BACKGROUND PAPER

Entrepreneurship and Economic Growth: A Cross-Section Empirical Analysis

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DISCLAIMER

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August 2022

Abstract

Entrepreneurship, or the activity of starting and running a business, is a vital ingredient of economic growth and development. Entrepreneurs contribute to innovation, and they are central to dynamic Schumpeterian competition and broader economic dynamism. In this paper, we contribute to the entrepreneurship literature by performing cross-section empirical analysis to examine the link between entrepreneurship and economic growth. We divide total early-stage entrepreneurship into opportunity-driven entrepreneurship versus necessity-driven entrepreneurship, and our sample economies into advanced economies versus developing economies. We do not find evidence of a positive link between aggregate entrepreneurship and economic growth. This is consistent with the hugely heterogenous nature of entrepreneurial activity. At a broader level, our empirical evidence points to the importance of distinguishing between different types of entrepreneurship and different groups of economies. In particular, for developing economies where manufacturing is relatively important, we find that opportunity-driven entrepreneurship is positively linked with growth. Intuitively, big scientific advances in the manufacturing sector create a lot of opportunities for innovative entrepreneurs, whereas other entrepreneurs gradually adapt to the slower pace of technological progress in the services sector.

JEL Codes
L26, M13, O47

Keywords
entrepreneurship, economic growth, development

I. INTRODUCTION

Entrepreneurship, or the activity of starting and running a business, is a vital ingredient of economic growth and development. Entrepreneurs contribute greatly to innovation, and they are central to dynamic Schumpeterian competition and economic dynamism. Innovative entrepreneurs are the principal agents of the never-ending Schumpeterian process of new products, services, technologies, firms, and industries replacing existing products, services, technologies, firms, and industries. Fortune 100 is replete with new companies that are using new technologies to produce and sell new products. Just as Fortune 100 of 1970 is unrecognizable today, today's Fortune 100 will be unrecognizable in 2070. Behind the constant emergence of new companies with new technologies and new products are visionary, game-changing, risk-taking entrepreneurs such as Steve Jobs who started Apple with his friends in the garage of a suburban California home. Competition forces even mundane, ordinary entrepreneurs such as street food vendors to innovate. Therefore, the contribution of entrepreneurship to the economy is not confined to transformational entrepreneurs.

Despite their significant contribution to innovation and economic growth, entrepreneurship was a relatively under-researched and under-appreciated. This is partly because of lack of data until recent years when the Global Entrepreneurship Monitor (GEM) and other entrepreneurship databases were developed. At a broader level, the lack of research and appreciation reflects the innate difficulty of quantifying entrepreneurship and the factors which motivate entrepreneurs to become entrepreneurs. Further, entrepreneurship is difficult to explain as a rational endeavor because most new businesses fail. Becoming an entrepreneur thus requires irrational exuberance or optimism. Yet another possible reason for why economists tended to neglect entrepreneurship is its tremendous diversity. Entrepreneurs range from street food vendors to transformational innovators such as Elon Musk, making it difficult to clearly conceptualize entrepreneurship. While mundane entrepreneurs contribute a lot to the economy, game-changing entrepreneurs contribute disproportionately to innovation, productivity growth, and economic dynamism.

Transformational entrepreneurs are often the first to take risk and seize unrecognized opportunities despite the low probability of success. Bold visionary creative entrepreneurs think outside the box and create new products, services, and industries. For instance, Ted Turner created a cable TV network that broadcast news 24 hours a day and 7 days a week at a time when most people only watched the news on TV on evenings. Yet four decades later, 24/7 news channels have become a part of daily life. Entrepreneurs are adept at commercializing new technology into products and services that are useful for consumers. Commercially successful applications of the internet such as Amazon and Google are classic examples. While the public sector played a big role

in the development of the basic internet technology, entrepreneurs were responsible for the bulk of its myriad commercial applications. In addition to products that consumers find useful, entrepreneurs produce products that address humanity's most urgent challenges. One prominent example is the coronavirus disease (COVID-19) vaccine produced by the German biotech start-up BioNTech founded by two innovative entrepreneurs, Dr. Ugur Sahin and Dr. Ozlem Tureci. By fostering knowledge spillovers and radical innovations, innovative entrepreneurs contribute greatly to economic growth, employment creation, productivity, and social welfare in economies of all income and development levels (Kritikos 2014). The distinction between everyday entrepreneurs and innovative entrepreneurs is not always clear-cut. For instance, creative street food vendors who invent uniquely delicious dishes become influential restaurateurs. Nevertheless, a relatively small group of highly productive entrepreneurs account for the lion's share of entrepreneurship's contribution to the economy.

The vital role of entrepreneurship in economic growth and development, combined with its neglect in economic research, is a powerful motive for delving into entrepreneurship in developing Asia. Entrepreneurship holds the key to the emergence and development of a vibrant private sector, an indispensable ingredient of sustained growth. The advent of digital entrepreneurship in recent years means that now is an especially opportune time to analyze why individuals start new businesses. Information and communication technology (ICT) or digital technology has drastically reduced the cost of starting a business since it reduces the need for brick-and-mortar stores and other physical facilities. More fundamentally, ICT reduces the costs of information and communication and thus promotes productivity. Specific benefits to entrepreneurs include expansion of market access at low cost, better coordination with other players, and exposure to new innovative ideas. Further, digital technology contributed greatly to entrepreneurial resilience during COVID-19. By lowering the barriers to entry into an industry, ICT can foster inclusive growth and development. For instance, ICT can open up entrepreneurial opportunities for the poor and women. Standing in the way of this promise is the digital divide which remains a major barrier to ICT-enabled entrepreneurship. However, good digital infrastructure alone does not automatically invigorate entrepreneurship.

Digital technology is not a panacea for lack of entrepreneurship because the level of entrepreneurial activity in a society is influenced by a multitude of factors. To become an entrepreneur or not is fundamentally an individual decision. Talented individuals who become game-changing innovative entrepreneurs have plenty of opportunities as highly paid workers. Their risky decision to start their own business instead is shaped by not only their own values but formal and informal institutions, social norms, and the overall business environment (Baumol and Strom 2008,

Acs et al. 2008). The same is true for everyday entrepreneurs. The enabling entrepreneurial ecosystem is constantly evolving. In recent years, organizational innovations such as venture accelerators and crowdfunding improved the entrepreneurial climate. Technological innovations such as the emergence of 5G also affect the climate. While it is difficult to pin down why some individuals start a business while others do not, what is certain is that the decision to become an entrepreneur is inherently a complex, multidimensional process.

The rest of this paper is organized as follows. Section II reviews the literature on entrepreneurship and economic growth. Section III discusses data and empirical framework, and section IV reports and discusses the empirical results. Finally, section V concludes.

II. LITERATURE REVIEW

Although entrepreneurship is a relatively under-researched topic in economics, there is nevertheless a sizable and growing literature on the relationship between entrepreneurship and economic growth. Much of the empirical analysis is based on cross-section regressions that use indices of entrepreneurial activity for each economy published annually in the GEM. Overall, there is empirical evidence which suggests that economies with higher levels of entrepreneurial activity tend to grow faster. However, the evidence is not definitive because some studies do not find a significant positive relationship between entrepreneurship and economic growth. Further, given the heterogeneity of entrepreneurship, one should be careful about drawing blanket conclusions because different strands of entrepreneurship are likely to influence growth in different ways. Further, the relationship between entrepreneurship and growth may differ in economies of different income and development levels.

Schumpeter (1942) and Baumol (1990) recognized the central role of entrepreneurship in economic growth and development. According to Schumpeter, entrepreneurship holds the key to economic growth and development. More precisely, he viewed innovative game-changing entrepreneurs as the main drivers of technological, societal, and human progress. Put differently, creative entrepreneurs are the catalysts of the never-ending process of creative destruction in which new products and technologies constantly drive out existing products and technologies. In the Schumpeterian framework, entrepreneurship and innovation are inextricably linked with each other. Baumol (1990) pointed out that some kinds of entrepreneurship are socially more productive than others. He emphasized that the overall entrepreneurial environment was a major factor in determining what kind of entrepreneurial activity will dominate in an economy.

Acs (2006) argues that economic development depends on combination of successful entrepreneurs and successful corporations. Using cross-sectional time series panel of economy-

specific measures of entrepreneurship, Acs et al. (2005) find that entrepreneurial activity makes a positive contribution to economic growth. They conclude that this is consistent with the notion that entrepreneurship serves as a conduit for the knowledge spillovers which foster productivity growth. Using a Schumpeterian approach to link gross domestic product (GDP), innovation, and entrepreneurship, Galindo and Méndez (2013) conducted a study of 13 developed economies for 2002–2007. Their analysis shows that several factors, including monetary policy and social climate, have a positive impact on innovation and entrepreneurship. They observed a feedback effect, which was significant. Economic activity promotes entrepreneurship and innovation, which, in turn, promote economic activity.

Valliere and Peterson (2009) examined the impact of different types of entrepreneurship on GDP growth in 44 emerging and developed economies for 2004 to 2005 using GEM data. They also include additional control variables from Global Competitiveness Report. They found that high-performing entrepreneurs account for a significant portion of economic growth in developed economies. However, the positive impact of entrepreneurs on growth is not found in emerging economies. Using 14 different indicators of entrepreneurship, Doran et al. (2018) analyze whether different measures of entrepreneurship can explain economic growth across an unbalanced panel of high-income and middle- and low-income economies in 2004–2011. They find that entrepreneurial activity fosters growth in high-income economies but not in in middle- and low-income economies. On the other hand, Adusei (2016) finds that entrepreneurship has a strong positive impact on the growth of 12 African economies.

