DISCUSSION NOTE

MONETARY POLICY DIVISION

N°6

The Productivity Slowdown

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banco central Chile

PREFACE

The Discussion Notes (DN) seek to examine issues that are relevant for monetary policy in Chile and the world. Their goal is to present a discussion regarding the current state of the literature, highlighting the most important implications for the design of monetary policy. For that purpose, the Notes describe the different approaches set forth by frontier research, highlighting the consensus as well as debates that are still open. The DN are elaborated by economists from the Monetary Policy Division and do not necessarily reflect the official position of the Board of the Central Bank of Chile

The sixth issue of the DN addresses the global slowdown in productivity growth in recent decades. This is an issue with relevant implications, since it affects the main source of sustainable growth in per capita income. Thus, the evolution of productivity has a direct impact on the well-being of the population, and its slowdown can frustrate the income growth expectations of current and future generations. This, together with demographic challenges, can generate fiscal pressures and financial instability. In addition, a slowdown in productivity has implications for long-term GDP growth and other parameters important for monetary policy. This phenomenon has been widely studied, and this note reviews the existing literature, analyzing the stylized facts in developed and emerging economies, the possible determinants of the process and its future prospects.

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CONTENTS

1. INTRODUCTION

The apparent slowdown in global aggregate productivity growth in recent decades has given rise to a large body of literature that studies its possible causes and implications. This note reviews this literature and revisits the stylized facts observed in developed and emerging economies. It then analyzes the possible determinants and prospects of this process.

It is worth noting that this deceleration has been observed both in average labor productivity growth and in the evolution of total factor productivity (TFP). Labor productivity refers to the amount of output generated per worker or per hour worked, therefore quantifying how efficiently labor is used to produce goods and services.

Total Factor Productivity measures the efficiency with which all inputs used in production, including labor, capital, technology, and any other productive factor, are combined. TFP provides a more comprehensive view of productivity, as it considers the combined effect of all inputs in generating output. Moreover, if the growth process is associated with a convergence process in the spirit of the Solow model, in the long run per capita income growth will be mainly associated with the evolution of TFP. This is calculated as the difference (residual) between actual output growth and the growth that can be explained from the evolution of productive factors, reflecting changes in efficiency or adjustments in their quality and composition. However, measuring TFP growth is not trivial, as it is not directly observable, and its estimation is subject to a considerable degree of uncertainty.

A slowdown in productivity growth is cause for concern as it affects the main source of sustainable per capita income growth. Its evolution has direct implications for society's welfare, and its slowdown may create social tensions insofar as income stagnation clashes with expectations generated by the higher growth observed in the past. These tensions, coupled with the challenges posed by the demographic transition, could result in fiscal pressures and financial instability. Moreover, a slower evolution of TFP has implications for long-term growth and other structural parameters relevant for monetary policy. In short, it is critical to understand and address the factors that are contributing to the slowdown in productivity growth, as its evolution has significant implications for the countries' economic and social welfare.

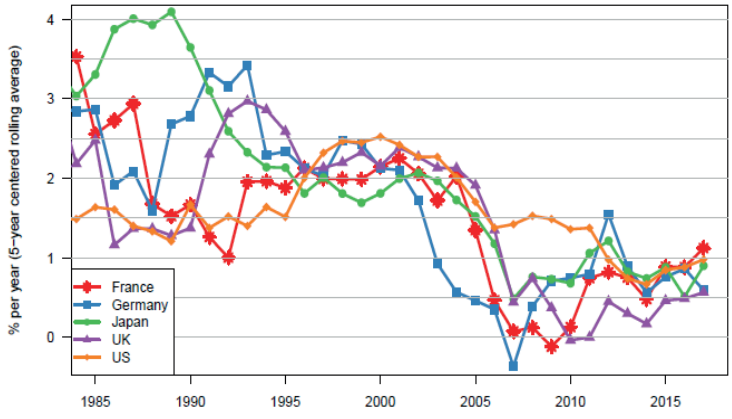
This note is structured as follows. Section 2 presents evidence on the productivity slowdown. Section 3 discusses its potential causes, including measurement problems, cyclical and structural factors. Section 4 analyzes prospects over the future. Finally, two boxes are included: Box A analyzes the additional factors that explain the decline in productivity growth in commodity exporting economies, and Box B examines the potential consequences of climate change.

2. EVIDENCE ABOUT THE PRODUCTIVITY SLOWDOWN

2.1 Decelarating labor productivity

The evidence for the developed world shows that labor productivity growth was significantly slower in the last two decades compared with the previous two. Figure 1 shows the considerable decline in the growth rates of labor productivity (the average product of labor) since 2005 for Germany, the United States, France, Japan, and the United Kingdom. This decline has had a tangible impact; studies by Goldin et al. (2021) and Syverson (2017) find that in 2017 per capita GDP underperformed projections based on pre-2005 trends by several thousand dollars. Their calculations suggest that lost per capita GDP ranges from 8% to 12% of 2017 figures for Germany, France, and Japan, while for the United States and the United Kingdom they exceed 20%.

