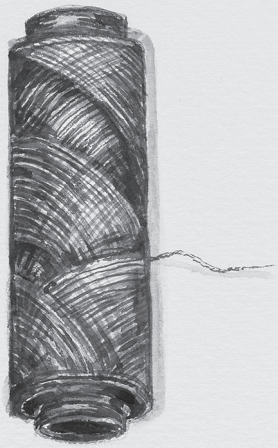

COINCIDENT GROWTH COLLAPSES

Brazil and Mexico since the early 1980s[1]

Edmar Bacha*
Regis Bonelli**

ABSTRACT

Brazil's and Mexico's economies collapsed almost simultaneously in the early 1980s. Their respective outputs per worker remained in a state of near stagnation since then. We develop a comparative analysis to try to understand what went wrong. Macroeconomic magnitudes (capital accumulation and technical progress) exhibit more similarities than differences. These appear more starkly when productivity changes are analyzed at disaggregated levels: by regions, sectors of activity, tradability, firm size, and labor-market informality. Our empirical findings are consistent with a view that Brazil's economic failure is associated to excessive protectionism; Mexico's to heightened domestic polarization.

KEYWORDS: *Brazil; capital accumulation; labor productivity; Mexico.*

Dois colapsos de crescimento: Brasil e México desde o início dos anos 1980

RESUMO

As economias do Brasil e do México entraram em colapso quase que simultaneamente no início dos anos 1980. Seus respectivos produtos por trabalhador permaneceram num estado de quase estagnação desde então. O texto desenvolve uma análise comparativa para tentar entender o que deu errado. Magnitudes macroeconômicas (acumulação de capital e progresso técnico) exibem mais similaridades do que diferenças. Essas aparecem de forma mais clara quando as mudanças de produtividade são analisadas de forma desagregada: por regiões, setores de atividade, comercialidade, tamanho de empresas e informalidade do trabalho. Nossos achados empíricos são consistentes com uma visão de que o fracasso econômico do Brasil esteve associado a protecionismo excessivo; o do México, a acentuada polarização doméstica.

PALAVRAS-CHAVE: *Brasil; acumulação de capital; produtividade do trabalho; México.*

1 INTRODUCTION

It is a tribute to Albert Fishlow's economic acumen that as early as 1978 he argued in favor of Latin America's foreign debt restructuring. At the time, most economists and regional policy makers still believed that minor domestic and external policy adjustments were all that was required for economic growth to resume in the region.[2] It took more than a (lost) decade for debt restructuring to be put in place, but even then — and this is something that not even Fishlow could have predicted — growth resumption continued to elude Brazil and Mexico despite substantial domestic reforms.

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The drama of Brazil's and Mexico's near stagnation — not secular, but already lasting for 35 long years — is particularly troubling because since the 1990s these countries have strived to put the house in order and follow the precepts of sound economic policy making. Brazil defeated hyperinflation, introduced a fiscal responsibility law, and implemented major income redistribution policies. Mexico opened up its economy, floated the peso, reprivatized its banking system, and executed relevant social programs. All this to no avail, as Graph 1 tells us. Since the early 1980s Brazil and Mexico stopped catching up with the industrial countries, even though in purchasing power terms (PPP) their per capita incomes stand respectively at only 27% and 33% of that of the United States.

Academic articles began asking "Why isn't Mexico rich?"[3], echoing the infamous dictum that "Brazil is the land of the future — and always will be".

A comparative analysis seems in order to understand what went wrong, particularly because there are important differences in the economic experience of these countries. Many analysts say that Brazil does not grow because it is a closed economy with very high taxes and interest rates that crowd out the private sector. The diagnostic on Mexico tends to the opposite view: the country does not grow because its opening up to foreign trade polarized the economy, delinking the rich North from the poor South, and its government doesn't invest in infrastructure because it can't collect taxes.

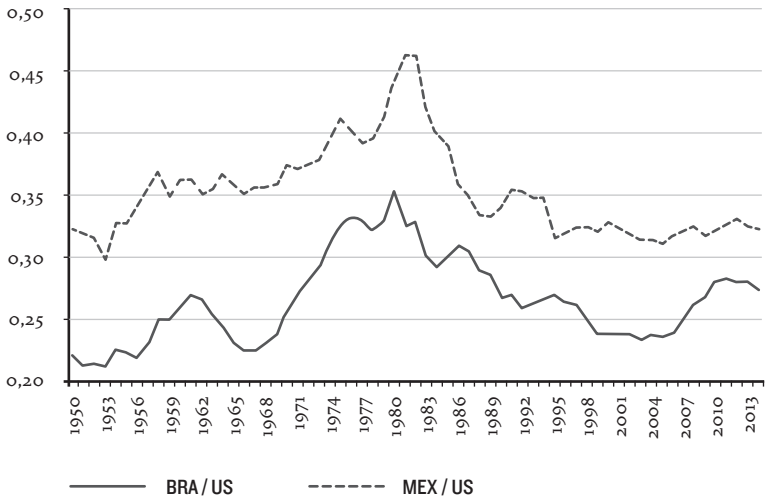
in seminars at Banco Nacional de Desenvolvimento Econômico e Social (BNDES), Casa das Garças, Instituto Brasileiro de Economia/Fundação Getulio Vargas (IBRE/FGV), Centro de Debate de Políticas Públicas (CDPP), and Centro Brasileiro de Análise e Planejamento (CEBRAP). The authors thank Carolina Melchert Marques and Marina Goulart Lopes for competent research assistantship; Vinicius Botelho, from IBRE, who offered helpful advice on statistical tests; Aurelio Bicalho, from CSHG Gauss Investimentos, and Jesús Garza and João Pedro Resende, from Itaú BBA, who developed useful statistical information; and André Hofman, from United Nations Economic Comission for Latin American and the Caribbean (ECLAC/UN), and Jaime Ros Bosch, from Universidad Nacional Autónoma de México (UNAM), who advised on Mexican data sources and commented on an earlier draft. Errors and omissions are the authors' sole responsibility.

[2] Fishlow, 1978, pp. 67-68.

[3] Hanson, 2010. See also the negative evaluations of Mexico's economic performance by Kehoe and Ruhl (2010), Kehoe and Meza (2011).

GRAPH I

Brazil and Mexico — GDP per capita in 2014 US$ relative to the US (converted to 2014 price level with updated 2011 PPPs)



Source: The Conference Board; internet site.

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These are big issues that we will consider but are under no illusion to be able to resolve. The contribution that we have to offer are accounting frameworks to analyze the historical evolution of relevant macro and "mesoeconomic" variables. In the process, we develop economic interpretations that are consistent with the empirical findings, while commenting on the controversies that these two countries' historical experience have evoked in the literature.