Salgado-Banda (2007) examined the impact of entrepreneurship on economic growth in 22 Organisation for Economic Co-operation and Development economies employing a new variable based on patent data to proxy for productive entrepreneurship and self-employment as an alternative proxy. He finds that the proposed measure of productive entrepreneurship and economic growth have a positive relationship. The alternative measure, based on self-employment, appears to be negatively correlated with economic growth. Using panel data from 2002 to 2018 and 22 European economies, Stoica, Roman, and Rusu (2020) find that entrepreneurship has a positive effect on economic growth. In particular, their evidence suggests that early-stage and opportunity-driven entrepreneurship promotes growth in the sample economies.

Most of the earlier studies on entrepreneurship and economic growth were centered on developed economies rather than developing economies. Empirically, the effect of entrepreneurship on growth in developing economies remains uncertain and further research is needed. According to the analysis of Stam and van Stel (2011), entrepreneurship does not influence the growth of middle-income economies but contributes to the growth of high-income economies. Lerner and Schoar

(2010) note that it is imperative to understand the dynamic interaction between environmental factors such as market regulation and entrepreneurship to better assess the impact of entrepreneurs on growth in developing nations. Acs (2010) observed an S-shaped relationship between entrepreneurship and economic development. In the initial stage of development, entrepreneurship plays a visible role, but its role increases at a decreasing rate as the efficiency stage takes hold. However, as the economy moves from the efficiency-driven stage to the innovation- or knowledge-driven stage, entrepreneurship reassumes a more important role which increases at an increasing rate. According to Acemoglu and Johnson (2005), as institutions are strengthened, more and more entrepreneurial activity is shifted toward productive entrepreneurship, thus promoting economic development. This burst of entrepreneurial activity gains momentum through the efficiency-driven stage and culminates in a high level of innovation when entrepreneurship eventually levels out.

Koster and Rai (2008) expect rates of entrepreneurship to decline with economic development which opens employment possibilities, and thus reduces the need to become entrepreneurs out of economic necessity. However, this pattern is not consistent with the Indian experience. Rather, entrepreneurship appears to be an important driver of economic growth. One possible explanation is that India is a service-based economy, which makes it easier for small business to exist. Although the level of entrepreneurship has increased over time, the quality of small firms and the share of registered firms has remained stable. The authors believed that whether entrepreneurship plays the same positive role in developing economies as it does in developed economies remains an open question. Van Stel, Carree, and Thurik (2005) show that the effect of entrepreneurship on economic growth depends on the economy's level of development as measured by GDP per capita. The authors find a much more limited impact of entrepreneurship on growth in poor economies. The authors attribute the limited impact to the lack of large companies and lower levels of human capital.

The findings of Sautet (2013) lend further support to the lack of growth-enhancing effect of entrepreneurship in developing economies. In many low-income economies, one can observe the coexistence of productive entrepreneurship and chronic underdevelopment, which is somewhat puzzling. The puzzle can be explained by the notions of local versus systemic entrepreneurship. He explains how, using recent research on social cooperation mechanisms, as well as network and firm theories, local entrepreneurship does not result in the economies of scale and scope associated with fast-growing firms. This is because rapid growth can only be achieved in the presence of systemic entrepreneurship, which captures opportunities that are broad enough to exist over an expanded space and extend beyond the entrepreneur's immediate community.

Extensive analysis over the last 25 years (1992–2016) by Urbano et al. (2019) reveal that institutions could be related to economic growth through entrepreneurship. This opens up new research questions about which institutional factors are conducive to growth-fostering entrepreneurship. Baumol and Strom (2008) confirm the importance of conducive institutions which attract socially productive entrepreneurial activity. Institutional factors such as excessive government regulation, ill–defined and poorly enforced property rights, and policy regime uncertainty are major impediments to systemic entrepreneurship. This is consistent with a growing broader literature which points to institutional weaknesses as the fundamental cause of underdevelopment [refer to, for example, Acemoglu et al. (2005) and Henrekson and Sanandaji (2011)].

According to ADB (2020), strong institutions enable innovative entrepreneurs. The quality of entrepreneurship in an economy is more important for innovation than its quantity. In terms of economic contribution, not all entrepreneurship is created equal. A small group of entrepreneurs known as "gazelles" in the business world account for most of the innovation and job growth, while the majority of entrepreneurs neither innovate nor create jobs. The ability of an economy to breed gazelles is largely determined by its institutional conditions. According to an analysis of over 36,000 businesses in 17 Asian economies, strong property rights and the rule of law encourage entrepreneurs to formalize their businesses, and greater formalization is associated with greater innovation.

A large and growing strand of literature points to the importance of new business creation in economic prosperity. Ribeiro-Soriano (2017) points out that new small businesses play a vital role in increasing competition in emerging sectors and enhancing an economy’s overall innovative capacity. While aggregate-level linkages between entrepreneurship and economic development are interesting and significant, entrepreneurship is essentially a firm-level phenomenon. The initiatives and decisions of individual entrepreneurs affect their own firms and other firms they interact with. The entrepreneurial activity of small firms serves as agents of change and innovation within the economy [refer to, for example, Acs (1992) and Carree and Thurik (2010)]. Carree and Thurik (1998) examined the relationship between the share of small firms in an industry, a rough measure of entrepreneurship, and aggregate industry output growth. Analyzing a sample of 14 manufacturing industries in 13 European economies, the authors found that a higher share of small business at the beginning of the 1990s led to higher aggregate output growth in the subsequent 3–4 years.

According to the National Bureau of Economic Research (2022), innovation and entrepreneurship are ubiquitous, especially in some regions like Silicon Valley. At the same time, many indicators of economic performance, such as productivity growth, have seen limited growth at best. This apparent paradox can be explained by dramatic heterogeneity across sectors. Some

industries are seeing robust innovation and entrepreneurship. These consist of manufacturing, agriculture, and ICT. Yet industries such as creative industries, logistics and delivery services, and the broader retail sector are followers and adopters. And yet other industries such as education, health, and public and social services are stagnating. Understanding the sector-by-sector potential for growth helps us understand the cumulative impact of innovation and entrepreneurship on overall economic performance.

Research into the phenomenon of innovative high-growth firms is recently gaining traction. These firms account for much of job and output creation in both high-income and developing economies. ADB (2020) and Wong et al. (2005) found out that, among four types of entrepreneurships, only high-growth potential entrepreneurship has a significant impact on economic growth. These findings are consistent with existing studies which find that fast-growing new firms, not new firms in general, account for most of the new jobs created by small and medium-sized enterprises in advanced economies. In-depth studies of firm dynamics in selected developing economies in South America, Africa, Asia, and the Middle East reveal that high-growth new firms are not only powerful engines of job and output growth, but they also create positive spillovers for other businesses along the value chain (Grover et al. 2019). De Nicola et al. (2021) analyzed Hungarian administrative microdata and found evidence for stronger productivity growth for firms operating in industries with more high-growth firms.

Parida et al. (2017) point out that start-ups often engage in networking to overcome resource constraints, especially in creative, innovation-based industries. However, successful networking requires network capabilities, defined as the ability to manage and gain benefits from external relationships. Their analysis confirms the importance of network capabilities for the innovativeness of start-ups. Using a unique longitudinal dataset covering 1996–2016, Shkolnykova and Kudic (2021) find that small and medium-sized enterprises, which produced radical innovations in the German biotech sector, enjoy superior innovation performance in subsequent periods. Further, firms that cooperate directly with radical innovators enjoy higher innovation performance than firms that do not.

III. DATA AND EMPIRICAL FRAMEWORK

Our paper performs cross-section empirical analysis to identify the effect of entrepreneurship on economic growth. In line with existing literature, our key independent variables are total early-stage entrepreneurship (TEA), which consists of opportunity-driven early-stage entrepreneurship (OEA) and necessity-driven early-stage entrepreneurship (NEA; refer to, for example, Wong et al. 2005 and Valliere and Peterson 2009). Data on these entrepreneurship variables were collected

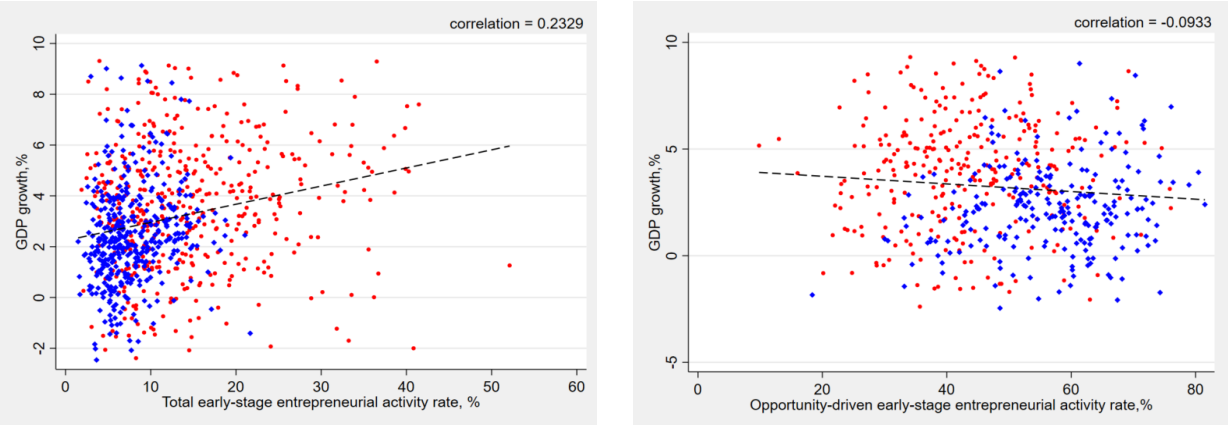
from the GEM, the most widely used source of entrepreneurship data.[1] The key dependent variables are GDP growth and GDP per capita growth, the two most widely used measures of economic growth. Data on these indicators were taken from the World Bank's World Development Indicators database.

We also divide the economy sample into advanced versus emerging and developing economies. In addition, we consider the economic structure of an economy. More specifically, we incorporate the relative importance of different sectors such as manufacturing and services in an economy's GDP. Our empirical analysis is based on panel data spanning 19 years (2001–2019) and covering 111 economies.