FIGURE 1 LABOR PRODUCTIVITY GROWTH IN DEVELOPED ECONOMIES



Source: Goldin et al. (2021).

The literature places this phenomenon in a broader historical context. Goldin et al. (2021) identify two major accelerations in labor productivity growth during the 20th century, each followed by a slowdown: the post-war boom and a minor upturn around 2000, generally associated with gains in information and communication technologies. In the United States, the first episode of slowdown was more marked than in Europe and Japan, posting considerably lower growth rates during the 1980s.

From a longer perspective, Table 1 shows that the slowdown in U.S. labor productivity growth began in the 1970s, notwithstanding the interruption in the mid-1990s. These differences between the United States and other countries point to a phenomenon of labor productivity convergence in developed countries. Despite these potential secular explanations, current labor productivity growth rates are surprisingly low by historical standards.

TABLE 1 LABOR PRODUCTIVITY (LP) GROWTH

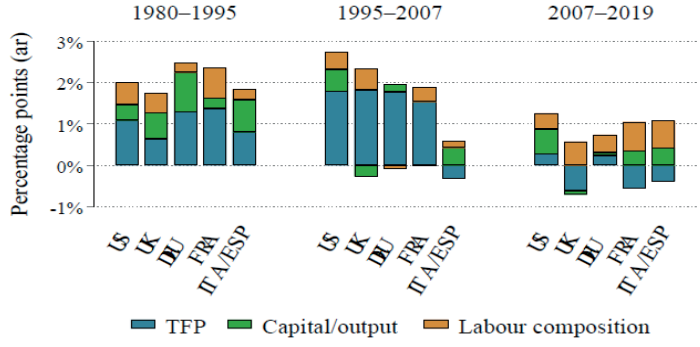
Period	LP growth (annualized, (%)
1947 - 1973	2.73
1974 - 1994	1.54
1995 - 2004	2.85
2005 - 2015	1.27

Source: Syverson (2017).

2.2 Total factor productivity as the main component of the labor productivity slowdow

The main factor in the slowdown in labor productivity appears to be sharply slower TFP growth. Fernald, Inklaar and Ruzic (2023) analyze growth accounts to identify trends in labor productivity. The exercise consists in disaggregating growth into several contributing factors: capital/output ratio, labor composition, and TFP. Capital accumulation and higher qualifications in labor composition improve labor productivity by increasing the resources and skills available to each worker, while TFP reflects the efficiency with which all inputs and/or production factors are combined. In light of this distinction, efficiency gains in factor use or the process of technological innovation seem not to be as strong as they were in the past.

FIGURE 2 SLOWDOWN IN TOTAL FACTOR AND LABOR PRODUCTIVITY



Notes: Growth-accounting contributions to market-economy labour productivity growth from equation (3). Sources are EU KLEMS (2021, 2012), ONS (2022) and BEA (2022). ITA/ESP is an unweighted average. We show the decomposition from equation (3), $\Delta \ln Y_t - \Delta \ln H_t = \alpha_t(\Delta \ln K_t - \Delta \ln Y_t)/(1-\alpha_t) + \Delta \ln LC_t + \Delta \ln TFP_t/(1-\alpha_t)$. France and Italy/Spain for the final period cover 2007–2018.

Source: Fernald, Inklaar y Ruzic (2023).

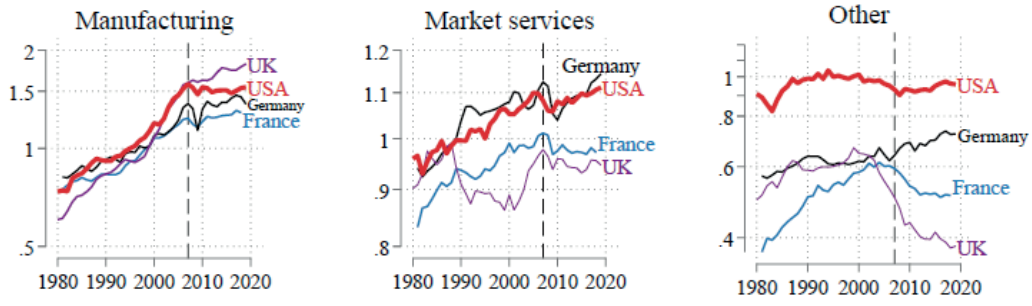
The decomposition of labor productivity growth (figure 2) reveals different dynamics for its components. Each bar represents the level of labor productivity and is divided into the contributions of TFP, capital, and labor. A striking fact is how changes in the contribution of TFP go in the same direction for most of the countries, while capital accumulation and labor composition show more idiosyncratic patterns. A comparison between 1980-1995 and 1995-2007 provides a clear example: During those years, the United States and the United Kingdom increased their labor productivity, whereas in Germany and France it declined even though in all four countries TFP rose. Since 2007, the fall in the TFP component is widespread and explains the results observed for labor productivity, despite the dynamics of the other factors.

