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Europe's Productivity Weakness

Firm-Level Roots and Remedies

Oyun Adilbish, Diego Cerdeiro, Romain Duval, Gee Hee Hong, Luca Mazzone, Lorenzo Rotunno, Hasan Toprak, Maryam Vaziri

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Europe's Productivity Weakness: Firm-Level Roots and Remedies

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ABSTRACT: Europe faces a well-known productivity malaise, with a large and widening aggregate productivity gap relative to the U.S. In this paper, we provide a novel diagnosis of the firm-level roots of Europe's productivity growth slowdown through an analysis of data covering the universe of firms in Europe and the U.S over their life cycles. Compared to their U.S. counterparts, we identify critical performance gaps among both Europe's frontier firms and young high-growth firms. Our firm-level analyses reveal that smaller markets and limited market-based financing are key bottlenecks for frontier European firms, while skill shortages and insufficient risk capital, such as venture capital, hinder the formation and subsequent growth of young firms in Europe. These findings suggest that removing remaining intra-Europe barriers to accelerate factor and product markets integration, alongside national reforms to facilitate swifter resource reallocation and enhance human capital, could help revive Europe's productivity growth.

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1. Introduction

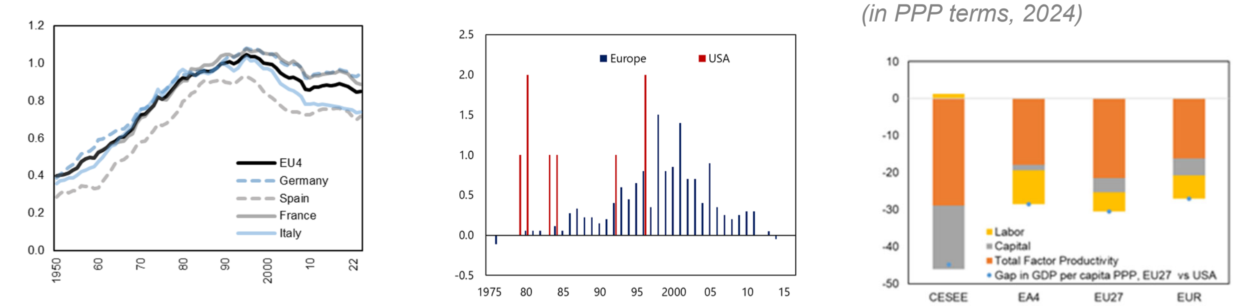
After an impressive four-decades-long productivity convergence spell with the United States in the second half of the 20th century, Europe's hourly labor productivity gap vis-à-vis the US widened again from the mid-1990s, and then again since the COVID crisis (Figure 1.1). This trend reversal is even more striking when considered against the backdrop of the extensive labor, capital, and product market reforms carried out across Europe during the 1990s and 2000s (Figure 1.2). The result is that today, in terms of per capita income, advanced European economies lag behind the United States by more than 20 percent, with other European countries facing even greater disparities. While fewer total working hours partly account for this income gap, weaker hourly labor productivity is the main culprit and, in turn, its weakness reflects Europe's comparatively low total factor productivity rather than low capital intensity (Figure 1.3).

Figure 1. Europe's Lagging Performance at the Aggregate Level

1. Labor Productivity Ratio *(GDP per hour worked in PPP terms, ratio to United States)*

2. Product Market Reforms *(Number of major reforms each year)*

3. Decomposition of GDP per Capita Difference with the United States *(in PPP terms, 2024)*



Sources: AMECO; IMF, World Economic Outlook database; Eurostat, Long Term Productivity Database, Duval and others (2018) and IMF staff calculations.
Note: In panel 1, Nominal gross domestic product in purchasing-power-parity dollars weighted data for France is available from 1950, while data for Spain, Italy, and Germany begins in 1960. In panel 2, Europe is average of Austria, Belgium, the Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, and the United Kingdom. In panel 3, the Central Eastern and Southeastern Europe (CESEE) region includes Bulgaria, the Czech Republic, Croatia, Estonia, Latvia, Lithuania, Hungary, Poland, Romania, Slovenia, and Slovak Republic. EUR includes European Union countries (except Romania) and the United Kingdom. EU4 = France, Germany, Italy, and Spain; EU27 = European Union, CESEE = Central, Eastern, and Southeastern Europe; EUR = Europe; USA = United States of America; PPP = purchasing power parity.

What explains Europe's declining productivity growth? Which set of policies should policymakers prioritize to revive it? In this paper, we search for some answers to these long-standing questions by tracing the firm-level roots of Europe's productivity problem both at and behind the global productivity frontier, drawing upon comprehensive cross-country firm-level and sector-level datasets.[1]

We start our analysis by comparing the lifecycle performance of European and U.S. firms using aggregate data covering the universe of firms. The U.S. remains the global productivity frontier in many sectors and, as such, has become a standard benchmark for Europe's performance. We uncover three stylized facts. *First*, Europe's large leading firms—defined as those publicly listed—innovate and grow less than their U.S. counterparts. Among these firms, the Europe-U.S. productivity gap has widened in both tech and non-tech sectors in the last two decades, but particularly so in the tech sector: European listed tech firms did not experience any aggregate productivity gain in

[1] We use five different corporate datasets overall. Aggregate comparisons are based on three databases: (i) Business Dynamics Statistics (BDS), which provides aggregated firm-level-based data for the U.S. (see e.g. Decker and Haltiwanger (2024)), (ii) CompNet, with which we are able to reproduce for European countries many of the data moments available in BDS for the U.S., and (iii) the OECD's DynEmp database, which measures entry and exit in a more similar way as BDS. Our two firm-level databases are (iv) Compustat, which we use to analyze the performance of European and U.S. listed firms, and (v) Orbis, on which we draw for our firm-level analysis of young high-growth firms. As noted in the sections below, a few additional databases are also used, e.g. when assessing intra-Europe trade barriers, aggregate intangible capital stocks, and the overall European venture capital landscape.

the last two decades, in stark contrast to the 40 percent growth enjoyed by their American counterparts. Accordingly, market valuations and innovative activity—as measured by spending on research and development (R&D)—have fallen sharply behind American tech firms. *Second*, Europe's young high-growth firms are less disruptive and have a smaller economic footprint—measured as their contribution to total employment—than their U.S. counterparts. *Third*, Europe suffers from a broader lack of business dynamism. Looking through wide cross-country heterogeneity, average firm entry and exit rates across Europe are comparable to U.S. levels, but "up-and-out" dynamics are weaker in Europe, allowing more unsuccessful firms to stay in business. In other words, it is less likely in Europe that the "right" firms survive and thrive, and that the "wrong" firms exit. This weaker selection process results in an overabundance of small mature low-growth firms.

These deficiencies are likely interlinked. For instance, all else equal, fewer disruptive firms entering implies a smaller pool of innovative ideas that make it to the top and also lower competitive pressure on leading firms to innovate. Conversely, European leading firms' struggle to compete with their U.S. counterparts in sectors that exhibit economies of scale may also discourage potential European entrants, and instead encourage startup formation in other less dynamic sectors where firms can survive more easily even if remaining small.

To understand the reasons behind this broad underperformance of European firms, we zoom onto the two groups of firms that stand out in the stylized facts and also happen to be key players for innovation and productivity growth in the modern Schumpeterian growth literature (see e.g. Akcigit and Ates, 2023): market leaders, which are typically large listed firms that define the domestic technology and productivity frontier, and innovative market followers, which are typically younger high-growth firms with the potential to catch up to or even leapfrog market leaders. Large leading firms account for a significant share of aggregates, benefiting from economies of scale and strong investment in R&D (see e.g. Garcia-Macia and others, 2015). Young high-growth firms often drive disruptive innovations and make an outsized contribution to job creation (Haltiwanger, 2015). We find that Europe's fragmented market, with a small effective market size and lower reliance on equity financing, prevent Europe's large leading firms from scaling up and investing consistently in innovative-enhancing projects. As for young high-growth firms, we find evidence that a weaker pool of high-quality human capital hampers their formation, while lower availability of risk capital further hinders their expansion, especially for those that invest more heavily in hard-to-collateralize intangible assets.

The overarching finding that Europe has been falling behind the U.S. on key dimensions of business dynamism is all the more worrisome in light of the well-documented decline in business dynamism in the U.S. itself (see for instance Syverson, 2017; Fernald and Jones, 2014; Gordon, 2015; Byrne and others (2016)).[2] Factors that led to the success of the current generation of leading U.S. tech firms, such as strong intangible investment and innovation activities (Crouzet and Eberly, 2019), have been partly associated with this declining dynamism, as they strengthened these firms' market power and discouraged competition (Akcigit and Ates (2021)). The failure of merger and broader antitrust policy to adapt swiftly to this new landscape may also have contributed to entrench corporate market power and slow innovation (Akcigit and others, 2021; Covarrubias and others, 2019; Vaziri, 2022). Other common headwinds to innovation that have also affected the U.S. economy include, among others, demographic ageing (Hopenhayn and others, 2022, Pugsley and others, 2015) and rising innovation costs (Bloom and others, 2020). Some of them, such as demographic ageing, might have affected Europe more than the U.S.