The paper is organized as follows. The next section provides a periodization for the growth experiences of Brazil and Mexico since 1950, with emphasis on the years after their respective growth collapses in the early 1980s. Section 3 compares these gross domestic product (GDP) growth collapses to concurrent sharp falls in capital accumulation, and decomposes the latter into changes in savings, capital-output ratios, and relative prices of investment.

Section 4 estimates a neoclassical accounting framework for the growth of GDP per worker, analyzing the contributions of capital deepening and total factor productivity for the evolution of labor productivity since 1950. In the process, we do an econometric exercise to estimate the roles of the terms of trade and of the output gap for the cyclical movements of measured total factor productivity since the early 1980s.

Section 5 introduces "mesoeconomic" variables into the picture to complement the macroanalysis of labor productivity in the previous section. In successive subsections, we consider the following dimensions of labor productivity growth: regional, sectorial, traded/non-traded, by firm size, and formal/informal. Conclusions are summarized in Section 6.

2 GROWTH COLLAPSES: A PERIODIZATION

Since the 1930s Brazil and Mexico experienced economic growth golden ages that extended through the early 1980s. With the debt crisis, growth submerged in the two countries and remained to date at levels only one-third as high as before. Graph 2 displays the 10-year average GDP growth rates in Brazil and Mexico from 1950 to 2014. The graph makes the parallelism of the two countries' experiences evident, either in terms of the pre-1980 fast-growth years, the growth collapses in the 1980s, and the meager growth outcomes since then.

The countries seem to have hit a wall in the early 1980s when they stopped catching up with the industrial economies. Brazil's performance was much better than Mexico's in the 1970s and, to a lesser extent, during the recent commodity boom. Nonetheless, Brazil's per capita income in PPP terms is still 15% lower than Mexico's.

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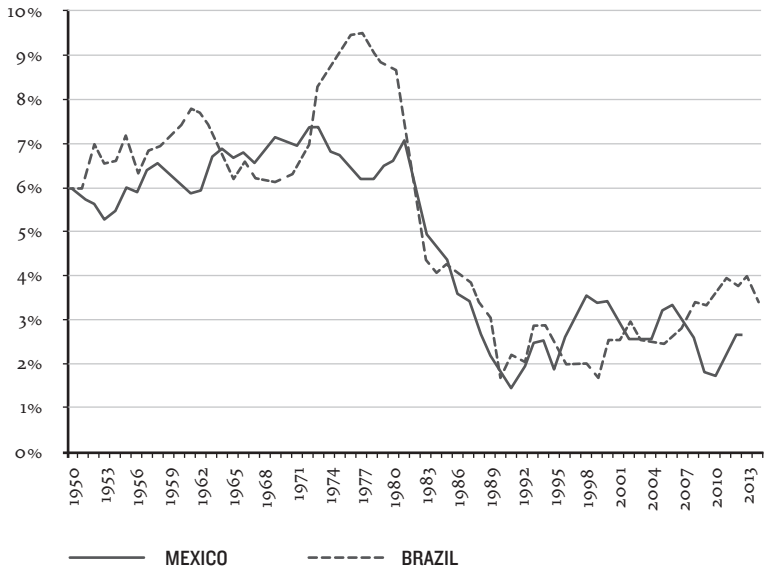
GRAPH 2

Mexico and Brazil — 10-year moving averages of real GDP growth rates, 1950-2014 (% p.a.)



Sources: National Accounts and Historical Statistics, Brazil and Mexico; elaborated by the authors.

Table 1 and Graph 3 identify five near-identical sub-periods in the GDP growth trajectories of the two countries since 1950. The first is the golden age starting for our statistical purposes in 1950 and going to 1980 in Brazil and to 1981 in Mexico. Average GDP growth rates in this period were 7.4% in Brazil and 6.8% in Mexico. There follows the so-called lost decade after the debt crisis of the early 1980s, identified in the table as the period from 1981 to 1992 in Brazil, and from 1982 to 1993 in Mexico. In this phase, yearly GDP growth rates collapsed to 1.4% in Brazil and to 1.7% in Mexico. Next is the period of liberal reforms with subpar growth, characterized by inflation stabilization in Brazil (starting with the implementation of the 1994 Real Plan) and trade opening in Mexico (with the enactment of North American Free Trade Agreement [NAFTA] in 1994). We denominate growth subpar even though rates doubled from the previous period because they were lower than anticipated at the inauguration of these major economic reforms. GDP growth averaged 2.8% in Brazil from 1993 to 2003, while in Mexico its average was 3.0% from 1994 to 2001.

A disconnection in the growth experiences of Brazil and Mexico occurs in the first decade of this century, in a phase that we labeled "China Syndrome". As indicated by this title, the rise of China seems to us to be the major influence for the growth rate disparities in the two countries. China's growth had a very positive influence on Brazil (through a major boom in the prices of its exported commodities associated with large

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TABLE I
Growth periodization, 1950-2014 (% p.a.)

	Brazil	Mexico	Brazil's average GDP growth	Mexico's average GDP growth
Post-WWII Golden Age	1950-1980	1950-1981	7.4%	6.8%
Post-1980 Near Stagnation	1981-2014	1982-2014	2.6%	2.2%
Lost Decade	1981-1992	1982-1993	1.4%	1.6%
Reforms with Subpar Growth	1993-2003	1994-2001	2.8%	3.0%
China Syndrome	2004-2010	2002-2010	4.5%	1.9%
Day after the Great Recession	2011-2014	2011-2014	2.1%	2.9%

Sources: National Accounts and Historical Statistics, Brazil and Mexico; elaborated by the authors.

capital inflows) and a very negative impact in Mexico (through a tough competition in manufactured exports to a slowly growing US market). Brazil grew at a yearly average of 4.5% in the 2004-2010 period, whereas Mexico's growth lingered on at 2.0% per year from 2002 to 2010.

There is finally the more recent 2011-2014 period, when Brazil suffered from a reversal of the commodity boom and also from domestic economic mismanagement. Mexico had to cope with the slow recovery of the US from the Great Recession, but fared better than previously. In this Day After the Great Recession period, GDP growth averaged 2.1% in Brazil and 2.9% in Mexico.

Graph 3 makes the contrast between these countries' growth experiences before and after the early 1980s clear. During the Golden Age, Brazil and Mexico grew in the neighborhood of 7% per year. After the early 1980s, average GDP growth rates have been only one-third of that. It is true that population growth slowed down substantially between 1950-80 and 1981-2014, from 2.8% to 1.5% in Brazil and from 3.4% to 2.2% in Mexico. But that does not help to change the dismal picture: in per capita terms post-1980 income growth rates were only a fraction of those before 1980: Mexico per capita income grew 3.4% a.a. from 1950 to 1981 and 0.7% from 1981 to 2013, while Brazil's GDP per capita growth dropped from 4.5% to 1% a.a.