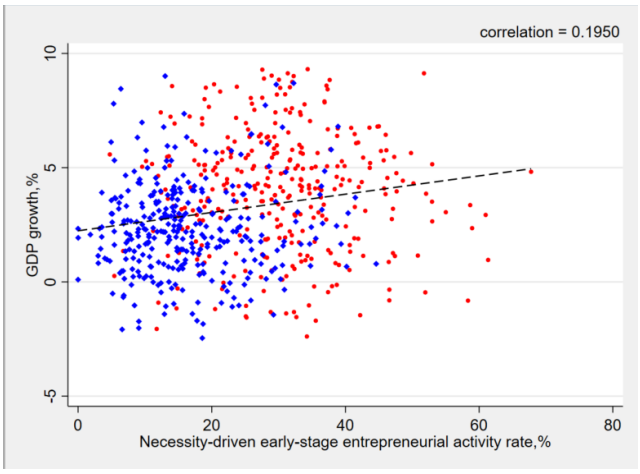
Figures 1 and 2 illustrate the relationship between economic growth and entrepreneurship. There is a positive relationship between all economic growth and both total early-stage of entrepreneurial activity and necessity-driven early-stage entrepreneurial activity. On the other hand, there is a negative link between opportunity driven early-stage entrepreneurial activity and economic growth. These cross-section patterns point to a need to control for economy's income levels and entrepreneurial types in econometric estimation. The emerging and developing economies, shown as red dots, form a cluster that is distinct from the advanced economies, shown as blue dots. The different types of entrepreneurship also display different patterns. Nevertheless, the simple correlations provide very limited support for a positive link between entrepreneurship, especially total entrepreneurship, and economic growth.

Figure 1: Type of Entrepreneurship and Gross Domestic Product Growth, 2001–2019

Across economies, GDP growth increases with the early-stage entrepreneurship activity rate.



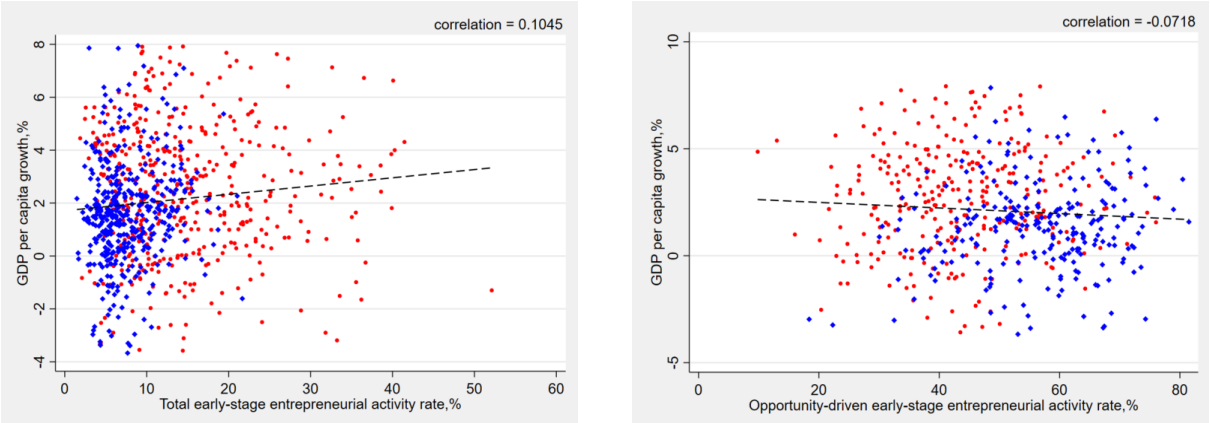
[1] There are at least 2,000 respondents per economy in GEM data based on the adult population. To ensure comparability, the survey used the same basic questions across economies.

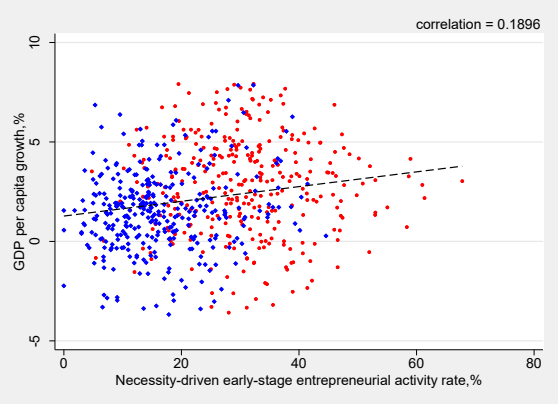


GDP = gross domestic product.
Notes: Each dot represents annual percentage GDP growth and entrepreneurial activity rate for an economy in a particular year. Observations with GDP growth below the 5% percentile and above the 95% percentile were considered as outliers and removed from the sample. Red dots represent emerging and developing economies, while blue dots represent advanced economies. Total early-stage entrepreneurial activity rate is the percentage of working-age population who are nascent (i.e., those actively involved in starting a new business) or new entrepreneurs/young business owners (i.e., those running a new business that is less than 42 months old). Opportunity-driven early-stage entrepreneurial activity is the percentage of individuals involved in early-stage entrepreneurial activity who claim to be purely or partially driven by opportunity as opposed to having no other options for work. Necessity-driven early-stage entrepreneurial activity is the percentage of individuals involved in early-stage entrepreneurial activity who claim to be motivated by necessity (having no better choice for work) rather than opportunity.
Sources: Global Entrepreneurship Monitor database; World Bank. World Development Indicators online database (accessed 25 January 2022).

Figure 2: Type of Entrepreneurship and Gross Domestic Product per Capita Growth, 2001–2019

Income per capita increases necessity-driven entrepreneurship.





GDP = gross domestic product.
Notes: Each dot represents annual percentage GDP per capita growth and entrepreneurial activity rate for an economy in a particular year. Observations with GDP per capita growth below the 5% percentile and above the 95% percentile were considered as outliers and removed from the sample. Red dots represent emerging and developing economies, while blue dots represent advanced economies.
Sources: Global Entrepreneurship Monitor database; World Bank. World Development Indicators online database (accessed 25 January 2022).

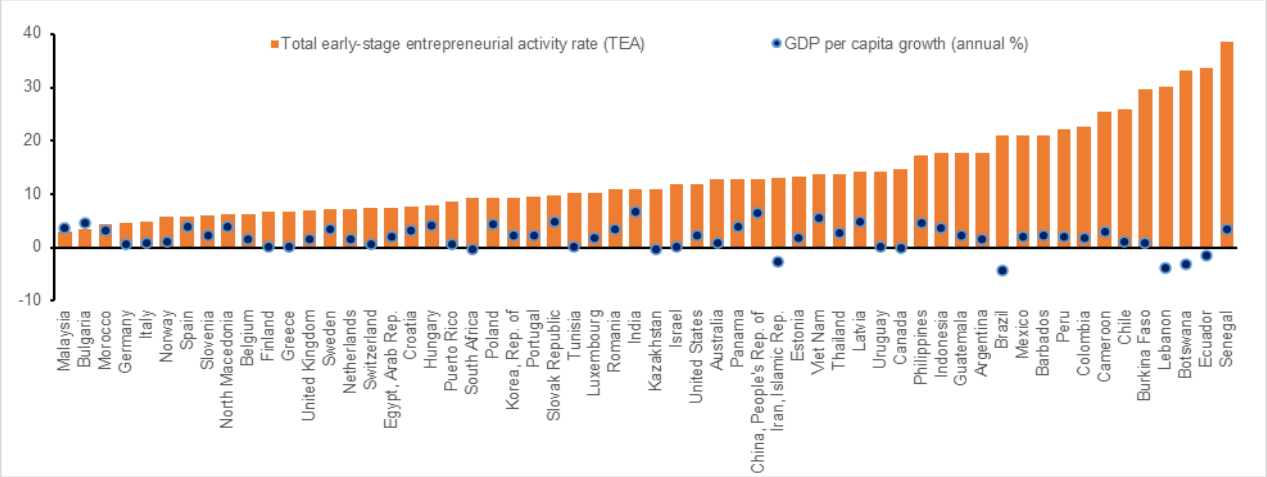
TEA is one of the main indicators in the GEM database. It is significant because some TEA entrepreneurs contribute to innovation, job creation, and economic development. GEM defines TEA as the percentage of working age population that is actively involved in starting a new venture and/or managing a business less than 42 months old. TEA thus includes two types of entrepreneurs, namely nascent entrepreneurs and young business owners, who are engaged in new business activity.

GEM distinguishes two types of entrepreneurial activity based on individual entrepreneurial motivation: OEA and NEA. We include these two variables in the analysis since several studies found that the effect of entrepreneurship on economic growth depends on the type of entrepreneurship. Figure 3 looks at the cross-section relationship between economic growth and early-stage entrepreneurial activity. The economies are ordered on the basis of the level of entrepreneurship. Figure 3 shows no clear pattern between entrepreneurship and growth.

Figure 4 illustrates the trend between the ratio of opportunity to NE and GDP per capita of an economy. The ratio is a measure of the relative importance of OE, which tends to be more productive, relative to NEA (Acs et al. 2008). The fitted line shows a positive relationship between GDP per capita and the entrepreneurship ratio. In other words, entrepreneurship is motivated more by opportunity than necessity in richer economies. Intriguingly, the single-year cross-sectional patterns of 2015 in Figure 3 and Figure 4 reveal a different pattern from the multi-year cross-sectional patterns of 2011–2019 in Figure 1 and Figure 2. Such difference suggests a need for panel estimation with appropriate controls for potential two-way causality between economic growth rates and entrepreneurial activities.

