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Productivity Puzzle of the Mexican Economy, 1994-2023

Benjamin Garcia Paez[1,2]

[1] Faculty of Economics, National Autonomous University of Mexico (UNAM), Ciudad de Mexico, Mexico

[2] Clare Hall College, Cambridge University, Cambridge, England-UK

Correspondence: Benjamin Garcia Paez, Faculty of Economics, National Autonomous University of Mexico, Universidad No. 3000, 04010 Coyoacan, Ciudad de Mexico. Tel: 55-5622-6585. E-mail: garpaez@unam.mx

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Abstract

Mexico's productivity landscape has faced significant challenges over the past few decades. This study aims to explain the productivity puzzle in the Mexican economy from 1994 to 2023 by utilising the labour productivity accounting framework to estimate an econometric model that measures Mexico's total factor productivity (TFP); furthermore, it identifies the factors that previously contributed to growth but are now weakening. The empirical results reveal that the decreasing trend of TFP is because of capital saturation rather than the labour factor. Additionally, it shows that both productivity per worker and per hour worked exhibit a negative but significant relationship with TFP. Therefore, strategic investments in education, training, and infrastructure are crucial for overcoming productivity challenges and leveraging opportunities like nearshoring for sustainable growth.

Keywords: productivity growth, labour productivity, persistent factors, cyclical factors, business survey, capacity utilisation, spare capacity, industrial policy, technological innovation, nearshoring

1. Introduction

Although low productivity has long characterised the Mexican economy, labour productivity growth has been particularly weak since the 1982 economic and monetary crisis. Notwithstanding the temporary improvements in 2013, recent increase in hiring, and moderate productivity growth associated with phenomena such as nearshoring during the 2021-2023 period, real output per hour for the entire economy remains approximately 2% below the level implied by its pre-crisis trend. This suggests that factors related to economic and financial crises are more likely to explain the current slowness given their impact on productivity levels. However, considerable uncertainty remains regarding the interpretation of the so-called 'productivity puzzle', particularly concerning the influence of cyclical factors. This phenomenon is referred to as the 'Mexican productivity puzzle' owing to the convergence of complex factors and measurement difficulties posed by its few ephemeral upturns alongside recurring downswings.

Productivity remains a crucial issue for Mexico, which has experienced low and even negative rates of growth some years in the 1982-2023 period, with output per hour and real wages remaining constant or lower than they were before the 1982 crisis (Note 1). Productivity performance influences various economic policies, including the balance of monetary and fiscal policies, debt sustainability, and the optimal level of investment for businesses across the country. This is critical, as long-term prosperity depends on the ability of Mexican firms (private and/or public) to consistently increasing output and adjust wages simultaneously.

Mexico faces the challenge of achieving accelerated productivity growth to close the widening gap with its principal commercial partners, the US and Canada (Figure 1). Therefore, it is imperative for Mexico to urgently prioritise a well-targeted industrial strategy to boost productivity growth, increase income levels, and mitigate poverty. Accomplishing this task will be difficult, given the absence of an existing industrial policy (Note 2).

Achieving this task is crucial, as the 'demographic dividend' (Note 3) is nearly exhausted. 'To achieve a GDP growth rate of 3.5% per year as labour-force growth slows, the productivity growth rate would have to rise by almost threefold from the average of 0.8% per year since 1995' (Ros, 2009, pp. 39-40). México actually has squandered exceptional opportunities to enhance its total factor productivity (TFP), including the productive absorption of economic rent stemming from substantial oil exports, the positive externalities of the North American Free Trade Agreement (NAFTA), and so far the failure to effectively capitalise on the advantages of nearshoring by major firms to the US market.

This research began with the hypothesis that long-term factors, such as low investment, inefficient capital allocation, 'zombie' firms, (Note 4) and the failure of education to keep pace with technology, (Note 5) may have disrupted the economy's capacity to supply goods and services. These factors have led to an inefficient allocation of resources, exerting a more persistent impact on productivity growth than cyclical factors. A subsidiary hypothesis suggest that, whilst in the short run the productivity puzzle in Mexico primarily stems from factors such as the size of available physical capital and lower levels of capacity utilisation, which directly affect the level of capital per worker or TFP, in the long run 'endogenizing productivity growth is a result of the presence of economy-wide increasing returns to scale and of the embedding of a endogenous labour force function' (Ros, 2013, pp. 246-256).

Notwithstanding, such assertions do not imply that the cyclical factors have a negligible effect on Mexico's productivity issues, as the industrial production indices of Mexico and the US, for instance, are synchronised (Figure 1).

2. Stylised Factors and Key Facts

Currently, the Mexican economy is expanding at a low but positive pace, but this growth is insufficient to sustain the country's 1980s convergence with the US economy. During that time, Mexico's output more than doubled, reaching 16% of US output, but it has since declined to approximately 8%. Subsequently, Mexico evolved from an oil-dependent economy in the early 1990s to a booming manufacturing centre following the implementation of NAFTA in the mid-1990s. Currently, it has become an international trade hub, underpinned by the nearshoring of production by large corporations to the US. However, low economic growth, high poverty levels, extensive informal economy, and insufficient educational achievement hinder Mexico's economic potential (Organisation for Economic Co-operation and Development, 2022).

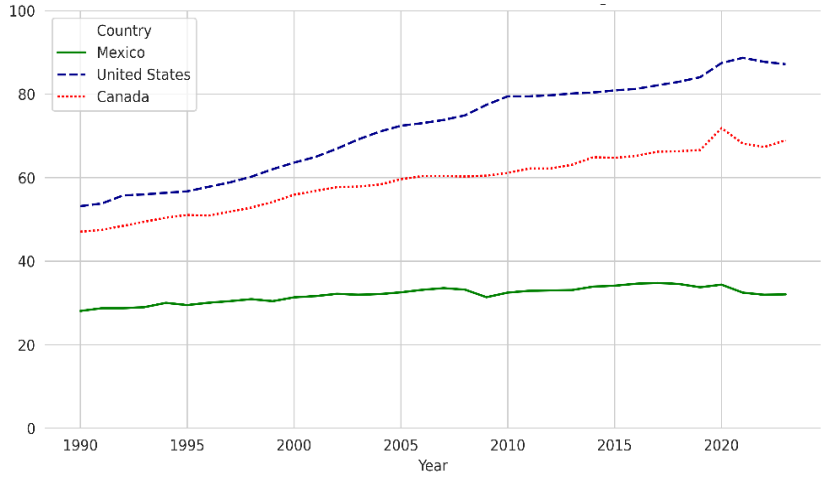

Figure 1. Labour productivity per hour worked (in 2022 international dollars, converted using PPP)

Source: The Conference Board Total Economy Database, April 2023.

Mexico has made no considerable progress in competitiveness and, in some cases, has regressed. The country's economic policy has consistently exhibited a short-term vision and grown at an annual average rate of 2.4% from 1980 to 2023, half of the expected 4.5%. Real wages have remained stagnant since the 1990s. This explains why the structure of Mexico's economy has not changed much: The growth of high-productivity activities has been moderate, and traditional sectors have not undergone substantial transformation (Bolio et al., 2014) (Table 1).