2.3 Total factor productivity across different industries

Focusing on TFP alone, Fernald, Inklaar and Ruzic (2023) show that the slowdown in growth has occurred in multiple sectors. This evidence reinforces the idea that productivity slowdown is a global phenomenon, not limited to specific sectors or countries, and therefore not a result of something idiosyncratic to a particular economy or industry. Figure 3 presents TFP dynamics separately for manufacturing, services and other sectors such as agriculture and construction. The three panels use as their base the TFP of the United States in 1995, which is set to 1, and plot the relative trajectories using the authors' estimated growth rates.

Disaggregating by sectors, a varied picture of the productivity frontier emerges, which allows for a more robust interpretation of the slowdown. On aggregate, the United States represents the productivity frontier because of its leadership in most sectors. However, Germany or the United Kingdom can also be seen to delimit the frontier in manufacturing and services, respectively. Thus, interpreting the slowdown as a global phenomenon gains relative importance against the developed countries' convergence argument.

FIGURE 3 SLOWDOWN IN SECTORAL PRODUCTIVITY



Notes: USA in 1995 equals 1. TFP level for 1997 is from Inklaar and Timmer (2009); the level is then extended forward and backward using growth rates. 'Manufacturing' covers NACE division C; 'market services' covers G through N and R through S; 'other' covers A, B and D through F.

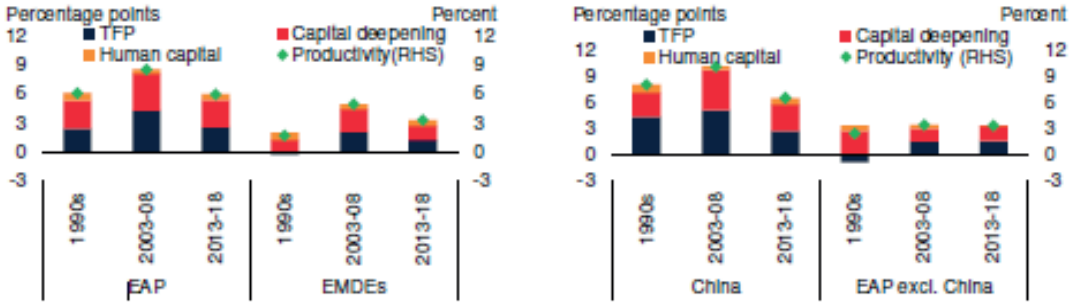
Source: Fernald, Inklaar y Ruzic (2023).

2.4 Deceleration in emerging economies

Emerging and developing economies also exhibit productivity deceleration patterns, mostly explained by TFP growth dynamics. Dieppe (2021) performs a decomposition analogous to Fernald, Inklaar and Ruzic (2023)'s for emerging economies, the results of which are shown in figure 4. Unlike developed countries, physical and human capital accumulation present similar dynamics to that of TFP. However, the magnitude of human capital accumulation suggests that this would be the one most closely associated with the most recent slowdown.

Brandt et al. (2020) point to an important difference with developed countries in the factors leading to productivity slowdowns. They note that, in China, the most important reason for the decline was the lack of new firms contributing to productivity improvement. In some sectors, even the contribution of new entrants was negative. Moreover, there were no gains from reallocating resources to more productive firms, which is the most important source of productivity growth in developed countries.

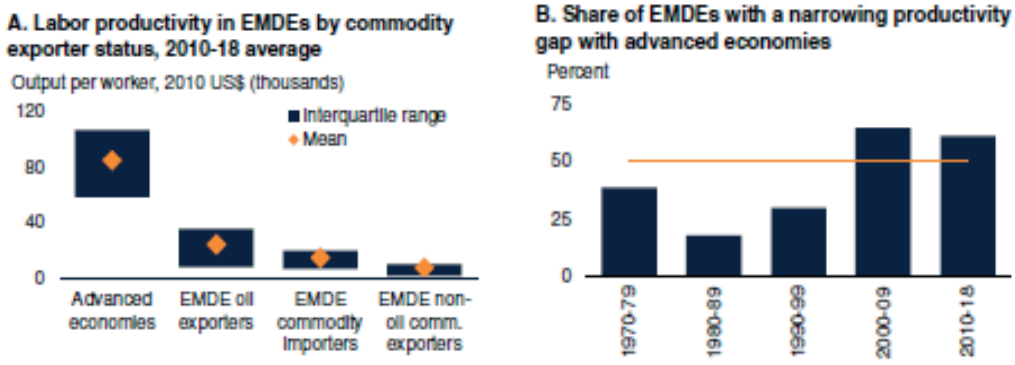
FIGURE 4 PRODUCTIVITY IN EMERGING ECONOMIES (*)



(*) EAP = East Asia and Pacific; EMDEs = emerging market and developing economies
Source: Dieppe (2021).