Figure 3: Total Early-Stage Entrepreneurial Activity Rate and Gross Domestic Product per Capita Growth, 2015

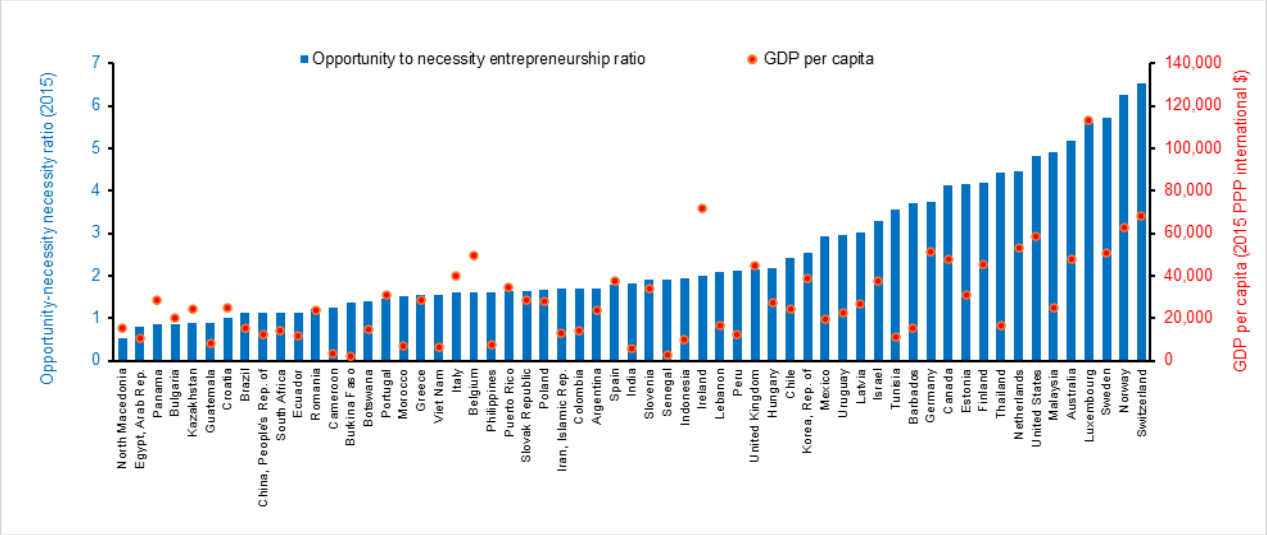
The association between entrepreneurship and capita growth is broadly mixed across economies.



GDP = gross domestic product.
Sources: Global Entrepreneurship Monitor database; World Bank. World Development Indicators online database (accessed 25 January 2022).

Figure 4: Opportunity-Necessity Entrepreneurship Ratio and Gross Domestic Product per Capita, 2015

The ratios of opportunity entrepreneurship to necessity entrepreneurship matter and their associations with growth vary across economies.



GDP = gross domestic product, PPP = purchasing power parity.
Sources: Global Entrepreneurship Monitor database; World Bank. World Development Indicators online database (accessed 25 January 2022).

In addition to entrepreneurship, our key independent variable of interest, we included several control variables that can also influence economic growth. These are standard variables drawn from the empirical literature on growth.[2] They include physical investment, which is measured by the ratio of investment to GDP; human capital, which is measured by secondary education enrollment level; population growth; and economic openness. The initial GDP and lag of GDP growth or GDP per capita growth were also included.

Table A1 of the Appendix lists the advanced economies and the emerging and developing economies. In Table A2, we summarized the dependent, independent, and control variables used in this study, including their definition and data sources.

The empirical model is[3]

$$y_{i,t} = \beta_1 ENT_{i,t-1} + \beta_2 X_{i,t} + \mu_{i,t}$$

i: represents the economy and t is time;

$y_{i,t}$: growth of GDP;

$ENT_{i,t}$: the types of entrepreneurships;

$X_{i,t}$: the control variables; and

$\mu_{i,t}$: the error term.

IV. EMPIRICAL RESULTS

In this section, we report and discuss the main findings of our empirical analysis.

A. Estimation Result

Our regression results, based on the fixed-effects estimation, of the baseline empirical model in equations (1) and (2) are reported in Tables A5 and A6 of the Appendix. We reported the regression results of the same models for advanced economies and emerging and developing economies. Additionally, we separately reported the estimation results without control variables in Tables A7 and A8.

In order to address potential reverse causality from economic growth to entrepreneurship activity, we used the lag of entrepreneurship activity rates. Although entrepreneurship can contribute to economic growth, as explained above, growth can also affect entrepreneurship. For instance,

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[2] According to Solow (1956) and Swan (1956), investments in physical capital and labor are the main factors in the growth model. Romer (1986) adds knowledge into the growth model.

[3] We have estimated with two sets of dependent variables, GDP growth and GDP per capita growth and the result of GDP per capita growth is presented in Tables A5 and A6 in the Appendix.

there may be more entrepreneurial opportunities when the economy is booming. Further, by including the lag of economic growth as an independent variable, we tried to limit the bias from omitted variables.

The estimation results show that the interaction of lag of TEA and lag of NEA with the share of the manufacturing sector have a significant and positive impact on economic growth (Tables A5 and A6). The results imply that the positive effects of TEA and NEA on economic growth increases when the share of the manufacturing sector in the economy is larger. The share of manufacturing sector is statistically insignificant.

In the case of the emerging and developing economies, the interaction of the lag of OEA and the share of the industry sector has a positive and significant impact on economic growth (Tables A5 and A6). This means that the positive effect of the lag of OEA on economic growth rises when the share of the industry sector in the economy is larger. The expansion of the industry sector creates new business opportunities for entrepreneurs with new ideas and new products.

For the advanced economy subsample, the interaction of the lag of NEA and the share of the industry sector is negative. This implies that, when the share of the industry sector in the economy grows, the effect of NEA on economic growth decreases. Intuitively, there is little synergy between NEA, which is typically embodied in small-scale entrepreneurs, and the industry sector, which typically requires large investments.

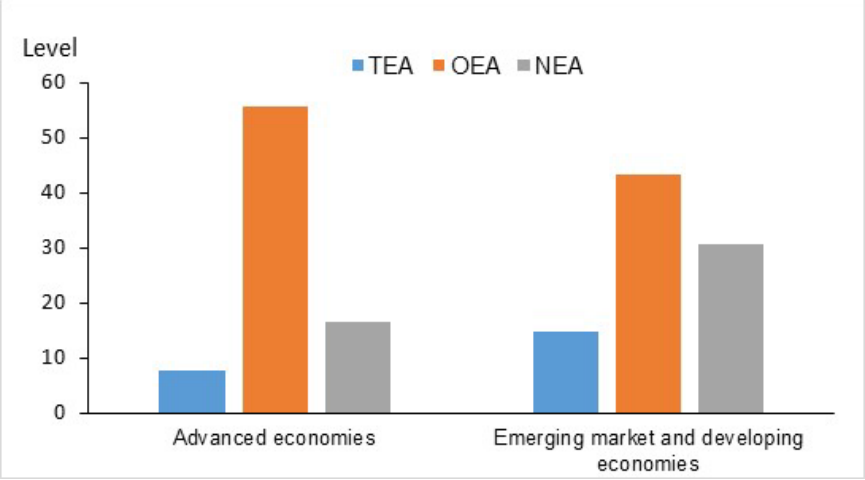
The results of the estimation without control variables show more or less similar results as the results of estimation with control variables. The interaction of the lag of TEA and lag of NEA with the share of the manufacturing sector are positively and significantly associated with economic growth for the full economy sample (Tables A7 and A8). For emerging and developing economies, the interaction of the lag of OEA with the share of the manufacturing sector is positive and significantly linked with economic growth (Tables A7 and A8). At the same time, the interaction of the lag of NEA and services sector is positive and significantly linked with economic growth (Tables A7 and A8). This implies that NEA has a bigger positive impact on growth in economies that have relatively large services sectors. Many control variables are statistically significant and their signs are consistent with the existing findings. To ensure the robustness of our estimations for advanced economies and emerging and developing economies, we conducted Chow test after each estimation. The results are all statistically significant at the 1% level (Table A9 of the Appendix). In addition, we report the summary statistics in Table A3 and the correlations in Table A4 of the Appendix. Overall, for developing economies, our results indicate that the expansion of manufacturing amplifies the positive growth effects of OEA whereas the expansion of services strengthens the positive growth effects of NEA.

B. Level of Entrepreneurship in Advanced versus Emerging and Developing Economies

Before we assess economic significance, we conduct a Chow test to compare the subsamples of advanced economies and developing economies, as shown in Table A9. The level of entrepreneurship varies among economies at different stages of economic development. A comparison of the two economy groups reveals that TEA is higher in emerging and developing economies, possibly because entrepreneurship is expanding faster than in advanced economies, where entrepreneurship is more mature. NEA is also higher in emerging and developing economies (Table A10 and Figure 5). The estimation results in Table A8 imply that an increase in OEA activity rate from the mean level of the developing economies to the mean level of the advanced economies (55.02 – 42.68 = 12.34), together with a standard deviation increase in the share of manufacturing's value-added in GDP (6.62), is associated with 0.005 × 12.34 × 6.62 = 0.41% increase in annual GDP per capita, or 4.1% increase in a decade.

Figure 5: Level of Entrepreneurship of Advanced versus Emerging Economies

The much-needed opportunity entrepreneurship remains low in developing economies.



NEA = necessity-driven early-stage entrepreneurial activity, OEA = opportunity-driven early-stage entrepreneurial activity, TEA = total early-stage entrepreneurial activity.
Note: The levels of TEA, OEA, and NEA are mean values between 2001 and 2019.
Source: Authors' calculations.