Table 1. Growth of GDP, employment and GDP per person employed by USMCA, 2021-2023, %

	2021			2022			2023(Forecast)		
Member Country	GPD	Employment	GPD per person employed	GPD	Employment	GPD per person employed	GPD	Employment	GPD per person employed
United States	5.9	3.6	2.3	2.1	2.9	-0.8	0.7	1.6	-0.9
Mexico	4.9	8.5	2	3.1	3.9	-0.8	1.6	2.1	-0.5
OECD	5.6	2.7	2.8	2.8	2.6	0.2	0.8	0.9	-0.2

Source: The Conference Board Total Economy Database, April 2023.

From 1950 to 1970, productivity increased by an average of 4.3% per year. Conversely, from 1991 to 2022, the TFP decreased by an average of 0.57% annually (National Institute of Statistics and Geography (INEGI), 2023). (Note 6) The performance of the Mexican industrial sector from 1991 to 2022 demonstrated positive outcomes in 2010, 2015, and 2021. However, it experienced downturns from 2011 to 2020, except in 2015. Whilst the TFP, on average, was -0.14% for the period 2010–2022, the contentiousness result for 2022 alone showed an increase of 2.5 percentage points.

This reflects Bolio et al.'s (2014) observation that Mexico is akin to a tale of two economies, with the gap between them widening. There are high-tech automotive, aerospace, and electronics sectors, and some local multinationals, such as Bimbo or Cemex. However, its larger economy encompasses small and mid-sized companies, which employ 80% of workers but struggle with the country's tax and bureaucratic burdens. Innovation is often scarce, and output is low for mid- and small firms. Numerous firms exist in the vast informal sector, employing 6 out of 10 Mexican workers, and exhibiting productivity levels 40% lower than those of the formal sector. Since 1999, modern enterprises' productivity increased by 5.8% annually, whilst Mexico's smallest firms decreased by 6.5% annually. Additionally, the 'traditional' sector of small and mid-sized firms is experiencing a faster hiring rate than the top firms, shifting more labour to low-productivity work (Table 2).

Table 2. Total factor productivity growth by USMCA, 2000-2023

	Annual average growth, 2000-2007, 2010-2023 (Forecast) and level as a % of USGDP					
Member Country	2000-2007	2010-2019	2020	2021	2022	2023 (Forecast)
United States	0.6	-0.1	0.1	1.8	-1.3	-1.4
Mexico	0.1	0.2	-3.8	-0.2	0.2	0.2
OECD	-0.5	-0.1	1.9	-3.2	-0.7	0.9
Latin America	0.3	-1.1	-1.3	-0.9	-0.8	-0.4

Source: The Conference Board Total Economy Database, April 2023.

Mexico's labour force works the most hours among the Organisation for Economic Co-operation and Development (OECD) (2022) (Note 7). With approximately 15 million people working each 8-hour shift, with one rest day, and a maximum of 48 hours a week, as stipulated by the constitution a century ago, Mexico's output per hour worked relative to that of the US has been near its lowest level since 1950 (Table 3).

Table 3. Growth of GDP, total hours worked and GDP per hour worked USMCA, 2021-2023, %

	2021			2022			2023(Forecast)		
Member Country	GDP	Employment	GDP per hours worked	GDP	Employment	GDP per hours worked	GDP	Employment	GDP per hours worked
United States	5.9	4.5	1.4	2.1	3.2	-1.1	0.7	1.4	-0.7
Mexico	4.9	11.2	-5.6	3.1	4.7	-1.5	1.6	1.2	0.4
OECD	5.6	5.3	0.3	2.8	3.4	-0.6	0.8	0.5	0.3

Source: The Conference Board Total Economy Database, April 2023.

This is because Mexico is struggling to address its lacklustre economic growth, which has averaged only 2.1% annually from 1981 to 2023. The economy expanded at a moderate rate of 3.2% in 2023, and the government's 2024 forecast of 3.9% appears optimistic. Mexico's slow income growth in the past four decades—GDP per capita has increased by an average of only 4.05% per year—exhibits weak labour productivity, which decreased from US $18.30 per worker per hour (in purchasing power parity; PPP) in 1981 to US $17.90 in 2023. According to CountryEconomy.com Data (2024), 'the low productivity of traditional companies is at the heart of Mexico's growth challenge'.

Since the 1990s, Mexico's industrial sector has been divided into two. Traditional industries are orientated to supply the expanding internal market. Their industrial units are essentially distributed throughout the country, from the central part to the deepest southern economic regions. However, modern industries have increased with the production of computers and electronics, particularly semiconductors within international value-chains, producing goods for exportation. They are composed of the long-established in-bond industries ('*maquiladoras*'), which are now supported by the newcomer high-technology firms embodied in the nearshoring process occurring at the northern border shared with the US, forming a sort of inter-oceanic industrial belt. This fact depicts the cyclical pattern of the changes in the industrial production indexes between Mexico and the US

(Figure 2).

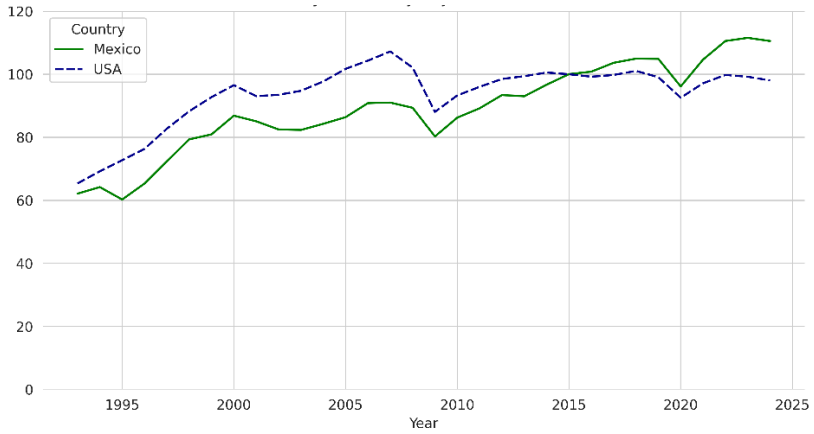

Figure 2. Manufacturing index production volume (2015=100), seasonally annually adjusted from 1993-2024

Source: Federal Reserve Bank of St. Louis. Federal Reserve Economic Data, Production Volume of Manufacturing (Index 2015) (Note 8).

3. Theoretical Framework

Productivity is the rate or efficiency at which a country produces goods and services, typically assessed in relation to the number of people and materials required (Haskel & Westlake, 2018). Productivity, as defined by an economic unit or area, is influenced by several factors that shape its patterns and timing. Nonetheless, some empirical observations must be established. For example, the output growth rate per worker is equal to the output growth rate minus the employment growth rate. Hence, 'if output in two sectors is increasing at the same rate, the sector with the faster productivity growth will have the employment growth and vice-versa. The employment share of the most dynamic sector will decline' (Rowthorn & Coutts, 2004, p. 7). Thus, because the non-manufacturing part of an economy primarily comprises of services, the real output of manufacturing goods might grow at a similar rate to the economy. This implies that the real output of services and manufacturers is growing at roughly the same rate (Note 9).

Productivity, measured by the entire economy's real output per hour worked per person, is an important macroeconomic indicator of the output size that an economy can produce with its existing resources. However, more workers with superior skills and more capital, such as factories, roads, machines, and technology, do not necessarily lead to higher and more sustainable output. Furthermore, the consensus is that the accumulation of traditional productive inputs—labour, capital, and technology—will not contribute as significantly to economic growth as it did in the past (Note 10).