The analysis in Dieppe (2021), illustrated in Figure 5, highlights that the slowdown in emerging economies occurs even though there is still a significant productivity gap with respect to the developed world, as well as persistent gaps in human capital, in terms of both coverage and quality of education. Panel A shows the big difference in productivity levels between the two groups of countries. Panel B shows the share of emerging economies that are closing the productivity gap with developed countries. A slowdown in this measure can be seen in the 2010s with respect to its sharp increase in the previous decade. Hypothetically, even if frontier economies were to stop growing, emerging economies could increase their productivity by converging to the higher productivity of the frontier, or boost their labor productivity by increasing their human capital. However, this has not occurred, suggesting that the slowdown phenomenon has happened in both developed and emerging countries.

FIGURE 5 LABOR PRODUCTIVITY IN EMERGING ECONOMIES (*)



(*) EMDEs = emerging market and developing economies
Source: Dieppe (2021).

3. POSIBLE EXPLANATIONS

The academic literature has proposed several possible explanations underlying the observed slowdown in labor productivity and TFP growth in recent decades. Although each explanation relates to different mechanisms, they are not mutually exclusive hypotheses, but rather forces that may influence growth dynamics to different degrees and over time horizons.

It is important to bear in mind that, as mentioned, the dynamics of labor productivity growth are not necessarily identical to those of TFP, so the determinants of each may differ. For example, although the existence of diminishing returns to productive factors may naturally slow down output per worker growth, this idea of convergence need not directly affect TFP dynamics. Similarly, changes in the rate of factor accumulation, such as investment in physical and human capital, have a direct impact on labor productivity growth, but may not affect the evolution of total factor productivity.

3.1 Measurement problems

A first argument in the literature suggests that the slowdown in growth seen in the data could be due to measurement problems, so that the slowdown recorded in national accounts has not actually existed. Under this approach, the apparent slowdown is a result of mismeasurement generated by the difficulties in correctly quantifying GDP and TFP in a context of rapid technological progress and changes in the economy's sectoral composition.

Specifically, the argument is that national accounts have failed to accurately capture aspects such as the increasing weight of intangible assets related to the information economy, nor have they been able to adequately incorporate changes in the quality and variety of goods and services. Moreover, technological change in recent decades has led to the development of many new goods and services that provide consumption flows without an explicit market transaction or direct monetary payment, which could result in significantly underestimating their contribution to output and economic welfare (Feldstein, 2017).

Some of these arguments, such as the difficulties in measuring new product varieties or quality improvements in existing products, are not unique to this period but are inherent to any era of innovation. However, others, like the growing importance of intangible assets such as information, are specific to recent decades and may indicate that this period is different. Despite acknowledging the existence of these measurement problems, most of the literature suggests that the magnitude of the slowdown appears to be too significant for measurement to be the main factor (Syverson, 2017). Moreover, the logic of the argument about the exceptionality of the recent period implies that measurement problems should be more pronounced in industries where information has played a crucial role. Yet the evidence shows that the decline in growth is widespread, even in "traditional" sectors less influenced by innovation (Syverson, 2017; Goldin et al., 2021)[1].

[1] A related and relevant measurement issue concerns the role of natural capital, typically not considered in backward-looking growth accounting analyses. The measured TFP decline is less severe if the contribution of the slowdown in natural capital extraction is considered, especially in countries abundant in natural resources. However, the magnitude of the difference is not substantial for emerging economies on aggregate (Dieppe, 2021).

In short, while difficulties in measuring GDP and TFP are a valid concern, it seems difficult to claim that these problems alone can explain most of the observed deceleration of productivity in developed and emerging economies. Therefore, the economic slowdown is an actual phenomenon, and attention must be directed to the economic forces that may be contributing to this trend.

3.2 Cyclical factors

A first economic explanation suggests that the slowdown in productivity growth originates in the direct impact and consequences of the Global Financial Crisis of 2007-2009, and its long-lasting effects on the performance of businesses. This became visible in both higher financial constraints and weaker demand. According to this argument, the crisis affected firms' ability and willingness to invest in capital (which eroded labor productivity by reducing the amount of capital per worker) and innovation (which directly affected TFP). This explanation is supported by evidence at the microeconomic level, which shows that the firms that experienced more severe financial constraints during 2008-2009 grew less in the next decade (Chen and Lee, 2023; Duval et al., 2020). Moreover, it aligns with the broader evidence showing that financial crises have persistent effects on economic growth and productivity that are more pronounced than those of typical economic recessions (Sufi and Taylor, 2021).

However, the timeline of events seems to rule out the 2008 crisis as the main factor behind the slowdown, because productivity growth rates were already declining several years before the Great Recession. Therefore, it is difficult to argue that the financial downturn triggered the forces that decelerated productivity, especially since productivity growth was already slower in a period with abundant access to credit. Moreover, considering that more than a decade has passed since the Great Recession, it is less plausible that a temporary phenomenon continues to have first-order effects (Fernald, Inklaar, and Ruzic, 2023). Consequently, it seems reasonable to argue that, while the financial crisis exacerbated the slowdown —at least temporarily— it cannot qualify as its primary cause or sustain it for many years.

