**Young (<5)**	**Mid-Age (5-19)**	**Old (20-39)**
Country characteristics							
Country Dummies	0.023	0.012	0.023	0.029	0.018	0.021	0.021
Legal Origin Dummies	0.001	0.002	0.004	0.001	0	0.001	0.001
Ethnic Fractionalization Dummies	0.006	0.001	0.006	0.004	0.002	0.012	0.006
Latitude Dummies	0.002	0.004	0.006	0.004	-0.001	0.001	0.001
Settler Mortality Dummies					0.003	0.012	0.013
Legal Origin, Latitude, Ethnic Fractionalization Dummies	0.008	0.004	0.009	0.009			
Legal Origin, Latitude, Ethnic Fractionalization, Settler Mortality Dummies					0.004	0.014	0.013
Firm-level characteristics							
Age	0.018						
Sector Dummies	0.002	0.004	0.004	0.002	0.001	0.003	0.004
Location (City Size) Dummies	0.001	0	0.001	0	0	0.002	0
Ownership Dummies	0	0	0.001	0	0.001	0.001	0
Legal Organization Dummies	0.008	0.003	0.007	0.013	0.005	0.012	0.019
Log (Size at birth)	0.034	0.032	0.038	0.048	0.031	0.030	0.049
All firm-level characteristics together	0.075	0.046	0.059	0.075	0.056	0.058	0.086
N	33982	6119	20144	5724	2234	8352	3896

Table 7: Productivity and Lifecycle – Analysis of Variance

The table documents how firm level variables and country level variables contribute to the adjusted R-square of the following regression model when they are entered one at a time: Labor Productivity = $\alpha + \beta_1$ Firm Characteristic Dummies + β_2 Country Characteristic Dummies + e. Labor Productivity (Log) is the logarithm of the ratio of total annual sales (in USD) to number of permanent, full time employees. The country characteristic is captured by using one of the following variables at the country level: Country dummies, Income Dummies, Legal Origin, Ethnic Fractionalization, or Latitude. Country Income Dummies consists of 4 dummies for low income, lower middle income, upper middle income, and high income countries. Legal Origin takes the value one if Common law, two if French civil law, and three if Socialist law countries. Ethnic Fractionalization is the probability that two randomly selected individuals in a country are not from the same ethnic group. Latitude is the absolute value of the latitude of the country scaled between zero and one. The firm effect is captured by one of the following variables: Sector, Location (City Size), Legal Organization, Ownership, and Size at birth. Sector is 14 industrial sector dummies. Location is 5 dummies for capital city, city with population over 1 million, city with population over 250,000 to 1 million, city with population 50,000 to 250,000, and city with less than 50,000 population. Legal Organization is one of three values that reflects whether the firm is organized as a publicly listed company, privately held limited liability company or one of the following - sole proprietorship, partnership, or another alternative form. Ownership is one of four values reflecting whether the owner (>=50% ownership) is the state government; private domestic individuals, companies or organizations; private foreign individuals, companies or organizations; or another ownership form. Size at birth is the firm size when the firm started operations. We rescale Size at birth, Ethnic Fractionalization, Latitude, and Settler Mortality on a four-point scale using quantiles. We use dummy variables for all the country and firm variables.

Age Groups	**All**	**Young (<5)**	**Mid-Age (5-19)**	**Old (20-39)**	**Young (<5)**	**Mid-Age (5-19)**	**Old (20-39)**
Country characteristics							
Country Dummies	0.524	0.559	0.519	0.520	0.628	0.569	0.501
Legal Origin Dummies	0.048	0.086	0.051	0.032	0.186	0.102	0.032
Ethnic Fractionalization Dummies	0.011	0.016	0.013	0.019	-0.000	0.010	0.021
Latitude Dummies	0.002	0.012	0.005	0.013	0.022	0.042	0.037
Settler Mortality Dummies					0.007	0.058	0.063
Legal Origin, Latitude, Ethnic Fractionalization Dummies	0.069	0.118	0.076	0.076			
Legal Origin, Latitude, Ethnic Fractionalization, Settler Mortality Dummies					0.251	0.206	0.124
Firm-level characteristics							
Age	0.003						
Sector Dummies	0.026	0.031	0.027	0.022	0.024	0.018	0.014
Location (City Size) Dummies	0.009	0.036	0.009	0.008	0.106	0.043	0.009
Ownership Dummies	0.004	0.006	0.003	0.004	0.013	0.002	0.004
Legal Organization Dummies	0.023	0.045	0.016	0.027	0.022	0.005	0.014
Log (Size at birth)	0	0.003	0.000	-0.000	0.014	0.001	0
All firm-level characteristics together	0.063	0.105	0.055	0.061	0.149	0.070	0.046
N		4218	13848	4035	1521	5521	2657

Table 8: Productivity Dispersion and Olley-Pakes Covariance Term

This table presents the standard deviation in (log) labor productivity and the covariance term from the Olley-Pakes decomposition in each country-age bin. Labor Productivity (Log) is the logarithm of the ratio of total annual sales (in USD) to number of permanent, full time employees. The Olley-Pakes covariance term is the difference between the weighted average of firm-level (log) labor productivity and the un-weighted average firm-level (log) labor productivity in each country-age bin. The weights used are the employment share of each firm in that country-age bin.