This observation leads to the following conclusions: First, in the long run, technology is a key driver of measured productivity, economic growth, and improvements in the standard of living. It is also crucial for the conduct of monetary policy, as it provides insights into the economy's capacity to grow without causing excessive inflationary pressure (Barnett et al., 2014). Second, in the short and medium run, productivity estimates can be influenced by the intensity of production factors and by demand conditions both within and outside any country, and by investment aimed at developing flexible productive capacity in private and public firms.

In 2022, output per worker increased by an annual average of -0.1% across all major mature economies, marking the slowest growth rate since the turn of the millennium, compared to an annual average of 2.1% between 2000 and 2007 (Note 11). Furthermore, a slowdown in productivity has become evident in almost all regions (The Conference Board, 2023), (Note 12) underscoring that the issue of lower productivity growth has now reached global proportions. TFP—which accounts for skill levels, investment, and the number of workers—decreased by 0.2% in 2023.

Worldwide disagreement exists on the precise cause of sluggishness in productivity. More optimistic explanations centre around the effects of the 2008-2009 and 2020-2021 crises, which led companies to adopt a conservative approach and avoid investing in advanced technology and processes. Emerging market economies are reaching their limits of easy growth based on catch-up technology, whereas advanced economies are concentrating on services, which tend to have less scope for rapid efficiency gains. According to the Conference

Board (2023), the slowdown in productivity growth is only partly caused by past crises, emphasising more deep-seated global economic problems. Thus, considering the current low productivity as only temporary does not fully explain the situation; there are larger persistent trends underlying.

Low productivity remains a major issue in several countries. For instance, the US and other OECD economies have experienced productivity slowdowns (Syverson, 2010). The US GDP appears to be growing at a steady rate of 2%, which is consistent with the economy's long-run growth potential. Its productivity continues to improve but not significantly. The growth of GDP per hour worked remained at 2.2% from 2000 to 2007; nonetheless, it decreased to 0.6% in 2011 and remained negative, reaching -0.7% in 2022. However, in this process, growth in the total hours worked increased from 0.5% to 1.4% in 2023, allowing real GDP to reach 2.8% by 2023.

Improving labour productivity remains an effective pathway for higher growth. First, a tight labour market improves the matching between employees and employers; well-matched workers perform better, leading to both stronger wage growth and margin expansion. Second, corporate investment in artificial intelligence (AI) pays off, allowing companies to automate tedious processes and expand output. Additionally, the US reaps benefits from green fiscal stimuli, rehabilitation, and surges in new businesses. Labour productivity growth in the US increased sharply by 2.6% over the last two decades. This is because its population is younger, rapidly growing, and has longer working hours. However, a significant portion of the output gap occurs because people in the US also produce more per hour (Note 13).

DeSilver (2017) states that most Americans are unaware that, despite strong manufacturing growth output over the past decades, US manufacturing jobs have largely disappeared. He further posits that the labour productivity index for manufacturing is two and a half times higher than it was at the beginning of 1987. This is an outcome of several factors, including businesses investing in more machinery and replacing old machines with more advanced ones, workers becoming more skilled and educated, and firms streamlining and improving their industrial processes.

Nonetheless, Gordon (2014) demonstrates that a potential growth of 2% is no law but a wave that has already run its course. He also estimates that demographics could reduce the long-run trend of 2% by 0.3%. According to Fernald and Jones (2024), everybody is pretty much in agreement in expecting slower growth in hours worked relative to what we have seen in the last 50 years. The growth in GDP per hour worked depicts an interesting pattern over time.

Whether computers will continue to make significant contributions to productivity is one of the most pressing issues. This issue revolves around whether the US could expect a productivity growth rate of 2.5%, such as the rate experienced from 1996 to 2004, in the coming decades. Brynjolfsson and McAfee (2014) argue that the impact of information technology is currently included in actual productivity measurements. An exponential expansion in computing power and the ability to rapidly diffuse innovations could mean growth like that in the late 1990s. Gordon (2014) agrees that while computers may become more powerful, living standards for average humans are improving slowly. Conversely, he anticipates a slower pace of productivity growth, consistent with the rate achieved over the past decade, as the discoveries of the past held more importance than those of today. Gordon (2014) remains doubtful about the potential productivity gains from inventions. He acknowledges the potential of robotics but remains unconvinced that technology has advanced sufficiently to fully replace humans.

One intriguing aspect of both analysts' arguments lies in their inability to resolve the dispute over productivity potential. Rather than emphasising the economy's capacity to make discoveries, they focus on what remains to be uncovered. While both analysts seek to enhance factorial quality and the growth metrics of capital and labour, they evaluate the discovery process based on the effort invested in their research (Note 14).

Fernald and Jones (2014) analyse the steady 2% growth in US output per capita from 1950 to 2007. They find that almost none of this growth can be attributed to increased capital per worker. Instead, approximately 0.4% is derived from human capital (better education). The largest contribution, 1.6% of the total, is derived from the increase in the number of people working in research and development (R&D). This is partly because of the scientific research conducted by several researchers. However, this results from devoting a steadily larger portion of the total population to R&D than before. In contrast to the European Union, what epitomises the US resolute is that 'regaining the long-term productivity growth rate of 2.2% annually would add $10 trillion to US GDP— a boost needed to confront workforce shortages, debt, inflation, and the energy transition' (Atkins et al., 2023, pp. 5-6).

In the UK, the slowdown in productivity and the decrease in real wages have been more pronounced. The GDP growth in 2000-2007 reached 1.9%, which subsequently decreased to 0.5% in 2011-2019 and to -0.1 in 2023. The growth of total hours worked was 0.7 in 2000-2007, 1.5 in 2011-2019, and -0.1 in 2023. The growth of real

GDP decreased from 2.6 in 2000-2007 to -0.2 in 2023. Barnett et al. (2014) examined this trajectory and explained it as: First, the role of lower levels of investment in different forms of capital—tangible and intangible capital investment and working capital— (Note 15) and second, the role of resource allocation.

Regarding the role of lower levels of investment, Barnett et al. (2014) assert that investment in the capital stock—tangible and intangible—available to each unit of labour is a crucial determinant of labour productivity. However, they find that these capital channels have subdued following the 2008-2009 crisis, as has working capital, which is defined as the net cash balance a company needs to hold to meet its day-to-day expenses. Another important explanation for the weakness in UK productivity is the waning reallocation of resources—capital and labour—to more efficient and productive uses. 'The possible causes for such impairment are the crescent uncertainty about the economic environment following large, asymmetric shocks to specific sectors or industries, and the prevalence of a dysfunctional financial system that impaired the effective movement of resources across the economy, bringing higher firm survival owing to forbearance and other forms of public policy support' (Barnett et al., 2014, p. 124).

Additionally, a survey conducted by the Centre for Macroeconomics reveals that low demand due to the global monetary crisis, austerity policies, and Brexit is a major cause of this productivity slowdown. The survey has raised questions related to human capital, including education and employee skills, (insufficient) investment in R&D, labour market factors, low demand (including the fiscal crisis, austerity policies, or Brexit), and productivity mismeasurement (Ilzetzki, 2020).

Two broad categories of explanations exist for the productivity slowdown in the UK. The first focuses on supply side factors, such as employee skills, including mismatch between skills and the field of employment; sluggish investment in R&D; and global factors, such as increases in market power. The second category focuses on demand-side factors, such as fiscal crises, austerity, and other causes of slow demand growth over the past decade. Reassessing the sources of the recent productivity slowdown, Winkler et al. (2021) find that the slowdown in productivity is attributable to a combination of mismeasurement, slowdown in capital deepening (for cyclical and structural reasons), spillovers from intangibles, trade integration, and the contribution of allocative efficiency (Note 16).