In the next section we investigate the relationship between the GDP growth collapses and capital accumulation, before introducing total factor productivity into the picture in the subsequent section.

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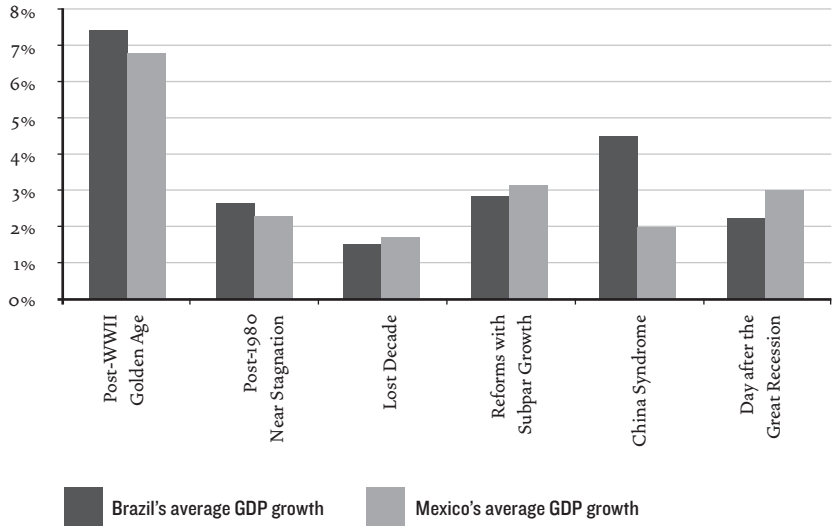
GRAPH 3

Growth periodization, 1950-2014 (% p.a.)



Source: Table 1.

3 CAPITAL ACCUMULATION AND THE GROWTH COLLAPSES

In both Brazil and Mexico deep and lasting contractions in capital accumulation were closely associated to the GDP growth collapses that started in the early 1980s.[4] We first display this association and then use a decomposition derived from the savings-investment identity to study the behavior of the capital stock changes.

Graphs 4 and 5 show the relationships between the GDP growth rates (dotted lines) and the capital stock growth rates (solid lines) respectively in Brazil and Mexico, from 1950 to 2014. During the Golden Age, the average yearly capital stock growth rate was 8.9% in Brazil and 8.0% in Mexico. In consonance with this rapid growth in the capital stock, average GDP growth rates of this period were 7.4% and 6.8%, respectively in Brazil and Mexico.

In Brazil, the capital stock growth rate reached a peak in 1975 and then started to fall. This drop became sharper after 1981, and a through was reached only in 1992. In Mexico, the change of regime was much faster, as it took only one year — 1983 —for the capital stock growth rate to sink from a peak to a near through, from which it recovered only mildly in subsequent years. In the Near Stagnation era, the average capital stock growth rate stood at only 2.9% in Brazil and 2.8% in Mexico. Correspondingly, average GDP growth rates descended to 2.6% in Brazil and 2.2% in Mexico.

On a yearly basis, output growth was rather more volatile than capital growth as can be seen in Graphs 4 and 5. As a result, the correla-

[4] Brazil's net capital stock estimates are preliminary. Mexico's data were kindly provided by André Hofman, from ECLAC/UN. Mexico's 2014 figure is our own estimate, based on the average depreciation rate implicitly observed in Hofman's figure for 2013 and INEGI's fixed gross investment estimate in 2014.

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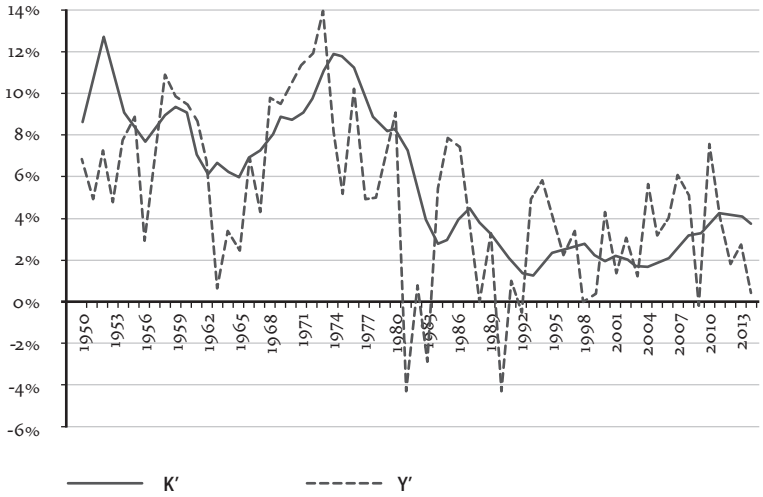
GRAPH 4

Brazil — Capital stock (K') and GDP (Y') growth rates, 1950-2014 (%)

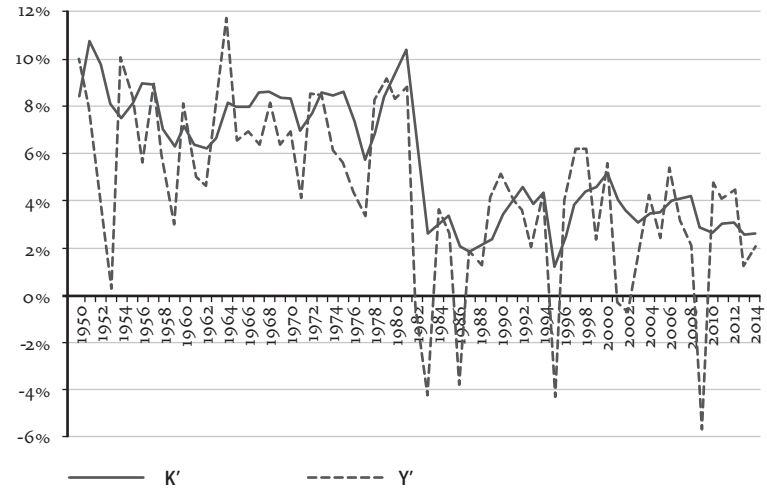


Source: National Accounts, Historical Statistics and authors' estimates.

tions between the capital and output growth series are not particularly high: 0.58 in Brazil and 0.68 in Mexico. The correlation between the capital stock growth rates of the two countries was a much higher 0.83, which highlights the kinship of their post-WWII macroeconomic histories. On the other hand, the correlation between their GDP growth rates was a much smaller 0.37.