	STD in Labor Productivity (Log)			**Olley-Pakes Covariance**		
Nation	**<5**	**5-19**	**20-39**	**<5**	**5-19**	**20-39**
N	92	92	89	92	92	89
min	0.212	0.504	0.515	-6.734	-5.509	-7.082
Mean	1.392	1.331	1.305	-1.464	-0.857	-0.840
Median	1.342	1.274	1.166	-0.858	-0.606	-0.263
max	3.170	3.192	3.216	1.548	1.299	1.154

Appendix Table A1: Summary Statistics on Firm Employment by Age

Panel A: Across income groups

Age	Index of Employment = Mean employment for firms in that age bin/Mean employment for firms				
	Full Sample	Low Inc	Lower-Middle Inc	Upper-Middle Inc	High Inc
<5	1	1	1	1	1
5-19	1.482	1.578	1.343	1.570	1.413
20-24	1.703	1.921	1.735	1.561	1.535
15-19	1.895	1.769	1.998	1.907	1.818
20-24	2.330	2.427	2.061	2.508	2.474
25-29	3.349	2.890	3.828	3.545	2.048
30-34	3.371	3.825	3.473	3.251	1.662
35-39	4.370	4.194	3.904	4.109	7.490
40+	5.304	4.823	4.676	5.502	7.684
# of countries	118	31	38	38	11

Panel B: Across Regions

Age	Index of Employment = Mean employment for firms in that age bin/Mean employment for firms					
	SAR	MNA	LAC	ECA	EAP	AFR
<5	1	1	1	1	1	1
5-19	1.019	1.261	1.483	1.377	1.597	1.587
20-24	1.438	2.153	1.827	1.645	1.529	1.708
15-19	2.010	1.418	2.140	1.736	1.733	1.859
20-24	2.044	1.194	2.640	2.129	1.796	2.407
25-29	1.872	1.957	2.875	4.465	2.038	3.592
30-34	2.236	1.533	3.452	2.877	2.601	3.944
35-39	1.851	2.232	3.386	6.094	2.873	4.979
40+	4.476	1.555	4.618	7.338	3.078	4.982
# of countries	4	2	31	30	10	41

Appendix Table A2: (Log) Firm Size and Age

This table shows results from the following regression: Firm Size = $\alpha + \beta_1$ Age Dummies + β_2 Industry Dummies + β_3Country Dummies + β_4Year Dummies + e. Firm Size is the logarithm of the number of permanent, full-time employees in the firm where permanent, full-time employees are defined as all paid employees that are contracted for a term of one or more fiscal years and/or have a guaranteed renewal of their employment contract and that work 8 or more hours per day. Age Dummies consist of 9 age dummies for the following age bins: <5(reference category), 5-9, 10-14, 15-19, 20-24, 25-29, 30-34, 35-39, and 40+. Manufacturing is a dummy variable that takes the value 1 for firms in the manufacturing sector and 0 otherwise. Year Dummies consist of dummies for each of the years in which the Enterprise Survey is conducted. All regressions are estimated by ordinary least squares. Robust standard errors are reported in parentheses. The square brackets in col. 1 is the % change in firm size given by 100 x (exp(b)-1) where b is the respective age coefficient.

	(1)	(2)	(3)	(4)
	Log (Firm Size)	Log (Firm Size)	Log (Firm Size)	Log (Firm Size)
			Manufacturing	Non-Manufacturing
5-9	0.284***	0.242***	0.260***	0.197***
	(0.016)	(0.015)	(0.023)	(0.020)
	[32.843%]			
10-14	0.536***	0.413***	0.429***	0.369***
	(0.017)	(0.017)	(0.025)	(0.023)
	70.916%			
15-19	0.654***	0.527***	0.498***	0.542***
	(0.020)	(0.020)	(0.028)	(0.028)
	[94.527%]			
20-24	0.661***	0.573***	0.603***	0.516***
	(0.026)	(0.026)	(0.033)	(0.042)
	[93.673%]			
25-29	0.798***	0.722***	0.724***	0.695***
	(0.030)	(0.030)	(0.038)	(0.051)
	[122.109%]			
30-34	0.947***	0.812***	0.782***	0.898***
	(0.037)	(0.036)	(0.045)	(0.060)
	[157.796%]			
35-39	1.015***	0.913***	0.962***	0.824***
	(0.042)	(0.041)	(0.053)	(0.067)
	[175.936%]			
40+	1.574***	1.371***	1.440***	1.267***
	(0.027)	(0.027)	(0.035)	(0.047)
	[382.591%]			
Constant	2.566***	2.495***	2.901***	1.814***
	(0.011)	(0.073)	(0.157)	(0.078)
Fixed Effects	None	Country, Industry, Year	|------- Country, Year --------|	
N	44696	44676	24564	20112
adj. R-sq	0.101	0.218	0.191	0.182