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MEASURING THE INTANGIBLE ECONOMY TO ADDRESS POLICY CHALLENGES

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European economies exhibit the so-called 'productivity puzzle', whereby investments in digital technologies and intangible assets have not delivered the hoped-for productivity gains. Explanations for this puzzle lie in the unequal ability of companies to make use of these technologies, and resulting patterns of market concentration, productivity divergence and dampened business dynamism. Access to firm-level data is essential to properly understand these rich dynamics. The purpose of the first work package of the MICROPROD project was to improve the firm-level data infrastructure, expand the measurement of intangible assets and enable cross-country analyses of these productivity trends. The MICROPROD researchers developed the Micro Data Infrastructure (MDI), a centralised platform that harmonises access to the firm-level data gathered by national statistical institutes. The data infrastructure developed through this work package offers valuable insights into the evolution of productivity across the European Union and into the effects of digitalisation and globalisation. It can thus generate important evidence for designing policies to support the European Commission's policy objectives, especially for achieving the digital and green transitions. In addition, the research enabled by this data infrastructure and carried out within the context of MICROPROD can provide valuable lessons about the response of European economies to the COVID-19 pandemic and its aftermath.

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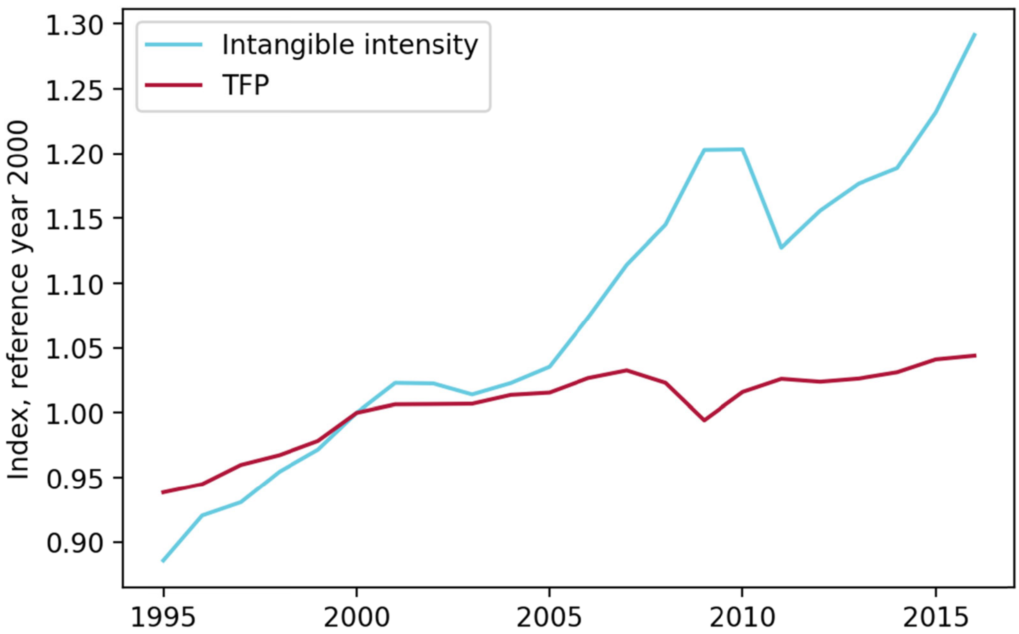
The disappointing performance of productivity in advanced economies for the last two decades has troubled economists and policymakers. Long-term evidence suggests that the deceleration of productivity growth started around the year 2000. This timing makes it difficult to reconcile productivity-growth deceleration with the extensive deployment of digital technologies and intangible assets. Between 2000 and 2016, Total Factor Productivity (TFP) grew on average by 5 percent across European economies, while the share of intangible investment in aggregate value-added grew by more than 25 percent over the same period (Figure 1). This is particularly puzzling in the face of the overwhelming amount of evidence at country, industry and firm levels, of the positive impact that investment in these assets has on productivity[1].