GRAPH 5

Mexico — Capital stock (K') and GDP (Y') growth rates, 1950-2014 (%)



Sources: Estadísticas Históricas de Mexico, A. Hofman's estimates and INEGI's internet site.

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We use an expression derived in Bacha and Bonelli[5] to decompose the capital stock growth rate, and identify for each period in Table 1 the roles of savings, the relative price of investment, and the capital-to-output ratio in the evolution of the capital stocks.

[5] Bacha; Bonelli, 2016.

The decomposition for the growth rate of the capital stock is derived from the investment and savings identity in current prices, and is expressed as:[6]

$$K' = s(1/p)v - \delta \qquad (1)$$

[6] We start from the National Accounts identity: $PI\ I = S$, where PI is the implicit price deflator of gross capital formation, I is gross real investment, and S is total savings in current prices. To simplify, inventory changes are netted out of savings. First divide both sides by PIK (where K is the capital stock), then divide and multiply the right-hand side by PYY (where PY is the implicit price deflator of GDP and Y is real GDP), then subtract the capital stock depreciation rate (δ) from both sides, and rearrange to obtain equation (1), where $K' = I/K - \delta$, $s = S/PYY$, and $p = PI/PY$. See Bacha and Bonelli (2016) for the derivation of a slightly more elaborate version of this equation that allows for a varying degree of capital stock utilization.

where: K' is the growth rate of the capital stock, s is the sum of the domestic with the foreign savings rate (which we denominate simply as the savings rate), p is the relative price of investment (ratio of the implicit price deflator of gross capital formation to the implicit price deflator of GDP), v is the aggregate output to capital stock ratio, and δ is the depreciation rate.

We treat the variables in the right-hand side of equation (1) as parameters, the changes in the values of which explain the changes in the growth rate of the capital stock. We are aware that this is only a first approximation that ignores the autonomous determinants of investment, such as profit rates, firms' expectations about future demand, credit availability, macroeconomic volatility etc. With this caveat, the exercise seems to us to illuminate important aspects of the growth experiences of Brazil and Mexico.

Equation (1) shows that the impact of the savings rate on the growth rate of the capital stock depends on the relative price of investment and on the output-to-capital ratio. The higher is the relative price of investment (the lower is $1/p$) and the lower is the output-to-capital ratio, the lower will be the growth rate of the capital stock for a given savings rate. The depreciation rate also needs to be taken into account — except that, as it varies little in the series we use, it does not contribute to explain the changes in capital accumulation through time.[7]

[7] Mexico's depreciation rates, as calculated from Hofman's capital data series, turned out to be substantially higher than Brazil's, estimated by us as a residual (but which are in line with the values computed by Lucilene Morandi, from the Fluminense Federal University (UFF), in a forthcoming paper). We were unable to detect the sources of these differences.

Tables 2 and 3 show the figures for equation (1) respectively for Brazil and Mexico in the periods identified in Table 1.

The most outstanding result in Tables 2 and 3 is that the sharp fall of the capital stock growth rates between the Golden Age and the Near Stagnation period is not accounted for by the evolution of the savings rates. In the thirty-some years before the early 1980s, the average savings rate was 19.4% in Brazil and 16.4% in Mexico. From the early 1980s to 2014, the average savings rate was in fact a bit higher at 19.5% in Brazil and 18.5% in Mexico. This did not prevent the average growth rate of the capital stock to sink between these two long periods from 8.9% to 2.9% in Brazil and from 8.0% to 3.4% in Mexico.

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TABLE 2
Brazil — Capital stock growth decomposition, selected periods

BRAZIL	Periods	K'	s	v	p	δ*
Post-WWII Golden Age	1950-1980	8.8%	19.4%	0.506	0.784	3.6%
Lost Decade	1981-1992	3.3%	20.9%	0.357	1.009	4.1%
Reforms with Subpar Growth	1993-2003	2.1%	18.3%	0.352	1.013	4.2%
China Syndrome	2004-2010	2.8%	18.5%	0.382	1.024	4.1%
Day after the Great Recession	2011-2014	4.0%	20.3%	0.383	0.973	4.0%
Post-1980 Near Stagnation	1981-2014	2.9%	19.5%	0.364	1.009	4.1%

* Residual
Source: Authors' elaboration based on Brazil's National Accounts.

TABLE 3
Mexico — Capital stock growth decomposition, selected periods

MEXICO[8]	Periods	K'	s	v	p*	δ**
Post-WWII Golden Age	1950-1981	8.0%	16.4%	0.656	0.795	5.6%
Lost Decade	1982-1993	3.3%	17.3%	0.470	0.915	5.6%
Reforms with Subpar Growth	1994-2001	3.7%	17.5%	0.443	0.842	5.5%
China Syndrome	2002-2010	3.5%	22.2%	0.410	0.967	6.0%
Day after the Great Recession	2011-2014	2.8%	21.5%	0.391	0.919	6.3%
Post-1980 Near Stagnation	1982-2014	3.4%	18.5%	0.438	0.887	5.8%

* Residual
** Depreciation implicit in Hofman's estimates
Source: Authors' elaboration based on Mexico's National Accounts.

[8] A direct calculation of *p* yields results only slightly different from those in Table 3. Thus, for instance, *p* in 1950-1981 estimated directly from the PENN World Tables is equal to 0.833 with 1980 = 1.0. It equals 0.943 in 1982-1993 and 0.910 in 1982-2014. Therefore, relative changes are similar under both alternatives. The savings rate in current prices (*s*) for Mexico was estimated by the authors from Hofman's investment rate in 1980 prices multiplied by the relative price of investment goods in the PENN Tables, with 1980 set equal to 1.0.

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A common culprit (by far the main one in the case of Mexico) for the sharp fall in the capital stock growth rate was a deep reduction in the output-to-capital ratio. This seems to have been partly a technological phenomenon, as these economies became more complex and urbanized than in the past. A sector-composition effect may also have had a role, as exemplified by the increasing share of services at the expense of goods-producing sectors. Investment misallocation is a further reason for the decline in the output-to-capital ratio, as we will discuss below. But, particularly in the case of Mexico, the drop in the capital stock growth rate was too sudden to be explained simply by such structural factors.

Apparently, cost-increasing and demand-depressing factors associated with the early 1980s debt crisis forced a sharp reduction in aggregate output, thus reducing the degree of utilization of the capital stock.[9] A drop in foreign savings also exerted a depressing effect on capital accumulation, as a compensatory increase in domestic savings did not immediately occur. Subsequently, domestic savings recovered, but this happened in a context (particularly in the case of Brazil) in which an inefficient import substitution of capital goods depressed the output-to-capital ratio and, more importantly, increased substantially the relative price of investment.[10]

Higher capital intensity and more expensive investment goods became permanent features of Mexico's and Brazil's economies since the early 1980s. Together they explain the drop in the capital stock growth rate in spite of higher savings rates. Brazil, which is a more closed economy, also suffered from a sharp rise in the relative price of investment. Mexico's opening up seems to have been able to hold back the rise in the price of investment, but it did not prevent the output-to-capital ratio from falling even more deeply than in Brazil.