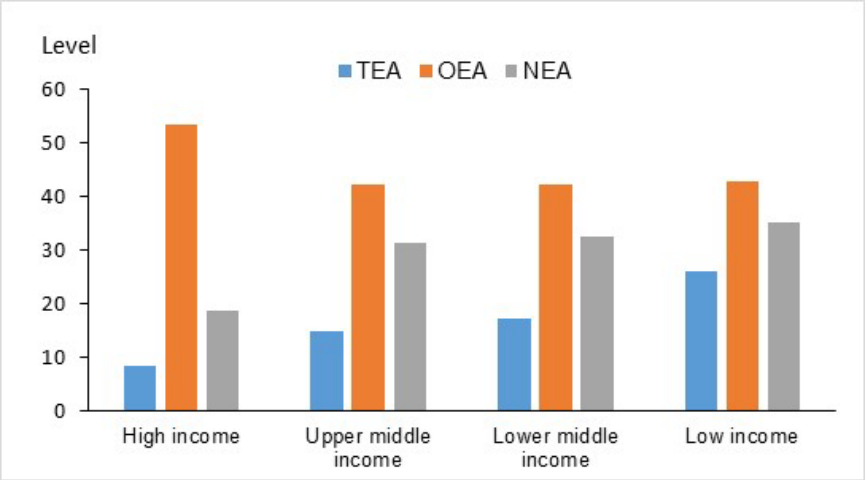
[4] The World Bank divides the world's economies into four income groups—low, lower-middle, upper-middle, and high-income economies. The classifications are updated annually on July 1 and are based on previous year's GNI per capita in current United States dollar (using the Atlas method exchange rates) . We followed the income classifications of the World Bank in 2021. Low-income economies have incomes of less than $1,046, Lower middle-income economies have incomes of $1,046–$4,095, Upper middle-income economies have incomes of $4,096–$12,695 and high-income economies have incomes of more than $12,695.

C. Level of Entrepreneurship in Different Income Groups of Economies[4]

Figure 6 and Table A11 show that TEA rate is higher in middle-income and low-income economies than in high-income economies. On the other hand, OEA is highest in high-income economies while NEA is highest in low-income economies. The relative underdevelopment of OEA in middle- and low-income economies suggests that the expansion of such entrepreneurship may yield potentially large growth gains.

Figure 6: Level of Entrepreneurship among Different Income Groups

Middle-income developing economies need to support OE.



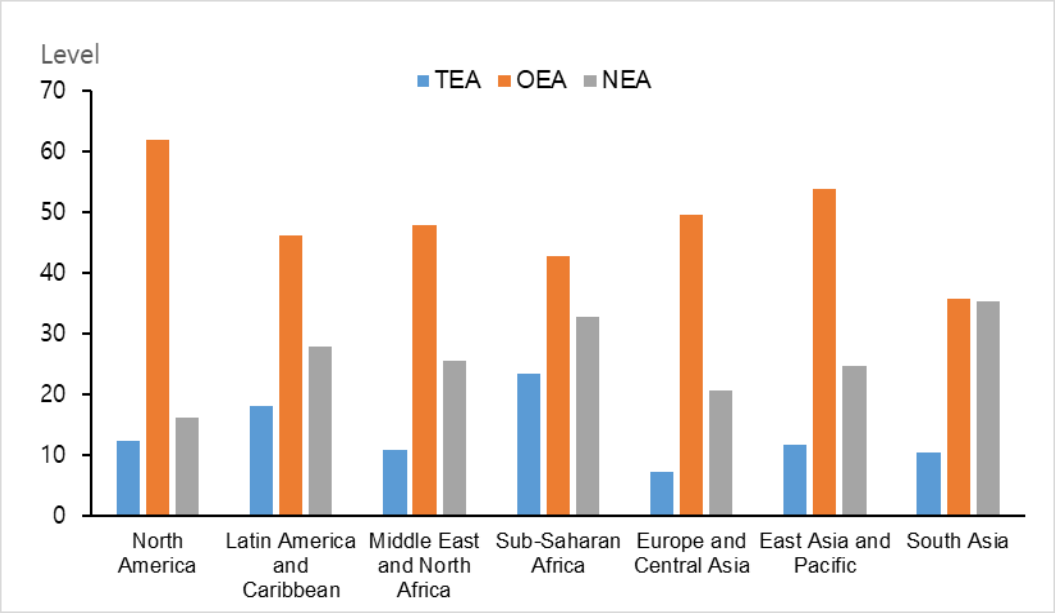
NEA = necessity-driven early-stage entrepreneurial activity, OEA = opportunity-driven early-stage entrepreneurial activity, TEA = total early-stage entrepreneurial activity.
Note: The levels of TEA, OEA, and NEA are mean values between 2001 and 2019.
Source: Authors' calculations.

D. Level of Entrepreneurship in Different Regions

According to the comparison of entrepreneurship of different regions in Figure 7 and Table A12, the TEA rate is highest in Sub-Saharan African economies and lowest in Europe and Central Asian economies. On the other hand, OEA is highest in North America, Europe and Central Asia, and East Asia and Pacific. The mean value of NEA is highest in Sub-Saharan Africa and South Asia (Table A12 and Figure 7). The estimation results of Table A8 imply that an increase in OEA activity rate from the mean level of the East Asia and Pacific (48.99) or South Asia (35.69) to the level of North America (respectively, 62.00 – 48.99 = 13.01 and 62.00 – 35.69 =26.31) and a standard deviation increase in the share of manufacturing's value-added in GDP (6.62) is associated with 0.005 × 13.01 × 6.62 = 0.43 and 0.005 × 26.31 × 6.62 = 0.87% increase in annual GDP per capita in East Asia and Pacific and South Asia, respectively, or 4.3% and 8.7% increase in a decade.

Figure 7: Level of Entrepreneurship of Regional Groups

Economies in Asia and the Pacific have lower activity rates of opportunity entrepreneurship than North America and Europe.



NEA = necessity-driven early-stage entrepreneurial activity, OEA = opportunity-driven early-stage entrepreneurial activity, TEA = total early-stage entrepreneurial activity.
Note: The levels of TEA, OEA, and NEA are mean values between 2001 and 2019.
Source: Authors' calculations.

V. CONCLUDING OBSERVATIONS

Entrepreneurship, or the activity of starting and running a business, is a vital ingredient of economic growth and development. Entrepreneurs contribute to innovation, and they are central to dynamic Schumpeterian competition and broader economic dynamism. In this paper, we contribute to the entrepreneurship literature by performing cross-section empirical analysis to examine the link between entrepreneurship and economic growth. We divide total early-stage entrepreneurship into opportunity-driven early-stage entrepreneurship versus necessity-driven early-stage entrepreneurship to capture the heterogeneity of entrepreneurship. In addition, we divide our sample economies into advanced economies versus developing economies.

We do not find evidence of a positive link between aggregate entrepreneurship and economic growth. This is consistent with the hugely heterogenous nature of entrepreneurial activity. At a broader level, our empirical evidence points to the importance of distinguishing between different types of entrepreneurship and different groups of economies. In particular, for developing economies where manufacturing is relatively important, we find that opportunity-driven entrepreneurship is positively linked with growth. Intuitively, big technological advances in the manufacturing sector

create a lot of opportunities for innovative entrepreneurs whereas other entrepreneurs gradually adapt to the slower pace of technological progress in the services sector.

To sum up, we do not find a statistically significant link between total entrepreneurship and economic growth, but we do find significant links between growth and the interaction of sectoral shares and different types of entrepreneurship. Our results imply that such effects can also be of sufficient magnitude to be economically significant. For instance, an increase in opportunity-driven entrepreneurship activity rate from the mean level of the developing economies to the mean level of advanced economies, together with a standard deviation increase in the share of manufacturing's value-added in GDP, is associated with 0.41% increase in annual GDP per capita or 4.1% increase in a decade.

APPENDIX

Table A1: Advanced and Emerging and Developing Economies

Advanced Economies	Emerging and Developing Economies		
Australia	Algeria	Libya	West Bank and Gaza
Austria	Angola	Madagascar	Yemen, Rep. of
Barbados	Argentina	Malawi	Zambia
Belgium	Armenia	Malaysia	
Canada	Bangladesh	Mexico	
Cyprus	Belarus	Montenegro	
Czech Republic	Belize	Morocco	
Denmark	Bolivia	Namibia	
Estonia	Bosnia and Herzegovina	Nigeria	
Finland	Botswana	North Macedonia	
France	Brazil	Oman	
Germany	Bulgaria	Pakistan	
Greece	Burkina Faso	Panama	
Hong Kong, China	Cameroon	Peru	
Iceland	Chile	Philippines	
Ireland	China, People's Rep. of	Poland	
Israel	Colombia	Puerto Rico	
Italy	Costa Rica	Qatar	
Japan	Croatia	Romania	
Korea, Rep. of	Dominican Republic	Russian Federation	
Latvia	Ecuador	Saudi Arabia	
Lithuania	Egypt, Arab Rep. of	Senegal	
Luxembourg	El Salvador	Serbia	
Netherlands	Ethiopia	South Africa	
New Zealand	Georgia	Sudan	
Norway	Ghana	Suriname	
Portugal	Guatemala	Syrian Arab Republic	
Singapore	Hungary	Thailand	
Slovak Republic	India	Tonga	
Slovenia	Indonesia	Uganda	
Spain	Iran, Islamic Rep. of	United Arab Emirates	
Sweden	Jamaica	Uruguay	
Switzerland	Jordan	Vanuatu	
United Kingdom	Kazakhstan	Venezuela, Bolivian Republic of	
United States	Lebanon	Viet Nam	

Source: Authors.