Figure 1: Evolution of intangible intensity and of TFP across European countries, 1995-2017



Source: INTAN-invest and Long term productivity database. Note: Intangible intensity is defined as investment in intangible assets divided by value-added. Countries included in the aggregate: AT, BE, DK, FI, FR, DE, EL, IE, IT, NL, PT, ES, SE, UK.

Research shows that a potential explanation of this puzzle is that behind these aggregate trends, complex dynamics are at play within and between firms. The process of creative destruction, which drives productivity growth by enabling firms to bring new ideas to market, seems to have weakened. Overall, markets have become less contestable. This can be seen in a number of trends, documented for the American and, to a lesser extent, European economies. The rate of firm creation and the contribution of young firms to economic activity have declined (Decker *et al*, 2017; Garcia-Macia *et al*,

[1] See Le Mouel and Schiersch (2022) for an overview.

2019). Top performing firms have been able to seize increased market shares. The American economy in particular has seen an increase in the average levels of markups and profits (De Loecker *et al*, 2020), and a decrease in the labour share of income (Autor *et al*, 2020). These researchers find that both trends arise from a reallocation across firms, rather than a general trend that affects all firms equally: firms earning higher profits and hiring a lower share of labour have increased their market shares. Finally, in Organisation for Economic Co-operation and Development countries, the top 5 percent most productive firms in each industry have been able to sustain sizeable productivity growth rates, while the average performance has been very moderate (Andrews *et al*, 2015; Criscuolo *et al*, 2019).

Access to firm-level data is thus essential to properly understand these rich business dynamics. The purpose of the first work package of the MICROPROD project was to improve the firm-level data infrastructure and enable cross-country analyses of these productivity trends. The MICROPROD researchers developed the Micro Data Infrastructure (MDI), a centralised platform that harmonises access to the firm-level data gathered and maintained by the National Statistical Institutes (NSI) of seven pilot countries. This allows researchers and policymakers to apply a single research design to the firm-level data of multiple countries, and opens the way for insightful cross-country comparisons of trends and analysis of policy initiatives.

Furthermore, a special focus was put on the role of intangible assets[2] in explaining the productivity puzzle. Research suggests that intangible assets, and especially digital technology, are a common driver of depressed productivity growth, increased divergence, rising profits and declining competition (Aghion *et al*, 2019; De Ridder, 2021). Intangible assets create increasing returns to scale and winner-takes-all dynamics. A select group of firms that is better able to make these intangible investments (for reasons such as access to finance or organisational capabilities) can drive a wedge between themselves and other firms in their industry. An initially good position on the market can thus become entrenched, discouraging followers from competing actively and investing in innovation. As part of the first MICROPROD work package, two papers were dedicated to measuring intangible capital and to understanding its role in production (Bisztray *et al*, 2020; Kaus *et al*, 2020).

The data infrastructure developed through this work package offers valuable insights into the evolution of productivity across the European Union and into the effects of digitalisation and globalisation. It can

[2] In their seminal work, Corrado *et al* (2009) proposed a classification of intangible capital into three broad categories. Computerised information covers all information that can be digitalised. Innovative property measures the knowledge, scientific or otherwise, used to develop new products. Economic competencies refer to the knowledge embedded in the employees and organisational structures of firms.

thus generate important evidence in designing policies to support the European Commission's policy objectives, especially for achieving the digital and green transitions. More generally, the research enabled by this data infrastructure and carried out within the context of MICROPROD can provide valuable lessons about the response of European economies to the COVID-19 pandemic and its aftermath.