The European Union (EU) has been engaged in a debate about productivity, considering that its sluggishness is attributed to structural factors. The Union argues that a major cause of low productivity is its failure to fully leverage the efficiency gains from digital technologies and related services, unlike the US, which has achieved this at an earlier stage. However, they also believe that fostering competition could be part of the solution, calling for a rapid and more effective implementation of the EU's Next Generation programme of public investment.

Recently, Sharma (2024) points out that the UK and EU are falling behind the US because their overprotective governments have allowed the burdens of an oversized state to stifle productivity growth, which is essential for rising prosperity. During the 1960s postwar peaks, productivity growth collapsed from approximately 7% to less than 0 in the EU Big 4—Germany, France, Italy, and Spain (Sharma, 2024). Although productivity has declined in the US, it is less severe, decreasing from 2.5% to approximately 1% owing to superior technological advancement. Adding productivity losses from oligopolies, zombies, bureaucracy, inequality, and other market distortions fuelled by big governments could explain the productivity slowdown.

Based on capital, labour, energy, material, and service inputs (KLEMS), a United Nations-backed model, the INEGI (2024) measures Mexico's TFP and its contribution to the economic growth of productive factors. By subtracting the economic value of these inputs from the gross added value of production, the remaining value is known as Solow residual. This serves as a good measure of technical progress, encompassing changes in the administrative processes and an efficient usage of productive factors. Thus, the Solow residual interrelates with adjustment costs and the economies of scale.

The production function of the KLEMS model is expressed as follows: $(x) = (K, L, E, M, S)$. It is a combination of human resources (L), capital (K), energy (E), materials (M), and services (S) utilised to produce goods and services that firms and other economic agent demand. This model examines the influence of weighed annual variations in intermediate inputs and integrates them into the KLEMS algorithm:

$$\Delta A = \Delta Y - \alpha K(\Delta K) - \beta L(\Delta L) - \gamma E(\Delta E) - \varepsilon M(\Delta M) - \theta S(\Delta S)$$

Where *K, L, E, M,* and *S* variables are capital, labour, energy, raw materials, and services, respectively, and the Greek letters $\alpha, \beta, \gamma, \varepsilon,$ and θ represent the factorial intensities on production (Y). Parameter *A* expresses the TFP, which interrelates the volume of production and combines the contributions of the inputs used (Note 17) (Figure

3).

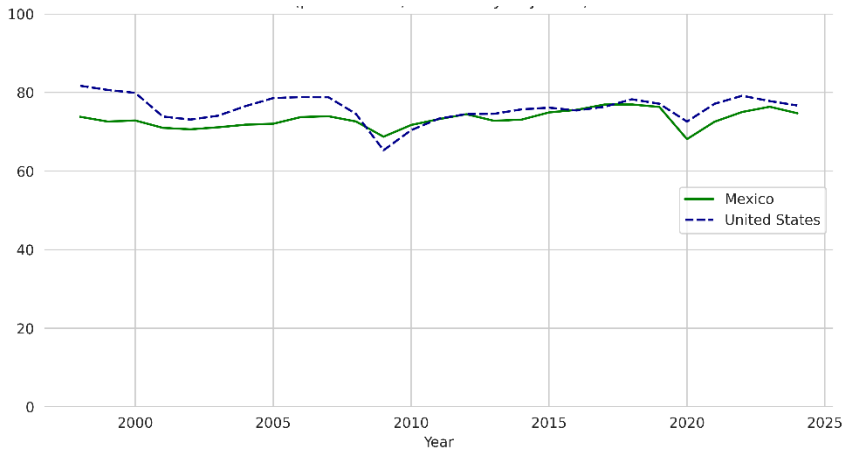

Figure 3. Capacity utilisation rates in manufacturing for Mexico and US (per balance, seasonally adjusted) (Note 18)

Source: Organisation for Economic Co-operation and Development, Business Tendency Surveys: Rate of Capacity Utilisation.

Productivity is also related to structural imbalances. Khan and Reinhart (1989) estimate the incremental capital output ratio for the 1961-2018 period. They find a determination coefficient R^2 of 0.463, denoting that the Mexican economy had shown low productivity of the economic investment realised during that period, along with high volatility.

4. Method

Productivity is a measure of economic activity based on output per unit of capital or labour. It increases with improved efficiency in using resources, despite various influencing factors. Productivity should be measured in terms of money or index numbers for comparison purposes as it reflects efficiency and potential economic output.

Putting aside the intellectual appeal of the two factors - size of available physical capital and capacity utilisation - there are operational advantages in combining them, as they affect the actual rate of GDP growth, which translates to growth in output per person employed. However, in the long term, underlying productivity, influenced by technology, innovation, and capital stock, is a key determinant of the supply potential of the economy.

Specifically, labour productivity is determined by several variables; however, 'the main proximate influences are capital accumulation, technological progress, acquired skills, economic scales, and improvement in the employment of resources' (Crafts, 1993, p. 14; Ros, 2013, pp. 15-16). Thus, by adopting a growth accounting technique (Note 19), labour productivity increases from the interplay between capacity utilisation, capital deepening, and technological growth. Thus, the estimation of the labour productivity rate of growth of a country, sector, or firm, even in the long term, is as follows:

$$Y = A\, f\left(K^{\alpha}, L^{\beta}\right) \tag{1}$$

where Y represents output, K represents capital, L represents labour, A represents technological efficiency, with parameters α and β depicting the input intensity of K and L, respectively. The rationale behind the parameters α and β is that they have different potential and exert different degrees of effort in the production process. Thus, output is a function f of the productive inputs K and L, adjusted by their degree of utilisation (α and β respectively), and enhanced by technological efficiency. By rearranging Equation (1), labour productivity is defined as output per unit of employment (Y/L) and can be divided into the levels of technological efficiency A, capital per hour worked, or 'capital deepening' (K/L), and their degree of capacity utilisation (*Util*), which is a function of (α, β) (Note 20):

$$Y/L = A_{\mathrm{F}}\,(\mathrm{K/L}, \mathrm{Util}) \tag{2}$$

Technological change and the associated increase in TFP are crucial drivers of long-term economic growth. According to Maddison (1991), growth is responsible for the increase in output beyond those resulting from plain quantities of L and K; thus, TFP growth also results from the eradication of inefficiencies in the utilisation

of resources and technological change. It is not directly observable; therefore, it is estimated as a residual by rearranging Equation (2) (Note 21).

To quantify the 6% decrease in the labour productivity index in Mexico from 1998 to 2023, a baseline model is required to capture both structural and cyclical effects, even partially. Equation (2) directly captures the structural effects through the *K/L* coefficient, and the variable *Util* can partially reflect the duality of the cyclical effect. This decreases the demand for goods and services because of the decrease in average earnings given the amount of unemployment during both recessions, 2008-2009 and 2020-2021. However, the reduction in product supply results in a lower intensity of input utilisation and the opening of spare capacity within firms during sluggish demand. The linear regression provides informative productivity estimates.