Levy[11] argues that the social programs created after the 1980s tilted the investment ratio in Mexico towards the informal sector and this would have raised the incremental capital-to-output ratio.[12] Ros[13] agrees that informality expanded somewhat since the 1980s but argues that this was a consequence not a cause of the low growth rate of the capital stock. We will have more to say about the role of informality in subsection 5.5 below.

We now turn to the consequences of the evolution of the capital stock together with that of total factor productivity (TFP) for the growth rate of output per worker. The focus on output per worker is justified because changes in labor force growth were a minor factor in the GDP collapses in the two countries. In the Golden Age, labor grew at nearly similar rates in Brazil and Mexico, respectively, at 3.1% and 3.2% per year. In the Near Stagnation age, yearly labor force growth was less, but still a respectable 2.2% in Brazil and an even higher 2.5%

[9] A simple measure based on actual versus trend GDP suggests a rather large drop (8%) in Mexico's output gap between 1981 and 1983.

[10] Bacha and Bonelli (2016) discuss the causes of the rise in the relative price of investment and of its role in the contraction of the capital stock growth rate in Brazil.

[11] Levy, 2008, p. 213.

[12] The argument is that labor productivity (Y/L) dropped by more than the reduction in the capital-labor (K/L) ratio. This would explain why the capital-to-output (K/Y) ratio increased when production shifted from the formal to the informal sector.

[13] Ros, 2013, ch. 2.

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in Mexico. These relatively small changes in labor force growth rates permit us to draw attention to the growth of aggregate output per labor, as explained by capital deepening and TFP.

4 PERIODIZATION FOR THE GROWTH OF OUTPUT PER WORKER

This section presents a standard growth decomposition exercise, using an aggregate Cobb-Douglas production function with capital and labor as production factors. Our interest is in the evolution of GDP per worker. The log-linearization of a function of this type results in:

$$y' = \alpha k' + TFP' \qquad (2)$$

where y' is the growth rate of GDP per worker, α is the capital share in GDP, k' is the growth rate of capital per worker, and TFP' is the growth rate of total factor productivity.

Tables 4 and 5, respectively for Brazil and Mexico, show the behavior of the variables in equation (2) for the periods identified in Table 1. For completeness, the tables also show the values of labor force growth (L') in these periods. In both countries, we set $\alpha = 0.45$. For Brazil, this value is in line with our previous work[14] and for Mexico with a forthcoming productivity study of the KLEM-Latin American project.[15]

These tables summarize the extraordinary loss of dynamism of the two economies from the Golden Age to the Near Stagnation era. Between these two long periods, average growth of output per worker fell from 4.2% to 0.4% in Brazil and from 3.4% to -0.2% in Mexico.[16]

[14] Bonelli; Bacha, 2012.

[15] Hofman et al. (forthcoming).

[16] Neither labor nor capital were corrected for utilization in these exercises.

TABLE 4
Brazil — Decomposition of labor productivity growth, selected periods (% p.a.)

Periods	y'	L'	α*k'	TFP'
1951-1980	4.2%	3.1%	2.5%	1.7%
1981-1992	-0.8%	2.2%	0.7%	-1.4%
1993-2003	0.3%	2.5%	-0.2%	0.4%
2004-2010	2.2%	0.5%	0.2%	2.0%
2011-2014	1.1%	1.0%	1.3%	-0.2%
1981-2014	0.4%	2.2%	0.4%	0.0%

Source: Authors' elaboration based on Brazil's National Accounts.

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TABLE 5
Mexico — Decomposition of labor productivity growth, selected periods (% p.a.)

Periods	y'	L'	α*k'	TFP'
1951-1981	3.4%	3.2%	2.1%	1.3%
1982-1993	-1.7%	3.4%	0.1%	-1.8%
1994-2001	0.7%	2.3%	0.6%	0.1%
2002-2010	0.3%	1.6%	0.9%	-0.5%
2011-2014	1.0%	1.9%	0.4%	0.6%
1982-2014	-0.2%	2.5%	0.5%	-0.7%

Source: Authors' elaboration based on Mexico's National Accounts.

Contractions in the growth rates of capital per worker and of TFP divide the responsibility for this collapse. The former was relatively more important in Brazil and the latter in Mexico. This proposition is valid for the Near Stagnation era as a whole. In this period, output per worker growth was negative in Mexico, in spite of a higher contribution of capital to growth than in Brazil. This was due to the Solow residual becoming strongly negative in Mexico during this era.

Roles of capital and TFP are nonetheless reversed in the two countries in the more recent Day After the Great Recession phase (2011-2014). Growth of output per worker was equally mediocre in the two countries, but in Brazil capital accumulation recovered while TFP growth sank. In Mexico, on the contrary, capital accumulation dropped while TFP growth improved. A possible reason is that Mexico may be dealing with more success than in the past with the structural sources of its traditional low productivity, but is suffering from a low propensity to invest associated with the economic slowdown of its main trading partner, the US. Meanwhile, in Brazil the end of the commodity boom and government meddling with resource allocation led TFP growth to become negative, even as capital accumulation recovered from the low levels prevailing since the 1980s.

This interpretation needs to be squared off with the high growth rate of TFP in Brazil during the China Syndrome period (2004-2010). Lisboa and Pessoa[17] argue that this was a deferred consequence of the economic reforms of the 1990s and early 2000s. However, the major commodity boom from which Brazil benefited may also have boosted TFP growth in this period. The positive association between the terms of trade (ToT) and measured TFP is well documented in the literature, as is the procyclicality of this variable.[18]

[17] Lisboa; Pessoa, 2013.

[18] We discuss the terms of trade effect below. On the procyclicality of measured TFP, see Hall, 1990; Basu; Fernald, 2001; Basu; Fernald; Kimball, 2006, and Bai; Ríos-Rull; Storesletten, 2012.

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Both in Mexico and in Brazil, the positive correlations between TFP and the ToT in the 1980-2014 period are very impressive indeed, as seen in Graphs 6 and 7, where TFP is measured in the left-hand axis and the ToT in the right-hand axis. Graph 6 displays the close evolution of TFP and the ToT in Mexico: both experienced a sharp drop from 1980 to 1988, followed by near stagnation in the remaining of the period. Graph 7 shows the more complex evolution of TFP and the ToT in Brazil. After an initial drop, these variables experienced ups and downs until 2003, when they gained substantial traction, to start falling again after 2011. The correlation coefficients between TFP and the ToT in the 1980-2014 period are 0.89 in Mexico and 0.74 in Brazil.