Our paper contributes to the rich literature that looks at firm-level sources of weak aggregate productivity growth. In particular, there is a growing body of literature focusing on European countries, using firm-level datasets. One branch of studies looks into the declining business dynamism in Europe to explain the aggregate productivity growth slowdown. For instance, Calvino and others (2020) documents cross-country differences in the factors

2 Other studies focus on the decline in firm entry rate and the share of young firms in economic activity (Akcigit and Ates, 2021; Haltiwanger, 2015) as well as the increase in industry concentration and firm market power (De Loekcer and others, 2020)

behind the declining business dynamism for a set of advanced and emerging market economies, including 12 European countries. Another example is Biondi and others (2023), which looks at various firm-level characteristics such as productivity and market power to uncover the driver of a decline in job reallocation rates for 19 European countries.[3] There is another set of papers that focus on resource misallocations as the key source of aggregate productivity growth slowdown. For instance, Gopinath and others (2017) explore how a two-decade long capital misallocation prevalent in southern European countries has contributed to large productivity losses, using rich firm-level data. Bartelsman and others (2013) use a harmonized firm-level dataset of selected advanced economies and transition economies of Eastern Europe and documents that the link between firm-level productivity and firm size varies across countries, between industries, and over time. More recently, Goldin and others (2024) study the extent to which distortions and misallocation explain the observed differences in productivity across five advanced economies, including France, Germany, and the United Kingdom. Finally, other factors that hamper productivity slowdown have been considered. Andrews and others (2015) highlight the importance of diffusion of new technologies as a key driver of growth and productivity dynamics and the role of national frontiers in acting as the key player in domestic technology diffusion process. Another set of paper study the impact of competition and concentration on growth outcomes in Europe (Gutierrez and Philippon, 2017; Bajgar and others, 2021; Kalemli-Özcan and others, 2024).[4] We contribute to this burgeoning literature by drawing from various firm-level and sector-level data sources to provide a complete and meaningful comparison of trends in business dynamism across European countries and in relation to the U.S. We further point to other long-standing structural deficiencies, such as labor, product, and financial market barriers to swift resource reallocation, that became more penalizing with the advent of the ICT revolution.

The paper is organized as follows. Section 2 documents key stylized facts related to productivity growth for the two groups of firms and the entire population of firms in European countries for which data are available comparing to the U.S. Section 3 focuses on the bottlenecks facing Europe's large and leading firms. Section 4 turns to the challenges facing Europe's young high-growth firms. Finally, Section 5 draws selected policy recommendations from the findings.

2. The firm-level origins of Europe's productivity problem

Much of aggregate productivity growth is driven by innovations from large leading firms and disruptive new entrants, as well as efficiency improvements by mature lagging firms. This dynamic is enhanced when financing and workers move swiftly to businesses that make the most of these resources, in a process that also necessarily entails the downsizing and potential exit of less productive firms. In this section we show that Europe's aggregate productivity problem can indeed be traced back to an underperformance across these dimensions. Specifically, relative to the United States, Europe's business landscape is characterized by large leading firms that innovate less, fewer and less vigorous startups, and—partly as a result, but also due to lower exits of unsuccessful firms—an overabundance of small, low-growth mature firms.

Europe's large leading firms are lagging in terms of productivity and innovation

[3] Their analysis relies on the OECD DynEmp and CompNet database, as in our paper.

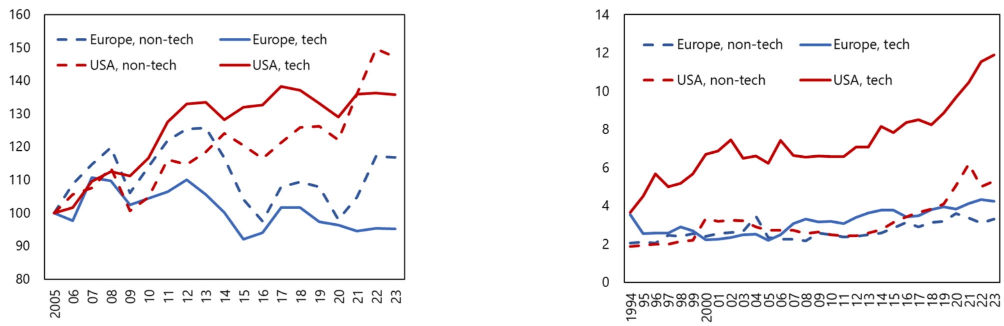
[4] Due to limited availability of comparable cross-country datasets, many studies focus on a single country and drivers of dynamism. For example see Bijnens and Konings (2018) for Belgium; Nunes and Sarmento (2010) for Portugal.

The total factor productivity growth of European listed firms has been trailing that of their US counterparts (Figure 2.1).[5] This divergence is broad-based. Over the last two decades, average annualized productivity growth among Europe's non-tech firms was just 0.9 percent, compared to 2.6 percent in the U.S. In the tech sector, European listed firms' measured productivity even *declined* at an annualized rate of 0.3 percent, compared to annualized growth of 1.5 percent among U.S. firms. In all, the productivity of US listed tech firms increased by around 40 percent over the past two decades, while that of European tech firms has remained stagnant. This divergence comes hand-in-hand with a widening gap in innovation efforts (Figure 2.2). R&D expenditures of European tech firms have been about 3 to 4 percent of sales in recent decades, while they have tripled in the United States, reaching 12 percent of sales in 2023. Considering that US tech firms also enjoyed higher sales growth, the absolute R&D spending gap between the two regions is even more pronounced. This has translated into a widening innovation gap as measured by patenting activity.[6]

Figure 2. Productivity and R&D Investment of Leading Firms in Europe and the United States

1. Productivity of Listed Firms *(2005=100)*

2. R&D Intensity over Sales *(R&D investment over sales, percent)*



Sources: Compustat and IMF staff calculations.
Note: In panel 1, productivity estimates are based on non-parametric approach proposed by Gandhi and others (2020), also used in IMF (2019). In panel 1 and 2, Europe includes Belgium, France, Germany, Great Britain, Ireland, Italy, Netherlands, Spain, and Switzerland. R&D = research and development; USA = United States of America

Young high-growth European firms have a smaller footprint in the economy compared to the U.S., and too few among them make it to the top…

At the other end of the spectrum, young firms in Europe also exhibit weaker dynamism than their US counterparts. Entry rates are comparable on average, although they vary significantly across European countries, with some countries such as Denmark showing higher rates than the U.S. (Figure 3.1). Stripping out the data from microenterprises (firms with fewer than 10 employees)—which make a markedly low share of total value added compared to their share of employment—and thereby focusing on "higher-quality" entrants, the average entry rate in the U.S. is at least about 25 percent higher than in Europe (1.5 in Europe, v. 1.9 for the US at firm-level).[7] Moreover, within this pool of entrants, high-growth firms tend to have a smaller footprint in the economy. US top-performing young firms (those under the age of five and in the top decile in terms of sales growth) make up around

[5] Firm-level estimates of total factor productivity are based on the non-parametric approach by Gandhi and others (2020), also used in IMF (2019). This approach addresses endogeneity issue that arise from simultaneity between input choices and productivity shocks by exploiting the non-parametric information contained in the first order condition for the flexible inputs. However, because it has to rely on sector-level rather than (unavailable) firm-level price indices, it may not properly disentangle firm-level changes in total factor productivity from changes in markups.

[6] In particular, Bergeaud (2024) shows how Europe's patenting activity has been dwarfed by the United States and China's, particularly in high-tech areas crucial for future transformations such as green technologies.

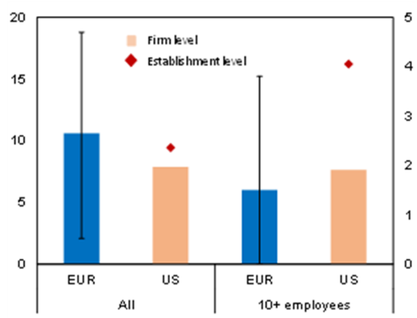
[7] Europe-US comparisons in this section are based on aggregated data covering the universe of firms in each economy. These comparisons should be interpreted with caution given that national statistical agencies can differ in how they compile business registries. Entry and exit rates are particularly sensitive to definition and sample choice (see the discussion in Decker and Haltiwanger, 2024, on various entry rates in the case of the United States). Tracking the exact timing of firms' entries and exits through business registries can be very challenging and entail measurement error. Importantly, entry and exit in the DynEmp database for Europe are measured at the firm level in some economies while at the establishment level in others.

six times the share of total employment of their European counterparts (Figure 3.2). As a result, fewer innovative young firms also end up reaching top-firm status in Europe. Indeed, the median founding year of the top 10 listed firms is 1985 in the U.S., versus 1911 for Europe.[8]

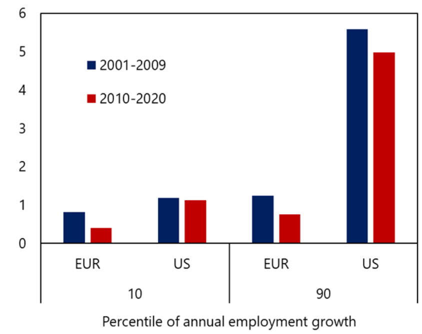
Europe shows a deficit not just of young high-growth firms, but also of exiting unsuccessful firms, as evidenced by an overabundance of small mature low-growth firms. As in the case of entry, aggregate exit rates are highly dispersed in Europe, but comparable to the US level on average (Figure 4.1). Excluding smaller firms, a slight exit rate gap opens up, with large gaps for some European economies. The scarcity of high-growth young firms and greater survival of low-growth firms result in a narrower firm growth distribution in Europe (Figure 4.2) and indicate weak "up-or-out" dynamics—a key characteristic of US business dynamism (Eslava and others, 2022).