4.1 Model Specification and Estimation

The econometric adequacy of Equation (3) for evaluating the labour productivity performance of the Mexican economy during the 1998-2023 period, is expressed as follows:

$$\frac{LnY}{L} = \beta_0 + \frac{\beta_1 LnK}{L} + \beta_2\, LnUtil + \varepsilon \tag{3}$$

The results of estimating Equation (4) are expressed as follows: MCO, sub-period: 1998–2022, T equals 26. Dependent Variable: *Ln Y/L*

$$LnY/L = 0.17 + 0.028\, K/L + 0.17\, Util \tag{4}$$

(3.9) (0.54) (3.21) (-0.34) (6.31) R^2 =0.68

A summation of the contributions from both types of effects, persistent and cyclical, in the Mexico productivity puzzle provides a gross benchmark with which the relative importance of each source is considered. Of the overall decline in labour productivity from 1998 to 2023, the *K/L* coefficient suggests that reduced investment in physical and intangible capital helps explain 1.8 percentage point (Note 22). Regarding cyclical, the *Util* coefficient suggests that lower levels of installed capacity utilisation indicate the remaining part of the overall drop in labour productivity, that is, 1.1 percentage point. This is the underlying driver of Mexico's productivity.

From 1998 to 2008, TFP, measured in terms of PPP and constant terms, follows a similar path to that of the *Util rate* (TUT), indicating the first signal concerning their positive association. However, the 2009 recession brings a meaningful change in their path, as illustrated in Figure 4. Owing to the 2009 recession, the *Util rate* reaches its highest point in 2017, while TFP shows a downward trend. Additionally, two points in Figure 4 are particularly worth noting: while TFP in terms of PPP and *Util rate* from 1998 to 2008 maintain a positive relationship, after 2009, the relationship emerges negative and statistically significant, indicating that the recession provokes a profound structural change in the dynamics of both variables.

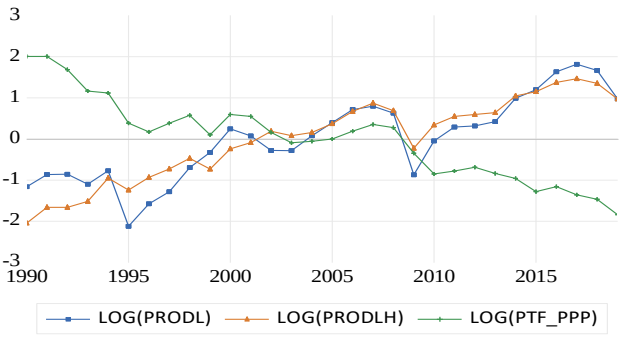

Figure 4. Mexico: TFP and labour productivity

Note. Series normalised with their mean and standard deviation values.

Source: Feenstra (2015) and The Conference Board Total Economy Database, April 2023.

Regarding the effect of labour productivity on the TFP variable, Figure 4 reveals that both productivity per worker (*prodl*) and productivity per hour worked (*prodlh*) exhibit a negative but meaningful relationship with TFP from 1998 to 2008. This result is paradoxical, as it suggests that the decreasing trend in TFP is not attributable to the labour factor but to the saturation of the capital situation; therefore, a decreasing trend in profitability will eventually become a disincentive to new investment (see Table 4).

Table 4. Correlation analysis between predictors and TFP, 1998-2019

Predictor	TFP
prodl	r = -0.63(-3.63)
prodlh	r = -0.72(-4.73)

Note. Variables in logarithmic values.

5. Analysis and Discussion Results

The rise of modern civilisation has been driven by the trend of increasing individual productivity. The most accurate measure of economic progress is GDP growth per hour worked. It is imperative to determine the economic value generated for each hour of human labour. In this paper, we identify factors that previously contributed to growth but are now weakening, including demographics, skills, and education.

Productivity measurement provides estimates of an economy's ability to grow without generating excessive inflationary pressure. This explains why the conduct of monetary policy as a fiscal policy must accommodate prices accordingly. In this context, a key challenge has been to more accurately understand whether the persistent productivity weakness is due to enduring factors or the ongoing effect of the 1982 and 1995 financial crises.

On average, the protracted sluggishness in productivity and the strength in employment growth over the 1990-2023 period suggest that the low level of productivity in the Mexican economy is attributable to structural factors, including reduced investment in both physical and intangible capital, such as innovation, and impaired resource allocation from low to high productive use. However, when assessing these factors, the results obtained are not exempt from entailing a significant degree of uncertainty in interpreting the weakness in productivity. The explanations covered in this article are unlikely to be exhaustive and cannot fully explain the slowdown in productivity.

There are reasons to believe that the reduction in measured labour productivity might overstate the correct size of the productivity puzzle (Chang, 2014). For instance, because labour productivity is the amount of output per hour worked, if output turns out to be greater or employment (or total hours worked) is weaker than initially estimated, it may reduce the size of the shortfall. Furthermore, because the productivity slowdown is compared with the level implied by the pre-crisis trend, any changes to this trend will also affect the magnitude of the productivity decline. Similarly, the degree of utilisation is an unobservable variable, as is the uncertainty surrounding governmental capital stock estimates.

Despite measurement issues, specific productivity targets must be added to pursue productivity goals. Thus, measurement issues and revisions to output account for a larger portion of the productivity decline in the study period—up to 4%—which could be explained by the variables envisaged; however, the rest remains unknown and contributes to the productivity puzzle. Additionally, important caveats must be noticed; while the analysis examines each cause independently, there is a possibility that overlapping factors could result in double counting (Note 23).

Mexico's productivity puzzle, by any measure, is lower than the pre-crisis trends observed in 1995-1995, 2008-2010, and 2020-2021. The annual decline in GDP per worker since the 1982 monetary crisis has reached an unprecedented scale of 4.55%. Mexico's large services sector, where investment and output are poorly measured, is unlikely to be the entire story. Nonetheless, this constitutes a portion of the productivity puzzle that cannot be explained by persistent factors such as low investment, inefficient allocation of capital, and 'zombie' firms.

Particularly, the low growth rate of physical investments must be prioritised as a vital policy. Another significant area of investment is skills, as their shortage impedes growth. Although the government's focus in 2019 was in the right direction, it was skewed. Therefore, prompting private investment is mandatory. However, aside from tax cuts, which can boost private investment, clarity about policies and transparent regulations are also crucial, as some companies are deterred from making big infrastructure investments, which can be attractive owing to their fixed returns. Additionally, regulating the amount of capital is crucial.

Increasing public investment can be beneficial, as it may have a crowding-in effect (Garcia-Paez, 2021), making private investments more efficient. Fiscal constraints should consider excluding investments that generate future returns; this distinction is worth noting. Government policy is not the only crucial issue for investment. Banco de Mexico has also identified capital misallocation as a related issue. To invest, businesses must borrow, which requires banks to lend efficiently. This issue is less significant for large firms, as most of the country's businesses are small. Introducing more competition to the banking system is challenging in small economies. Investment is important; however, structural issues underpinning the productivity puzzle also exist. Globalisation and skill

upgrades in the economy have affected wages. Cheaper overseas workers and higher rewards for those working at the higher-skill end of the economy have depressed median incomes. Cheaper workers imply that companies also substitute workers for capital, which depresses investment; therefore, the issues are all related (Note 24).

The Mexican government has prioritised productivity intermittently since 1995 in its economic growth agenda. However, there has not been a noticeable improvement in productivity. Actually, it was not until 2013 that the Mexican government explicitly acknowledged a chronic problem with productivity, issuing a ten-step programme to enhance productivity and competitiveness, which was subsequently enacted into law. Additionally, the government has implemented various productivity-boosting policy initiatives aimed at redesigning state industrial policy for the long term. Specifically, the government established a National Productivity Committee to prioritise the issue within public policy and committed to including long-term goals in planning with a 20-year horizon (Secretary of Labour, 2025). The new law represented a positive step towards increasing productivity, as it strived to enhance the role of the government's industrial policy, which has been nearly absent in Mexico for a long time.