3.3 Structural factors

The persistence of productivity deceleration in recent decades and in different industries and economies, points to underlying secular forces that go beyond the measurement issues or cyclical factors mentioned above. Again, it is important to emphasize that these factors are not mutually exclusive and can operate simultaneously and interact with one other.

A first possible explanation is the evolution of international trade. This argument has two elements. First, the process of trade integration and globalization of the 1990s and 2000s brought about aggregate efficiency gains, linked to the reallocation of productive factors and the development of value chains (Baldwin, 2016). Conceptually, this can be thought of as a one-off increase in the level of TFP that does not permanently change its growth rate. Therefore, the period of accelerated TFP growth in the 1990s could be interpreted as a period of convergence towards that new level, an effect that dissipated after the adjustment process was completed. Second, it has been claimed that the deceleration of trade growth during the last decade has slowed down these efficiency gains (Constantinescu, Mattoo and Ruta, 2016).

A second cluster of explanations focuses on the nature of technological change in recent decades. One argument put forward by Gordon (2016, 2018) suggests that recent innovations, mainly associated with information technologies, do not and will not have the same productive impact as

those made in the late 19th and early 20th centuries, such as the internal combustion engine or the widespread adoption of electricity. By that logic, the increase in productivity of the late 1990s and early 2000s would have been an exception, and the subsequent low average productivity growth is the expected scenario in an era with fewer major innovations, which has been dragging on since the mid twentieth century.

A related argument, although a rather more optimistic, is that recent innovations, which by nature focus on information and intangibles, have so far resulted in less spillover to other sectors. This is partly so because innovation has manifested itself in ways and sectors other than those of the past, which has created "bottlenecks" that make it difficult to transfer productive gains to broader sectors (Acemoglu, Autor and Patterson, 2023). This does not mean, however, that such spillovers cannot occur in the future.

A third line of explanations relates to changes in business dynamics and the competitive structure of the economy. The literature has documented a significant slowdown in firm entry and job creation and destruction rates in the United States and developed economies in general (Decker et al., 2014, 2020; Calvino, Criscuolo and Yerlhac, 2020; Hyatt and Spletzer, 2013). This phenomenon is relevant because the reallocation of employment to more productive firms is a crucial determinant of TFP growth (Syverson, 2011), and the entry of successful new firms is essential for aggregate growth (Klenow and Li, 2020). Therefore, this reduced business dynamism could be discouraging innovation and undermining the efficiency gains associated with the reallocation process. This is consistent with evidence that points to a rise in the inefficiency in the economy's resource allocation.

At the same time, market concentration has increased (Bajgar et al., 2019)[2]. A priori, the relationship between productivity and concentration is not obvious. It is possible that, thanks to technology, more productive firms gain a larger market share due to their lower costs. In turn, industries whose concentration increases may tend to undergo faster technological change (Autor et al., 2020). Although the literature has run into serious methodological difficulties (definition of 'market' or scope of a firm), there is consensus that higher concentration was associated with increased productivity during the 1990s.

However, the evidence for the last two decades has been mixed, showing a positive correlation in some cases (Ganapati, 2021), and a negative correlation in others along with a pronounced fall in investment (Covarrubias, Gutiérrez and Philippon, 2020). There is also evidence suggesting, albeit not as conclusively, that this concentration has translated into less competition, with an increase in firms' markups (De Loecker, Eeckhout and Unger, 2020; Baqaee and Farhi, 2020), which could be associated with lower efficiency. Importantly, these changes in market structure may be related to some extent at least, to the growing importance of intangible assets and information technologies, which, by their nature, may create barriers to entry that shield the position of dominant companies.

[2] This topic will be addressed in greater depth in a later paper in the Discussion Notes series.

TABLE 2 EXPLAINED DECREASE IN TFP AND LABOR PRODUCTIVITY

Period	France	Germany	Japan	U.K.	U.S.
Decrease in labor productivity	0.99	0.94	0.82	1.75	1.61
Explained decrease in labor productivity	0.50	1.28	1.52	1.41	1.72
Capital deepening: Global Financial Crisis	0.04	0.27	0.40	0.27	0.35
Capital deepening: Secular decrease in investment	0.04	0.27	0.40	0.27	0.35
Human capitalHumano	-0.09	0.17	0.04	0.39	-0.01
Explained decrease in TFP	0.52	0.57	0.68	0.50	1.02
Measurement problems	0.21	0.21	0.21	0.21	0.21
Intangibles	-0.07	0.06	0.48	-0.01	0.28
Trade	-0.04	0.20	0.00	-0.05	0.15
Allocative efficiency	0.42	0.10	-0.01	0.35	0.38

Source: Goldin et al. (2021).

