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Autor:
José De Gregorio

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sdt@econ.uchile.cl
econ.uchile.cl/publicaciones

Productivity in Emerging Market Economies: Slowdown or Stagnation?

José De Gregorio*
Universidad de Chile
Peterson Institute for International Economics

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Abstract

This paper analyzes productivity growth trends in emerging-market economies vis-à-vis advanced economies, both in the recent global productivity slowdown and from a long-term perspective. While income has converged in most countries in the last three decades, total factor productivity has diverged. Periods of high productivity growth coincide with episodes of output accelerations, while during normal times productivity growth is modest. Most recently, the correlation between productivity growth in emerging markets and advanced economies has increased. This paper analyzes potential factors explaining this increase, which presumably is due to the slowdown in trade and microeconomic factors that underlie technology diffusion. It concludes with a discussion of long-term challenges and opportunities facing emerging-market economies in a low productivity environment.

Keywords: productivity growth, emerging markets, income convergence.
JEL Classification numbers: O40, O47, O57

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Introduction

Since the global financial crisis, productivity growth in advanced economies has been sluggish and is expected to remain slow. Medium-term prospects have also been declining. Whether the slowdown reflects secular stagnation, caused by lack of aggregate demand (Summers 2014), or a long-term trend decline in productivity growth (Gordon 2016), the implications for emerging-market economies are far-reaching. These economies will face low global demand for their goods and services and weak tailwinds from the global economy. Closing the productivity gap with advanced economies could improve their growth prospects.

Total factor productivity (TFP) is central because it is the driver of growth in the long run in traditional models of economic growth. This paper examines the main historical facts about productivity in emerging-market economies compared with the United States and other advanced economies. (Table A.1 in the appendix lists the 41 economies in the sample.)[1] The next section describes the outlook for a long-term decline in growth and productivity and reviews the historical evolution of productivity and GDP across groups of countries. The following section examines the convergence of GDP in emerging-market economies and the evolution of factors and productivity gaps across emerging-market economies. The third section presents a development accounting exercise for a group of Asian, European, and Latin American emerging markets, which shows that low TFP explains most of the income gap with respect to the United States. The fourth section analyzes episodes of growth accelerations and compares growth decompositions during those episodes with the whole period covered by the Penn World Tables 9.0 for each country. The fifth section looks at the correlations between TFP in emerging-market economies and advanced economies and the frequency of growth accelerations with the global cycle. It shows a recent increase in the correlation of TFP growth between emerging-market economies and advanced economies and discusses potential factors that may explain the increase. The sixth section discusses factors affecting TFP in the long run. The last section summarizes the paper's main conclusions.

[1] I use the definition provided by the International Monetary Fund's *Fiscal Monitor*, which includes "emerging markets and middle-income economies." I include only countries for which sufficient data are available and that had GDP per capita greater than $5,000 in purchasing power parity dollars and population of more than 3 million in 2010. I compare this definition with the *World Economic Outlook's* classification of emerging-market economies, which adds Bulgaria. I excluded Kuwait, Saudi Arabia, and the United Arab Emirates, because total factor productivity data for these countries are too volatile, largely because of the importance of oil. Some countries would have been classified as emerging-market economies decades ago but are now classified as advanced economies. Looking at those countries is useful because they reveal the evolution of "successful" emerging-market economies. Advanced economies that in 1990 had per capita GDP of no more than 60 percent that of the United States were included in the emerging-market economies group. They are the Czech Republic, Greece, Israel, Korea, Lithuania, Portugal, the Slovak Republic, and Taiwan. Most data come from version 9.0 of the Penn World Tables.

The main findings of this paper are:

- The GDP per capita gap between emerging-market economies and the United States has narrowed.
- The narrowing of the gap is explained by faster accumulation of physical and human capital than in the United States.
- In contrast, the TFP gap has not narrowed. In most countries, productivity has been growing slower than in the United States. Low productivity explains about two-thirds of the output gap.
- Emerging-market economies are characterized not by a smooth process of growth but by growth bursts followed by slowdowns. Periods when growth accelerates are also periods when the contribution to TFP growth is the largest.
- Productivity growth in emerging-market economies is correlated with that in advanced economies. Growth accelerates in emerging-market economies during periods of higher global growth.
- In recent years the correlation between TFP growth in emerging-market economies and that in advanced economies has increased.

1. Long-Term Decline in Growth and Productivity Outlook

Long-term prospects for growth and productivity increases have softened. The decline began before the global financial crisis and intensified thereafter. A simple way to gauge long-term growth prospects is to look at five-year-ahead forecasts produced by the International Monetary Fund (IMF) for each of its biannual *World Economic Outlook* reports and how they have changed over time. Figure 1 shows the change in the five-year-ahead rate of GDP growth forecasts in the IMF's *World Economic Outlook* of April 2008, April 2012, and April 2017.[2]

For the world economy as a whole, expected long-term growth declined from 4.9 percent in 2008 to 4.7 percent in 2012 and 3.8 percent in 2017. Most of the change thus came well after the crisis, for both the world as a whole and most country groupings. Only for the United States, five-year-ahead projections of growth increased from 3.2 percent in 2008 to 3.3 percent in 2012, but then fell to 1.7 percent in 2017. In the unweighted average for emerging-market economies used in this paper, forecasted potential output growth fell from 4.9 percent in 2008 to 4.4 percent in 2012 to 3.2 percent in 2017.[3] The downward revision of China's expected growth—from 10 percent in 2008 to 8.5 percent in 2012 and 5.7 percent in 2017—drove the sharp decline in growth expectations in Asia. The euro area is the only region in which the downward forecast revision between 2008 and 2012 was greater than the revision between

[2] The five-year-ahead forecast is not always an estimate of long-term potential, because some countries may be in a cyclical position that may affect growth forecast at longer horizons. However, the dates chosen for the comparisons as well as the fact that I look at country averages should provide a reasonable estimate of the IMF's assessment for long-term growth.

[3] Averages in documents from international organizations are usually computed as weighted averages. My focus is on countries. I therefore use simple average or medians in the rest of this paper. In figure 1 only the average of the sample of emerging-market economies used in this paper is a simple one; the rest are weighted averages.

2012 and 2017. The revisions made in the 2000s coincided with the productivity slowdown that started in that decade and deepened in the current decade.

Now I turn to the historical evidence. Figure 2 shows the average of five-year median growth of GDP and TFP in emerging-market and advanced economies.[4] The rates are correlated, but the most striking fact is that GDP growth in emerging-market economies has generally been higher than that of advanced economies whereas TFP growth has been lower. Between 1951 and 2014, average annual GDP growth was 4.5 percent in emerging-market economies and 3.5 percent in advanced economies. In contrast, average TFP growth was 1.0 percent in emerging-market economies and 1.2 percent in advanced economies. TFP growth in emerging-market economies was consistently below that of advanced economies until the 2000s, the period of the commodity price boom, when TFP growth was significantly higher. That growth came to a halt with the global financial crisis.

Differences in TFP account for the bulk of the differences in levels of income across countries, as Klenow and Rodríguez-Clare (1997) and Hall and Jones (1999) show; I confirm these findings below. Clark and Feenstra (2003) show that the source of income divergence since the Industrial Revolution has been TFP divergence. I go one step farther, showing that even within countries that have been converging to high levels of income, TFP has been diverging.

2. Income, Factors, and Productivity Catch-Up

There is a significant income gap between emerging-market and advanced economies. I follow the convention of using the United States as the benchmark for comparisons.

The income gap has declined but remains significant. For the sample of countries I use, the simple average income gap (1 minus relative GDP per capita) was 71 percent in 1990. It declined to 65 percent in 2014. The decline may reflect the accumulation of factors and the more rapid growth of productivity in emerging-market economies than in the United States.

This section examines the evolution of the gaps in per capita GDP, per capita physical capital, per capita human capital, and TFP. All of the data are from the Penn World Tables 9.0. It compares these gaps in 2014 (the last year of the database) and 1990.[5]

[4] The sample of advanced economies follows the classification of the IMF. I exclude a group of countries that were classified as emerging markets many years ago and are now advanced economies. Those countries are included in the sample of emerging-market economies as described in the text. For each year I compute median growth and then the average of these medians over a five-year period.

[5] The comparisons could have been made with 1980, but the 1980s were years of low growth in emerging-market economies, in particular in Latin America, where countries suffered the debt crisis ("the lost decade"). In 1980 Latin American countries had high levels of income, often fueled by the abundant liquidity in the global economy. In contrast, the 1990s marked the beginning of increased international financial integration and were a period of resurgence of capital flows to emerging-market economies (Calvo, Leiderman, and Reinhart 1993). In addition, the size of the sample increased after 1990 (by, for example, including members of the former Soviet Union). In any case, using 1980 or 1990 leads to broadly similar results.

Most countries increased their GDP per capita relative to the United States over this period (figure 3). Of the 41 countries studied, 31 had a larger ratio in 2014 than in 1990. The most successful cases were Korea, where the ratio rose from 32 percent to 67 percent, and Taiwan, where it rose from 40 percent to 80 percent. The ratio in China went from 6 percent to 24 percent. Russia, Greece, Venezuela, and Ukraine are among the countries that experienced declines in relative GDP. Mexico, which signed the North American Free Trade Agreement (NAFTA) in 1994, also experienced a decline in relative GDP per capita, which fell from 33 percent to 30 percent.

Figures 4 and 5 show the relative levels of physical and human capital, respectively. Most countries have been catching up to the United States with respect to physical capital ("capital" for short). The magnitudes are similar to those of relative GDP. The average stock of capital per capita rose from 29 percent of the United States' in 1990 to 40 percent in 2014. In 36 economies, the share increased; it declined in only 5. The cases of Korea and Taiwan are the most remarkable. The ratio in Korea rose from 27 percent to 83 percent; the ratio in Taiwan rose from 37 percent to 89 percent. Among middle-income countries, Lithuania closed the gap by 20 percentage points. Chile and Malaysia, which started at lower income per capita levels, also narrowed the gap by more than 20 percentage points. China stands out in the lowest income portion, with the stock of capital soaring from 4 percent that of the United States to 31 percent.