Beyond this, outdated approaches to economic development are insufficient to overcome contemporary economic, health, and climate crises. Governments must establish bold goals and collaborate with proactive private sector partners to promote a sustainable and inclusive economy. By advancing mission-oriented industrial policies, countries can stimulate cooperation, diversify production, increase productivity, and direct economic growth that is both sustainable and inclusive (Mazzucato, 2022).

Additionally, as McMillan et al. (2014) indicate, the manufacturing subsector has abruptly reduced its ability to integrate inter-sectorial dynamics productively. Consequently, it struggles to drive the higher rates of growth and development that Mexico needs (Note 25). Despite these challenges, Mexico must increase its productivity performance by revitalising manufacturing, which remains an affordable sector where emerging countries have historically achieved growth and even outperformed wealthier countries. As depicted in Figure 5, Mexico must explicitly narrow the widening gap between its domestic and foreign inputs in the manufacturing of complex goods; otherwise, it may miss the opportunity to strengthen sustainable endogenous sources for boosting productivity growth.

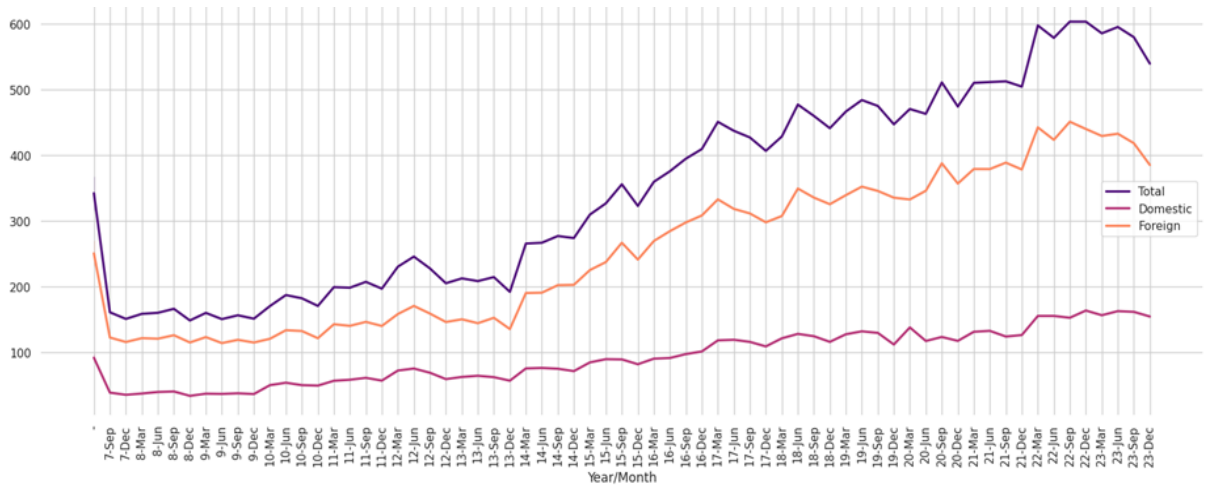

Figure 5. Mexico's utilised inputs in manufacturing for exportation, categorised by domestic and foreign origin, 2007-2024 (Thousands of millions MXN)

Source: National Institute of Statistics. Monthly statistics of the manufacturing, maquiladora and export services Industry Program (IMMEX). Retrieved from https://www.inegi.org.mx/app/tabulados/interactivos/?px=IMMEX_1&bd=IMMEX

Modern industries may not offer the same benefits as those in the 20th century. Mexico must strive to capitalise on this. The nearshoring process presents an exceptional opportunity; it requires the implementation of industrial policy and reapproach of Mexico's relationship with its commercial partners, the US and Canada, within the framework of the USMCA trade deal. Mexico has been unable to consolidate genuine or endogenous industrialisation according to its economic configuration. Therefore, without renouncing the net gains stemming from the trade deal, Mexico must delineate an economic policy to raise growth and development in regions that have not yet adapted to new economic trends.

5.1 Caveats and Implications

Productivity indicates how employment and investment form the foundation for long-term growth. Increases in productivity result from improved efficiency in either labour or capital, though it is often challenging to differentiate their individual contributions. Conventionally, productivity metrics focus on the output generated using certain amounts of factor inputs - mainly land, labour, and capital. As land is generally fixed and capital is complex to quantify, attention typically centres on labour productivity. This explains why the productivity term is usually associated with labour productivity, given that both essential inputs, capital and labour, are implicit in the capital-labour ratio. Thus, labour productivity depends on new investments that elevate the capital-labour ratio, known as factor substitution, and technology advancements that boost output for a specific capital-labour ratio (The Economist, 2010).

Labour productivity reflects capital investment and serves as a guide to capital productivity. A company employing advanced capital and input goods is likely to yield greater total output per hour than a company using obsolete technology. Thus, apart from the limited sample size used in the econometric exercise, there is also a scarcity of data capturing other factors influencing labour productivity such as social attitudes, work ethics, unionisation, and notably, training. They are not measured properly by economic statistics. Probably this unacceptable research constraint has prolonged the dilemma surrounding existing measuring methods during a period where it is rightly believed that economic growth signifies an increase in the labour force within the formal market alongside growth in labour productivity.

Furthermore, even when opting for a robust method that combines the capital coefficient and utilisation index in the productivity function, thereby accounting for both endogenous and exogeneous factors; it still cannot evade the inherent limitation. While an effort has been made to focus deliberately on the segmentation of the labour market by confining the analysis to the manufacturing subsector, the underlying conditions explaining segmentation are not addressed. As a result, using the empirical findings from this study as indicators of efficiency and potential economic output warrants cautions.

Hence, recognising the pivotal role that productivity plays in shaping policies across private and public sectors, at both national and international levels; efforts must be directed towards enhancing and strengthening economic data concerning productivity. This would facilitate academic researchers in yielding more robust results, improving interpretations, regardless of whether productivity figures are expressed in terms of money or index numbers, and incorporating economic cycles into the analysis, given that productivity is highly cyclical due to the less flexibility of employment and fixed capital compared to demand and output. Additionally, aligning economic trends to synchronise wages, productivity, and profitability should also be considered.

6. Conclusions and Policy Options

The pivotal hypothesis that Mexico's faltering productivity has been influenced by structural factors rather than cyclical influences has been validated. Labour productivity behaviour has been puzzling owing to its persistently low levels, suggesting that both insufficient capital accumulation and stagnant spare capacity margins in the companies have been key explanatory factors. Furthermore, demand weakness has been evident across frequent economic and financial crises throughout the 1982-2023 period, affecting both their earlier and latter stages.

Mexico's latest productivity statistics show some betterment. This is a correct signal as improving labour productivity is the most direct path to higher growth. Analysts are increasingly identifying low productivity as a major threat to raising living standards, not only in Mexico but also in both, less developed and higher income countries alike. Weak productivity has contributed to low wage gains in recent years. Higher productivity should be the utmost economic priority of any government.

Enhancing productivity is a primary way to strengthen living standards, particularly as Mexico faces an ageing population and a rapidly increasing retirement rate. Without stronger productivity growth, the country can become accustomed to lower economic expansion rates. Therefore, implementing pro-productivity policies should become a constant and obligatory focus in both Mexico's private and public sectors.