Table A2: Dependent and Independent Variables

Variable	Description	Predicted Sign	Data Source
Dependent variable			
GDP growth 1	GDP growth (annual %)	World Bank's World Development Indicators database	
GDP growth 2	GDP per capita growth (annual %)		
Independent variables			
Entrepreneurship			
Total early-stage entrepreneurial activity rate	The percentage of working age population who are either actively involved in starting a new business (nascent entrepreneurs) or are running a new business that is less than 42 months old (new entrepreneurs	(+)	Global Entrepreneurship Monitor
Necessity-driven early-stage entrepreneurship activity	The percentage of early-stage entrepreneurs who are involved in entrepreneurship because they had no other option for work	(+)	Global Entrepreneurship Monitor
Opportunity-driven early-stage entrepreneurship activity	Percentage of early-stage entrepreneurs who indicate that their main driver for becoming entrepreneur is the opportunity of being independent, or increasing their income, as opposed to finding no other option for work or just maintaining their income	(+)	Global Entrepreneurship Monitor
Control variables			
Investment (% of GDP)	Total investment (% of GDP)	(+)	World Bank's World Development Indicators database
Population growth (annual %)	Annual population growth rate for year t is the exponential rate of growth of midyear population from year t-1 to t, expressed as a percentage	(+)	
Education	The percentage of people aged 25–64 who have successfully completed secondary education	(+)	
Economic openness (% of GDP) (end of period)	The sum of exports and imports of goods and services measured as a share of gross domestic product	(+)	
Industry value added	Industry (including construction), value added (% of GDP)		
Manufacturing value added	Manufacturing, value added (% of GDP)		
Services value added	Services, value added (% of GDP)		
Economy	Advanced and emerging and developing economy		World Bank and International Monetary Fund description

GDP = gross domestic product.
Note: For advanced and emerging and developing economies, refer to Table A1.
Source: Authors.

Table A3: Summary Statistics

Variables	Numbers of Observation	Mean	Std. Dev.	Min	Max
GDP growth (annual %)	413	2.98	3.70	-14.26	25.18
GDP per capita growth (annual %)	413	1.82	3.54	-12.83	24.00
Total early-stage entrepreneurial activity rate	242	11.55	6.96	2.35	52.11
Opportunity-driven early-stage entrepreneurship activity	242	47.76	12.48	9.82	80.47
Necessity-driven early-stage entrepreneurship activity	242	23.82	10.34	3.55	52.98
Investment (% of GDP)	414	23.39	6.61	8.60	47.88
Population growth (annual %)	414	1.12	1.23	-2.08	7.35
Education	414	92.03	19.71	22.69	132.94
Economic openness (% of GDP) (end of period)	414	87.59	58.66	24.64	442.62
Industry value added	414	26.60	10.08	6.72	68.19
Manufacturing value added	414	14.01	6.62	1.11	47.90
Services value added	414	59.06	9.91	28.92	91.51

GDP = gross domestic product, Max = maximum, Min = minimum, Std. Dev. = standard deviation.
Source: Authors' calculation.

Table A4: Correlation Table

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) Gross domestic product (GDP) growth	1.00											
(2) GDP per capita growth	0.90	1.00										
(3) Total early-stage entrepreneurial activity rate	0.21	0.09	1.00									
(4) Opportunity-driven early-stage entrepreneurship activity	-0.08	-0.12	-0.16	1.00								
(5) Necessity-driven early-stage entrepreneurship activity)	0.13	0.15	0.29	-0.68	1.00							
(6) Investment (% of GDP)	0.28	0.25	0.11	0.03	0.08	1.00						
(7) Population growth (annual %)	0.23	-0.20	0.34	0.11	-0.05	0.07	1.00					
(8) Education	-0.25	-0.10	-0.43	0.32	-0.47	0.01	-0.44	1.00				
(9) Economic openness (% of GDP)	0.02	0.04	-0.17	0.17	-0.21	0.02	-0.05	0.24	1.00			
(10) Industry value added	0.13	0.05	0.19	0.01	0.08	0.25	0.21	-0.05	-0.09	1.00		
(11) Manufacturing value added	0.03	0.13	-0.14	0.00	0.04	0.06	-0.21	0.04	0.00	0.37	1.00	
(12) Services value added	-0.28	-0.16	-0.37	0.21	-0.32	-0.21	-0.30	0.53	0.33	-0.61	-0.22	1.00

Source: Authors' calculation.

Table A5: Estimation Result of Gross Domestic Product Growth

Variables	**GDP Growth** (annual %)								
	All Economies			**Advanced Economies**			**Emerging and Developing Economies**		
	<1-1>	<1-2>	<1-3>	<2-1>	<2-2>	<2-3>	<3-1>	<3-2>	<3-3>
L.GDP growth (annual %)	0.001	0.024	0.004	-0.118	-0.096	-0.044	0.10	0.11	0.09
	(0.042)	(0.039)	(0.041)	(0.068)	(0.051)	(0.059)	(0.12)	(0.10)	(0.10)
L.Total early-stage entrepreneurial activity rate (TEA)	-0.399			-1.593			-0.37		
	(0.278)			(2.371)			(0.47)		
L.Necessity-driven early-stage entrepreneurship activity (NEA)		-0.030			1.314			0.04	
		(0.137)			(0.728)			(0.29)	
L.Opportunity-driven early-stage entrepreneurship activity (OEA)			0.018			-0.345			-0.13
			(0.130)			(0.481)			(0.14)
Investment (% of GDP)	0.173***	0.180***	0.181***	0.173	0.313*	0.382**	0.177*	0.144**	0.175**
	(0.025)	(0.026)	(0.026)	(0.138)	(0.129)	(0.118)	(0.06)	(0.04)	(0.05)
Population growth (annual %)	0.582*	0.578**	0.551*	1.153	0.855	0.768	0.720*	1.030*	0.789*
	(0.186)	(0.161)	(0.176)	(0.568)	(0.433)	(0.617)	(0.24)	(0.35)	(0.30)
Education	-0.013	-0.009	-0.012	0.000	0.052	0.022	0.03	0.04	0.0327*
	(0.010)	(0.011)	(0.011)	(0.046)	(0.035)	(0.039)	(0.02)	(0.02)	(0.01)
Economic openness (% of GDP) (end of period)	0.003	0.003	0.005	-0.002	0.001	-0.001	0.01	0.02	0.01
	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)	(0.01)	(0.01)	(0.01)
Industry value added	-0.063	-0.057	-0.167	-0.139	1.209	-2.562	-0.18	-0.20	-0.420**
	(0.047)	(0.035)	(0.088)	(0.417)	(0.641)	(1.768)	(0.10)	(0.11)	(0.11)
Manufacturing, value added	-0.015	-0.022	0.210*	0.416	-0.969	2.261	0.18	0.520**	0.002
	(0.053)	(0.054)	(0.073)	(0.361)	(0.613)	(2.275)	(0.13)	(0.12)	(0.21)
Services, value added	-0.119*	-0.073	-0.063	-0.288	0.122	0.126	-0.18	-0.210*	-0.07
	(0.041)	(0.039)	(0.082)	(0.163)	(0.149)	(0.214)	(0.12)	(0.08)	(0.12)
L.TEA # Industry value added	-0.0003			0.017			0.002		
	(0.003)			(0.061)			(0.01)		
L.TEA # Manufacturing, value added	0.0122**			-0.046			0.005		
	(0.003)			(0.048)			(0.01)		
L.TEA # Services, value added	0.004			0.027			0.004		
	(0.003)			(0.025)			(0.01)		
L.NEA # Industry value added		-0.001			-0.079*			0.001	
		(0.001)			(0.032)			(0.004)	
L.NEA # Manufacturing, value added		0.005**			0.068			-0.01	
		(0.002)			(0.032)			(0.005)	
L.NEA # Services, value added		-0.0004			-0.007			0.002	
		(0.002)			(0.007)			(0.004)	
L.OEA # Industry value added			0.002			0.043			0.006*
			(0.001)			(0.030)			(0.002)
L.OEA # Manufacturing, value added			-0.002			-0.036			0.005
			(0.002)			(0.037)			(0.004)

Variables	**GDP Growth** (annual %)								
	All Economies			**Advanced Economies**			**Emerging and Developing Economies**		
	<1-1>	<1-2>	<1-3>	<2-1>	<2-2>	<2-3>	<3-1>	<3-2>	<3-3>
L.OEA # Services, value added			-0.001			-0.002			-0.002
			(0.001)			(0.005)			(0.002)
Constant	7.824*	3.898	4.773	14.490	7.500	-31.110	7.66	10.69	2.85
	(2.977)	(6.518)	(3.008)	(15.580)	(20.580)	(18.980)	(6.56)	(7.36)	(7.33)
Numbers of observation	414	414	414	89	89	89	125	125	125
R^2	31.80	30.90	30.90	26.00	32.30	34.90	36.50	42.90	39.60
adj. R^2	29.80	28.80	28.80	14.30	21.70	24.60	29.70	36.80	33.20

GDP = gross domestic product.
Notes: We report robust standard errors in parentheses and rounded off the numbers to three decimal places. *** , ** and * denote statistically significant at the 1% level, 5% level, and 10% level, respectively.
Source: Authors' calculation.