The Micro Data Infrastructure

The Micro Data Infrastructure (MDI) builds on existing firm-level data infrastructures maintained by national statistical institutes (NSI) and used to measure the economy. The objective is to facilitate cross-country analysis of productivity by addressing two main shortcomings. First, while each country's data infrastructure is accessible to researchers, this comes at a high administrative cost. In practice, this greatly limits the number of cross-country analyses carried out. NSIs impose strict rules to protect their sensitive data sources. Permission to perform research needs to be obtained for each country individually, and the results that can be published need to respect certain confidentiality rules, which can differ across countries. A significant advantage of the MDI is that is provides a single platform through which a research project can obtain access to all participating NSIs[3], and which ensures that the published results respect all confidentiality rules. This harmonisation of data access means that a theory can be tested in multiple countries. It allows researchers to explore the diversity of experiences in European countries, and to evaluate the different policy choices made in different countries, such as in the areas of innovation funding or market regulation.

Second, to follow the development of an ever-evolving economy, new methodologies are constantly being developed, before they are harmonised internationally. Hence, the second contribution of the MDI is to improve the harmonisation of variable definition and data sources. As part of the MDI, a common set of analytical tools was developed to simplify research designs to study the dynamic evolution and the drivers of productivity. In particular, the MDI has worked on linking various datasets to analyse common drivers of productivity. The core data infrastructure relies on the business register, which collects information on the legal status of companies. Information on the economic activities of firms (eg their use of labour and capital inputs, and the amount of output produced) is obtained from structural business statistics. These two data sources are then linked to the EU Community Innovation Survey (CIS)[4] and the ICT Usage and E-commerce Survey (ICTEC)[5] to obtain information on firms'

[3] As for the time of writing, the participating NSIs are: Denmark, Finland, Norway, Sweden, France and the Netherlands.
[4] See https://ec.europa.eu/eurostat/web/microdata/community-innovation-survey.

innovative activities, and to international trade statistics and foreign affiliate statistics for information on integration in global value chains (Bartelsman *et al*, 2020).

Finally, the MICROPROD project focused on improving the measurement of intangible assets. The definition of which expenditures correspond to investment in intangible assets still differs across countries, and tends to be collected in different types of data. For example, some companies consider spending on intangibles as investments in productive assets and report them on their balance sheets. Other companies consider these as expenses and report them in profit and loss accounts. Hence, the same item, at least in economic terms, can be found in different datasets.

The measurement of intangibles can differ between different research projects and depends on the data sources used. Kaus *et al* (2020) considered expenditure on internal R&D, purchased software and purchased patents/licenses/trademarks, which are included in the German structural business statistics surveys in manufacturing. Bisztray *et al* (2020) linked information from several firm-level surveys on innovation, R&D, intangible investments and ICT capital, to information on firm activity in Hungary, to assess how different measures of intangible assets correlate with each other and with firm productivity. Each source of data picks up an important input into production, which does not fully overlap the other measures. This highlights the importance of collecting information from these different sources.

Achieving the European Commission's policy objectives

The MDI enables the production of evidence to support policy analysis and evaluation to help achieve the objectives of the European Commission. In particular, the European Commission wishes to guide the European economy through two major transformations, the digital and the green transitions. The Commission's digital strategy aims to make Europe fit for the digital age by fostering the adoption of digital technologies, in particular intangible assets. The objective of the European Green Deal is to fully decarbonise the European economy by 2050, with an intermediary target of reducing emissions by 55 percent by 2030 compared to the 1990 level. The MDI can help researchers understand the barriers faced by firms in the adoption of digital and green technologies, and the long-term ramifications of these changes, especially on productivity growth.