An effort to provide empirical support for these hypotheses is found in Goldin et al. (2021). As shown in table 2, the authors attempt to measure the relative impact of different forces on labor productivity, distinguishing between forces related to factor accumulation (physical and human capital) and changes in TFP. Although this exercise involves multiple assumptions to measure each component and, therefore, its results should be interpreted with caution, it does provide information on the role of the various forces involved. Changes in TFP are partly explained by measurement errors, the role of intangible assets, the type of technological innovation, the impact of trade and allocative efficiency, the latter associated with the economy's ability to allocate resources efficiently. In the case of the United States, the fall in TFP explained by all these factors combined is slightly more than 1%. One-fifth of that can be blamed on measurement error, while lower allocative efficiency explains almost 40%. Intangible assets and trade also have important roles, suggesting that the role played by all the forces described above in the U.S. economy has been non-negligible.

4. PROSPECTS

So far, we have studied the causes of the productivity slowdown, and its implications for the current state of the economy. From this analysis, we can think of the productivity slowdown as a global phenomenon, both in geographical and sectoral terms, affected by cyclical and structural factors, and subject to non-trivial measurement issues. The study of its main causes and consequences also identifies potential tools to face current challenges. Technological innovation, business dynamics, competitive structure, trade integration and education stand out as crucial issues.

To conclude this note, this section will address the prospects for future productivity growth from multiple dimensions. It highlights that technological innovation, including artificial intelligence, has the potential to boost productivity, although its full impact may take time to adopt and optimize. De-globalization could reverse previous efficiency gains in the world economy. Climate change is expected to have adverse effects on productivity due to extreme weather events, underscoring the need for investment in adaptation and mitigation. The COVID-19 pandemic had a negative effect on productivity, with long-term consequences on investment in research and development, although remote work technologies offer opportunities in some places. Emerging countries, for their part, have made significant progress, but face challenges in closing the productivity gap with developed economies, which requires policies aimed at encouraging investment in human capital and efficient resource allocation.

4.1 Technological change

As previously mentioned, the potential productivity gains from recent technological innovation may not yet have been fully realized (Juhász, Squicciarini and Voigtländer, 2020). Adopting these technologies takes time, as the need to reorganize production requires a considerable period of trial and error before establishing the best practices.

One hypothesis on productivity dynamics places several OECD countries at the inflection point of the J-shaped productivity curve (Brynjolfsson and Petropoulos, 2021). Under that interpretation the initial impact of a new disruptive technology may be limited. However, after a period of adaptation and refinement, productivity can increase significantly. Among other reasons, the authors highlight the development of artificial intelligence and its widespread access due to "cloud computing", to believe that productivity dynamics will be stronger than in the last century. In addition, general purpose technologies (GPT) can have an impact on investment in intangible assets, as well as significant reallocations of employment that contribute to productivity growth (Brynjolfsson, Rock and Syverson, 2021). This complementarity is important for distinguishing between the impact on the rate of technological change and the changes in its level that boost TFP growth only temporarily.

Clearly, this optimistic view of the innovation process differs from that of Gordon (2016, 2018), who is very skeptical about the intrinsic ability of these technologies to replicate the impact of past ones.

4.2 Economic integration

In a de-globalization scenario, the efficiency gains achieved in recent decades could be partially reversed. Constantinescu, Mattoo, and Ruta (2019) link the vertical integration structure of production with productivity growth, finding that the impact of a 10% increase in the participation in global value chains increases average productivity by about 1.6%. In addition, heterogeneous effects of trade integration on productivity growth have been observed, identifying key factors such as sectoral composition, competitive currency, and flexible labor markets (McMillan and Rodrik, 2011).

4.3 Covid-19

Although the pandemic has had a strong impact on measured productivity, some sources suggest that its effects may be less persistent than those of the GFC. While the International Monetary Fund (IMF) forecasts a drop in global growth compared to pre-pandemic projections for COVID-19, it also indicates that the medium-term impact of the pandemic will not be as severe as that of the GFC (IMF, 2023;2024). The McKinsey Global Institute points to the potential to accelerate annual labor productivity growth by about 1% per year through 2024, more than twice the rate achieved after the GFC (Mischke et al., 2021).

Regarding the impact of COVID-19 on the future evolution of productivity growth, there are different positions, and the definitive answer is still open. On the one hand, lower investment in research and development, diverting resources to address the pandemic, and the disruptive effects on the labor and other markets could have long-term negative effects (Bloom et al., 2023). However, pandemic-induced adoption of new technologies may have softened the effect of the pandemic on labor productivity. For example, those economies that succeeded in effectively adopting technologies such as teleworking may see an increase in output relative to pre-pandemic trends (Nodari, Rees, and Rungcharoenkitkul, 2022). Considering both arguments, it is still unclear what the net effect will be in the long run.

4.4 Emerging countries

Despite the slowdown of the 2010s, emerging economies made significant progress in productivity growth in the last 25 years compared to the 1990s (Figure 4), partly thanks to the strengthening of their macroeconomic policies since the turn of the century, which has allowed them to more than double average per capita income (Duttagupta and Pazarbasioglu, 2021). Yet there are still significant gaps with developed countries, suggesting the existence of significant potential for further growth, with reallocation across sectors as the main source of productivity gains (Dieppe, 2021).