Human capital in the Penn World Tables 9.0 is measured with an index based on average years of schooling that weights years of education by returns estimated by Mincer equations, which link earning to the quantity of education. The index assumes a return of 13.4 percent to the first four years of schooling, 10.1 percent to the next four years, and 6.8 percent to all subsequent years.[6] These returns are not country specific; the results thus do not reflect differences in the quality of education across countries.

All the countries in the sample increased their ratios with respect to the United States between 1990 and 2014 (figure 5). On average, these ratios rose from 66 percent to 77 percent, and dispersion was relatively low. The Slovak Republic, the Czech Republic, and Israel reached or exceeded the level of the United States, and Korea neared it.

The Penn World Tables include no data on the level of TFP at constant prices. They include an index for TFP at constant national prices, on which 2011 is equal to 1. With this index, it is possible to compute the real rate of growth of TFP but not the level, preventing the computation of a gap with respect to the United States. However, the Penn World Tables also provide an index for TFP at current prices in which the United States equals 1 for each year. The ratio for 2011 can be used to compute relative values for TFP (figure 6).

[6] For details on the measure of human capital in the Penn World Tables see www.rug.nl/ggdc/docs/human_capital_in_pwt_90.pdf.

The Penn World Tables calculate measures of TFP for every country using its own income shares. Using country-specific income shares may present some measurement anomalies for some countries. Later in this paper, I present other evidence using identical income shares, which also provides a robustness check. The results are similar to the ones presented in this section.[7]

The results are striking. There is no pattern of catching up; on average the productivity gap increased. In 1990 average TFP was 67 percent that of the United States; by 2014 the figure had declined to 60 percent. The countries that enjoyed the largest GDP catch-up (Korea and Taiwan) experienced only a small productivity catch-up. Mexico, Russia, Ukraine, and Venezuela showed significant divergence. Of the 33 countries shown in figure 6, only 10 experienced productivity catch-up. In all of the others, the gap widened.

This widening does not necessarily reflect a decline in TFP; it merely shows that growth was slower than in the United States. Figure 7 shows the annual average growth productivity during 1990–2014. China, Sri Lanka, Poland, and a handful of other countries experienced faster TFP growth than the United States. About a third of countries had slower but still positive growth. Other countries experienced negative TFP growth. This finding may reflect reallocation from more productive firms and sectors to less productive ones.

TFP is intrinsically difficult to measure,[8] and the figures from the Penn World Tables 9.0 often differ from more careful estimates made in each country. These comparisons should therefore be taken as broadly indicative of productivity developments across countries rather than as precise country-by-country figures.

A puzzling case is Mexico, which experienced negative productivity growth. This finding is not an artifact of the Penn World Tables data: National sources (e.g., Torre and Colunga 2015), show that TFP contracted by an average annual rate of 0.4 percent between 1990 and 2011 (the Penn World Tables for the same period indicate a contraction of 0.8 percent a year). The only five-year period in which productivity growth was positive was 1996–2000, which corresponds to the recovery from the Tequila crisis and the first years of NAFTA.

Declining productivity in Mexico is puzzling, given NAFTA, the stabilization of inflation, and other important reforms, including in the energy sector. Openness increased. Exports rose from 6 percent of GDP in 1990 to 27 percent in 2014. Levy and Rodrik (2017) argue that dualism is an important explanation of the "Mexican paradox." After liberalization, the size of the informal

[7] Some countries, including Bulgaria, Egypt, Iran, and Turkey, enjoyed higher TFP than the United States. I exclude these countries from the comparisons because I have no explanation for this result, which seems to reflect a measurement problem. The are no data on TFP for Algeria, Angola, Azerbaijan, and Belarus.

[8] Low productivity in Chile, for example, partly reflects low TFP in the mining sector that reflects geological rather than technological factors. Excluding mining, Chile's TFP growth was higher (Blagrave and Santoro 2016). In Uruguay agriculture played a key role: TFP in agriculture grew at about 7 percent during 2002–13 (Lema 2015).

sector widened, deepening dualism, as reflected in large growth disparities across Mexican regions (OECD 2017). The entrance of China into the global economy may also have reduced the potential benefits of NAFTA, although Mexican exports have been dynamic. Another contributing factor could be the weak rule of law and high levels of corruption.

According to Levy (2018), Mexico's problems stem from the misallocation of physical and human capital. Lack of competition in many sectors and the ability of too many inefficient and small firms, many of them informal, to survive, may account for the fact that the rise in investment has not been accompanied by TFP growth.

The closing of the GDP per capita gap between emerging-market economies and the United States has largely reflected the decline in the gap between the capital and human capital stocks, with no contribution from productivity. This evidence is reminiscent of the discussion generated by the findings of Young (1994), who showed that the Asian miracle was more "perspiration" than "inspiration"—the result of increased labor force participation and high levels of investment, with modest TFP growth. In Indonesia, Malaysia, and Thailand, TFP growth is below that of the United States, resulting in a widening of the gap. In the Philippines, the gap remains unchanged. Only Korea and Taiwan experienced a small decline in the gap.

This pattern is not particular to Asia; it characterizes most emerging-market economies. One important exception is China, where productivity growth has been close to 3 percent a year. With a labor share of 0.65 percent and annual TFP growth of 3 percent, the steady-state rate of growth of per capita GDP in the neoclassical growth model would be 4.6 percent, allowing for rapid catch-up. The question is how long can this TFP growth can be sustained.

3. Development Accounting

To obtain additional evidence on the closing of the GDP gap, I perform development accounting for a group of Asian, emerging European, and Latin American countries. Given the production function

$$Y = AK^{\alpha}H^{1-\alpha}, \tag{1}$$

where *Y* is output, *A* is TFP, *K* is capital, *H* is human capital (assumed to be a linear function of labor), and *H = hL* (where *h* is human capital per worker, measured as a combination of years of schooling and returns and *L* is labor), GDP per capita can be expressed as

$$y = (k/y)^{\alpha/(1-\alpha)}hA^{1/(1-\alpha)}, \tag{2}$$

where lowercase letters represent per worker variables, which, assuming no changes in labor force participation, should be proportional to GDP per capita. Using a subscript *i* for emerging-market economies and *u* for the United States yields the following decomposition for the GDP per capita ratio:

$$\frac{y_i}{y_u} = \left(\frac{k_i/y_i}{k_u/y_u}\right)^{\alpha/(1-\alpha)} \left(\frac{h_i}{h_u}\right)\left(\frac{A_i}{A_u}\right)^{1/(1-\alpha)}. \quad (3)$$

This equation can be used to undertake a development accounting exercise. The first two terms capture gaps in physical and human capital, respectively; the third gap is for TFP.

In an alternative decomposition, the component of capital would be measured not as the relative capital-output ratio in equation (3) but as the ratio of capital per worker. In this case, the equation for development accounting becomes

$$\frac{y_i}{y_u} = \left(\frac{k_i}{k_u}\right)^{\alpha} \left(\frac{h_i}{h_u}\right)^{1-\alpha} \left(\frac{A_i}{A_u}\right). \quad (4)$$

Equation (3) is preferred, because, in the neoclassical growth model, capital per worker depends on the level of productivity; TFP therefore explains part of the differences in capital in equation (4). In contrast, the capital-output ratio is independent of TFP (for details, see Jones 2016). In the appendix I report the decomposition using equation (4) as an alternative to the traditional one. As the capital gap between emerging markets and the United States is larger than the gap in the capital-output ratio, equation (4) tends to indicate a smaller TFP gap than equation (3).

I assume that labor shares ($1 - \alpha$) are the same across countries and equal to 0.65. Data on GDP, physical capital, and human capital are taken from the Penn World Tables 9.0. In contrast to the previous figures, *A* is computed as a residual from equation (3) or (4), dividing the ratio of GDP per worker by the ratio of factors. Table 1 presents the results for equation (3); table A.2 presents the results for equation (4). To avoid giving excessive weight to large countries, I aggregate using geometric averages, so the multiplication of the averages of columns 2, 3, and 4 yields exactly 1. The last column is the share of the GDP per worker ratio explained by TFP.

As evident from the rising values in the first column of tables 1 and A.2, all groups of countries reduced their GDP per worker gap. The physical capital and human capital gaps also narrowed. The TFP gap declined in Asia and emerging Europe but increased in Latin American countries.

The last column of table 1 shows the share of the TFP gap explaining the GDP gap.[9] In all regions, the TFP gap explains 60–70 percent of the total gap in output per worker. From 2000 to 2010, the TFP gap increased its explanatory power of the GDP per worker gap.

The results of this decomposition are similar to the results shown above, with the output and factor gaps declining. The pattern for TFP is less clear. The development accounting decomposition also illustrates another stylized fact—namely, that the TFP gap explains about

[9] If relative shares were equal to 1, a ratio equal to f1 = 1/[column (2) x column (3)] would be explained by factors and f2 = 1/[column (4)] would be explained by TFP. Hence the share explained by TFP is f2/(f1 + f2).

two-thirds of the output gap.[10] In the decomposition presented in the appendix, the TFP gap is about 50 percent, and the capital gap increases its share. Which measure of the TFP gap is more relevant depends on how tightly capital is linked to productivity in the long run.

The main result of the decomposition, consistent with the rest of the evidence in this paper, is that although there has been broad income convergence in emerging-market economies, TFP has diverged.

4. Evidence during Growth Accelerations

Economic growth is not a smooth process. Countries with high rates of average growth over long time spans have experienced long periods of moderate growth and some episodes of growth acceleration (growth spurts) before returning to more normal levels (Hausmann, Pritchett, and Rodrik 2005; Jones and Olken 2008; Berg, Ostry, and Zettelmeyer 2012). In this section I examine whether the patterns of TFP growth in normal times and during growth accelerations differ.