EU countries are not equal in the face of digital technology adoption and investment in intangible assets more generally. Figure 2 shows significant differences between countries in the amount

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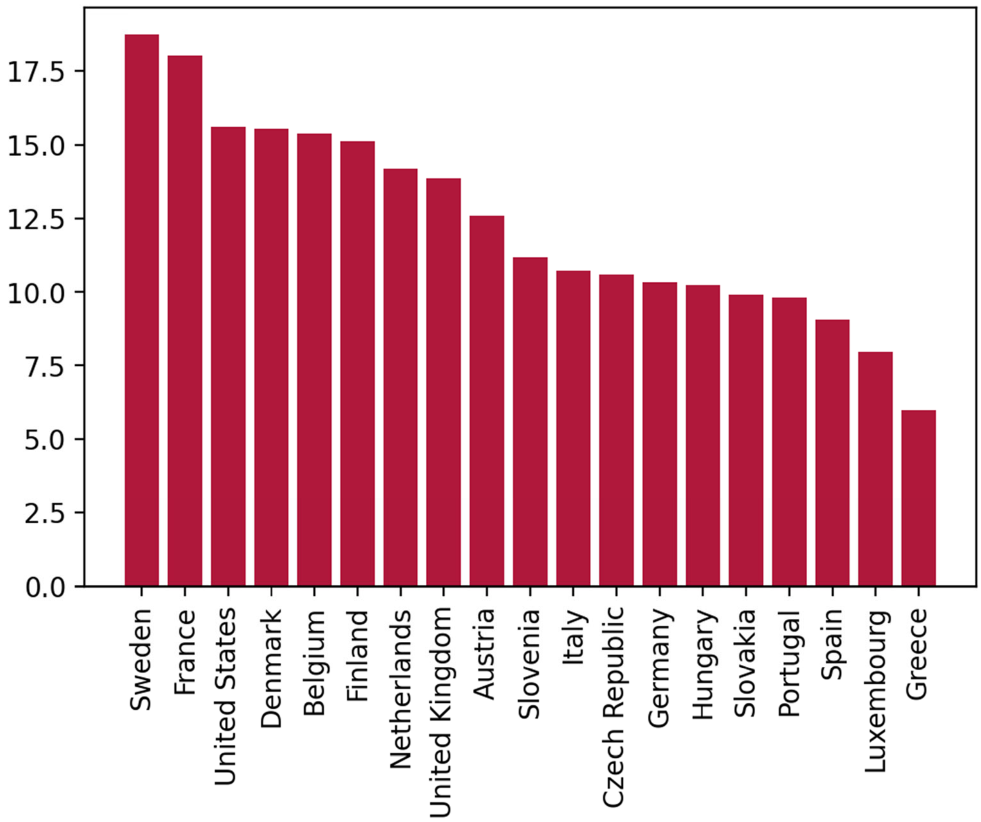
[5] See https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Statistics_on_ICT_usage_and_e-commerce_introduced.

invested in intangible capital. Given the important role of intangible assets in driving productivity performance, this disparity across countries raises the risk of divergence between European economies. In addition, the disparity in intangible investment is strongly present across firms within sectors[6]. This uneven distribution of intangible investment across firms also translates into unequal returns to intangible investment. There appears to be a small group of intangible-intensive firms which obtain sizeable productivity gains. The performance of these firms contrasts with the behaviour of the majority of firms in each industry, which invest small amounts, if at all, in intangible assets, and reap limited rewards from these (Kaus *et al*, 2020).

Figure 2: Intangible intensity in percentage, 2016



Source: INTAN-invest. Note: Intangible intensity is defined as investment in intangible assets divided by value-added.

Theoretical results from studies such as Aghion *et al* (2019) and De Ridder (2021) suggest that intangible assets, by creating increasing returns to scale, lead to the entrenchment of this group of superstar firms. Investments in intangible assets, and especially digital technologies, represent large upfront costs for firms, subsequently allowing them to reduce their operating costs and to become

[6] This has been documented by Arrighetti *et al* (2014) for Italy, Kaus *et al* (2020) and Le Mouel and Schiersch (2022) for Germany, and De Ridder (2021) for the United States and France.

more competitive. This makes it more difficult for laggard firms to catch-up. It reduces the competitive pressure faced by leading firms, which in turn invest less in innovation. In the long run, this dampened competitive pressure leads to lower productivity growth overall. Aghion *et al* (2019) argued that this mechanism explains the observed productivity performance of the United States since the 1990s. This country saw a productivity boom in the 1990s as firms invested heavily in ICT, but since then, productivity growth has slowed, while concentration has increased.