Figure 3. Dynamism of Young Firms in Europe and the United States

1. Entry Rates
(Percent, 2019)



2. Employment Share of Young Firms: Low-Growth versus High-Growth Firms
(Percent)



Sources: OECD DynEmp; CompNet; Business Dynamics Statistics; and IMF staff calculations.
Note: In panel 1, establishment-level entry rates for the United States are calculated based on BDS-calculated entries and total number firms; firm-level entry rates are calculated as the ratio of age-0 firms to firms in the relevant category. Country-level entry rates for European countries are from the OECD DynEmp database. Out of 30 European countries, 10 report at the firm level, 1 at the establishment level, and for 19 the metadata are not available. The average entry rate for Europe is calculated as the weighted average of country-level entry rates, using the share of firms of each country in the European aggregate as weights. "All" represent the entry rates for employer firms and "10+" reflect entry rates of firms with at least 10 employees. The following countries are covered: Austria, Belgium, Bulgaria, Switzerland, Cyprus, the Czech Republic, Germany, Denmark, Spain, Estonia, Finland, France, Greece, Croatia, Hungary, Iceland, Italy, Lithuania, Luxembourg, Latvia, Malta, the Netherlands, Norway, Poland, Portugal, Romania, the Slovak Republic, Slovenia, Sweden, and Türkiye. The sample for "10+" excludes Switzerland and Greece. Panel 2 shows the total employment shares of young low-growth firms (those with employment growth at or below the 10th percentile) and young high-growth firms (those with employment growth at or above the 90th percentile) for 2001–09 and 2010–20. In this chart, Europe includes Belgium, Croatia, the Czech Republic, Denmark, Hungary, Italy, the Netherlands, Slovenia, Spain, and Sweden. USA = United States of America; EUR = Europe; OECD = Organisation for Economic Co-operation and Development.

… which, together with weaker "up-or-out" dynamics, results in an overabundance of small mature low-growth firms

As a result, the difference in average firm size between Europe and the United States grows over a firm's life cycle. An average mature firm (above 25 years old) employs just twice as many workers as an average young firm (below the age of three) in Europe, versus over eight times in the U.S. (Figure 4.3). In other words, European firms tend to remain smaller, which shows in European micro firms (with ten employees or fewer) making up for 20 percent of total employment, nearly twice as much as in the U.S. (Figure 4.4). Further, this employment share of micro firms has risen in the past decade, in line with their stalling productivity growth and a rising productivity gap between national productivity leaders and other firms in their industry, especially in Europe's advanced economies (Box 1 in IMF, 2024a; Andrews and others, 2015).

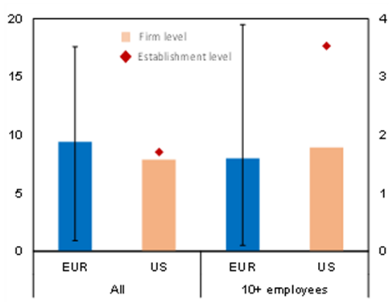
[8] These newer US superstars also account for most of the growing valuation gap between European and US stock markets since the mid-2000s. While US listed firms already present in 1995 collectively outperformed Europe's stock market by 60 percent since 2005, once firms that entered after 1995 are included the overperformance rises to 160 percent.

These shortcomings are interlinked

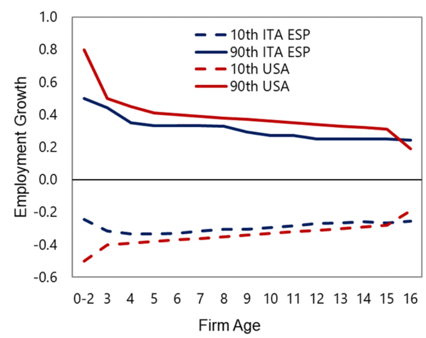
The following sections turn to the drivers of these various gaps in business dynamism vis-à-vis the United States. While these gaps are studied in isolation, they largely feed off each other. For instance, with fewer disruptive firms entering and making it to the top, leading listed firms may face weaker competitive pressures and thereby decide to invest less in innovation. Conversely, European leading firms' struggle to compete with US counterparts in sectors that exhibit economies of scale and network effects may also discourage potential European entrants, and instead encourage startup formation in other less dynamic sectors where firms can survive more easily even if remaining small.

Figure 4. Business Dynamism and Distribution of Employment by Firm Size and Age

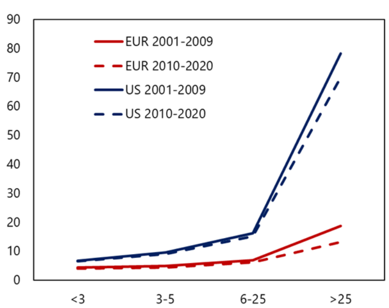
1. Exit Rates
(Percent, 2019 values)



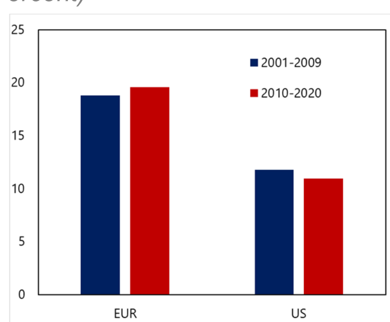
2. Distribution of Employment Growth by Firm Age
(Percent)



3. Average Employment by Firm Age
(Number of persons)



4. Employment Share of Micro Firms
(Percent)



Sources: OECD DynEmp; CompNet; Orbis; Business Dynamics Statistics; Business Dynamics Statistics of High Growth Firms; and IMF staff calculations.
Notes: In panel 1, exit rates for the United States are based on BDS-calculated exits and total number firms or establishments; the exit rates for European countries are from the OECD DynEmp dataset. Out of 30 European countries, 10 report at the firm level, 1 at the establishment level, and for 19 the metadata are not available. "All" corresponds to firm exit rates of all firms and "10+ employees" reflects firm exit rates for firms that have at least 10 employees. The following countries are covered: Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Germany, Denmark, Spain, Estonia, Finland, France, Greece, Croatia, Hungary, Iceland, Italy, Lithuania, Luxembourg, Latvia, Malta, the Netherlands, Norway, Poland, Portugal, Romania, the Slovak Republic, Slovenia, and Sweden. The sample for "10+" excludes Greece. Firm exit rates for the United States are from Business Dynamics Statistics, which defines exit rates as the "count of firms that have exited in their entirety during the period" divided by the average of the total number of establishments in the current and previous years. Under this classification, exits due to merger and acquisition activity are not classified as firm deaths. In panel 2, the US data are from Eslava and others (2022), where the age of firms is defined as the age of the oldest establishments for that firm in the first year of positive business activity. Annual employment growth for Spain and Italy is weighted by the PPP-adjusted nominal GDP in US dollars. In panel 3, the vertical axis shows the average employment by firm age. CompNet is used for European firms, covering Belgium, Croatia, the Czech Republic, Denmark, Hungary, Italy, the Netherlands, Slovenia, Spain, and Sweden. Business Dynamics Statistics are used for US firms. In panel 4, USA = United States of America; EUR = Europe; ITA = Italy; ESP = Spain; OECD = Organisation for Economic Co-operation and Development.

3. Why are Europe's leading firms falling behind?

What explains subdued productivity growth among Europe's large leading firms? What are the bottlenecks that prevent them from investing more intensely and consistently in innovative activities? This section sheds light on two of the key explanations, namely Europe's limited effective market size, which hinders firms' ability to scale up, and firms' limited reliance on equity, which may result in lower, lumpy and procyclical intangible investment patterns.[9]

These weaknesses can be particularly detrimental to the production and adoption of digital technologies. Entering industries highly reliant on digital technology, such as AI, requires massive upfront investments in R&D, developing a large customer base and/or collecting proprietary data. After entry, firms benefit from low variable production costs and can obtain a first-mover advantage provide they quickly exploit network effects and economies of scale. This creates a "winner-takes-all" dynamic where profits predominantly accrue to the winners, which then hard-to-displace incumbents. To become a dominant player in a highly competitive environment, firms must secure large amounts of capital upfront, invest heavily in R&D and other intangible assets, and have access to a large market that facilitates quick scaling-up. And to deflect the risk of leapfrogging by young innovative firms, dominant players must continuously invest in intangibles as well. This, in turn, requires a financing structure that accommodates large-scale long-term investments in risky and hard-to-collateralize intangible assets (Hall and Lerner, 2010).

3.1. Limited market size impedes innovation and growth among Europe's most productive firms

A cursory comparison might suggest little difference in terms of market size between Europe and the U.S.—each economy represents around 15 percent of the global economy when measured at purchasing power parity. Yet, the effective market size is comparatively much lower in the European Union, as segmentation forces firms to operate in a much smaller market than their U.S. counterparts. Indeed, the intensity of intra-EU trade is less than half of the level of trade across U.S. states (IMF, 2024). As a result, European firms cannot reap the benefits of economies of scale and network effects as much as U.S. firms do.