I focus on the period starting in 1950. The analysis serves as a robustness check on the results presented above, confirming that the low growth of TFP among emerging-market economies has been a long-standing problem, not one that appeared only after 1990. I also conduct standard Solow growth decompositions using a labor share of 0.65 and obtain TFP as a residual.[11] These decompositions are independent of the ones using the United States as a benchmark

Most growth accelerations come after the implementation of reforms, and they seem to be more frequent in periods of high global growth. They are associated with faster TFP growth, which could indicate that more than single policies, what matters is the joint implementation of major reforms, such as macroeconomic stabilization and opening up to trade, as well as political transitions.

To define a growth acceleration, I extend the evidence from Hausmann, Pritchett, and Rodrik (2005) by endogenizing the length of the high growth spell. They look at periods of acceleration lasting exactly eight years. I start searching for periods of seven-year growth accelerations and then extend them to estimate whether the period lasts longer.

The Hausmann, Pritchett, and Rodrik method proceeds by estimating log-linear regressions for GDP per capita on time. It assumes a fixed seven-year period for growth accelerations, an assumption that I relax. The coefficient of time in the regression is the average rate of growth, denoted by $g(t, t + n)$, where $n = 7$.[12] The change in the rate of growth is defined as $\Delta g = g(t, t +$

[10] The results are not sensitive to the labor share. If the labor share were 0.5 instead of 0.35, the last column would be 58–74 percent instead of 56–73 percent.

[11] The Solow decomposition looks at the contribution of factors and TFP to GDP growth. In the previous section, I performed development accounting that compares the output gap to the gaps in factors and TFP.

[12] As it considers seven years of growth, it must use eight years for the level of per capita GDP.

$n) - g(t - n, t)$, that is, the difference between growth in a seven-year period and the previous seven years. A growth acceleration is defined when the following three conditions hold:

- $g(t, t + n) > 3.5$ percent.
- $\Delta g \geq 2$ percent.
- Per capita GDP at the end of the episode is greater than or equal to the maximum growth before the episode (meaning that no recoveries from big slumps are considered).

The year that maximizes the *F*-statistic of a spline regression is assumed to be the year of the break in growth.[13] To define the last year of the acceleration without being constrained to exactly seven years, I consider whether average growth for three years following the seven-year episode is greater than or equal to 2.5 percent (i.e., whether growth is still high). The idea is that growth can decelerate but only by 1 percentage point in a three-year average. A three-year period is chosen to avoid sensitivity to a single year's growth rate.

Table A.3 in the appendix presents the periods of growth accelerations identified using this method. For each country, I conduct Solow growth decompositions and compare the results of during accelerations and during the whole period for which data are available. Figure 8 summarizes the results. The basic data from the Penn World Tables cover the period 1950–2014. I use the longest period of data available for each country.[14]

In most cases, the contribution of TFP growth was larger during accelerations (the average was 32 percent during the whole period and 55 percent during periods of acceleration). In Korea and Taiwan, TFP growth was higher in the whole period, but these economies had one of the longest periods of growth acceleration (and the longer the episode, the more similar is the period of growth acceleration to the whole period). In both economies, the contribution of TFP to growth during accelerations was somewhat smaller than in the nonacceleration period.

For Korea the growth acceleration lasted from 1963 to 1995; for Taiwan it ran from 1960 to 2000. China also experienced a long period of high growth, from 1978 to 2014, except for 1988–91. It has not ended. The contribution of TFP was 42 percent during periods of growth and 22 percent during the 1952–2014 period, where data for China are available. Thailand also had a long growth spell, from 1957 to 1995. The contribution of TFP growth was 50 percent during this period, compared with 41 percent for the whole period.

[13] The Matlab files used to estimate seven-year growth accelerations are those of Buera and Shin (2017).
[14] There are 53 episodes of growth acceleration. For graphical convenience, I exclude the six cases (in Croatia, Morocco, Russia, and Uruguay) in which productivity during the episode or the whole period was negative. These episodes are in table A.3. I also exclude Azerbaijan and Belarus, because no data were available on which to perform growth decompositions.

Some growth accelerations end in large recessions. These episodes are likely to include ones that originated in transitory factors, such as financial liberalizations, massive capital inflows that end with sudden stops, or booms caused by exchange rate–based stabilizations.

To distinguish between sustainable and unsustainable accelerations, I compare the level of per capita GDP four and five years after the end of the episode. If per capita GDP in some of those years is below the level at the end of the spell, I call it unsustainable. The evidence, shown in table A.3, shows no significant differences between types of accelerations. All accelerations, whether sustainable or not, tend to coincide with a larger contribution of TFP growth. There are, of course, difficulties in defining unsustainable episodes, in particular after the global financial crisis, when external shocks largely caused the slump. Good external conditions and financial liberalization often drive unsustainable episodes; sustainable ones are associated with large increases in trade, real depreciations, and economic reforms. They also start after political changes (Hausmann, Pritchett, and Rodrik 2005). Berg, Ostry, and Zettelmeyer (2012) also endogenize the duration of the spells in episodes of growth spurts. They find them to be positively related to export orientation, openness to foreign direct investment, democratic institutions, and, particularly, equality levels. More work could be done on a larger sample of countries to study more carefully the distinction between sustainable and unsustainable growth accelerations. In the episodes studied here, relatively few were unsustainable.[15]

These results suggest that many economies take off after the implementation of reforms, most of them related to trade and stabilization. Buera and Shin (2017) show how reforms that remove distortions trigger growth accelerations and TFP growth.[16] Before the reforms, capital is misallocated across sectors; reallocation is what causes TFP to grow. The question is why TFP subsequently decelerates. An interpretation is that growth accelerations are periods in which the economy may be reaching its potential level of productivity, after which growth becomes more difficult.

Rather than removing basic distortions, countries need to move their own frontier. Many observers have argued in favor of second-generation reforms, such as increasing transparency and improving governance. But there is little evidence suggesting which of those reforms spur growth.

[15] An alternative definition for growth acceleration is that used in a report by the European Bank for Reconstruction and Development (EBRD 2017) which refers to such episodes as "periods of exceptionally strong growth." It computes episodes in which the rate of growth in some countries is significantly higher than in a group of similar countries. Growth accelerations may therefore not show up in a period in which global growth is strong. I focus on episodes of absolute growth accelerations, which also reveal how they are related to growth in advanced economies.

[16] In their model, savings rise before investment takes off. At the beginning of the period, there are thus capital outflows.

5. Productivity in Emerging-Market Economies and the Global Economy

Will the slowdown in productivity growth in the advanced economies result in a drag on productivity in emerging-market economies? To answer this question, I examine the relationship between productivity in the two groups of countries for the longest available period.

Aggregate productivity growth in the two country groups (measured as five-year averages) is correlated (see figure 2). Figure 9 shows the correlation of median TFP growth of emerging-market economies with respect to advanced economies for 10- and 20-year-rolling data. The 20-year correlation was low before the first oil shock, increased until the early 1990s, and declined in the decade that followed. The correlations increased again in more recent years. These correlations are similar when the sample is broken down by region. Therefore, without examining the causal links or the mechanisms for this correlation, the decline in advanced economy productivity should be associated with a decline in potential TFP growth among emerging-market economies. This result is also consistent with the worldwide decline in growth prospects reported in figure 1. The increased correlation of TFP growth is consistent with the evidence reported in Adler et al. (2017), who observe that "the drop in total factor productivity (TFP) growth following the global financial crisis has been widespread and persistent across advanced, emerging, and low-income countries."

Is the frequency of growth accelerations correlated with global growth? Figure 10 shows the number of accelerations and two measures of global growth: the rate of growth of advanced economies and the simple average rate of growth from the Penn World Tables. The figure starts in 1960 because the first growth accelerations are detected only by the end of the 1950s. In order to avoid biasing the results by including new countries, I include only countries for which data are available for the whole period.

Until the early 1970s, global growth was robust and accelerations frequent. The number of episodes declined thereafter, before picking up again in the 1990s, during which the correlation between productivity in emerging-market economies and advanced economies declined. After the global financial crisis, the number of growth accelerations declined.

Gruss, Nabar, and Poplawsky-Ribeiro (2018) examine the relationship between growth accelerations and external conditions in emerging and developing economies. They find that strong country-specific external conditions increase the probability of experiencing a growth acceleration. This finding reveals the relevance of a good external environment for growth, in particular in inducing growth accelerations. Their measure is country specific and not driven by common global factors.

If productivity growth in emerging-market economies consists mostly of adopting technologies from the frontier in advanced economies, one should not expect correlations as high as those seen in the data, particularly in recent years. In the rest of this section, I discuss some potential

explanations for these correlations, leaving the discussion of long-term headwinds and opportunities in emerging-market economies for the next section.

Business Cycle Synchronization

One possible reason why the correlation is high is that business cycles in the world are synchronized. TFP tends to be procyclical, suggesting that standard measures do not take into account the utilization of production factors. Hence a global deceleration of GDP should be reflected in a global deceleration of measured TFP. Another reason is that periods of high (low) growth are periods that are most (least) conducive to the adoption of better technologies.

Did the business cycle became more synchronized after the global financial crisis? The evidence suggests that although there was more synchronization in the financial cycle (see, e.g., Rey 2014), there was no increase in business cycle comovements as a result of greater financial and trade globalization (Cesa-Bianchi, Imbs, and Saleheen 2016; Monnet and Puy 2016). Indeed, financial integration could desynchronize national levels of activity from world output. The worldwide decline in TFP growth does not appear to be the result of an increase in the correlation of domestic cycles with that of the global economy.

Cesa-Bianchi, Imbs, and Saleheen (2016) compute the inverse of the pairwise differences in GDP growth in absolute value. I compute two alternative measures of whether growth is moving in the same direction across countries. I assign a value of 1 when growth between two years is rising and a value of –1 when growth is falling. For each year, I then compute the absolute value of the sum of these variables divided by the number of countries, S1, which takes a value of 0 when countries with rising and declining growth are evenly split and 1 when all move in the same direction. An alternative measure is S2, which compares the growth rate in a given year with the average of the previous five years. The greater the index, the greater the synchronization. Both measures increased, displaying similar trends (figure 11).