Therefore, understanding the drivers of investment in intangible assets is essential in order to design policies that can prevent this entrenchment effect while maintaining enough competition to keep the engine of growth active. The results of the MICROPROD analysis echo much of the literature in identifying two sorts of barriers to investment. The first is access to resources, and the second is lack of incentives.

The results of Bisztray *et al* (2020) confirmed those of Bloom *et al* (2012), in that the successful adoption of digital technologies requires complementary investments in other sorts of intangible assets, in particular organisational capabilities. Bisztray *et al* (2020) emphasised the broad nature of intangibles, whereby the productivity gains from the adoption of ICT technologies are maximised when accompanied by innovation expenses and investment in economic competencies. This analysis shows that the definition of intangibles recorded on balance sheets misses some important components. The data infrastructure that permits effective measurement of the deployment of digital technologies and the complementary intangible assets thus needs to link the various data sources listed above. The need to invest in a broad bundle of assets can explain the skewed distribution of investment, with many firms reporting no intangible activity at all. If these firms lack access to the complementary resources, notably human and organisational, needed to deploy digital technologies effectively, they will not engage in such activities. Hence, the European Commission's digital strategy needs to encompass policies that promote the adoption of these complementary assets, including labour market policies that promote investment in training.

The other major hurdle faced by firms that wish to invest in digital technologies, and especially intangible assets, is access to finance. One of the reasons put forward to explain the slower deployment of intangibles in Europe compared to the United States is the bigger role of banks in financing economic activity in Europe compared to other regions (Claeys and Demertzis, 2021). Intangible assets are ill-suited for bank financing because they cannot serve as collateral. Their value tends to be specific to the firm that has invested in them, which means that they are difficult to transfer between firms. There are generally no markets on which they can be exchanged, which means there is no commonly agreed price or value against which a firm could borrow. This means that intangible assets are often financed through internal funding, which contributes to the entrenchment dynamics described above. Successfully investing in intangible assets helps firm charge higher markups and earn larger profits, which can be used to finance the next round of intangible investments from their own cash flows. Therefore, developing equity markets and venture capital funding are important measures to level the playing field between firms, and allow a larger share of companies to enter the competitive race.

When it comes to ensuring that all firms have sufficient incentives to invest in digital and intangible assets, competition policy becomes crucial. Striking the right balance between ensuring a level playing field and allowing investors to get the rewards of their investments is not easy. One the one hand, increased market power, and the ability to charge higher mark-ups, is a reward for undertaking these investments, especially if they result in better quality products and services. On the other hand, the abuse of this market power to block entry of new participants is detrimental in the long-run as it dampens even the incentives of leading firms to continue innovating. Policy initiatives such as the EU Digital Markets Act (DMA)[7] seek to maintain competition between large digital platforms and ensure that these platforms do not prevent the entry of new actors or stunt the growth of potential smaller competitors.

The MDI infrastructure can also provide valuable evidence in support of the European Commission's second long-term objective, that of decarbonising the European economy by 2050. This transition implies deep structural changes to the economy, raising a number of questions about the future productivity of the European economy. First, the path of productivity growth over the transition is unclear. If green technologies are deployed rapidly, before they are fully competitive with brown technologies, productivity performance will be dampened for several years. In addition, it is also unclear whether technological progress will match historical trends once the transitional phase is over. Second, it is also unclear whether fossil-fuel energy will be substituted mostly for capital or for labour. This will have implications for the productivity of these factors of production, and hence their compensation. Finally, the exposure of companies to international competition and their ability to offshore their most carbon-intensive activities determines the extent of carbon leakage that can be

[7] See https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/digital-markets-act-ensuring-fair-and-open-digital-markets_en.

expected. Solid evidence on this question is relevant for the policy discussion on the proposed EU Carbon Border Adjustment Mechanism[8].