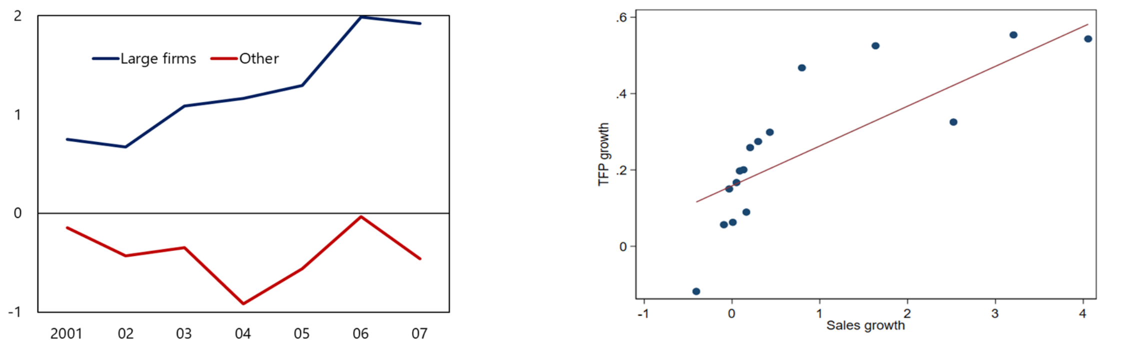
Europe's own history testifies to the productivity gains of a large market size. Past expansions of the European Union have driven income convergence by boosting both total factor productivity and capital accumulation (see Grassi, 2024). In line with economic theory, firm-level analysis also confirms that EU accession raised aggregate productivity by incentivizing larger firms to expand relative to smaller, less productive ones (Figure 5.1). While large firms saw a steep and steady post-accession rise in sales, smaller firms experienced a more muted increase.[10] Firms that experienced larger increases in sales also enjoyed larger increases in productivity (Figure 5.2).

[9] This section relies primarily on the Compustat database compiled by Standard & Poor's. European listed firms refer to companies incorporated in Belgium, France, Germany, Italy, Ireland, the Netherlands, Spain, Sweden, Switzerland, and the United Kingdom.

[10] See also Neri-Laine, Orefice and Ruta (2024), who find that signing deep trade agreements (such as accession to the EU) boost the exports of large firms involved in global value chains but can reduce those of smaller (less productive) firms. Note that Figure 5 focuses on the impact of accession by firm size rather than by TFP level because the sample for which TFP can be estimated for accession countries around 2004 is too small.

Figure 5. Sales and Productivity Growth Following EU Accession

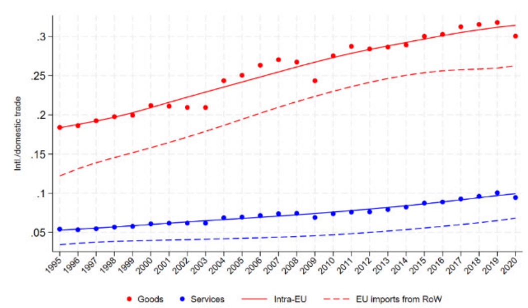
1. Continuing manufacturing firms' sales growth of 2004 accession countries | **2. Large manufacturing firms: sales and TFP growth of 2004 accession countries (2004-07)**



Sources: Orbis; and IMF staff calculations.
Note: Panel 1 shows the log difference of deflated sales for large manufacturing firms (blue line) and other manufacturing firms (red line). Large firms are defined as those with deflated sales above the 95th percentile of the deflated sales distribution in the year 2003. Aggregates are constructed using deflated sales as weights. Panel 2 is a binned scatter plot of the log difference of deflated sales (horizontal axis) and the log difference of TFP (vertical axis), pooling together all observations over 2004-2007.

Looking ahead, what matters is to gauge the extent of remaining intra-EU trade barriers. We conduct several analyses to this end. A first indication of the trend in barriers to trade comes from analyzing the ratio of international trade flows to domestic trade flows. As the latter are not directly affected by cross-border frictions, the difference can serve as a very rough initial proxy for international trade barriers. As shown in Figure 6, this ratio has been on a trend rise, signaling a fall in trade barriers between EU countries, for both goods and services–by 2020, the value of intra-EU trade was 30 percent of that of domestic (within-EU-country) sales for goods, and 10 percent for services. Over the same period, EU imports from non-EU countries increased at a similar rate, indicating a concomitant decline of broadly similar magnitude in external trade barriers.

Figure 6. Ratios of Intra-EU and EU-Rest of the World (RoW) Trade to Domestic Trade



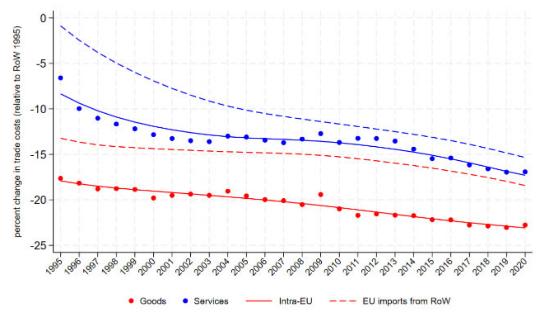
Source: Inter-Country Input-Output TiVA tables and IMF staff calculations.
Note: Each dot denotes the ratio of trade between EU-28 countries to domestic sales within EU-28 countries. The lines are local regressions fitted values of the ratios on year dummy variables. Solid lines are for intra-EU trade flows and dashed lines are for EU imports from non-EU (RoW) countries.

We infer barriers more carefully by controlling for drivers of trade flows unrelated to trade policies within a standard gravity trade model. Specifically, we estimate the following model of bilateral trade at the sector level ($X_{in,t}^k$) for domestic and international trade:

$$X_{in,t}^k = \exp(\beta_{INEU,t}^k EU_{in,t} + \beta_{OUTEU,t}^k EUROW_{in,t} + \beta_{ROW,t}^k ROW_{in,t} + \beta_{TA}^k TA_{in,t} + \chi_{i,t}^k + \varphi_{n,t}^k + \mu_{in}^k + \epsilon_{in,t}^k)$$

This specification is a sector-level variant of the model in Head and Mayer (2021). Bilateral exports from origin i to destination n (where $i = n$ for domestic sales) are regressed on a set of dummy variables that decompose international trade flows into cross-border flows between EU countries (the EU variable), EU imports from non-EU countries (the EUROW dummy), and cross-border flows between non-EU countries. The associated β coefficients are allowed to vary over time by interacting each of the trade flows indicator with year dummies. The model controls for participation in Preferential Trade Agreements (PTAs) other than the EU and membership in the World Trade Organization (variables collected in the TA matrix), as well as for time-varying exporter (χ) and importer (φ) fixed effects. Country-pair fixed effects (μ) further absorb the influence of time-invariant determinants of trade. The regression is estimated by sector k using yearly data over 1995-2020 on international and domestic trade flows computed from the OECD TiVA inter-country input-output database.[11]

Figure 7. Estimates of Changes in Intra-EU and EU-Rest of the World (RoW) Trade Costs



Source: Authors' gravity models for bilateral trade flows.
Note: Each dot denotes output-weighted averages of coefficients on interactions between a dummy for trade between EU countries and year dummies. The lines are local regressions' fitted values of the averages of coefficients on a year variable, where the excluded trade category is trade among non-EU countries in 1995. Solid lines are for intra-EU trade flows and dashed lines are for EU imports from non-EU (RoW) countries.

Trade barriers can be inferred from the β coefficients as these identify how different types of international trade flows evolve relative to domestic trade flows. Because of the unit (country-pair) fixed effects, only changes in the costs of both intra-EU and external-EU trade over time can be inferred.[12] To measure trade costs, the estimated coefficients are then converted into ad-valorem equivalent trade cost using the formula $\left[\exp\left(\frac{\beta_{f,t}^k}{\theta^k}\right) - 1\right] \times 100$ for $f \in \{INEU, OUTEU, ROW\}$, where θ^k is the elasticity of trade with respect to trade costs, whose values are drawn from Fontagne et al. (2022).

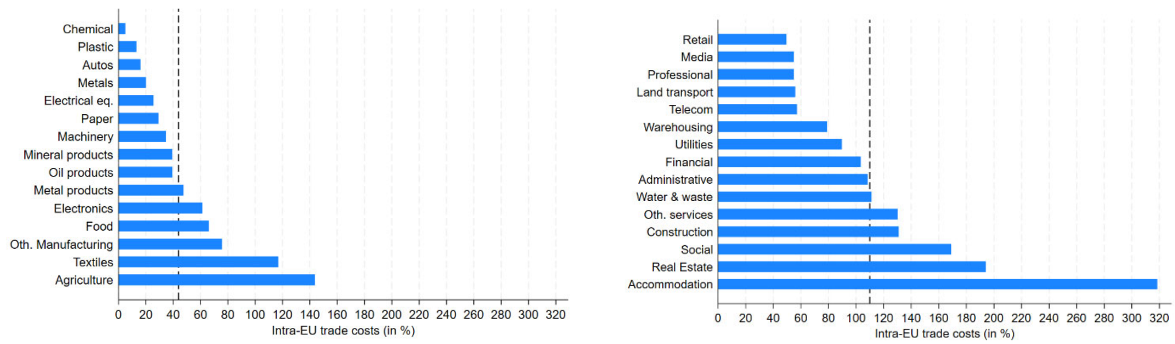
The results are reported in Figure 7, which shows the evolution of estimated output-weighted average ad-valorem trade costs that EU members impose on each other and on non-EU countries for goods and services sectors, separately. The costs of intra-EU trade have fallen across the board, although those of external-EU trade also declined by a broadly comparable extent as international trade liberalization proceeded. In 1995, intra-EU trade costs were estimated to be already 17.6 percent lower than trade costs between non-EU countries in goods, and 6.6 percent lower in services (see solid lines). EU market integration then further lowered trade barriers, both internally and towards non-EU countries. For goods, intra-EU trade costs went down by 6 percent over 1995-2020, while in services the drop was 11 percent—which was however less than the estimated 16 percent decline for services imports from non-EU countries. These average changes mask profound heterogeneity across sectors, however. Among the major goods industries, the largest drops in intra-EU trade costs are estimated for electrical machinery and other manufacturing (9 percent), whereas in the car and electronics industries trade costs are not found to have changed materially over 1995-2020. Those service industries where EU integration was the fastest were telecoms and media services, with trade cost declines of 18 and 19 percent, respectively.