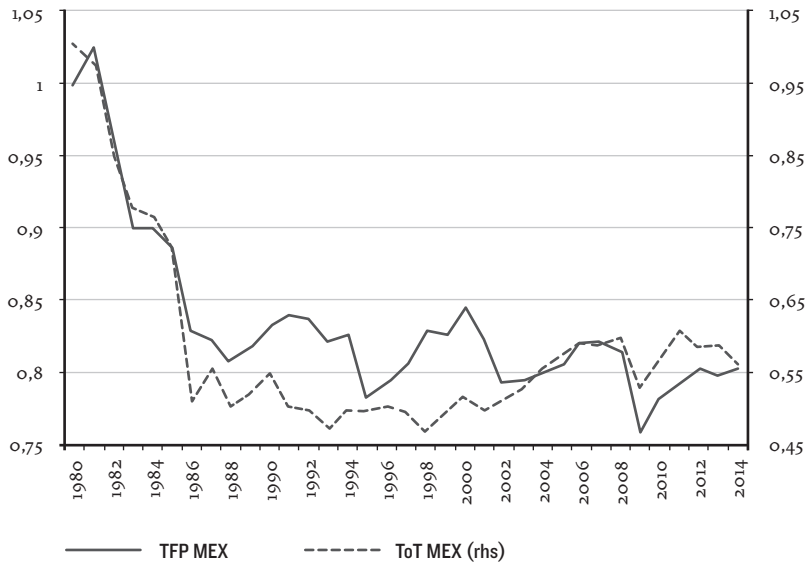
The OLS regressions in Table 6 confirm that in both countries part of the changes in TFP during the near stagnation period can be explained by the vagaries of the terms of trade and of the economic cycles. The table shows the results of regressions of the rate of change of TFP on the rate of change of ToT and on alternative measures of the economic cycle: changes in the degree of capital stock utilization or in the output gap (in the case of Brazil), and changes in the unemployment rate or the output gap (in the case of Mexico).[19]

Depending on the measure of the cycle that is used, these results suggest that a 10% improvement in the ToT raise measured total factor productivity in the interval of 0.65% to 0.8% in Brazil and in the interval of 0.9% to 1.8% in Mexico. Similarly, a one-percentage point

[19] Sources for the data in Table 6 were as follows: i) *TFP'* for Brazil and Mexico, see Tables 4 and 5; ii) ToT for Brazil, Ipeadata (www.ipeadata.com.br); iii) ToT for Mexico, Banco de Mexico (www.bancodemexico.gov.mx); iv) utilization gap for Brazil, Bonelli; Bacha, 2012, updated by the authors; v) output gap for Brazil, HP filter extracted from the national accounts; vi) unemployment rate for Mexico, IMF (www.imf.org); vii) output gap for Mexico, HP filter extracted from the national accounts by Jesús Garza and João Pedro Resende, from Itaú BBA.

GRAPH 6

TFP and ToT levels in Mexico, 1980-2014 (1980 = 1.0)



Source: Authors' elaboration. ToT data from Banco de Mexico internet site.

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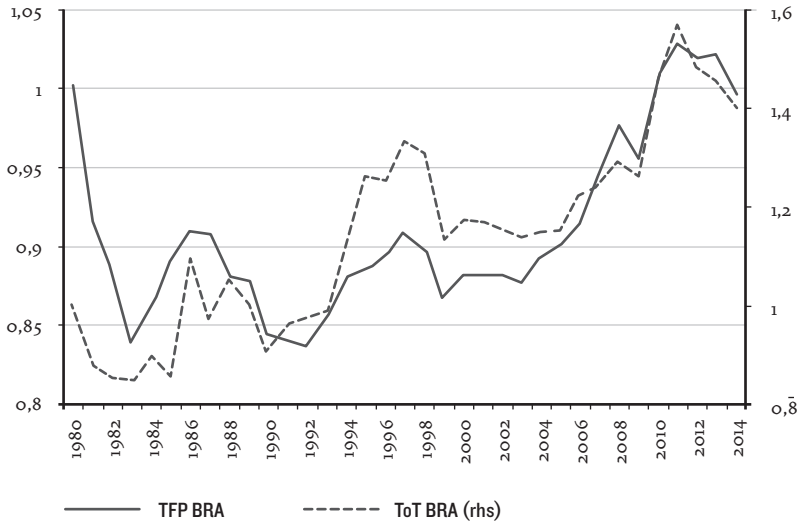
GRAPH 7

TFP and ToT levels in Brazil, 1980-2014 (1980 = 1.0)



Source: Authors' elaboration. ToT data from Ipeadata.

increase in the gap in resource use reduces measured TFP in 0.9% in Brazil and in the interval of 0.7% to 1.6% in Mexico.

Part of the reason why measured TFP turned out to be so sensitive to the economic cycle is that we were not able to adjust the capital and labor inputs for the intensity of their utilization. When output contracts and labor-hours and capital utilization are reduced following a negative demand shock, such input reductions are not reflected in our measures of labor and capital. Consequently, the result of a demand contraction is a lower measured TFP (because output is lower and our measured inputs remain constant, except for the possible reduction in engaged laborers). Mutatis mutandi, the same is valid for a positive demand shock. In summary, the observed procyclicality of TFP' in Table 6 is associated to the deficiencies in our measurement of labor and capital inputs. Thus, we cannot infer from this procyclicality that other factors such as economies of scale are at play.

The positive relation of measured TFP with ToT is more complex to explain. A common story in a recent literature[20] is that a ToT improvement generates a real exchange rate appreciation that leads to a more intensive use of highly taxed intermediate imported goods. These inputs are more efficient and more diversified than the domestic intermediate goods that they replace. Thus, output increases with the same inputs of capital and labor. Mutatis mutandi, a ToT deterioration would depreciate the real exchange rate and induce an inefficient substitution of domestic for imported intermediate goods. In addition to

[20] The accepted wisdom is that ToT shocks represent a major source of business cycles in emerging and poor countries. For some relevant literature and a critical view, see Schmitt-Grohé and Uribe (2015). Kehoe and Ruhl (2008) argue that the positive association of ToT changes with TFP growth observed in the historical data cannot be derived in a model with perfect competition and constant returns to scale. Following on the footsteps of Hall (1990) several authors have recently bypassed this objection with the use of models with monopolistic competition, multi-good settings, trade costs, and/or search environments. In all these models relative intermediate-good import prices are important determinants of measured TFP. See Burstein; Cravino, 2015; Feenstra et al., 2013; Gopinath; Neiman, 2014; Kim, 2011.