During the commodity price boom, synchronization rose, reaching a peak in 2009 with the Great Recession. For the period as a whole, however, synchronization of growth rates did not increase, ruling out synchronization as a major explanation for the global decline in productivity.

Crises, Legacies, and Hysteresis

Blanchard, Cerutti, and Summers (2015) argue that there are permanent output losses after a deep and long-lasting crisis—because, for example, of effects on the abilities of people unemployed for a long time.[17] The decline in the long-term level of income may result in lower investment rates and TFP growth. Adler et al. (2017) argue that after the global financial crisis, financial conditions remained weak for many firms, undermining TFP growth.

[17] A stronger proposition is that of Cerra and Saxena (2008), who present evidence from a broad sample of countries that all recessions have negative permanent effects on output.

These stories may work well for advanced economies, which suffered from a very long recession, serious financial market dislocations, and debt overhang. The global financial crisis was not as severe in emerging-market economies as it was in advanced economies, however, and their financial systems were resilient. Indeed, for many emerging-market economies, one could have expected greater hysteresis after the Asian crisis than after the global financial crisis. Therefore, it is unlikely that common causes, such as hysteresis and financial dislocations, explain the worldwide decline in productivity.

Trade

Between 1990 and 2007, real trade grew twice as rapidly as real GDP; before 1990 it grew about 1.5 times as quickly. Since 2011 trade has been growing at about the same rate as GDP. In 2018–19 trade is expected to grow faster, about 1 percentage point more than GDP, which is projected to increase at 3.9 percent. This rate is much slower than the average rate of global trade growth of 7 percent a year in 1990–2008.

This slowdown does not appear to be related to increased protectionism (Freund 2016). It probably reflects the decline in growth in China, the halt in the expansion of global value chains, and the cyclical downturn in global investment, as trade in capital goods is an important component of global trade. The trade slowdown is a potential explanation for low TFP growth in emerging-market economies.

Openness has been shown to be one of the most robust determinants of long-term economic growth, with some caveats. Trade integration allows the transmission of knowledge and requires efficiency to compete in global markets. Trade is no longer the only means of interconnection across economies, however. Technological diffusion may take many other forms. Nevertheless, the decline in trade growth may dent technology adoption and hold down efficiency gains in small open economies.

Although the empirical evidence is still inconclusive, sector-level evidence suggests that trade could be one of the reasons for the global decline in TFP growth. Comparing the change in TFP growth before and after the crisis for a sample of 28 countries, Jeanne (2017) finds that it is unrelated to the degree of trade and financial openness. Aggregate correlations are persuasive. However, Adler et al. (2017) show that among advanced economies, the spillovers from a decline in TFP growth in the United States are greater the more exposed the country is to the frontier. They also show that countries and sectors that benefited the most from increasing trade with China also enjoyed faster productivity growth. The decline in China's rate of growth is one of the reasons why trade growth declined after the global crisis. Therefore, the links are more likely to be at the sectoral than the country level, which may explain why the aggregate evidence is inconclusive.

The worldwide decline in TFP growth may have to do with the decline in trade and spillovers from the slowdown in TFP growth in the frontier economies, which suffered a deep and

protracted recession. As a result of globalization, spillovers from the global economy into emerging markets are stronger than they once were. The mechanism of transmission is not a simple correlation of the business cycle, as there is no evidence that such correlation increased after the crisis, but more likely the diffusion of knowledge through trade and other channels.

6. Factors Affecting Total Factor Productivity in the Long Run

There are reasons to be pessimistic about productivity growth in advanced economies. Gordon (2014, 2016) points to three factors—inequality, education, and demographics—that can explain the slowdown of labor productivity growth in the United States to about 1.3 percent in the next two to four decades.[18] The question is whether they are also relevant for emerging-market economies and whether other factors could hinder TFP growth there.

Inequality

High levels of inequality not only raise concerns about social justice. They also hamper potential growth (Berg and Ostry 2017) and may adversely affect productivity. High or rising inequality can induce increases in taxation to provide transfers and equalizing government expenditure, with consequent distortions. It can negatively affect public finances and inflation. More generally, it induces bad policies and weakens institutions (De Gregorio and Lee 2004). Inequality causes a waste of potential human resources. It could also exacerbate the financial cycle, by, for example, increasing demand for financial aid in the housing.[19] Rising inequality may generate social demands that cannot be met in a manner that is consistent with maintaining an environment that is conducive to economic growth.

For emerging-market economies, the evidence is mixed, but it can be summarized, with some caveats, as follows. In less unequal areas (emerging Asia and Europe), inequality has increased since the early 1990s.[20] In Latin America, where inequality is relatively high, it declined (De Gregorio 2015, figure 14). Inequality has thus become an issue everywhere. When inequality is high or rising but growth is also high, demands for greater redistribution diminish. At times of low growth, they increase, possibly weakening growth prospects. Tackling high and rising income inequality is important to foster productivity growth.

[18] Gordon (2014) also notes the high level of public debt in the United States, which will impose a heavy burden on public debt service. This issue is not relevant in emerging-market economies, which have lower (albeit rising) levels of public debt. However, the situation is quite heterogeneous among emerging-market economies.

[19] Rajan (2010) argues that rising inequality in the United States led to subsidized mortgages, which were a central cause of the financial crisis. Bordo and Meissner (2012) do not find evidence of the link between inequality and crisis in a broad sample of countries.

[20] Lee and Lee (2017) show that in Asia, fast economic growth, globalization, and technological change explain the rise in inequality, which has occurred despite the equalizing effects of higher and less unequal educational attainment.

Demographics

Population aging may be a drag on growth in the United States and other advanced economies. Emerging-market economies are also experiencing this phenomenon.

Population aging reduces income per capita for a given level of labor productivity, as older people work shorter hours or not at all. The change in the age composition of the labor force may also affect TFP, as older people have more experience while younger ones bring more knowledge to the labor force. The net effect may have reduced TFP growth by 0.1 percent a year in emerging-market economies (Adler et al. 2017).

Another important development in advanced economies in the postwar period was the entry of women into the labor force. Female participation in the labor force in the United States rose from 40 percent in 1960 to 57 percent in 2017. There are no comparable long-term data for Latin America, but in 1990 it was 40 percent, just like in the United States thirty years before, and reached 52 percent in 2017. Whereas in the United States female participation in the labor force remained broadly the same between 1990 and 2017, it rose 12 percentage points in Latin America.[21] Although there are disparities across emerging-market economies, increasing female participation in the labor force can overcome some of the demographic headwinds, but the scope for increase has diminished.

Another policy implication of the demographic drag are the benefits of allowing greater migration around the world, so that labor can be reallocated more efficiently. Greater migration flows may create political and social tensions that need to be attended to before they result in a ban on immigration, the populist welfare-reducing solution.

Education

There has been catch-up in terms of relative human capital. In 1990 the level of human capital in emerging-market economies was 66 percent that of the United States; in 2014 it increased to 76 percent (see figure 5). All countries partially closed the gap in recent decades.

According to Gordon (2016), coverage rates in the United States plateaued, and completion rates stagnated or even declined. As measured by international tests, the quality of secondary school in the United States is lower than in other advanced economies. The data in figure 5 do not correct human capital by quality of education, which is at least as important as school enrollment in fostering economic growth (Barro and Lee 2015). Most measures of quality of education are based on test scores, and the gaps between emerging-market economies and advanced economies are significant. Not just increasing school attainment but also improving quality could provide opportunities for productivity catch-up.

[21] For the United States the data come from OECD.Stat and for Latin America from data.worldbank.org. They refer to the percentage of the female population aged 15 and older.

Other areas of educational quality are also relevant, but broad worldwide evidence is scant. Preschool, for example, is central for developing cognitive skills and an important determinant of the returns to education. The distinction between vocational and technical education and training on the one hand and general education on the other is also relevant, however there is no evidence to assess their relative importance for TFP growth. Reducing inequality in education also reduces income inequality. Improvements in all of these areas could help catch-up. The benefits come only in the long term, however, because it takes time for better-educated workers to become a relevant share of the labor force.

Rule of Law and Institutions

The weakness of institutions, which is pervasive in emerging-market economies, hinders growth (Acemoglu and Robinson 2012). Like inequality, weak institutions are related to bad policymaking, often driven by the interests of particular groups, including groups prone to illegal activities. Weak institutions also lead to weak protection of property rights—reducing incentives for investment and productivity-enhancing activities—and high levels of corruption. Corruption and weak institutions are negatively correlated with income. Causation runs both ways, but strengthening institutions would help increase economic growth.

Firm-Level Evidence

Andrews, Criscuolo and Gal (2016) look at firm-level evidence in 23 OECD countries since the early 2000s. They find that the productivity slowdown reflects a widening of the gap between firms at the productivity frontier and laggards rather than a slowing of productivity growth at the frontier. For example, while frontier firms increased labor productivity by about 2.8 percent in manufacturing and 3.6 percent in services, productivity growth in all other firms was about 0.5 percent in both sectors. The differences in labor productivity growth are not the result of capital deepening but a widening gap in TFP growth across firms.

Some technological factors may be behind this evidence. Technological progress in many high-tech and information technology (IT)–intensive industries may be of the winner takes all form. In addition, diffusion may be more limited, particularly in IT-intensive sectors. Technological adoption is costly and may require complementary factors, such as human capital, which may explain why, although new technologies may be readily available, diffusion is limited. It may also explain low turnover and the persistence of firms at the frontier.

These ideas are consistent with aggregate, very long-run, cross-country evidence that shows that technological adoption between rich and poor countries has converged but that the intensity of adoption differs across countries (Comin and Mestieri 2018). This evidence could help explain the TFP gap between frontier and emerging-market economies.

Frontier firms have higher sales, pay higher wages, and charge higher markups than other firms (Andrews, Criscuolo and Gal 2016). In the services sector, the persistence of firms at the frontier has increased. Both phenomena could indicate weak competition, in particular in the

services and less tradable sectors, where regulation is also heavier than in other sectors. Pro-competition policies and regulatory reform could hence potentially increase technological diffusion.