[11] Trade values include flows for intermediate use and final demand. In the estimation, standard errors are clustered by country pair.
[12] The year-specific coefficients are identified relative to the non-EU trade coefficient in 1995 ($\beta_{ROW,1995}^k$).

In addition to analyzing the *change* in trade costs, we use an alternative specification to assess the *level* of existing intra-EU trade barriers by replacing the country-pair fixed effects with time-invariant trade cost shifters such as distance (in logs, internal and international) and dummies for sharing a border, an official language, and the origin of the legal system. The implicit identifying assumption in this alternative model is that these barriers fully absorb the influence of country-pair-level, time-invariant determinants of bilateral trade flows. this is a strong assumption given that other potentially influent time-invariant determinants of bilateral trade flows, such as home bias in consumer preferences, cannot be controlled for. Therefore, the levels of trade costs inferred from this approach should be seen as upper bounds.

Figure 8. Estimates of Intra-EU Trade Barriers, 2020

1. Goods 2. Services



Source: Estimations from gravity models for bilateral trade flows in 2020.
Note: Each bar denotes the coefficient on a dummy for intra-EU trade. The vertical dashed lines are output-weighted averages within manufacturing (Panel 1) and services (Panel 2).

Figure 8 reports the ad-valorem equivalent of the gravity-based intra-EU trade costs for different industries in 2020. It shows that despite significant progress towards market integration, the within-EU trade barriers remain significant in both goods and—particularly—services. Average intra-EU trade costs for goods are estimated to be around 44 percent (excluding agriculture), with wide heterogeneity across individual industries. Estimated intra-EU trade barriers remain even higher in services, at 110 percent on average, with all individual services sectors suffering higher barriers than those of the average goods sector. This is suggestive evidence of significant remaining impediments to intra-EU trade, e.g. because of poor border infrastructure (for some of goods trade), procurement rules, or lack of harmonized rules.

It is important to note that these estimates are not only best seen as upper bounds but are also sensitive to the choice of datasets and aggregation of trade flows. These factors explain, *inter alia*, why the estimates presented here are higher than the baseline estimates in Head and Mayer (2021; HM henceforth) of around 10 percent. Regarding the level of aggregation, we use sector-specific trade elasticity parameters to convert empirical estimates into tariff equivalents. If we replicate our analysis using aggregate goods sector data as in HM and impose the common elasticity parameter value they use (five), we obtain an ad-valorem tariff equivalent for intra-EU trade barriers of 30 percent, which is smaller than our 44 percent estimate based on the more refined sector-level estimates, but still higher than the 8 percent figure reported by HM. The remaining difference might be explained by differences in the trade flows data, particularly in how internal (i.e., within-country) trade flows are estimated. Our larger intra-EU cost estimates might reflect the fact that the domestic trade flows from ICIO are systematically larger than the those constructed by HM.[13][14]

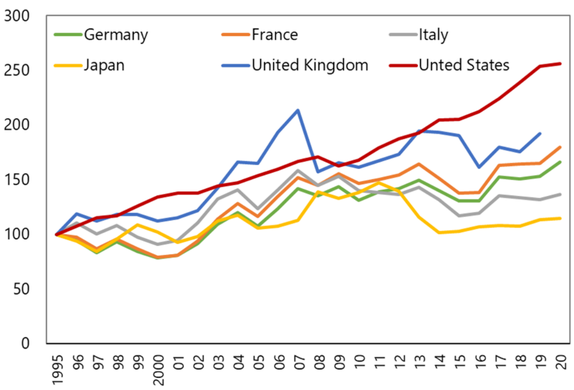
Our empirical results underscore the potential for further EU market integration to support productivity growth. For example, using estimates of the productivity effects of the 1988 U.S-Canada trade agreement (CUSFTA) found in Trefler (2004), each 10-percentage point reduction in goods tariffs could lead to a 1 percent increase in labor productivity. Applying these numbers to our estimates of intra-EU sectoral barriers suggests that reducing the latter to the level observed between US states could potentially increase productivity by 6.7 percent.[15] Broader evidence unpacking these effects points to productivity gains through enhanced innovation, which would be more pronounced for already more productive firms (see the review by Shu and Steinwender, 2019).

3.2 Lower reliance on equity compared to U.S. listed firms contributes to lower and more volatile R&D investments

Another factor that appears to hamper the innovative activity of Europe's leading firms relates to the financing structure of investment, which may be conducive to harmful "stop-and-go" behavior of intangible investment that can be seen from its greater volatility in Europe compared to the U.S (Figure 9).

Specifically, European firms rely less than their U.S. competitors on equity; relative to their size, U.S. listed firms have been able to issue about twice as much equity as European ones (Figure 10.1, which compares the levels of equity issuances, net of share repurchases, as a share of firms' book values). Compared to debt financing, equity financing is better suited for risk-taking ventures. This is particularly true for intangible investments, which cannot be pledged as collateral but, yet, constitute a primary component of firm capital in innovative industries. Producing innovation requires the ability to sustain high levels of research spending irrespective of temporary fluctuations in economic activity, as R&D project disruptions derail the production of innovations (Aghion and others, 2010). Figure 10.2 shows the within-firm volatility of R&D expenses and gross income, averaged across sectors. Despite comparable volatility in revenues across both sides of the Atlantic, swings in R&D spending over time are more common for European firms.

Figure 9. Real Intangible Capital Stock
(1995=100)

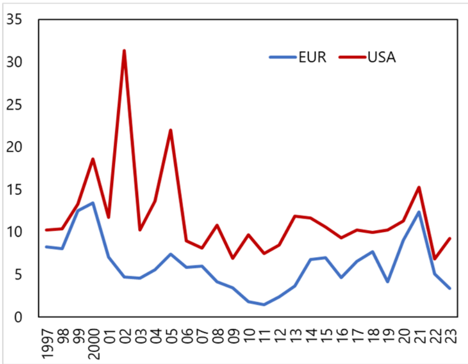


Sources: EU KLEMS & INTANProd; IMF WEO Database.
Note: Total intangible capital stocks in real terms are normalized to the level in 1995. Annual end-period exchange rates from the IMF WEO database are used to convert the original variables into US dollars. The patterns are broadly similar when using alternative measures of deflators, including the official annual GDP deflators.

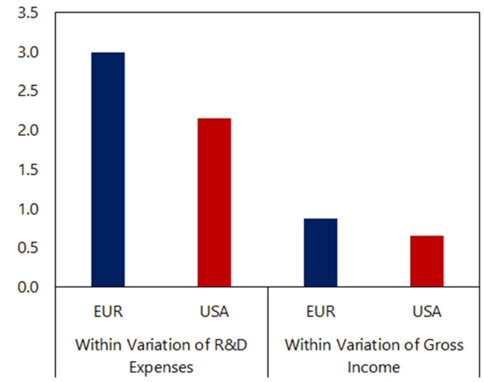
[13] In the ICIO data we use, domestic trade flows are constructed within the input-output system, based on official data and balancing constraints. For Europe, Head and Mayer (2021) impute domestic trade flows as the difference between the values of manufacturing output and total exports from COMTRADE. It is worth noting that our estimates of the level of intra-EU trade costs are close to those obtained by Santamaria et al. (2024). By exploiting data on regional trade and a different methodology than ours, their average border effect across industries implies an ad-valorem tariff equivalent of intra-EU trade barriers of approximately 40 percent over 2011-2017.
[14] It is worth emphasizing that the influence of any (roughly stable over time) under-estimation of domestic trade flows in the HM data relative to ours should disappear in the specification with bilateral fixed effects. Indeed, our estimated changes in average trade costs reported in Figure 7 are quite close to those found in HM's Figure 1.
[15] In the case of goods sectors (including agriculture), the calculation assumes that the average ad valorem trade barriers in 2020 (53 percent) falls to 13 percent, the level estimated by Head and Mayer (2021) to prevail in the U.S. in the aggregate of all goods sectors. For services sectors, it assumes that barriers between U.S. states are higher than for goods in the same proportion as in the case of the EU. The aggregate increase in productivity equals the output-weighted average of the simulated increases across the goods (4 percent) and services (8.3 percent) sectors.