Making sense of the pandemic response and recovery

Since the MICROPROD project was designed, the European economy has faced a major disruption from the COVID-19 pandemic. Governments responded to the health situation by forcing the effective shut-down of specific economic activities and implementing support mechanisms to cushion some of the more severe economic and social effects. This massive intervention in the economy has disrupted the standard process of business dynamics. The data infrastructure created in the context of this project and some of its research findings offer timely insights to understand the consequences of this shock for the evolution of European economies, especially in terms of productivity growth, digitalisation and globalisation.

The lockdown measures imposed to respond to the COVID-19 pandemic have forced many companies to accelerate their adoption of digital technologies, and to re-think organisational practices. The results discussed above suggest that this has likely exacerbated the disparities between firms. Indeed, intangible-intensive companies entered the crisis on a much stronger footing than firms that were unaccustomed to investing in intangible assets. The focus of the MDI on measuring ICT adoption makes it well suited to analyse the patterns of digital investment during the pandemic, and the resulting productivity dynamics, albeit with a lag.

Productivity dynamics have also been altered by the generous support packages put in place during the pandemic. By stalling the process of business creation and destruction, the presence of these support packages has slowed down the reallocation of resources from low-productivity firms towards more productive firms. The long-run effect on aggregate productivity also depends on how firms respond to the scaling back of these support packages. Altomonte *et al* (2021a) showed that, in France, Germany and Italy, while there was no explicit targeting, the funds from the support packages were allocated to firms with a good chance of surviving after the crisis. The MDI can be used to measure the effect on productivity of removing the support packages. Its cross-country dimension gives researchers the opportunity to evaluate different policy choices in terms of their aggregate economic outcomes.

[8] See https://ec.europa.eu/commission/presscorner/detail/en/qanda_21_3661.

The pandemic has also disrupted global supply chains severely, most prominently in the area of medical equipment, and then extending to the supply of semiconductors. The concept of 'strategic autonomy' has gained visibility and traction, as policymakers have become increasingly wary of dependence on supply chains where there are potential bottlenecks. However, policies seeking to shorten supply chains or reshore certain activities require balancing resilience to shocks with possible productivity gains. The literature has emphasised several complex channels through which global integration affects productivity. Global value chains play a major role in channelling knowledge flows (Altomonte *et al*, 2021b; Bisztray, 2021). Import competition from high-income countries creates incentives for productivity improvements, but this does not seem to hold for import competition from low and middle-income countries (Bräuer *et al*, 2019). Finally, the relationship between offshoring and productivity gains has been long studied, with mixed results. The type and timing of offshoring appear to be determining factors[9].

Conclusion

European economies face both short-term and long-term transformations. While the ripple effects of the economic shock from the COVID-19 pandemic are still being managed, the European economy is being steered in a more digitally intensive and low-carbon direction. These policy objectives rest on understanding the behaviour of firms and the competition dynamics between them. Firm-level data is central to understanding the barriers faced by firms in adopting digital technologies, such as limited access to human and financial capital. Access to administrative datasets, which combine the business register with structural business statistics survey data, offers the most representative view of the population of firms, and allows for the whole productivity distribution to be observed. This is particularly useful in identifying the winning and losing firms from various policy efforts, such as the pandemic support packages or the adoption of digital technologies. Finally, the ability to implement a single analysis across multiple countries, such as the measurement of productivity trends or of intangible investment, offers the scope for a fine-grained analysis of the productivity implications of specific policy choices.

[9] Kaus and Zimmermann (2022), using German data from the International Sourcing Survey, did not find an effect of offshoring on productivity. A potential explanation for this finding could be the time period observed. The analysis was carried out with data covering the period 2014 to 2016, while most of the productivity gains from offshoring may have already materialised in previous waves of offshoring.

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