Interest Rates

In this somewhat gloomy outlook, an important positive development for emerging-market economies has been the systematic decline in global interest rates since the late 1980s, which is expected to persist (Rachel and Smith 2017). Lower long-term sovereign rates have also been passed through to market rates, helping explain the massive increase in corporate debt in emerging markets.

To compare real rates in emerging-market economies and the United States, I use an estimate of the real rate in the United States based on the Michigan survey of inflation expectations and the 10-year bond yield as well as the 10-year Treasury Inflation-Protected Securities (TIPS) yield, which may be a better estimate of long real rates (this series is somewhat shorter).[22] I compare these rates with the indexed interest rate for a 10-year bond in Chile, which has had a deep market in indexed paper for several decades (figure 12). Since the early 1990s, real rates have declined by 400–500 basis points.

This decline in the cost of capital is good news for investment, still the main driver of output growth. Moreover, investment, foreign and domestic, may bring in technologies, spurring further growth in productivity.[23]

Low interest rates and investment booms also create macroeconomic tensions in emerging-market economies, however. The search for yield could lead to booms in capital inflows, current account widening, and exchange rate appreciation. In this context countries need to safeguard financial stability by using prudential regulation. Allowing the exchange rate to float to facilitate adjustment and using exchange rate intervention in exceptional cases may also help. The use of capital controls may be another option, but the experience of emerging-market economies that already have significant financial integration shows that such measures are broadly ineffective and may add distortions. However, economies with relatively low levels of financial integration need to be cautious when opening the capital account, and the discussion should be about how and when to open up to capital inflows, an issue that is more relevant for lower-income economies.[24]

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[22] On average, the TIPS yield is 1,000 basis points higher than the rate I constructed, but the trend is very similar.
[23] Adoption of frontier technologies does not necessarily result in higher growth. The effect depends on the skill intensity of these technologies as well as the absorptive capacity of the economy (Mies 2017). This issue may be more relevant in lower-income countries, where the skill gap may be large.
[24] For a discussion of the Latin American experience during the global financial crisis, see De Gregorio (2014). Capital controls do not help explain better performance during the global financial crisis, as Alvarez and De Gregorio (2014) show.

7. Concluding Remarks

Emerging-market economies have reduced their income gap with respect to the United States. In many cases, progress has been remarkable. However, except in China and a few other countries, the TFP gap has not declined significantly—and in most cases it has widened. The evidence also shows that TFP growth has been a bigger driver of income catch-up in periods of growth acceleration and that TFP growth among emerging-market economies is correlated with that of advanced economies, suggesting that persistently low productivity growth in advanced economies is likely to affect emerging-market economies, through trade channels and diffusion of knowledge.

Prospects for TFP growth in emerging-market economies are not very promising, although some economists are more sanguine than Gordon (2016). Brynjolfsson and McAfee (2016), for example, argue that it will take time for the technological revolution to spread broadly across economic activities, as it did in the case of other great inventions.

This paper does not explore the important question of whether statistics are measuring GDP and productivity appropriately. If there is a downward bias in the measures of GDP, TFP may be underestimated. Progress in health, IT, and other sectors may not have been properly measured. Moreover, free goods such as WhatsApp and Wikipedia do not add to GDP but have enormous welfare gains, especially in emerging-market and low-income economies.

There may be opportunities for productivity catch-up in emerging-market economies. In the current context of low interest rates, the cost of investment and productivity-enhancing technologies is low. The productivity slowdown in advanced economies and the decline in global trade growth are a drag on productivity growth in emerging-market economies, however—although the problem seems to pre-date this slowdown. Emerging-market economies have not enjoyed robust TFP growth for a long time, despite having taken important steps to stabilize and reform their economies.

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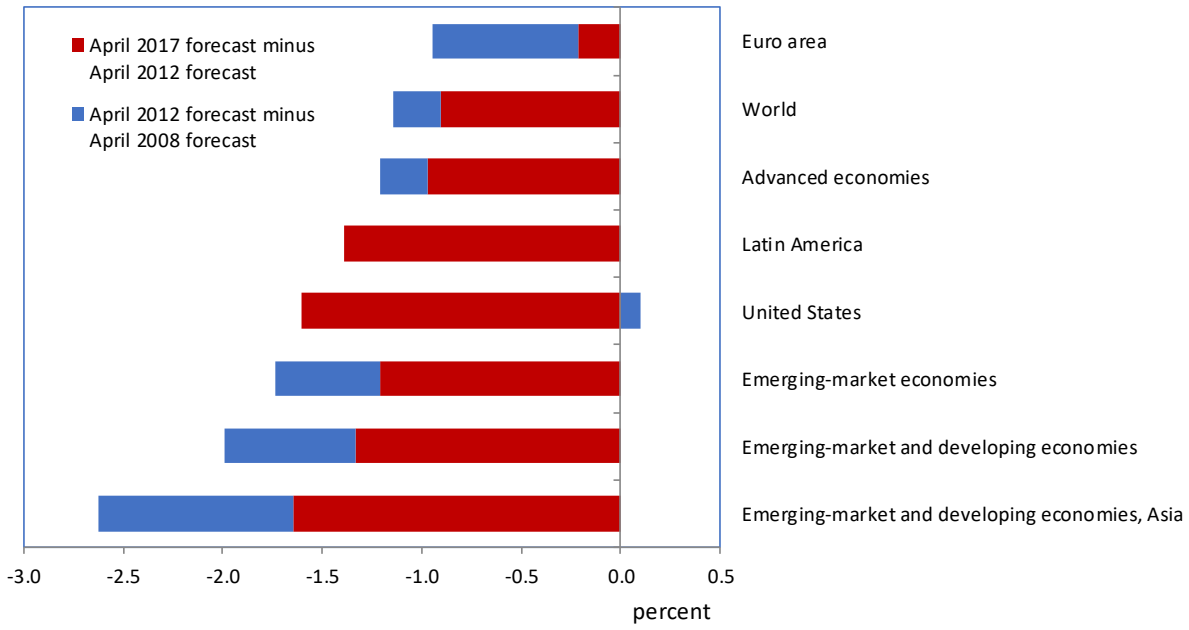
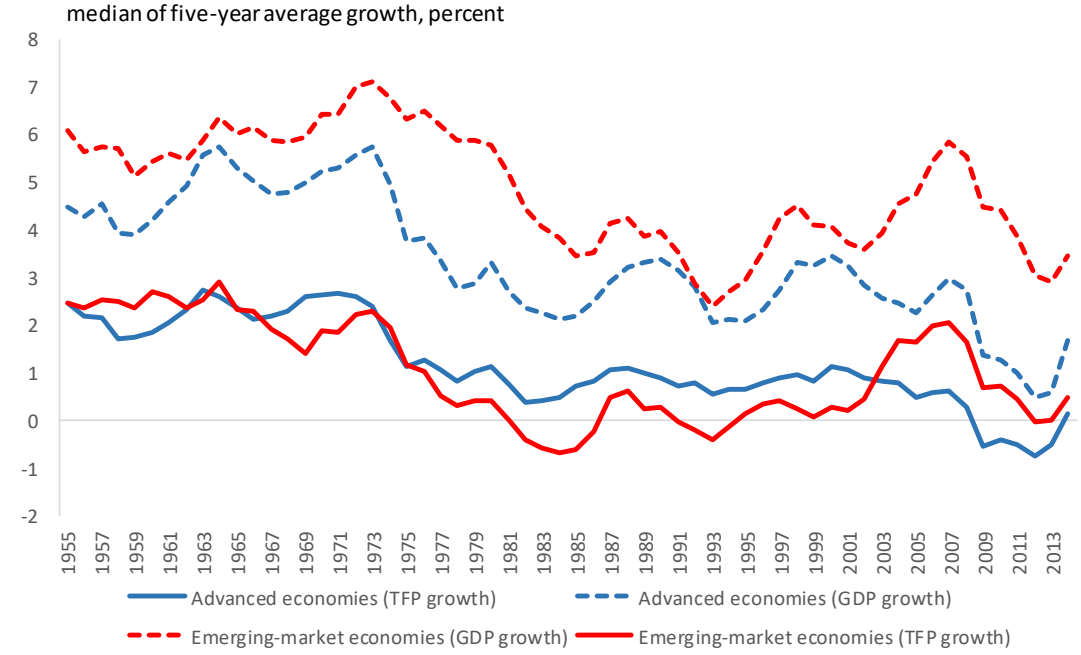
Figure 1 Changes in five-year-ahead growth forecasts



Note: This figure presents the differences between the five-year-ahead growth forecast of the IMF *World Economic Outlook* in 2017 and 2012 and in 2012 and 2008—that is, the difference between the forecast for 2022 made in 2017 and the forecast for 2017 made in 2012 and the difference between the former forecast and the forecast for 2013 made in 2008. The length of the bar represents the total change from 2008 to 2017. The figure for emerging-market economies is the simple average for the sample used in this paper.

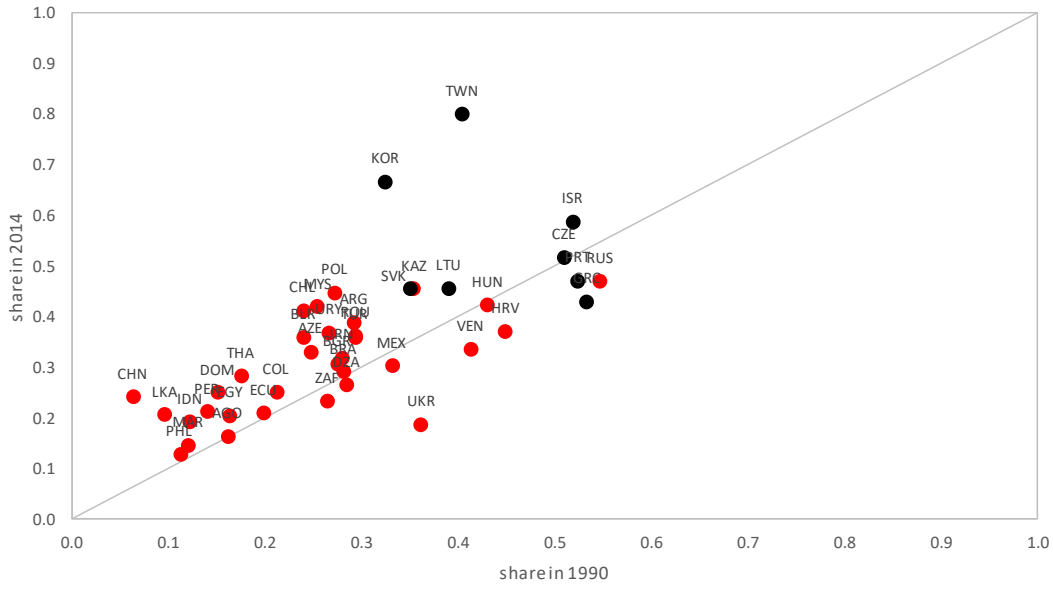
Source: IMF *World Economic Outlook,* April 2008, April 2012, and April 2017.