Notwithstanding, raising income level does not depend on higher productivity, but it is a sustainable way to increase income levels compared to relying on debt for growth. While the causes of low productivity are not entirely unknown, their consequences affect people's wellbeing ahead. Therefore, given that the productivity puzzle has gained prominence on the policy agenda owing to the crisis, it is imperative to address this crucial issue just from their proximate and deep determinants so to raise and sustain productivity in the long term.

To address this issue, the Mexican government requires a strategy to revive the economy through increased public and private investment. A programme investing in 21st century activities and technologies to address

climate change, biodiversity loss, and environmental degradation, including air and water pollution, would significantly be a step change in both productivity and economic growth.

Mexico's transition to a sustainable, inclusive, and resilient economy provides a genuine opportunity to drive innovation and competitiveness and revive productivity growth. However, this also requires the government to embrace a coherent, credible, and targeted set of policies to unlock new, intelligent, and sustainable forms of investment and growth. To effectively manage aggregate demand through fiscal and/or monetary policy, a comprehensive internal pact must be signed between the government and economic and social sectors. Similarly, addressing the protracted low-productivity problem requires a variety of policies, including infrastructure investment; human capital investment, including education and job retraining; regulatory and competition policies, potentially involving financial regulation; and tax and subsidy policies. In a country with Mexico's structural characteristics, productivity growth must also be promoted through investments in education and worker training.

A significant component of this strategy should focus on accelerating the transition away from fossil fuels. As the cost-of-living crisis has highlighted, the reliance on these fossil fuels creates insecurity and hinders economic growth. Mexico investing money in measures to promote energy efficiency and reducing its exposure to fossil fuel price volatility would be significant. Reducing the consumption of fossil fuels will generate significant savings to the economy, and improved energy efficiency will increase productivity.

Sustainable investment has the potential to improve Mexico's current economic situation. The country has been experiencing stagnant productivity and economic growth, which adversely affects living standards and competitiveness owing to a lack of investment. Mexico is at the bottom of the OECD table for investment. Over the past 30 years, Mexico's gross fixed capital formation has averaged 18% of GDP, which is 4.7% below the OECD average over this period, which is low in both the public and private sectors. The government must adjust the prevailing patterns of low investment, productivity, and growth.

Productivity plays a crucial role in industrial policies. Within the context of the two 'Mexico' configurations, the Mexican economy needs essential reforms in both the private and public sectors to address the industrial dynamics that emerged during the stabilising development period. This period, a hybrid experience of the import-substitution-industrialisation strategy prevalent in the 1960s, 1970s, and even early 1980s, has been succeeded by outward-looking approaches that emerged following external debt crisis. From this perspective, effective state intervention is required to balance between reindustrialising to restore productive efficiency in traditional industrial sectors and establish a new industrial policy that embraces advanced manufacturing activities. Empirical evidence indicates that there are effective means to improve productivity at a faster rate than in developed countries, especially in comparison to Canada and the US, which are Mexico's main commercial partners. These methods also allow for the utilisation of new opportunities like nearshoring in the short run, without adopting a laissez-faire approach.

Although the productivity puzzle persists, it is crucial to address these challenges and explore pathways to sustainable growth. In summary, Mexico's productivity landscape remains complex; however, strategic investments in education, training, and infrastructure should be advocated in order to advance productivity.

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References

Atkins, C., White, O., Padhi, A., Ellingrud, K., Madgavkar, A., & Neary, M. (2023). *Rekindling US productivity for a new era*. McKinsey Global Institute Report. Retrieved from https://www.mckinsey.com/mgi/our-research/rekindling-us-productivity-for-a-new-era

Barnett, A., Batten, S., Chiu, A., Franklin, J., & Sebastiá-Barriel, M. (2014). The UK productivity puzzle. *Bank of England Quarterly Bulletin, 2014*(Q2), 114-128. Retrieved from https://www.bankofengland.co.uk/quarterly-bulletin/2014/q2/the-uk-productivity-puzzle

Bolio, E., Remes, J., Lajous, T., Manyika, J., Ramírez, E., & Rossé, M. (2014). *A tale of two Mexico: Growth and prosperity in a two-speed economy*. McKinsey Global Report. Retrieved from https://www.mckinsey.com/featured-insights/americas/a-tale-of-two-mexicos

Brynjolfsson, E., & McAfee, A. (2014). *The second machine age: Work, progress, and prosperity in a time of brilliant technologies*. W.W. Norton & Company.

Chang, H. J. (2014). We do not live in a post-industrial age. In *23 things they don't tell you about capitalism*

(pp.77-92). Penguin Random House.

Cohen, R. (2024). AI productivity will be as profound as Adam Smith's pin factory. *Financial Times*. Retrieved from https://www.ft.com/content/c03c37e8-905a-4bc5-a73f-ac87a87885f5

Countryeconomy. (2024). *Mexico GDP - Gross Domestic Product 2023*. Retrieved from https://www.countryeconomy.com/gdp/mexico

Crafts, N. (1993). *Can de-industrialisation seriously damage your wealth?* Institute of Economic Affairs, Hobart Paper 120.

DeSilver, D. (2017). Most Americans unaware that as U.S. manufacturing jobs have disappeared, output has grown. *Pew Research Centre*. Retrieved from https://www.pewresearch.org

Feenstra, R. (2015). The next generation of the Penn World Table. *American Economic Review, 105*(10), 3150-3182. https://doi.org/10.1257/aer.20130954.

Fernald, J. G., & Jones, C. I. (2014). The future of U.S. economic growth. *National Bureau of Economic Research Working Paper No. 19830*. https://doi.org/10.3386/w19830

Garcia-Paez, B. (2021). Capability of financial variables to raise the productivity of investment: A reassessment for the Mexican economy. *International Journal of Academic Research in Economics and Management Sciences, 10*(2). https://doi.org/10.6007/IJAREMS/v10-i2/10069

Goodridge, P., Haskel, J., & Wallis, G. (2013). Can intangible investment explain the UK productivity puzzle? *National Institute Economic Review, 224*, R48-R58. https://doi.org/10.1177/002795011322400109

Gordon, R. J. (2016). *The rise and fall of American growth: The U.S. standard of living since the Civil War*. Princeton University Press. https://doi.org/10.1515/9781400873302

Haskel, J., & Westlake, S. (2018). *Capitalism without capital: The rise of the intangible economy*. Princeton University Press. https://doi.org/10.1515/9781400888320

Hughes, A., & Saleheen, J. (2012). UK labour productivity since the onset of the crisis: An international and historical perspective. *Bank of England Quarterly Bulletin, 2012*(2), 138-146. Retrieved from https://www.bankofengland.co.uk/quarterly-bulletin/2012/q2/uk-labour-productivity-since-the-onset-of-the-crisis

Ilzetzki, E. (2020). *Explaining the UK's productivity slowdown: Views of leading economists.* The Centre for Economic Policy Research. Retrieved from https://cepr.org/

International Bank for Reconstruction and Development. (2008). *Strategies for sustained growth and inclusive development*. Commission on Growth and Development, The Growth Report No. 44986.

Khan, M., & Reinhart, C. (1990). Private investment and economic growth in developing countries. *World Development, 18*(1), 19-27. https://doi.org/10.1016/0305-750X(90)90100-C

Maddison, A. (1991). *Dynamic forces and capitalist development: A long run comparative view*. Oxford University Press.