Table A6: Estimation Result of Gross Domestic Product per Capita Growth

Variables	**GDP per Capita Growth** (annual %)								
	All Economies			**Advanced Economies**			**Emerging and Developing Economies**		
	<1-1>	<1-2>	<1-3>	<2-1>	<2-2>	<2-3>	<3-1>	<3-2>	<3-3>
L.GDP per capita growth (annual %)	0.0002	0.020	0.006	-0.145	-0.135	-0.099	0.08	0.12	0.09
	(0.045)	(0.046)	(0.047)	(0.085)	(0.071)	(0.080)	(0.12)	(0.10)	(0.10)
L.Total early-stage entrepreneurial activity rate (TEA)	-0.395			-1.156			-0.29		
	(0.272)			(2.284)			(0.44)		
L.Necessity-driven early-stage entrepreneurship activity (NEA)		-0.026			1.482			0.02	
		(0.132)			(0.771)			(0.29)	
L.Opportunity-driven early-stage entrepreneurship activity (OEA)			0.017			-0.454			-0.12
			(0.130)			(0.476)			(0.13)
Investment (% of GDP)	0.169***	0.176***	0.177***	0.174	0.312*	0.383**	0.174*	0.141**	0.172**
	(0.025)	(0.027)	(0.027)	(0.137)	(0.129)	(0.116)	(0.06)	(0.04)	(0.05)
Population growth (annual %)	-0.437*	-0.441*	-0.467*	0.138	-0.155	-0.191	-0.25	0.07	-0.19
	(0.187)	(0.166)	(0.180)	(0.561)	(0.412)	(0.600)	(0.25)	(0.33)	(0.31)
Education	-0.012	-0.009	-0.012	0.004	0.056	0.021	0.03	0.0431*	0.0334*
	(0.010)	(0.012)	(0.011)	(0.046)	(0.034)	(0.037)	(0.02)	(0.02)	(0.01)
Economic openness (% of GDP) (end of period)	0.003	0.003	0.005	-0.001	0.001	-0.001	0.01	0.02	0.02
	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)	(0.02)	(0.01)	(0.01)

Variables	**GDP per Capita Growth** (annual %)								
	All Economies			**Advanced Economies**			**Emerging and Developing Economies**		
	<1-1>	<1-2>	<1-3>	<2-1>	<2-2>	<2-3>	<3-1>	<3-2>	<3-3>
Industry value added	-0.063	-0.055	-0.164	-0.074	1.295	-2.639	-0.17	-0.20	-0.424**
	(0.046)	(0.033)	(0.087)	(0.408)	(0.651)	(1.768)	(0.10)	(0.11)	(0.11)
Manufacturing, value added	-0.013	-0.017	0.203*	0.362	-1.032	2.256	0.20	0.521**	0.02
	(0.051)	(0.053)	(0.075)	(0.365)	(0.613)	(2.287)	(0.13)	(0.13)	(0.21)
Services, value added	-0.118*	-0.073	-0.061	-0.244	0.149	0.075	-0.17	-0.221*	-0.07
	(0.040)	(0.038)	(0.080)	(0.158)	(0.153)	(0.216)	(0.11)	(0.09)	(0.12)
L.TEA # Industry value added	-0.0003			0.009			0.002		
	(0.003)			(0.059)			(0.01)		
L.TEA # Manufacturing, value added	0.012**			-0.041			0.004		
	(0.003)			(0.048)			(0.01)		
L.TEA # Services, value added	0.004			0.022			0.003		
	(0.003)			(0.024)			(0.01)		
L.NEA # Industry value added		-0.001			-0.0827*			0.001	
		(0.001)			(0.032)			(0.004)	
L.NEA # Manufacturing, value added		0.005**			0.070			-0.01	
		(0.001)			(0.032)			(0.005)	
L.NEA # Services, value added		-0.0004			-0.009			0.002	
		(0.002)			(0.007)			(0.004)	
L.OEA # Industry value added			0.002			0.045			0.006*
			(0.001)			(0.030)			(0.002)
L.OEA # Manufacturing, value added			-0.002			-0.036			0.005
			(0.002)			(0.037)			(0.004)
L.OEA # Services, value added			-0.001			-0.001			-0.003
			(0.001)			(0.004)			(0.002)
Constant	7.774*	3.905	4.683	10.280	12.350	-33.940	6.92	10.32	3.63
	(2.856)	(6.488)	(2.988)	(15.240)	(20.800)	(19.110)	(6.16)	(7.09)	(7.35)
Numbers of observation	414	414	414	89	89	89	125	125	125
R^2	26.00	25.00	24.90	17.40	25.00	28.20	38.90	45.50	42.10
adj. R^2	23.80	22.70	22.70	4.40	13.10	16.80	32.40	39.70	35.90

GDP = gross domestic product.
Notes: We report robust standard errors in parentheses and rounded off the numbers to three decimal places. *** , ** and * denote statistically significant at the 1% level, 5% level, and 10% level, respectively.
Source: Authors' calculation.

Table A7: Estimation Result of Gross Domestic Product Growth[a]

Variables	GDP Growth (annual %)								
	All Economies			Advanced Economies			Emerging and Developing Economies		
	<1-1>	<1-2>	<1-3>	<2-1>	<2-2>	<2-3>	<3-1>	<3-2>	<3-3>
L.GDP growth (annual %)	-0.007	-0.018	-0.032	-0.12	-0.08	-0.06	0.01	0.05	0.02
	(0.039)	(0.036)	(0.036)	(0.11)	(0.07)	(0.07)	(0.09)	(0.07)	(0.09)
L.Total early-stage entrepreneurial activity rate (TEA)	-0.499*			-2.64			-0.41		
	(0.214)			(2.19)			(0.26)		
L.Necessity-driven early-stage entrepreneurship activity (NEA)		-0.080			1.12			-0.46	
		(0.171)			(1.42)			(0.24)	
L.Opportunity-driven early-stage entrepreneurship activity (OEA)			-0.026			-1.02			0.20
			(0.144)			(0.70)			(0.26)
Industry value added	-0.0676*	-0.043	-0.066	-0.30	1.14	-3.75	-0.04	-0.08	-0.05
	(0.026)	(0.035)	(0.080)	(0.49)	(0.80)	(2.05)	(0.05)	(0.05)	(0.14)
Manufacturing, value added	-0.108	-0.012	-0.195*	0.63	-0.85	3.20	0.02	0.322***	-0.226*
	(0.056)	(0.054)	(0.067)	(0.46)	(0.69)	(2.37)	(0.06)	(0.06)	(0.09)
Services, value added	-0.181***	-0.161***	-0.112	-0.33	0.09	-0.23	-0.11	-0.384**	0.15
	(0.022)	(0.033)	(0.090)	(0.16)	(0.23)	(0.35)	(0.08)	(0.11)	(0.18)
L.TEA # Industry value added	0.003			0.04			0.003		
	(0.002)			(0.07)			(0.00)		
L.TEA # Manufacturing, value added	0.0111*			-0.06			0.008*		
	(0.004)			(0.07)			(0.003)		
L.TEA # Services, value added	0.004			0.04			0.003		
	(0.002)			(0.02)			(0.004)		
L.NEA # Industry value added		0.001			-0.07			0.002	
		(0.002)			(0.04)			(0.002)	
L.NEA # Manufacturing, value added		0.001			0.05			-0.007**	
		(0.002)			(0.03)			(0.002)	
L.NEA # Services, value added		0.001			-0.01			0.01*	
		(0.002)			(0.01)			(0.003)	
L.OEA # Industry value added			0.001			0.07			0.0011
			(0.001)			(0.04)			(0.003)
L.OEA # Manufacturing, value added			0.004*			-0.06			0.007***
			(0.002)			(0.04)			(0.001)
L.OEA # Services, value added			-0.001			0.005			-0.01
			(0.002)			(0.01)			(0.003)
Constant	17.27***	13.800	13.91***	22.33	55.47	-17.26	11.68*	0.25	21.93*
	(2.125)	(7.233)	(2.790)	(13.86)	(34.93)	(24.14)	(4.96)	(13.27)	(7.08)
Numbers of observation	548	548	548	90	90	90	214	214	214
R^2	18.60	17.10	15.70	11.70	18.70	20.60	19.70	24.90	22.20
adj. R^2	17.40	15.80	14.50	3.00	10.70	12.70	16.60	22.00	19.20

GDP = gross domestic product.
[a] We report the estimation without control variables: investment (% of GDP), population growth (annual %), education and economic openness (% of GDP).
GDP = gross domestic product.
Notes: We report robust standard errors in parentheses and rounded off the numbers to three decimal places. *** , ** and * denote statistically significant at the 1% level, 5% level, and 10% level, respectively.
Source: Authors' calculation.

Table A8: Estimation Result of Gross Domestic Product per Capita Growth[a]

Variables	GDP per Capita Growth (annual %)								
	All Economies			Advanced Economies			Emerging and Developing Economies		
	<1-1>	<1-2>	<1-3>	<2-1>	<2-2>	<2-3>	<3-1>	<3-2>	<3-3>
L.GDP per capita growth (annual %)	-0.026	-0.028	-0.036	-0.15	-0.16	-0.14	-0.05	-0.001	-0.02
	(0.040)	(0.040)	(0.038)	(0.09)	(0.08)	(0.08)	(0.06)	(0.04)	(0.05)
L.Total early-stage entrepreneurial activity rate (TEA)	-0.319			-1.54			0.21		
	(0.225)			(1.82)			(0.30)		
L.Necessity-driven early-stage entrepreneurship activity (NEA)		-0.038			1.87			-0.49	
		(0.195)			(1.28)			(0.27)	
L.Opportunity-driven early-stage entrepreneurship activity (OEA)			0.101			-1.54			0.30
			(0.147)			(1.82)			(0.27)
Industry value added	-0.096*	-0.101	-0.020	1.87	1.37	-2.08	-0.49	-0.09	-0.05
	(0.034)	(0.046)	(0.095)	(1.28)	(0.76)	(2.06)	(0.27)	(0.09)	(0.16)
Manufacturing, value added	-0.027	0.131*	-0.109	1.87	-0.92	1.22	-0.49	0.331**	-0.05
	(0.055)	(0.049)	(0.056)	(1.28)	(0.65)	(2.47)	(0.27)	(0.08)	(0.11)
Services, value added	-0.148***	-0.149**	-0.029	1.87	0.22	-0.28	-0.49	-0.393**	0.20
	(0.023)	(0.040)	(0.087)	(1.28)	(0.22)	(0.32)	(0.27)	(0.10)	(0.18)
L.TEA # Industry value added	0.001			0.03			-0.002		
	(0.004)			(0.05)			(0.004)		
L.TEA # Manufacturing, value added	0.011*			-0.07			0.01		
	(0.004)			(0.04)			(0.004)		
L.TEA # Services, value added	0.002			0.03			-0.01		
	(0.003)			(0.02)			(0.004)		
L.NEA # Industry value added		0.001			-0.07			0.001	
		(0.003)			(0.04)			(0.004)	
L.NEA # Manufacturing, value added		-0.001			0.04			-0.005	
		(0.002)			(0.03)			(0.003)	
L.NEA # Services, value added		0.001			-0.01			0.0101*	
		(0.002)			(0.01)			(0.004)	
L.OEA # Industry value added			-0.001			0.04			-0.0001
			(0.002)			(0.04)			(0.003)
L.OEA # Manufacturing, value added			0.004**			-0.02			0.005*

Variables	GDP per Capita Growth (annual %)								
	All Economies			Advanced Economies			Emerging and Developing Economies		
	<1-1>	<1-2>	<1-3>	<2-1>	<2-2>	<2-3>	<3-1>	<3-2>	<3-3>
L.OEA # Services, value added			(0.001) -0.002 (0.002)			(0.04) 0.005 (0.006)			(0.002) -0.01 (0.003)
Constant	13.50*** (2.159)	5.576 (7.372)	11.28** (3.344)	15.87 (10.81)	49.37 (32.48)	-31.41 (22.43)	2.01 (4.71)	-6.04 (13.98)	21.75* (6.92)
Numbers of observation	548	548	548	90	90	90	214	214	214
R^2	14.80	13.60	12.70	14.70	14.60	16.40	20.40	23.50	24.10
adj. R^2	13.60	12.30	11.40	6.20	6.10	8.10	17.30	20.50	21.20

GDP = gross domestic product.