However, there are hurdles to consider, such as the increasing complexity of manufacturing processes, which, by requiring a more skilled labor force, could hinder the reallocation of jobs to high-productivity sectors. The persistent human capital gap between emerging countries and the developed world poses a major challenge. This gap reflects not only differences in average schooling or tertiary education coverage, but also differences in the quality of the education received. For example, while schooling levels in Chile have steadily increased in recent decades, as seen in the higher tertiary education coverage of younger generations, a comparative analysis of international standardized tests reveals significant quality gaps (Central Bank of Chile, 2017).

To boost sustainable growth, it is essential to design policies that promote productivity in various dimensions. Making primary sectors more productive is essential, as they remain the main employers in most emerging economies (Dieppe, 2021). Moreover, the rise of automation suggests that manufacturing-driven development is becoming ever more challenging, but also opens up opportunities in high-value-added service sectors, such as information and communication technologies, finance, accounting and legal services (Maloney and Nayyar, 2018).

By reducing barriers to the efficient allocation of resources, both capital and labor, significant productivity gains can be achieved (Hsieh and Klenow, 2009). Greater investment in human capital, with higher levels of coverage and quality, and upgrading management approaches in firms can be crucial for emerging markets to reach their potential and close the productivity gap with the more advanced economies (Hsieh and Klenow, 2009).

Box A: Commodities and productivity slowdown

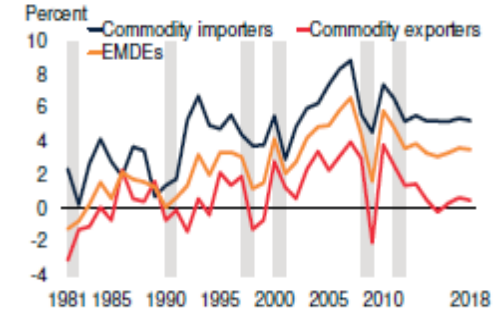
In commodity-intensive economies, additional factors influence economic dynamics. This box explores the evidence that reveals a more pronounced deterioration in productivity growth in commodity-exporting countries and examines in detail the additional factors, both cyclical and structural, that contribute to this trend.

A.1 Evidence

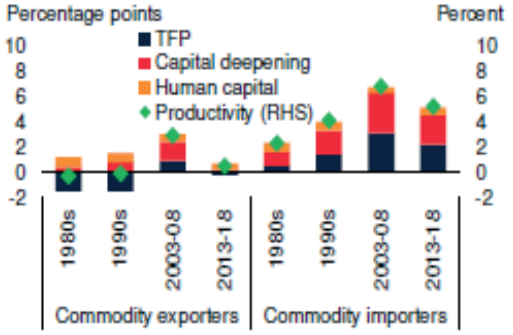
Although the slowdown of labor productivity after the Global Financial Crisis affected a variety of emerging economies, its impact was particularly pronounced in commodity-intensive countries (figure 6, left panel). The fall in commodity prices between 2011 and 2016 stagnated investment in these economies, leading the contribution of both capital accumulation and TFP to fall sharply (figure 6, right panel). The pace of productivity growth went from 2.9% between 2003 and 2008 to 0.5% between 2013 and 2018, a rate barely above that of the 1980s.

FIGURE 6 LABOR PRODUCTIVITY GROWTH IN EMERGING COUNTRIES COMMODITY EXPORTERS AND IMPORTERS (*)

A. PRODUCTIVITY GROWTH IN EMDEs



B. PRODUCTIVITY GROWTH CONTRIBUTION



(*) EMDEs = emerging market and developing economies
Source: Dieppe (2021).

A.2 Cyclical factors

High commodity prices tend to generate an increase in capital investment aimed at extracting greater quantities of these goods, taking advantage of favorable market conditions. However, this extraction process takes time to complete, implying that capital is not fully utilized during the initial investment stage, which in turn constrains productivity growth (Parham, 2012).

In parallel, higher prices may encourage investment in the creation of new operations with lower productivity levels, which become profitable in a context of rising prices, resulting in a further reduction of TFP.

On the other hand, higher incomes from higher commodity prices may ease budget and credit constraints, thus facilitating investment in technology and human capital, which could boost TFP growth in the medium term.

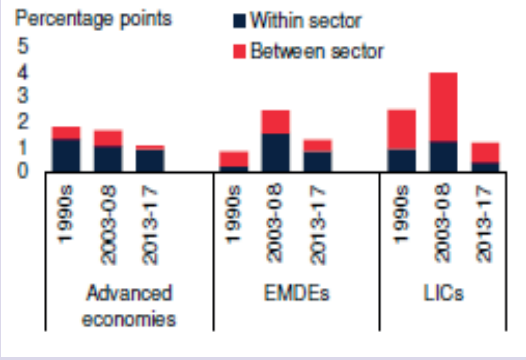
A.3 Structural factors

As time passes, the extraction of raw materials typically becomes more costly and their quality tends to decline. This is especially true for the exploitation of non-renewable resources such as oil and minerals. Therefore, an increasing quantity of inputs is required to obtain the same yield, which mechanically reduces TFP (Aguirregaviria and Luengo, 2015; Parham, 2012). This sector-specific phenomenon puts downward pressure on overall TFP growth in producing countries.