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TABLE 6
OLS regression results for rate of change of total factor productivity

Brazil and Mexico, 1981-2014 (34 observations)

	Dep. Var.	Dep. Var.	Dep.Var.	Dep. Var.
Variable	TFP' Brazil (1)	TFP' Brazil (2)	TFP' Mexico (3)	TFP' Mexico (4)
Constant	-0,073	0,098	-0,210	-0,449
(t-ratio)	(-0,26)	(-0,42)	(-0,76)	(-2,18)
Terms of trade rate of change	0,080	0,065	0,177	0,092
(t-ratio)	(-1,94)	(-1,93)	(-4,63)	(-2,95)
Utilization gap change (Brazil)	-0,915			
(t-ratio)	(-5,66)			
Output gap change (Bra) HP filter		-0,876		
(t-ratio)		(-7,80)		
Unemployment rate change (Mex)			-1,604	
(t-ratio)			(-5,50)	
Output gap change (Mex) HP filter				-0,712
(t-ratio)				(-8,96)
Adjusted R2	0,671	0,775	0,669	0,818
Standard error of regression	1,60	1,33	1,58	1,18
DW	1,68	1,21	1,90	1,61
F-ratio	34,68	57,68	34,29	75,02

Sources: Authors' calculations.

this effect, an increase (decrease) in the ToT would raise (reduce) aggregate demand and impact positively (negatively) on measured total factor productivity under increasing returns to scale.

5 GROWTH AND STRUCTURAL HETEROGENEITY[21] IN FIVE DIMENSIONS

In the previous sections, we identified a number of parallelisms between the growth experiences of Brazil and Mexico since 1950. In this section, we are interested in the more recent period, in which both

[21] Structural heterogeneity is a term made popular by Aníbal Pinto (1970) in Latin America, to denote the extreme inter- and intra-sector differences in productivity provoked by import substitution industrialization in the continent.

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countries failed to recover high growth rates and their respective productivities per worker lingered on a state of near stagnation.

There is a basic similarity in these countries' post-1980 macroeconomic experience. Because of policy failures of structural conditions, Brazil and Mexico were unable to undo the increases in the relative price of investment and in the capital intensity of production observed in the early 1980s. They were also unable to raise their respective savings rates to compensate for such investment-depressing factors.

But there are also relevant differences in these countries' recent slow-growth experiences. Mexico opened up its economy to trade with the outside world (mostly to the US) and thus succeeded in developing a first-class industrial sector in the country's richer Northern region. However, a similar domestic integration did not accompany this external integration. The dynamism of the large exporting firms in the North did not feed back to the non-traded, informal, small and medium-sized firms in the country's poorer Southern regions. The consequence was a very low aggregate labor productivity growth rate, because medium and small firms generate not only most of the country's jobs but also a substantial part of its output.

The structural heterogeneity between "modern" and "traditional" sectors seems to have widened in Mexico in the post-reform period. In Brazil, in several dimensions this dualism decreased: the poorer North grew faster than the richer South; the lower-productivity agriculture did better than the higher-productivity industry;[22] bigger manufacturing firms did not outflank medium and small firms; informality decreased in the last decade. Brazil's problem seems to have been that in contrast to Mexico its high-productivity large-manufacturing firms did not integrate into the world economy and as a consequence their productivity stagnated, except in a few subsectors. This provided a weak lever to move the rest of the economy up. Therefore, the country lingered on in a low overall productivity path, except when the commodity lottery dictated otherwise.

To give some substance to this story, in the following we explore five disaggregated dimensions of the evolution of labor productivity in the two countries. The dimensions are: geopolitical units, economic sectors, tradability, firm size, and informality.

[22] Productivity in agriculture (including stock breeding) increased by a substantial 5.2% yearly average rate between 1995 and 2013, while in services the average rate was only 0.4% p.a. and in manufacturing nearly zero. For the economy as a whole the corresponding rate was 1.1%. These figures are from an ongoing research by F. Veloso, S. Marques and B. Coelho, from IBRE/FGV, to whom we express our gratitude for letting us use their unpublished results.

5.1 Regional Dimension

In this subsection we investigate the evolution of the dispersion of real per capita incomes among the States in Brazil and Mexico. The analysis considers the 27 Brazilian States and the 32 Mexican federative entities. The periods for which we were able to obtain good data were 1990-2012 for Brazil and 1990-2013 for Mexico.

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We use the ratio of the standard deviation to the unweighted average real per capita state income (sigma, for short) to answer the question of whether the distribution of per capita income among states narrowed or widened over time. The results are shown in Graph 8.

It is well known that in the personal dimension Brazil has a more unequal income distribution than Mexico. Graph 8 shows that this is also true in the states dimension. Brazil's sigma is always higher than Mexico's. However, the dispersion of the states' per capita incomes diminishes in Brazil, with its sigma falling from 0.79 in 1990 to 0.61 in 2012. In Mexico, a widening pattern is observed since 1996. Initially, Mexico's sigma falls, from 0.50 in 1990 to 0.47 in 1995, but then it increases almost continuously, to end at a value of 0.54 in 2013.[23]

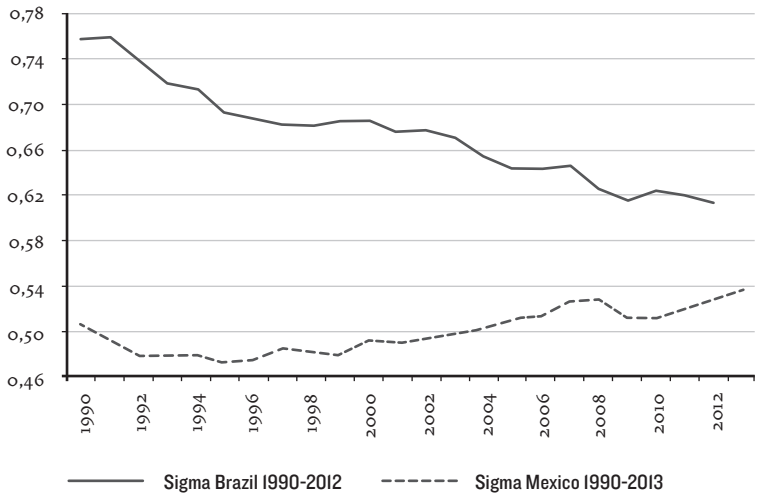
Thus, in the regional dimension we observe a tendency for income inequality to increase in Mexico and to decrease in Brazil since the 1990s. The speculation is that manufacturing activity blossomed in Northern Mexico, well integrated to the US but with few linkages to the rest of the country, while oil production stagnated in the country's South. In Brazil, manufacturing activity, which is inward looking and highly concentrated in São Paulo, the country's richer state, lost dynamism. Agriculture and mining, in turn — which are outward looking and better disseminated regionally — gained traction with the commodity supercycle. Additionally, minimum wage policies and income transfers through the Bolsa Família program benefited Brazil's poorest Northern states and were more effective at income redistribution than similar Mexico's programs.[24] According to

[23] Mexico's sigma of state per capita incomes seems to have fallen in the previous 1970-1989 period, from 0.76 to 0.55, but we are unsure of the comparability of this data with that presented above for the subsequent 1990-2013 period. Brazil's state real per capita incomes data previously to 1990 seem totally unreliable. We thank Bernardo Coelho, from IBRE, for the Brazilian data.