Figure 10. Financing and R&D Expenses: US and European Listed Firms

1. Net Equity Issuance of European and U.S. listed firms
(Share of total assets)



2. Volatility of R&D Expenses and Income Among European and U.S. listed firms
(Percent)



Sources: Orbis; and IMF staff calculations.
Note: In panel 2, volatility is measured by the (within-firm) standard deviations of respective variables.

We carry out two formal analyses to test the hypothesis that financial frictions are more binding for European firms more than U.S. firms and, hence, result in more volatile investment, including in R&D.

In the first exercise, using the balance sheets of listed firms in Compustat, we estimate firms' marginal propensity to invest (MPI) across countries and sectors. To do so, we rely on the estimation procedure proposed by Blundell and others (2008) focusing on household consumption patterns, later extended to firm investment patterns by Martin-Baillon (2021). The key intuition is that firms without financial frictions will not adjust investment plans in response to transitory cash flow shocks, as investment plans tend to extend beyond the near term. By contrast, firms facing financial frictions will curtail investment in response to adverse transitory cash flow shocks, as they will be unable to fully offset such shocks through increased borrowing. As a result, the sensitivity of firm-level investment to transitory cash flow shows, MPI, or the elasticity of investment to revenue shocks, is indicative of the degree of financial frictions that firms face.

MPIs are calculated as follows. First, $\Delta log\ y_{i,t}$ denotes the growth rate of residualized gross sales for firm i in year t, which is our measure of transitory cash flow shocks. The residualized gross sales are calculated from an OLS regression as residuals of log sales, controlling for firm-level employment, R&D expenses to assets, one-year lag of leverage, as well as year, country and sector fixed-effects. $\Delta log I_{i,t}$ denotes the growth rate of firm-level investment for firm i in year t.

MPI, or the elasticity of investment to revenue shocks ($\theta^{y,I}$), is the ratio of the covariance between log-investment growth and transitory shock, over the covariance of contemporaneous and future transitory cash flow shocks.

$$\theta^{y,I} = \frac{Cov(\Delta log I_{i,t}, \Delta log y_{i,t+\tau})}{Cov(\Delta log y_{i,t}, \Delta log y_{i,t+\tau})}$$

where τ takes values of 1 - 3.[16] Following the interpretation of Kaplan and Violante (2010), this is the share of the variance of the transitory shocks passed onto log investment decision.

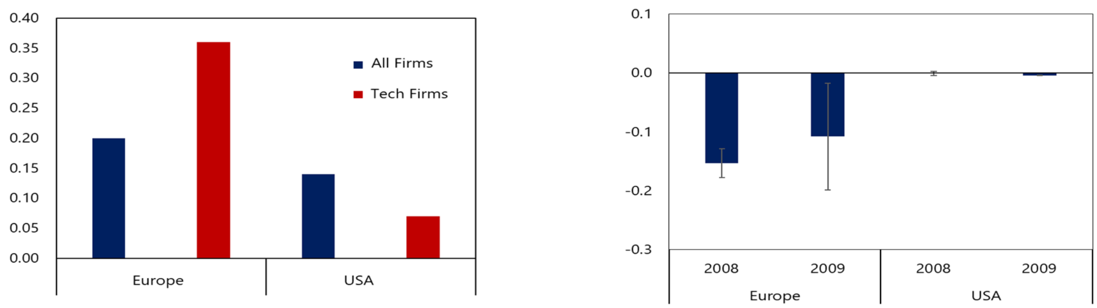
[16] To finally obtain the MPI, one then simply multiplies the average of the above defined elasticity for the share of investment to sales.

We find this elasticity to be higher for European listed firms compared to their U.S. counterparts (0.2 versus 0.13). The difference is particularly pronounced when we restrict our analysis to tech sectors, where an unexpected one-percent increase in sales is estimated to increase investment by 0.4 percent for European listed firms versus only 0.1 percent for U.S. firms (Figure 11.1).

Figure 11. Financial Frictions and R&D Investment

1. Marginal propensities to invest out of temporary shocks are significantly higher for European than for U.S. tech firms, pointing to financing constraints.

2. European firms with greater exposure to the global financial crisis shock sharply curtailed investment, much more so than U.S. counterparts.



Sources: Compustat; and IMF staff calculations.
Note: In panel 2, financial constraints are measured by the share of current liabilities to total assets in 2007. The whiskers represent 90 percent confidence intervals. Industry fixed effects and firm-level controls including total assets and leverage are included.

A second approach zeroes in on the impact of the 2008-2009 global financial crisis (GFC) on the investment patterns of European and U.S. firms. The GFC and the subsequent sovereign debt crisis in Europe have been associated with persistent reductions in firms' ability to invest and innovate. Duval, Hong, and Timmer (2020) and Mezzanotti and Simcoe (2023) show that bank-related financial stress during the GFC led distressed firms to cut investments in intangibles, a finding consistent with the notion that costly access to capital can result in volatile R&D spending. Exploiting the fact that the tightening in financial conditions after the September 2008 Lehman shock affected disproportionately firms that had a lot of debt to roll over back then, we can study the impact of financial frictions on R&D spending.

Define $\Delta log\ r_{i,t}$ as the firm-level growth rate of R&D spending in year t, and $z_{i,t}$ as the value of the financial frictions index proposed by Whited and Wu (2006). We restrict our sample to firms that report positive R&D spending in at least two years between 2004 and 2022, and estimate:

$$\Delta r_{i,t} = \beta z_{i,t-1} + \gamma \Gamma_{i,t-1} + \theta X_i + \varepsilon_{i,t}$$

where Γ is a matrix of firm-level controls that includes the external financing dependence variable of Rajan and Zingales (1998), log sales, current research intensity levels, leverage, and profitability measured as return to assets (or the ratio of income before interest and taxes to book value of assets). We also include country and 2-digit SIC sector fixed effects in the matrix X. We find the average impact of tightening financing conditions on R&D spending growth to be almost two orders of magnitude larger for European firms compared to their U.S. counterparts (Figure 11.2). As would be expected, this effect is muted for both European and US firms when the model is estimated for other periods in the sample over which financial conditions were more benign.

4. In search of Europe's high-growth young firms

Looking beyond top firms, Europe suffers from a broader lack of business dynamism. Most strikingly, as documented in Section 2, Europe has a deficit of high-performing startups, with too few among them growing fast and eventually making it to the top. Using microdata for a wide range of European countries, this section explores impediments to the formation and expansion of promising young firms. Unlike in the case of listed firms analyzed in section 3, data availability constraints prevent a direct US-Europe comparison in this section. It is well-known that Orbis has insufficient and non-representative coverage of non-listed U.S. firms. Rather, we focus on the rich within-Europe variation that the data allows to investigate the constraints that startup firms face.

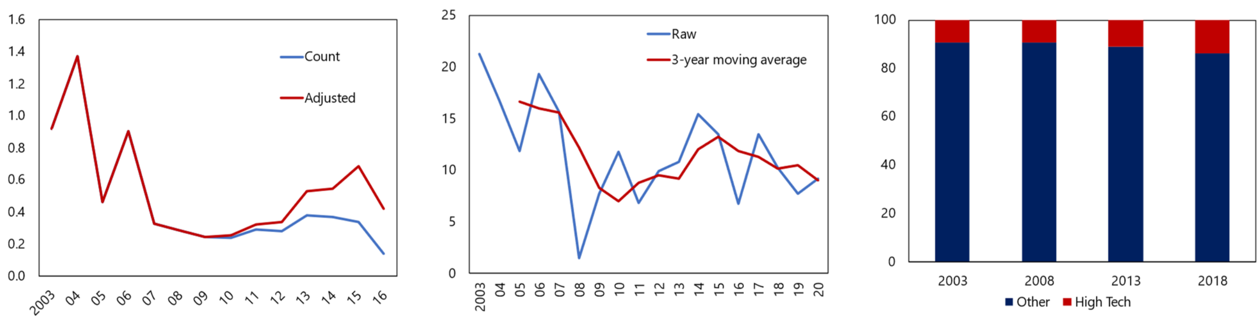
The performance of Europe's "gazelles" has deteriorated, and while growing, their presence in tech remains limited

Figure 12. Stylized Facts of European Gazelles

1. Number of Gazelles by Birth Cohort
(Index; thousands)

2. Gazelles Sales Growth Overperformance
(Percent)

3. Gazelle Births by Cohort
(Percent)



Sources: Orbis; and IMF staff calculations. Notes: In panel 1, the red line corresponds to a series adjusted for the fact that a firm can become a gazelle until it turns 10 years old, but because the sample ends in 2021, firms born more recently may become a gazelle in the future, after the last year of the sample.

Broadly following the literature (e.g. Sterk and others, 2021), we define gazelles as firms that, by age 10: (i) feature at least one three-year period of annualized growth in deflated sales of 20 percent or more; and (ii) eventually reach more than 100 employees. [17] Using firm-level data for 22 European countries reveals that annual gazelle births in the sample used have recently risen somewhat but remain below pre- global financial crisis levels (Figure 12.1) at about 0.5 percent of total firms, and their sales growth has exceeded that of large leading firms by about 10 to 15 percentage points.[18] However, this overperformance has somewhat waned since the 2000s (Figure 12.2). Further, in terms of sectoral composition, while the share of gazelles found in tech sectors has increased from about 10 to 19 percent of births between 2008 and 2018, it remains small (Figure 12.3).[19]

[17] The main difference with Sterk and others (2021) is that we condition on sales growth rather than employment growth; this more factor-neutral definition aims to avoid biasing our analysis of gazelles' productivity patterns below. It also increases sample size since employment is not systematically covered in Orbis.