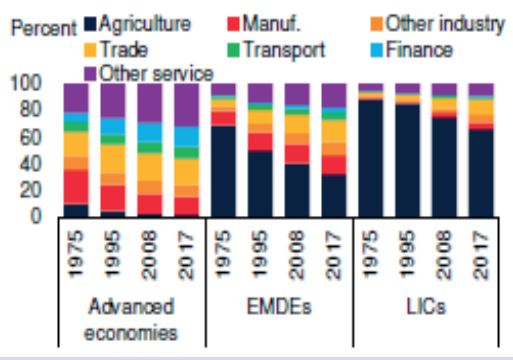
Factor reallocation across different economic sectors has been a key driver of productivity growth in low-income emerging countries (Figure 7, left panel) (Cusolito and Maloney, 2018; de Vries and Timmer, 2015). Nonetheless, in the case of commodity producers, especially in Latin America, this sectoral reallocation has slowed in recent years, partly due to lower labor absorption in the services and construction sectors (figure 7, right panel) (Diao, McMillan and Rodrik, 2017).

FIGURE 7 SECTORAL FACTOR REALLOCATION (*)

A. INTRA AND INTERSECTORAL CONTRIBUTION TO PRODUCTIVITY GROWTH



B. SECTORAL COMPOSITION OF EMPLOYMENT



(*) EMDEs = emerging market and developing economies; LICs = low incomes countries.
Source: Dieppe (2021).

Box B: Climate change

The process of climate change and, more generally, the way in which human activity has impaired the sustainability of the planet's ecosystems and resources may have a significant impact on future productivity dynamics. First, changes in the environmental conditions of the economy may directly affect the productive capacity of countries and the availability of the natural resources necessary for their functioning. Second, productivity can be affected by mitigation actions taken in response to these events, as well as by the development and adoption of technologies that are better prepared to cope with the new conditions. Although this box briefly examines these forces in the specific context of climate change, the implications derived from them can be applied to the problems associated with environmental degradation.

B.1 Measuring productivity in the context of climate change

Given the recent increase in the documented degradation of nature, climate change can be linked to the productivity measurement arguments discussed in section 3.1. On the one hand, by not including natural capital as a factor of production, the degradation of nature could be wrongly measured as a deterioration of TFP (Dasgupta, 2021). On the other hand, the measurement of natural capital still poses enormous challenges, with an approach that currently underestimates the impact of human activity on nature (Albagli and Vial, 2022) and, therefore, does not correctly capture the negative impact on labor productivity. It should be noted that these two effects are associated with different measures of productivity, with the former associated with TFP and the latter with labor productivity. However, both approaches suggest that the concern about efficiency losses conceals a similar concern about the consequences of climate change.

B.2 Direct effects of climate change

In the central forecasting scenarios for the coming decades, climate change is expected to have a direct and significant impact on productivity in every country. This is so because major changes in the global distribution of temperatures and rainfall are already occurring and are expected to continue into the near future. These changes entail important physical risks, such as increased frequency and intensity of episodes like floods and power outages, as well as extreme temperature events.

These events have the potential to cause significantly negative impacts on the productivity of various sectors, in addition to destroying or at least damaging infrastructure and physical capital in the areas hardest hit. The effects can be large and differ substantially from the causes that contributed to the productivity slowdown observed in the last decade (Ditlevsen and Ditlevsen, 2023). There are studies suggesting that the effects of climate change could vary across industries and geographic locations, with possible benefits in some regions (Cruz and Rossi-Hansberg, 2021; Kahn et al., 2021; Roson and van der Mensbrugghe, 2012). It seems clear, however, that the net expected direct impact of climate change on activity and productivity will be negative, and that there are risk scenarios where the effects may have severe implications.

B.3 Indirect effects of mitigation and adaptation efforts

The responses to the process of climate change can take two forms. On the one hand, mitigation strategies, aimed at reducing the damage caused by the climate transition, and thus at least partially recovering lost capital and productivity. These policies can potentially alleviate some of the direct costs just mentioned. On the other hand, they can also consider investments aimed at improving efficiency, generating productivity gains, such as changes in the energy matrix, reducing emissions and developing cleaner technologies. Thus, for example, the implementation of policies that correct climate externalities can have a positive impact on human welfare by improving efficiency in the allocation of resources (Jones and Klenow, 2016; Bannister and Mourmouras, 2017).

From this perspective, climate transition policies have the potential to boost productivity, although they may be unable to undo the adverse impact associated with first-order effects. It is important to note that a country like Chile, given its endowment of natural resources and its climatic conditions, can especially benefit from the use of clean energy, opening the door for significant gains in productivity and activity due to its ability to generate energy at a low cost.

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