[a] We report the estimation without control variables: investment (% of GDP),population growth (annual %), education and economic openness (% of GDP).

Notes: We report robust standard errors in parentheses and rounded off the numbers to three decimal places. ***, ** and * denote statistically significant at the 1% level, 5% level, and 10% level, respectively.

Source: Authors' calculation.

Table A9: Result of Chow Test for Advanced Economies and Emerging and Developing Economies

<1-1>	<1-2>	<1-3>
ADV = 0	ADV = 0	ADV = 0
ADV#L. GDP growth (annual %)= 0	ADV#L. GDP growth (annual %)= 0	ADV#L. GDP growth (annual %)= 0
ADV# L.TEA = 0	ADV#L.OEA = 0	ADV#NEA = 0
ADV# Investment (% of GDP) = 0	ADV# Investment (% of GDP) = 0	ADV# Investment (% of GDP) = 0
ADV# Population growth (annual %) = 0	ADV# Population growth (annual %) = 0	ADV# Population growth (annual %) = 0
ADV# Education= 0	ADV# Education= 0	ADV# Education= 0
ADV# Economic openness (% of GDP)= 0	ADV# Economic openness (% of GDP)= 0	ADV# Economic openness (% of GDP)= 0
Indgdp = 0	Indgdp = 0	Indgdp = 0
Mfggdp = 0	Mfggdp = 0	Mfggdp = 0
Svcsgdp = 0	Svcsgdp = 0	Svcsgdp = 0
ADV#L.TEA#i Indgdp = 0	ADV#L.OEA#i Indgdp = 0	ADV#L.NEA#i Indgdp = 0
ADV#L.TEA#i Mfggdp = 0	ADV(L.OEA#i Mfggdp = 0	ADV(L.NEA#i Mfggdp = 0
ADV#L.TEA#i Svcsgdp = 0	ADV#L.OEA#i Svcsgdp = 0	ADV#L.NEA#i Svcsgdp = 0
chi^2 (7) = 40.35	chi^2(7) = 45.1	chi^2(7) = 37.52
Prob > chi^2 = 0.0001	Prob > chi^2 = 0.0000	Prob > chi^2 = 0.0003
<2-1>	<2-2>	<2-3>
EMD = 0	EMD = 0	EMD= 0
EMD# L. GDP growth (annual %)= 0	EMD# L. GDP growth (annual %)= 0	EMD# L. GDP growth (annual %)= 0
EMD#L.TEA = 0	EMD#L.OEA = 0	EMD#L.NEA = 0
EMD# Investment (% of GDP) = 0	EMD# Investment (% of GDP) = 0	EMD# Investment (% of GDP) = 0
EMD# Population growth (annual %) = 0	EMD# Population growth (annual %) = 0	EMD# Population growth (annual %) = 0
EMD# Education= 0	EMD# Education= 0	EMD# Education= 0
EMD# Economic openness (% of GDP)= 0	EMD# Economic openness (% of GDP)= 0	EMD# Economic openness (% of GDP)= 0

Indgdp = 0	Indgdp = 0	Indgdp = 0
Mfggdp = 0	Mfggdp = 0	Mfggdp = 0
Svcsgdp = 0	Svcsgdp = 0	Svcsgdp = 0
EMD#L.TEA#i Indgdp = 0	EMD#L.OEA#i ndgdp = 0	EMD#L.NEA#iIndgdp = 0
EMD#L.TEA#i Mfggdp = 0	EMD#L.OEA#iMfggdp = 0	EMD#L.NEA#iMfggdp = 0
EMD#L.TEA#i Svcsgdp = 0	EMD#L.OEA#iSvcsgdp = 0	EMD#L.NEA#iSvcsgdp = 0
$chi^2(7) = 40.35$	$chi^2(7) = 51.39$	$chi^2(7) = 49.10$
Prob > chi^2 = 0.0001	Prob > chi^2 = 0.000	Prob > chi^2 = 0.000

GDP = gross domestic product.
Note: ADV represents advanced economies and EMD represents emerging and developing economies.
Ind represents Industry, Mfg represents Manufacturing and Svcs represents Service.
Source: Authors' calculation.

Table A10: Level of TEA, OEA, and NEA of Advanced Economies versus Emerging and Developing Economies

	Observation	Mean	Std. Dev.	Min	Max
Total early-stage entrepreneurial activity rate (TEA)					
Advanced economies	230	7.2	2.45	4.12	17.57
Emerging market and developing economies	240	14.78	7.96	3.46	52.11
Opportunity-driven early-stage entrepreneurship activity (OEA)					
Advanced economies	230	55.02	8.31	41.7	78.94
Emerging market and developing economies	240	42.68	7.52	23.6	69.22
Necessity-driven early-stage entrepreneurship activity (NEA)					
Advanced economies	230	17.07	7.03	5.84	37.3
Emerging market and developing economies	240	29.9	7.43	11.76	48.59

Max = maximum, Min = minimum, Std. Dev. = standard deviation.
Note: The levels of TEA, NEA, and OEA are mean values between 2001 and 2019.
Source: Authors' calculation.

Table A11: Level of TEA, OEA, and NEA of Income Groups

Income Groups	Observation	Mean	Std. Dev.	Min	Max
Total early-stage entrepreneurial activity rate (TEA)					
High-income	296	8.05	3.38	4.12	18.34
Upper middle income	122	14.68	6.91	3.46	27.64
Lower middle income	43	19.14	11.36	7.42	52.11
Low-income	9	23.23	5.92	14.73	31.84
Opportunity-driven early-stage entrepreneurship activity (OEA)					
High-income	296	52.50	9.27	37.52	78.94
Upper middle income	122	42.41	7.02	28.86	57.87
Lower middle income	43	41.28	9.24	23.60	56.54
Low-income	9	45.19	9.68	36.15	69.22
Necessity-driven early-stage entrepreneurship activity (NEA)					
High-income	296	19.68	8.48	5.84	40.11
Upper middle income	122	29.51	7.71	13.07	48.59
Lower middle income	43	32.36	7.26	20.59	46.84
Low-income	9	31.79	7.68	20.35	42.81

Max = maximum, Min = minimum, Std. Dev. = standard deviation.
Note: The levels of TEA, OEA, and NEA are mean values between 2001 and 2019. As for the Income group, we followed the income classifications of the World Bank in 2021. Low-income economies with less than $1,046, Lower middle-income economies with $1,046–$4,095, Upper middle-income economies with $4,096–$12,695 and high-income economies with more than $12,695. Please see foot note 4.
Source: Authors' calculations.

Table A12: Level of TEA, OEA, and NEA of Regional Groups

Regions	Observation	Mean	Std. Dev.	Min	Max
Total early-stage entrepreneurial activity rate (TEA)					
East Asia and Pacific	34	13.50	9.03	5.98	52.11
Europe and Central Asia	252	6.86	2.04	3.46	14.94
Latin America and the Caribbean	112	17.89	5.29	7.14	31.94
Middle East and North Africa	22	9.65	2.92	4.66	15.74
North America	16	11.15	0.09	11.09	11.27
South Asia	10	9.99	0.99	9.57	12.77
Sub-Saharan Africa	24	21.81	12.41	7.27	38.55
Opportunity-driven early-stage entrepreneurship activity (OEA)					
East Asia and Pacific	34	48.99	10.84	23.60	78.94
Europe and Central Asia	252	50.91	10.27	28.86	69.87
Latin America and the Caribbean	112	44.92	6.32	31.66	56.59
Middle East and North Africa	22	45.23	9.80	24.06	63.02
North America	16	62.00	1.65	60.92	64.37
South Asia	10	35.69	6.16	29.08	50.05
Sub-Saharan Africa	24	42.75	8.25	30.17	69.22
Necessity-driven early-stage entrepreneurship activity (NEA)					
East Asia and Pacific	34	27.09	11.51	7.23	44.72
Europe and Central Asia	252	20.26	9.47	5.84	48.59
Latin America and the Caribbean	112	27.55	6.64	12.19	38.19
Middle East and North Africa	22	28.68	10.06	11.76	43.28
North America	16	17.22	2.02	14.32	18.54
South Asia	10	32.59	9.84	26.34	46.84
Sub-Saharan Africa	24	31.49	4.78	20.35	42.81

Max = maximum, Min = minimum, Std. Dev. = standard deviation.
Note: The levels of TEA, OEA, and NEA are mean values between 2001 and 2019.
Source: Authors' calculations.

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