Figure 2 Total factor productivity (TFP) and GDP growth in emerging-market and advanced economies, 1955–2014



Source: Penn World Tables 9.0.

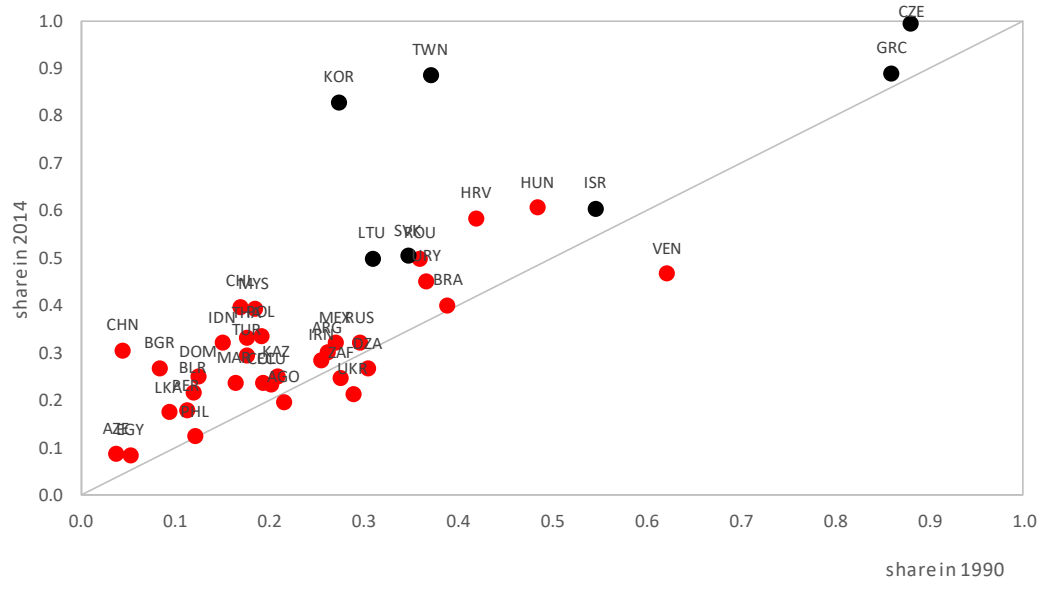
Figure 3 GDP per capita relative to the United States, 1990 and 2014



Note: Red dots represent emerging-market economies; black dots are former emerging-market economies that are now classified as advanced economies. See table A.1 for country names.

Source : Penn World Tables 9.0.

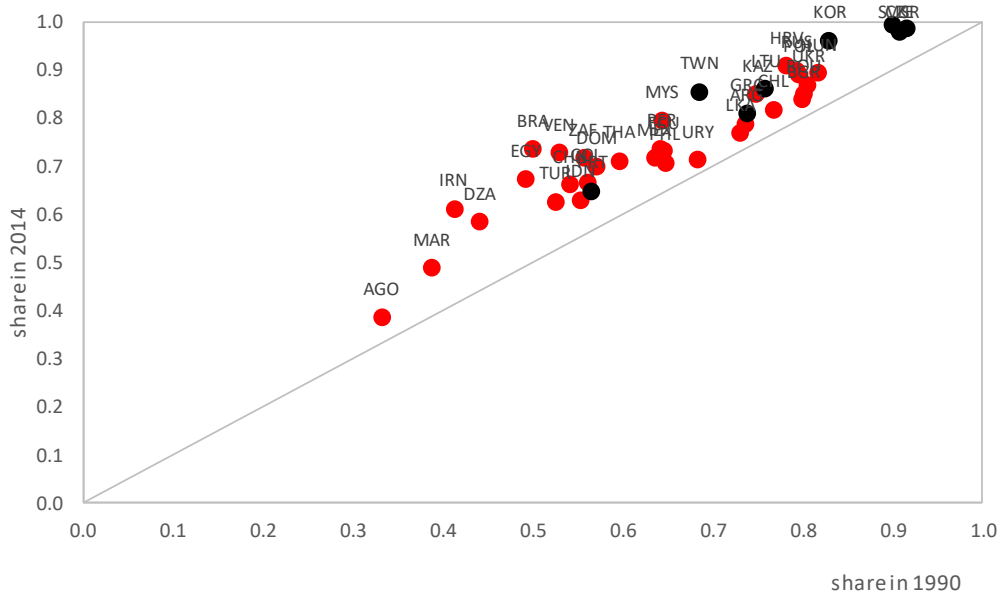
Figure 4 Capital stock per capita relative to the United States, 1990 and 2014



Note: Red dots represent emerging-market economies; black dots represent former emerging-market economies that are now classified as advanced economies. See table A.1 for country names.

Source: Penn World Tables 9.0.

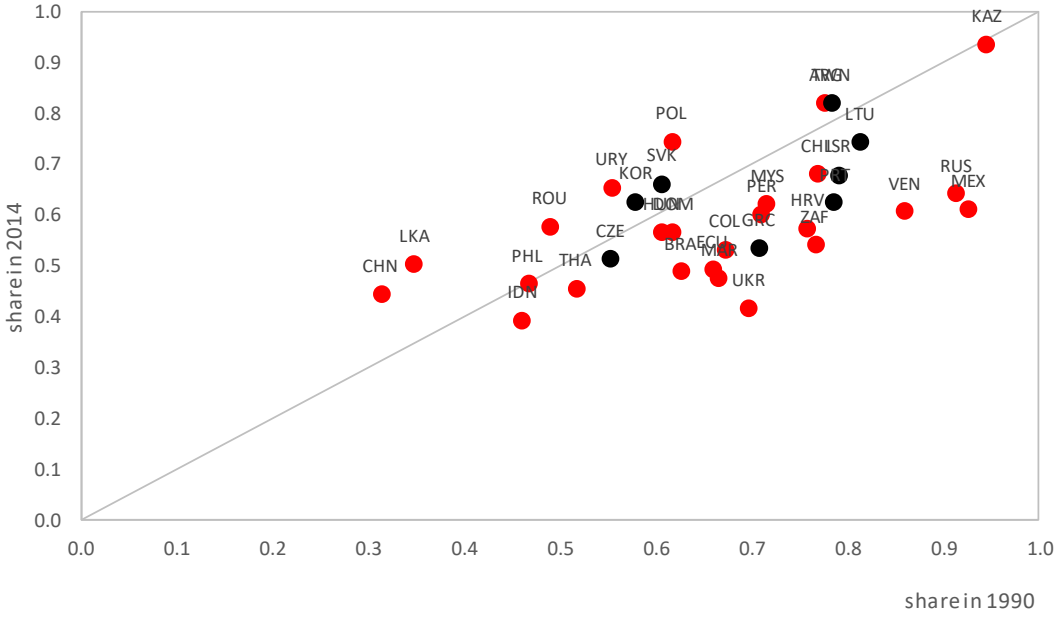
Figure 5 Human capital relative to the United States, 1990 and 2014



Note: Red dots represent emerging-market economies; black dots represent former emerging-market economies that are now classified as advanced economies. See table A.1 for country names.

Source: Penn World Tables 9.0.

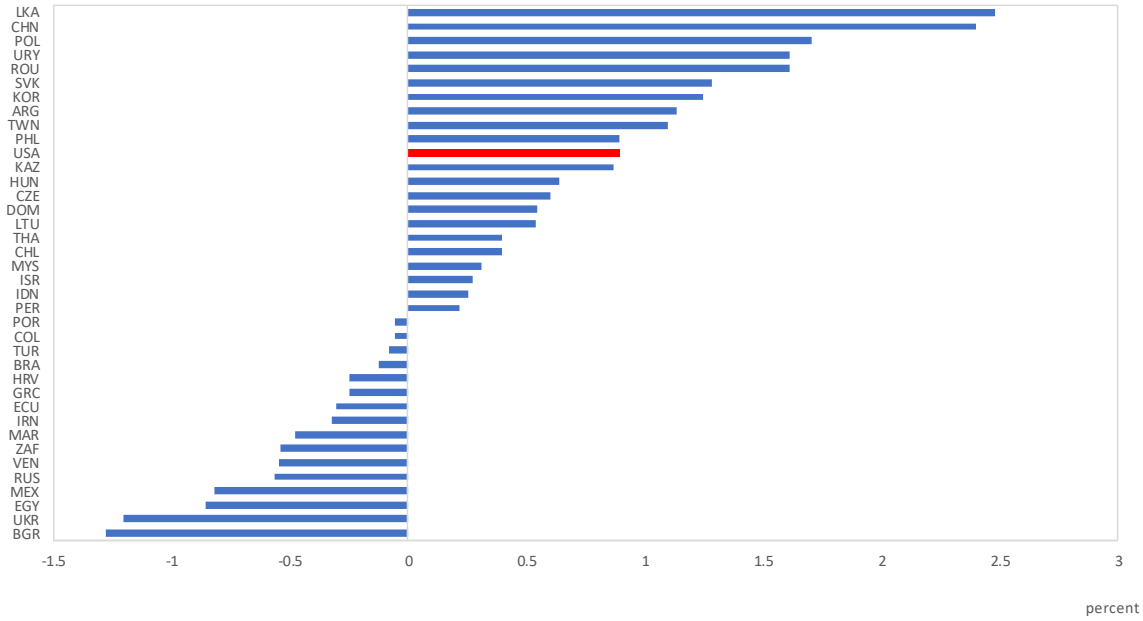
Figure 6 Total factor productivity relative to the United States, 1990 and 2014



Note: Red dots represent emerging-market economies; black dots represent former emerging-market economies that are now classified as advanced economies. See table A.1 for country names.