Mazzucato, M. (2022). New missions for Latin America. *Project Syndicate*. Retrieved from https://www.project-syndicate.org/

Mazzucato, M. (2023). *Transformational change in Latin-America and the Caribbean: A mission-oriented approach*. The Economic Commission for Latin America of the United Nations.

McMillan, M., Rodrik, D. & Verduzco-Gallo, I. (2014). Globalization, structural change, and productivity growth, with an update on Africa. *World Development, 63*, 11-32. https://doi.org/10.1016/j.worlddev.2013.10.012

National Institute for Statistics, Geography, and Informatics of Mexico. INEGI. (2023). *Productividad total de los factores (PTF) Modelo KLEMS: Serie anual 1990-2022*. Retrieved from https://www.inegi.org.mx/contenidos/saladeprensa/boletines/2023/PTF/PTF2022.pdf

National Institute of Statistics, Geography, and Informatics of Mexico. INEGI. (2024). *Programas PTF 2018*. Retrieved from https://www.inegi.org.mx/programas/ptf/2018/#tabulados

Organisation for Economic Co-operation and Development. (2022). *OECD economic surveys: Mexico 2022*. OECD Publishing. https://doi.org/10.1787/2e1de26c-en

Ros, J. (2009). *Poverty reduction in Latin America*. Economic Commission of Latin America and the Caribbean,

United Nations, Review no 98.

Ros, J. (2013). *Rethinking economic development, growth & institutions*. Oxford University Press.

Rowthorn, R., & Coutts, K. (2004). De-industrialisation and the balance of payments in advanced economies. *Cambridge Journal of Economics*, *28*(5), 767-790. https://doi.org/10.1093/cje/beh034

Secretary of Labour. (2024). *Law to promote a sustained increase of productivity and competitiveness of the national economy*. Diario Oficial de la Federación México. (Updated on April 17, 2024).

Sharma, R. (2024). *What went wrong with capitalism*. Simon & Schuster.

Stiglitz, J. (2015) Inequality, Wealth, and Capital, Queries- Summer, Foundation for European Progressive Studies.

Syverson, C. (2011). What determines productivity? *Journal of Economic Literature, 49*(2). https://doi.org/10.1257/jel.49.2.326

The Conference Board. (2023). *Total economy database: Summary tables & charts*. Retrieved from https://www.conference-board.org › data › total-economy-database-productivity

The Economist (2010). *Guide to economic indicators. Making sense of economics* (7th ed.). London.

Winkler, J., Koutoumpis, P., Lafond, F., & Goldin, I. (2021). Re-evaluating sources of the recent productivity slowdown. *Centre for Economic Policy Research*. Retrieved from https://cepr.org/voxeu/columns/re-evaluating-sources-recent-productivity-slowdown

Notes

Note 1. Slow productivity growth increases the risk of firms passing the cost of higher wages on to consumers.

Note 2. Mexico transitioned from a highly distortive industrial policy in the 1970s to the belief in the 1990s that no industrial policy was optimal.

Note 3. Demographic dividends surged when rapid growth in the labour force was used to fuel GDP growth in less-developed countries.

Note 4. They are firms lacking energy, acting without thinking, and failing to notice their surroundings and habitats. Distinctively, they do not earn sufficient income to cover even interest payments on their debt and are not spontaneous entities. Quintessentially, when markets become increasingly distorted by easy money and state bailouts, ‘zombies’ commence.

Note 5. Shadow work, that is, all the unpaid work performed in economies, such as mothering and housekeeping, and the work that firms offload onto their customers via technology, has also been considered by authors such as Stiglitz (2015) as some productivity inhibitors.

Note 6. This allows the identification of the contribution of productive factors, such as labour, capital, intermediate goods, and technology, to the growth of goods and services production, which decreased by an average of 0.7% annually.

Note 7. The average annual hours worked is calculated by dividing the total hours worked per year by the average number of people in employment per year.

Note 8. Seasonally Adjusted for Mexico and USA. Retrieved from https://fred.stlouisfed.org/series/USAPROMANAISMEI.

Note 9. In many economies, the growth rate of labour productivity in the manufacturing sector has exceeded that of the services sector and the entire economy. Thus, to preserve its share of real output, the manufacturing sector has required a decreasing share of total employment. Conversely, for the services sector to maintain its share of real output, it has to increase its share of employment.

Note 10. However, there are also techno-optimists, such as Brynjolfsson and McAfee (2014), who believe that new discoveries will accelerate growth rather than decline it, given their unusual economic properties: scalability, sunkeness, spillovers, and synergies.

Note 11. Productivity, as GDP per hour of work, is a good measure. This parameter, weighted for inflation and differences in the cost of living between countries, becomes a more efficient indicator.

Note 12. Except for India and Singapore.

Note 13. According to official data, output per hour worked, a standard measure of labour productivity, has grown more than 6% in the US non-farm business sector since 2019. Thus, the recent jump in US productivity follows a substantial fiscal stimulus centred on green industry, a frenzied period of rehiring, and a surge in new business formation in homeworking hotspots.

Note 14. 'AI productivity workers will be as different as the labourers in Adam Smith's pin factories who work on craft production owing to productivity gains resulting from the division of labour. We might even see an inflection point where AI and related digital technologies drive remarkable upticks. This would be like the US productivity boost driven by information technology and the internet from 1995 through 2000. During those years, US trendline productivity growth doubled from a sluggish 1.4% in 1973 –95 to 2.8% in 1995 to 1999' (Cohen, 2024).

Note 15. Though some authors (e.g. Goodridge et al., 2013) advocate that intangible investment is currently significant in the UK productivity puzzle.

Note 16. The measurement differences between the Bank of England and business surveys on the UK economy's persistent low productivity highlight whether a significant or minimal spare capacity prevails (Hughes & Saleheen, 2012).

Note 17. In practice, the TFP reflects the change in efficiency, scale economies, and capacity utilisation.

Note 18. Economic Activity: Manufacturing: Current for Mexico and USA, retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/BSCURT02MXM160S

Note 19. The growth accounting approach of Maddison (1991) attempts to measure the contributions of various sources of growth and decomposes the growth rate into contributions from the inputs of K and L and from TFP as follows: $\Delta Y/Y = \Delta K/K + \Delta L/L+\Delta TFP/TFP$ where α and β are the elasticities of K and L, respectively, conventionally approximated by the shares of profits and wages in national accounts. TFT is the output per unit of total input.

Note 20. Technological efficiency 'A', also called TFP, is sometimes used as an alternative measure of productivity and reflects how efficiently labour and capital, as well as any other inputs, are combined to produce output. Thus, the extra product might have resulted from improvement in the quality of the traditional factors, reductions in inefficiency, or better techniques.

Note 21. A further challenge is that the scale of utilisation is also unobservable directly. Additionally, there is currently a large degree of uncertainty around official estimates of the capital stock.

Note 22. Without including impaired resource allocation and firms' survival rates because of the lack of information.

Note 23. The list of measurement shortcomings is unlikely to be exhaustive and requires ongoing research.

Note 24. Total investment in Mexico remains approximately 2% below its pre-pandemic level, reflecting high business uncertainty. Reducing uncertainty through a clear economic strategy can go a long way to raising productivity, and therefore economic growth.

Note 25. Sixty percent of the output is made up of services. The labour productivity fell by 0.2% at an annualised rate, meaning that the boost was driven by services.