[18] The countries covered are Austria, Belgium, Bulgaria, Czech Republic, Denmark, France, Germany, Greece, Iceland, Italy, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

[19] While Orbis' data coverage constraints prevent detailed comparisons with the U.S., a rough comparison is still possible at a relatively high level of aggregation using CompNet for Europe and Business Dynamics Statistics for the US. Over the period of 2010-20, the share of young firms below the age of 2 is low in Europe compared to the U.S. in some tech-related sub-sectors such as "Management, Scientific, and Technical Consulting Services" (around 3 percent in Europe versus 5 percent in the U.S.) and "Computer Programming, Consultancy and Related Activities" (around 3 percent in Europe versus 4 percent in the U.S.).

To promote gazelle formation, Europe will need to offset its demographic headwinds through enhanced investments in human capital…

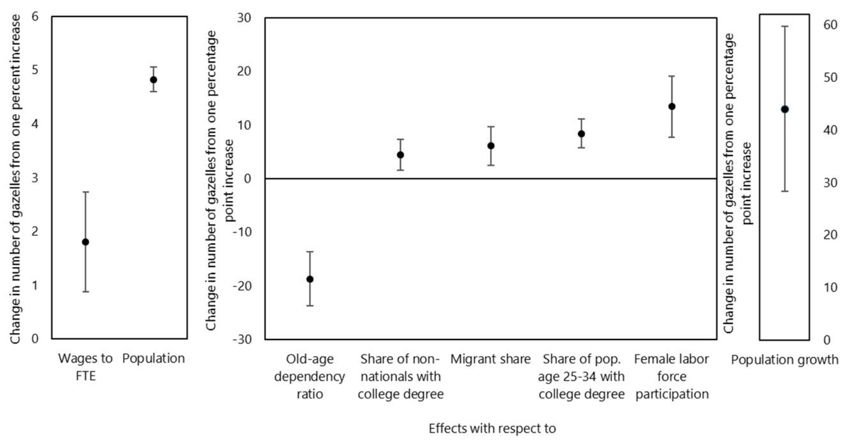
Gazelle formation is shaped by many policy and non-policy-related forces. To understand the proximate correlates of gazelle formation, we exploit the variation in gazelle births across European countries and regions over time. Specifically, the count of gazelle births is modeled through a Tobit model estimated at the country level. The regression specification involves a latent variable, $N^*_{r,t}$, representing the uncensored number of gazelles in country *c,* at year *t*. We include region fixed effects (α_r) to control for unobserved differences between countries (such as the quality of educational systems that may lead to unmeasured differences in the effect of educational attainment) and year fixed effects (α_t) that control, inter alia, for the right-censoring of the gazelle-birth data.

$$N^*_{c,t} = \alpha_c + \alpha_t + \beta X_{c,t} + \varepsilon_{c.t}$$

The observed number of gazelle firms for each country at time t, $N^*_{c,t}$, only takes non-negative values, that is, is left-censored. The error term is assumed to follow a standard normal distribution. $X_{r,t}$ includes time-varying country-specific variables of interest on demographic characteristics, such as population growth, migrants share, share of skilled workers, and female labor force participation, among others (see also Figure 13 below).

The results indicate that adverse demographic trends can undermine gazelle formation. The number of gazelles is positively correlated with population growth, while negatively correlated with the median population age and the old-age dependency ratio (Figure 13). While the negative relationship between aging and startups has also been documented for the U.S. (Engbom, 2019; Hopenhayn and others, 2022), Europe has to contend with overall worse demographic headwinds. By contrast, human capital formation supports gazelle formation. This is evidenced by the beneficial impact of young high-skilled workers (share of 25–34-year-olds with college degrees), including high-skilled *migrant* workers.

Figure 13. Europe: Determinants of Gazelle Formation



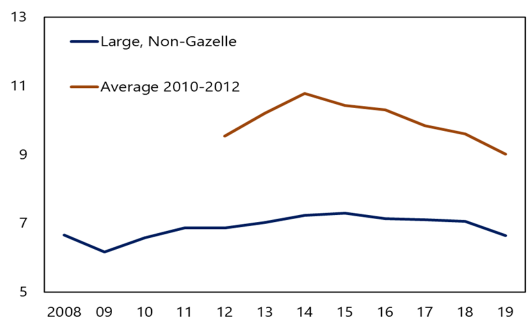
Sources: Orbis; and IMF staff calculations.
Note: Whiskers denote confidence intervals at the 95 percent level. Dots correspond to regression coefficients. These depend on the unit of respective variables and, therefore, cannot be readily compared. For instance, for regressors in logs, coefficients are interpreted as the change in the number of gazelle formations in response to 1 percent change of the regressor. In Figure 1.10, Europe includes Austria, Belgium, the Czech Republic, Denmark, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, the Netherlands, Poland, Portugal, Romania, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, and the United Kingdom. FTE = Full-time equivalent.

…and more risk capital

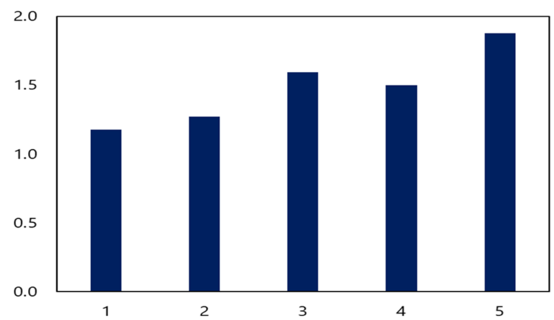
European gazelles also suffer from under-financing. This is reflected in their high marginal productivity of capital compared to large firms, which tends to persist over their life cycle and is indicative of binding investment financing constraints that keep their capital intensity below its optimal level (Figure 14.1).[20]

Figure 14. Financing Constraints of Gazelle firms

1. Average revenue per unit of assets: Gazelles vs. Large Non-gazelles
(Percent)



2. Average interest rate gap between gazelle and large non-gazelle firms by intangible asset share
(Percentage Points)



Sources: Orbis; and IMF staff calculations.
Note: In panel 2, interest rates are calculated as financial expenses divided by debt, including loans and long-term liabilities.

Financing constraints also manifest themselves as higher borrowing costs, especially for gazelles with larger intangible assets that cannot be pledged as collateral. We run the following firm-level regression to gauge the extent to which gazelles face higher borrowing costs and those are disproportionately higher for more intangible-asset-intensive gazelles:

$$ir_{c,s,t,j} = \alpha_{cst} + \beta I(i_{cst} = gazelle) * I\left(q^{j}_{icst} = 1\right) + \varepsilon_{cst}$$

where j =1,2,..5.

For each firm i in country c, sector s, and year t, and asset quantile j, the average interest rate (*ir*) is calculated as financial expenses as a share of total debt, including loans and long-term liabilities. The regression specification introduces an interaction of two indicator functions, intended to capture the differential impact of intangible asset intensity on a firm's borrowing costs, depending on a firm's gazelle status. The first indicator function takes value 1 if a firm i is a gazelle firm (in a given country, sector and year) and 0 if otherwise. The second indicator function takes value 1 if the intensity of intangible assets of firm *i* belongs to quintile j, with j ranging from 1 (bottom quintile) to 5 (top quintile), or 0 otherwise. Importantly, the regression includes country-sector-year fixed effects to control for unobserved country-sector-time-level drivers if firms' interest payments. We find that gazelles with higher intangible intensity face higher borrowing costs: gazelles in the top quintile of intangible intensity pay on average nearly 2 percentage points more than large incumbents in the same country, sector and year, while this gap is just above 1 percentage point for gazelles in the bottom quintile of intangible intensity (Figure 14.2).

One specific and particularly damaging aspect of under-financing is the scarcity of venture capital. Venture capital (VC) can be particularly effective in fostering the growth of young and innovative firms by providing equity-based

[20] As shown for example in Hsieh and Klenow (2009), under some conditions the average revenue product of capital is proportional to its marginal revenue product.

financing and managerial advice.[21] In the past decade, VC investments were less than 0.2 percent of GDP in the EU compared to nearly 0.7 percent in the U.S. (Figure 15. 1), and they were concentrated in a few countries (Figure 15. 2).