Source: Penn World Tables 9.0.

Figure 7 Annual average change in total factor productivity between 1990 and 2014



Note: See table A.1 for country names.

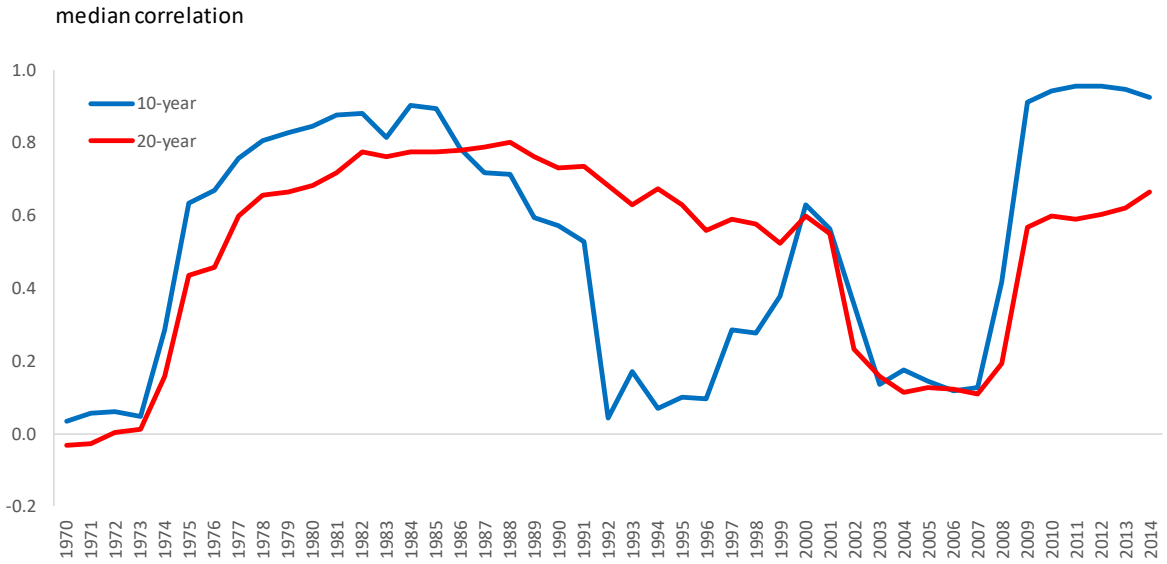
Source: Penn World Tables 9.0.

Figure 8 Contribution of total factor productivity to changes in GDP per worker, 1990 and 2014

Note: Blue dots represent emerging-market economies; black dots represent former emerging-market economies that are now classified as advanced economies. See table A.1 for country names.

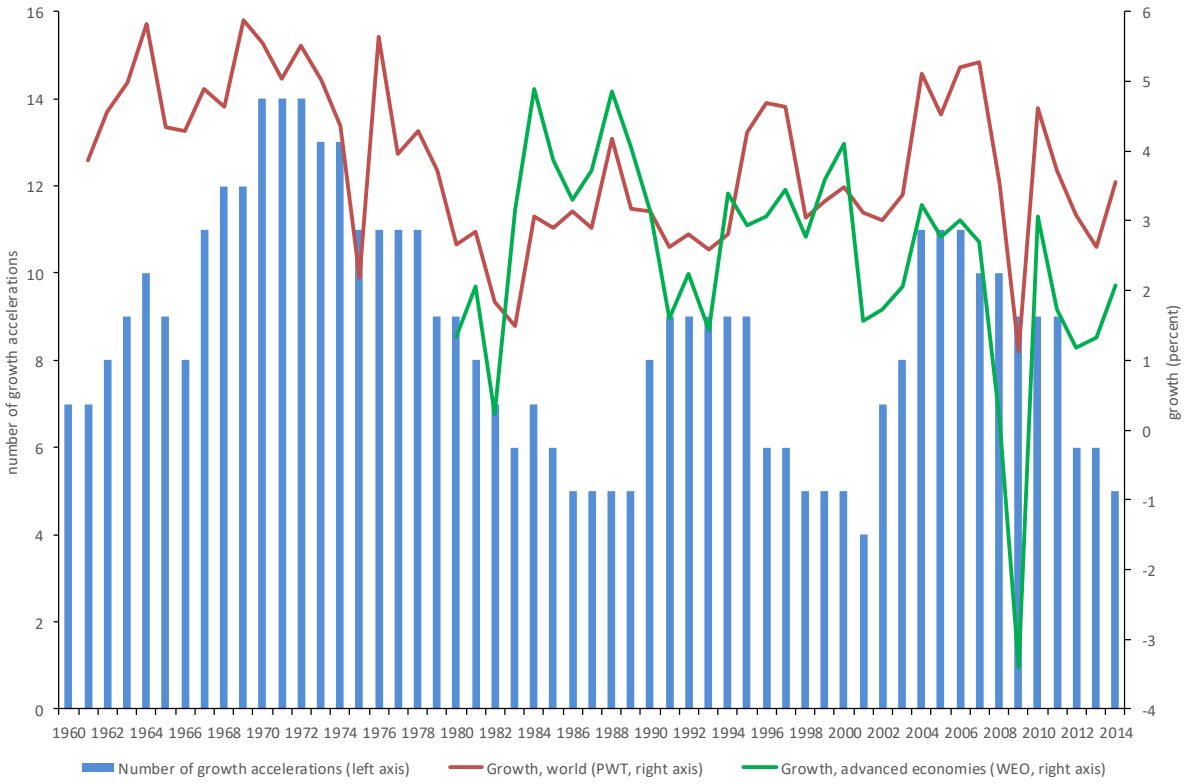
Source: Author's calculations.

Figure 9 Ten- and 20-year correlation between median total factor productivity growth in advanced and emerging-market economies, 1970–2014



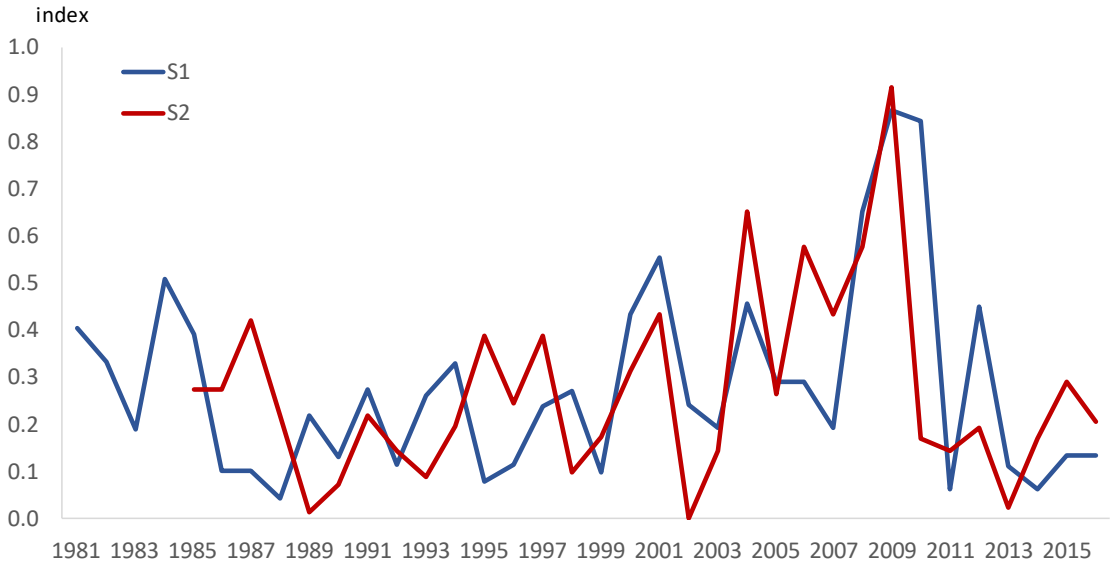
Source: Data from Penn World Tables 9.0.

Figure 10 Number of growth accelerations and world and advanced economy rates of growth, 1960–2014



Sources: Data from the IMF *World Economic Outlook* (WEO), October 2017, and Penn World Tables (PWT) 9.0.

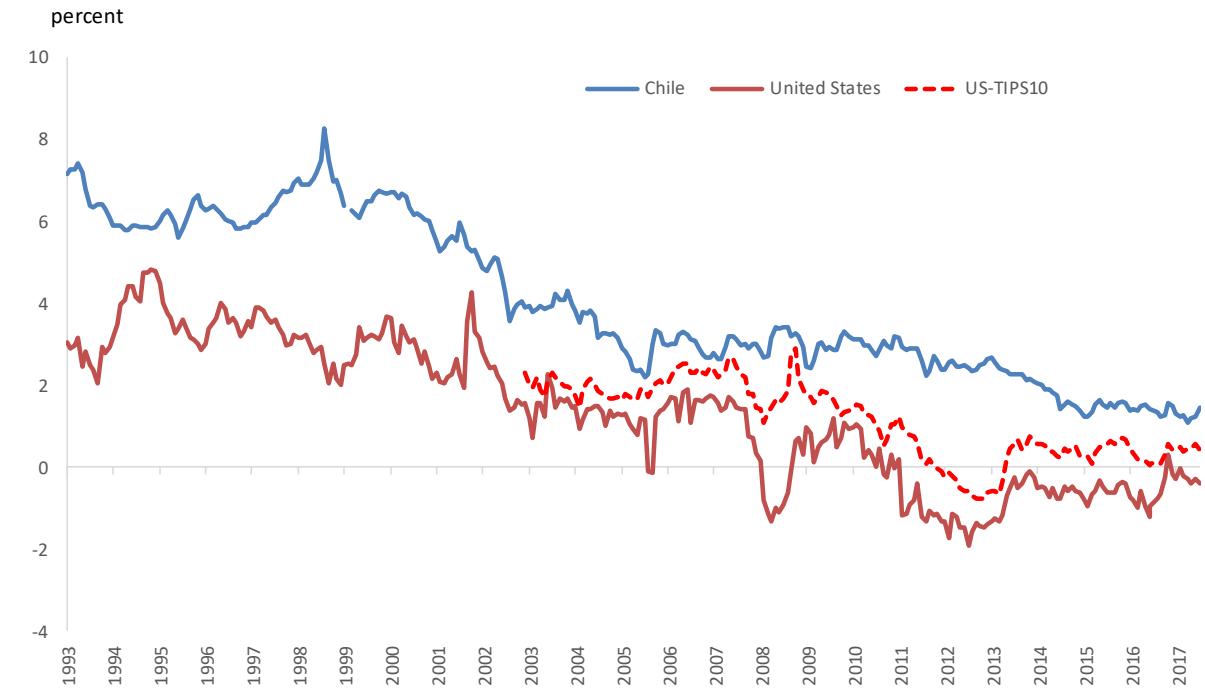
Figure 11 Synchronization of output growth, 1981–2016



Note: Sample includes all countries for which data were available in the *World Economic Outlook* database that had GDP per capita in 2010 of at least $5,000 in purchasing power parity dollars and population of more than 3 million. See text for explanation of figure.

Source: Data from the IMF *World Economic Outlook* database, October 2017.

Figure 12 Real interest rates in Chile and the United States, 1993–2017



TIPS-10 = 10-year Treasury Inflation-Protected Securities

Sources: Central Bank of Chile; Federal Reserve Economic Data, Federal Reserve Bank of St. Louis.

Table 1 Development accounting

Region/year	GDP per worker (1)	Capital/GDP (2)	Human capital (3)	TFP (4)	Share due to TFP (5)
Asia					
1990	0.127	0.799	0.595	0.266	64.1
2000	0.147	0.969	0.654	0.232	73.3
2010	0.208	1.024	0.694	0.293	70.8
Latin America					
1990	0.246	0.909	0.617	0.440	56.0
2000	0.242	1.025	0.668	0.354	65.9
2010	0.293	0.961	0.714	0.428	61.6
Emerging Europe					
1990	0.306	0.938	0.796	0.410	64.6
2000	0.307	1.034	0.846	0.351	71.4
2010	0.473	1.106	0.873	0.490	66.3

TFP = total factor productivity
Note: Asia: China, India, Indonesia, Korea, the Philippines, Malaysia, and Thailand. Latin America: Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela. Emerging Europe: Czech Republic, Hungary, Latvia, Lithuania, Poland, and Romania.
Source: Data from Penn World Tables 9.0.

Appendix A Tables

Table A.1 Emerging-market economies included in the study

Economy	Abbreviation	Economy	Abbreviation
Algeria	DZA	Korea[a]	KOR
Angola	AGO	Lithuania[a]	LTU
Argentina	ARG	Malaysia	MYS
Azerbaijan	AZE	Mexico	MEX
Belarus	BLR	Morocco	MAR
Brazil	BRA	Peru	PER
Bulgaria	BGR	Philippines	PHL
Chile	CHL	Poland	POL
China	CHN	Portugal[a]	PRT
Colombia	COL	Romania	ROU
Croatia	HRV	Russia	RUS
Czech Republic[a]	CZE	Slovak Republic[a]	SVK
Dominican Republic	DOM	South Africa	ZAF
Ecuador	ECU	Sri Lanka	LKA
Egypt	EGY	Taiwan[a]	TWN
Greece[a]	GRC	Thailand	THA
Hungary	HUN	Turkey	TUR
Indonesia	IDN	Ukraine	UKR
Iran	IRN	Uruguay	URY
Israel[a]	ISR	Venezuela	VEN
Kazakhstan	KAZ		

a. Currently classified as an advanced economy, but in 1990 these countries had income per capita less than 60 percent of the United States and could have been considered emerging markets. When comparisons are made with the advanced-economy aggregate of the International Monetary Fund, these countries are excluded from the sample of emerging-market economies.

Table A.2 Development accounting using equation (4)

Region/year	GDP per worker (1)	Capital/GDP (2)	Human capital (3)	TFP (4)	Share due to TFP (5)
Asia					
1990	0.127	0.420	0.714	0.423	41.4
2000	0.147	0.501	0.759	0.386	49.6
2010	0.208	0.586	0.788	0.450	50.7
Latin America					
1990	0.246	0.576	0.730	0.586	41.8
2000	0.242	0.618	0.769	0.509	48.3
2010	0.293	0.634	0.803	0.576	46.9
Emerging Europe					
1990	0.306	0.634	0.862	0.560	49.4
2000	0.307	0.676	0.897	0.506	54.5
2010	0.473	0.822	0.915	0.629	54.4

TFP = total factor productivity
Note: This table covers the same set of countries as in table 1 and uses equation (4) instead of (3).
Source: Author's calculations.

Table A.3 Episodes of growth acceleration (percent)

Country/period	Share of		
	Capital per worker	Education per worker	Total factor productivity
Argentina			
1990–1997[a]	14.3	7.5	78.1
2003–2011	7.6	10.6	81.8
1950–2014	49.7	43.8	6.5
Brazil			
1967–1978[a]	31.7	–0.2	68.5
1950–2014	25.1	37.0	37.9
Bulgaria			
2000–2007	66.5	10.1	23.3
1970–2014	64.5	12.2	23.3
Chile			
1974–1981[a]	26.9	30.4	42.7
1990–1997	33.2	6.6	60.2
1951–2014	59.7	26.5	13.7
China			
1978–1987	38.8	18.2	43.0
1992–2014	48.9	10.7	40.4
1952–2014	55.1	22.8	22.1
Colombia			
1967–1974	17.8	13.6	68.6
2002–2014	29.7	38.3	31.9
1950–2014	29.5	43.2	27.3
Croatia			
1997–2006[a]	33.7	31.0	35.3
1990–2014	81.4	40.6	–21.9
Czech Republic			
2001–2008[a]	10.2	3.4	86.4
1990–2014	41.6	22.7	35.8
Dominican Republic			
1968–1975	27.4	13.6	59.1
1991–2000	46.9	21.2	31.9
2004–2014	29.0	31.3	39.7
1951–2014	36.3	33.2	30.5
Ecuador			
1970–1978[a]	12.6	12.0	75.5
1950–2014	17.7	37.3	45.0
Egypt			
1958–1965	9.1	7.8	83.1
1977–1985	47.5	18.1	34.4
1950–2014	32.6	29.0	38.4
Greece			
1959–1972	36.4	6.4	57.2
1998–2006[a]	19.5	18.2	62.3
1951–2014	41.7	26.6	31.7
Hungary			

1999–2006[a]	24.8	14.5	60.7
1970–2014	59.1	18.3	22.6
Indonesia			
1967–1984	32.4	28.5	39.1
1988–1995[a]	37.3	17.5	45.2
2002–2014	28.9	8.2	62.9
1960–2014	38.7	31.1	30.2
Israel			
1967–1974[a]	48.0	10.6	41.4
1950–2014	32.4	16.7	51.0
Kazakhstan			
1997–2014	6.3	7.6	86.1
1990–2014	30.4	24.2	45.3
Korea			
1963–1995	52.0	20.0	28.0
1950–2014	47.2	16.7	36.1
Lithuania			
1997–2006	20.1	9.5	70.4
1990–2014	48.5	17.2	34.2
Malaysia			
1967–1982	41.4	24.1	34.6
1988–1995	43.4	24.1	32.5
1955–2014	36.8	28.4	34.8
Mexico			
1962–1973	23.7	18.2	58.0
1950–2014	38.2	43.7	18.1
Morocco			
1957–1964[a]	–4.4	2.0	102.3
1970–1977[a]	68.6	38.6	–7.2
1999–2011	133.9	843.5	–877.5
1950–2014	23.1	41.6	35.3
Peru			
1959–1966	10.5	10.7	78.8
2002–2013	31.9	3.7	64.3
1950–2014	36.5	59.8	3.7
Poland			
1993–2000	29.2	11.5	59.3
1970–2014	45.8	19.8	34.4
Portugal			
1959–1972	30.6	8.5	60.9
1984–1991	24.9	29.8	45.3
1950–2014	42.2	24.4	33.4
Romania			
1970–1979	36.9	12.5	50.6
2001–2008[a]	26.9	3.8	69.2
1960–2014	40.4	13.6	45.9
Russia			
1999–2006	0.2	7.2	92.6
1990–2014	95.7	105.5	–101.2
Slovak Republic			
2001–2008	12.7	14.0	73.3
1990–2014	39.2	15.6	45.2

Sri Lanka			
1976–1984	40.7	24.9	34.5
1990–1998	22.0	26.9	51.1
2004–2014	32.2	–0.8	68.6
1950–2014	24.3	22.7	53.0
Taiwan			
1960–2000	45.4	16.2	38.3
1951–2014	36.6	16.3	47.1
Thailand			
1957–1995[a]	34.9	15.3	49.7
2001–2008	13.4	28.9	57.7
1950–2014	36.1	22.7	41.2
Turkey			
1964–1976[a]	39.4	9.4	51.2
2002–2011	37.5	25.1	37.4
1950–2014	36.8	21.8	41.4
Uruguay			
1973–1980[a]	39.7	18.6	41.6
2004–2014	13.6	9.7	76.8
1950–2014	74.6	36.6	–11.2

a. Unsustainable episode, as defined in the text.
Note: The last row for each economy is the Solow decomposition for the entire period, based on data available in Penn World Tables 9.0.
Source: Author's calculations.