Firm-level analysis confirms the strong beneficial impact of VC for recipient European firms, whose intangible assets and productivity improve markedly after receiving VC (Figure 16). To address reverse causality concerns arising from the attractiveness of high-potential firms for venture capitalists, we exploit information regarding differences in the timing of VC disbursements between eventual VC recipients.[22] The core idea is that young firms go through a lengthy process when attempting to obtain funds, and the exact timing over which funds are disbursed to a given VC recipient versus another is both outside the control of both firms and little informative of their intrinsic quality, which remains unobservable to us. Looking at the distribution of firm age at the moment of their first injection of VC funds confirms our intuition, with the overwhelming majority of deals happening between years 1 and 4 of a firm's life cycle. Let $y_{i,t}$ be a general firm-level variable in year t, which be either intangible assets, employment or total factor productivity. The estimated specification is:

$$log\ y_{i,t} = \alpha_t + X_{i,t}\beta + \sum_{k=-3}^{+5} \delta_k D_{i,t+k} + \varepsilon_{i,t}$$

where $X_{i,t}$ is a matrix of firm-level controls, and $D_{i,t}$ are time dummies that take value 1 when firm i receives VC funding for the first time. The econometric results imply that receiving VC funding increases firms' intangible assets by roughly 100 percent one year after the first round of VC funding (Figure 16.2), in line with the raw data (Figure 16.1). Relatedly, three to four years after the VC injection, the total factor productivity of recipient firms is over 30 percent higher compared to its average level in pre-funding years (Figure 16.3). The effect of VC on employment is also positive but not statistically significant (Figure 16.4). This finding may be consistent with the fact that high-tech and high intangible-intensive firms tend to contribute far more to aggregate output than they do to employment.[23]

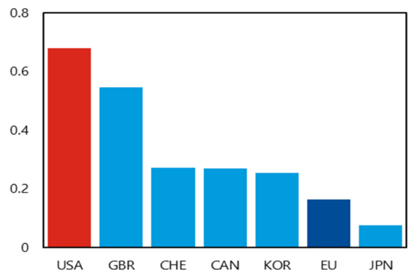
[21] For an overview of the VC landscape in Europe vis-à-vis the U.S., see Arnold and others (2024).

[22] Estimating the direct effect of VC funding falls short of accounting for the full role of VC funding on the life cycle of a firm. For instance, it abstracts from the signaling role that a successful funding round plays in attracting new capital. For this reason, our estimates should be seen as providing a lower bound for the full beneficial effect of VC funding.

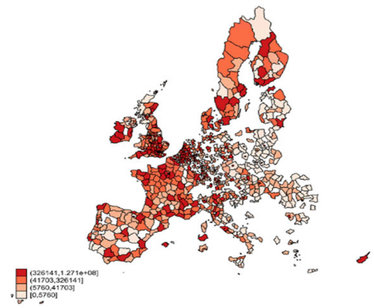
[23] In the US, high-tech industries produced over 18 percent of output in 2016 but only accounted for 10 percent of all jobs. High-tech industries: an analysis of employment, wages, and output: Beyond the Numbers: U.S. Bureau of Labor Statistics

Figure 15. Venture Capital Usage in Europe and Its Impact on Intangible Investments

1. Venture Capital Investments, 2013-23
(Average percent of GDP)



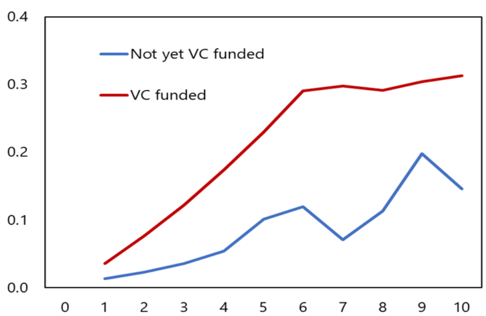
2.VC: Total Equity Invested, 2007-2021
(Index; Thousands of Euros)



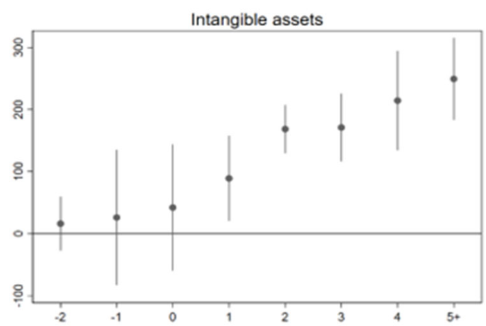
Sources: Arnold and others (2024); VICO database; and IMF staff calculations.
Notes: In panel 1, CAN = Canada, CHE = Switzerland, EU = European Union, GBR = United Kingdom, JPN = Japan, KOR = Korea, and USA = United States. In panel 2, Cumulative sum of 2007-2021 in NUTS3 region.

Figure 16. Impact of Venture Capital Funding on Firm's Innovation Activity and Performance

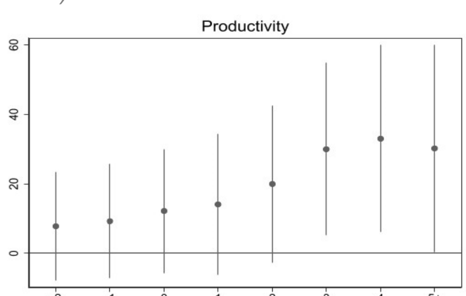
1. Median Intangible assets of firms after receiving VC-backing grows significantly faster than not-yet-funded firms of the same
(Million Euros)



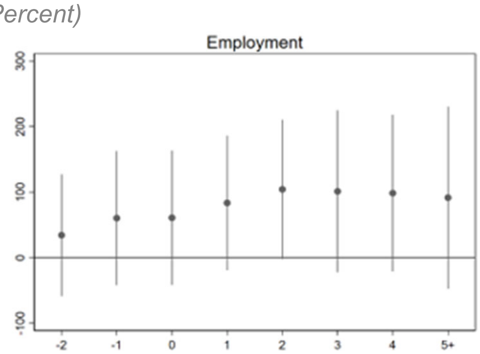
2. Intangible Assets Growth
(Percent)



3. TFP growth
(Percent)



4. Employment growth
(Percent)



Sources: Orbis; and IMF staff calculations.
Notes: In panels 2 to 4, the horizontal axis shows years before and after the recipient of VC funding, with time=0 showing the year when a firm receives VC funding. The vertical axis shows the percent change of the variable considered relative to the average level of that variable during the reference years, which are three or more years prior to VC funding.

5. Concluding remarks

This paper documents the firm-level origins of Europe's ongoing productivity malaise. We find that Europe's widening aggregate productivity gap with the United States shows up both at and behind the frontier: Europe's large leading firms have fallen behind in terms of both productivity and innovation efforts, while the continent also fosters fewer dynamic startups. A smaller effective market size, a more limited role of equity financing (including venture capital) and lower availability of human capital are among the main factors that constrain Europe's most productive firms from scaling up and investing consistently in innovation.

Addressing these and other underlying structural deficiencies, such as labor, product and financial market barriers to swift resource reallocation that became more penalizing with the advent of the ICT revolution, should guide Europe's growth-enhancing reform agenda. This will require major efforts at both regional and domestic levels.

Continued efforts towards a deeper single market would support firm growth by lifting constraints related to market size. Removing remaining barriers to trade within the EU would incentivize firms to undertake R&D and other investments that pay off when the customer base is large. For example, there is scope for expanding firms' market access within Europe by addressing underinvestment in border infrastructure, opening up protected sectors, pursuing further services trade liberalization, and harmonizing regulations. Many non-EU countries, most notably in the Central, Eastern, and Southeastern Europe (CESEE) region, feature higher barriers to trade than EU members (see IMF, 2024b). Lowering these barriers would promote scaling up and can also help incentivize foreign direct investment.

Efforts to lower trade barriers should be accompanied by advancements towards the EU capital markets union. Many of the required reforms, such as the review of the prudential regime for insurers and steps toward greater EU harmonization of capital markets' oversight, would better harness Europe's considerable savings and increase the availability of equity financing for firms of all sizes. Easing the constraints that inhibit VC growth and closing the VC-funding gap vis-à-vis other advanced economies would unlock equity financing for startups and young firms that lack tangible collateral, which would promote entry and innovation. Concrete measures include, among others, harmonizing VC regulations to incentivize the development of larger funds, and having the European Investment Fund play a catalytic role and provide due diligence as a public good (Arnold and others 2024). A fully harmonized "28th corporate regime" could also reduce constraints that inhibit VC, including across borders. Finally, increasing the portability of pensions and mutual-recognition agreements for professional services requiring licensing can promote talent agglomeration in innovation clusters.

Measures at the European level should be complemented by ambitious domestic reforms. Despite much progress, there remains scope for promoting entry by easing administrative barriers to entry, especially in some service sectors. Labor market regulations can facilitate worker reallocation towards young innovative firms if they protect workers rather than jobs. As in Denmark's so-called *flexicurity* system, such an approach would combine more flexible layoff procedures with adequate unemployment benefits and strong active labor market policies that support job search and employability. In some European economies, closing performance gaps in tertiary education, upgrading skills and addressing mismatches, including through vocational training, will also help foster idea creation, formation of high-growth firms and, together with investments in digitalization, the adoption of frontier technologies by European firms.

Further improvements in insolvency frameworks could facilitate exit of less productive firms and remove barriers that may discourage investors—particularly foreign ones—from taking equity participations in innovative firms (Peter 2021). Existing R&D tax incentives can be strengthened to better support young, innovative firms. Currently, fewer than a quarter of EU countries implement such systems, with most instead using size-based taxes that may discourage firm growth (see Benedek and others 2017; Mitchell and others 2020). To better encourage firm growth, firm size-based tax and regulatory incentives should be avoided. To encourage R&D, tax incentives should narrowly target firms' R&D investments—for instance, through accelerated depreciations and R&D investment tax credits—rather than take the form of broad reductions in corporate tax rates. They should also ideally be harmonized across countries so that R&D investments take place where their expected returns are highest.

A thriving business sector is key to reducing, and eventually closing Europe's large productivity and income per capita gap. There is no magic wand to make it happen. Instead, this is a multifaceted agenda that will require European policymakers' years of sustained efforts cutting across multiple areas, from education to regulation to the innovation ecosystem. But this is a clear starting point: deepening the single market, supported by domestic regulatory reforms.

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