[24] See Lustig (2010) for a perceptive analysis of the impact of twenty-five years of reforms on Mexico's poverty and inequality.

GRAPH 8

Relative dispersion of states per capita incomes, Brazil and Mexico



Sources: IBGE and INEGI. Computed by the authors.

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Ros,[25] in Mexico the inflation-corrected minimum wage remained constant since 1996. In Brazil, meanwhile, the inflation-corrected minimum wage doubled in value from 1996 to 2012, according to Bacha and Hoffmann.[26]

[25] Ros, 2013, graph 3.1.

[26] Bacha; Hoffmann, 2015, graph 3.

5.2 Economic Sector Dimension

In this subsection, we investigate aspects of the evolution of labor productivity in one-digit economic sectors. The data is from the 10-Sector Database of the Groningen Growth and Development Center (GGDC).[27] This database covers the ten main sectors of the economy as defined in the International Standard Industrial Classification, Revision 3.1. These sectors cover the total economy and are as follows: 1) agriculture, hunting, forestry and fishing; 2) mining and quarrying; 3) manufacturing; 4) electricity, gas and water supply; 5) construction; 6) wholesale and retail trade, hotels and restaurants; 7) transport, storage, and communication; 8) finance, insurance, real estate and business services; 9) government services; 10) community, social and personal services. Productivity is defined as gross value added per employee in constant 2005 national prices. The period covered is 1950-2011.

[27] Timmer; De Vries; De Vries, 2014.

Our first analysis is on the evolution of the dispersion of labor productivity levels among these sectors in the two countries. In Graph 9, we graph the evolution from 1950 to 2011 of the ratio — sigma, for short — between the standard deviation and the (unweighted) average productivity level in the ten sectors in Brazil and Mexico. It is apparent that the dispersion of sectorial productivities not only increased through time but became much more pronounced in the Near Stagnation Era.

The dispersion of sectorial productivities remained relatively constant in Brazil during most of the import substitution period. This was a surprise, as we expected to find more heterogeneity in that phase. After 1980, there was a very noticeable trend of increasing dispersion in productivity levels among sectors.

Graph 9 shows that Mexico's sigma trended downward in the 1950s and 1960s. There followed a pronounced increase that lasted for three decades. After 2003 the movements of Mexico's sigma were not uniform: there was a sharp decrease up to 2008, followed by an increase thereafter. If we exclude mining (that is, oil extraction) from the analysis, the picture that emerges is different. There was a slight downward trend in Mexico's sigma throughout the period. That is, both the extraordinary increase in the dispersion of productivity levels after the late 1970s and the ups and downs of this dispersion after 2003 are mostly due to the oil sector.

The ratio between the sigmas (MEX/BRA) in Graph 9 is consistently higher than one, implying higher dispersion of sectorial produc-

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tivities in Mexico. But the discrepancy between the countries' sigmas tended to decrease: the ratio between them fell from 1.5 in 1950-1959 to 1.3 in 2002-2011. Again, most of these movements can be explained by the ups and downs of Mexico's oil sector.

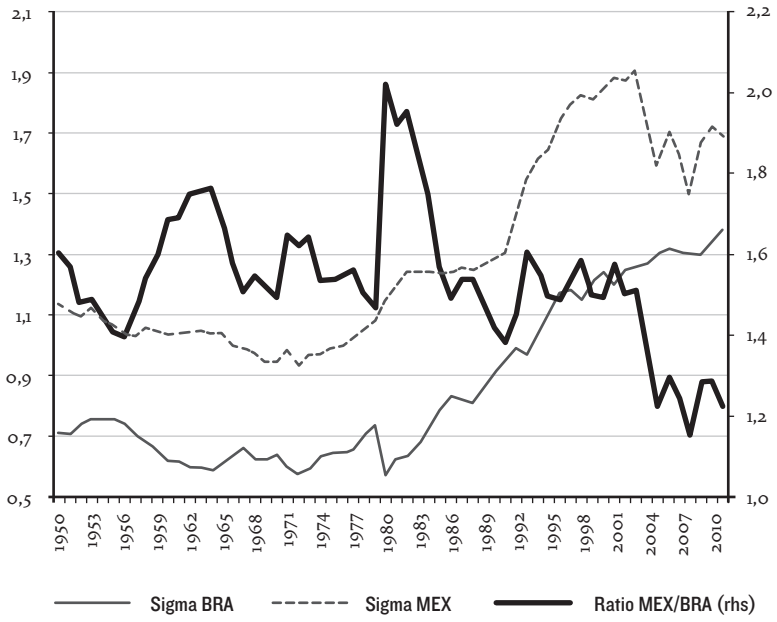
The conclusion is that the structural heterogeneity of labor productivity at the sectorial level became more pronounced in both countries accompanying the slump in GDP growth rates after 1980. From a sectorial perspective, because of the oil sector Mexico is structurally more heterogeneous than Brazil, but the difference between the sigmas of the two countries has decreased recently.

Using the same database we aggregated the ten sectors into only two: mainly traded sectors (agriculture, mining, and manufacturing) and mainly non-traded sectors (the remaining seven). Except for the inclusion of construction in the latter, this division is roughly similar to one between goods-producing vs. service-producing sectors. We then computed the evolution of the labor productivity ratio of the traded to the non-traded sector in 1950-2011 in the two countries.

The results are shown separately in Graph 10 and 11 and are also somewhat surprising. First, the relative productivity in the traded (or goods-producing) sector started from a very low basis. In 1970, the productivity in the traded sector in both countries was only around 15% of the productivity in the non-traded (or service-producing) sectors. Second, starting from this low basis the relative productivity of

GRAPH 9

Relative dispersion of sector productivities, Mexico and Brazil, 1950-2011



Source: Authors' elaboration based on the GGDC database.

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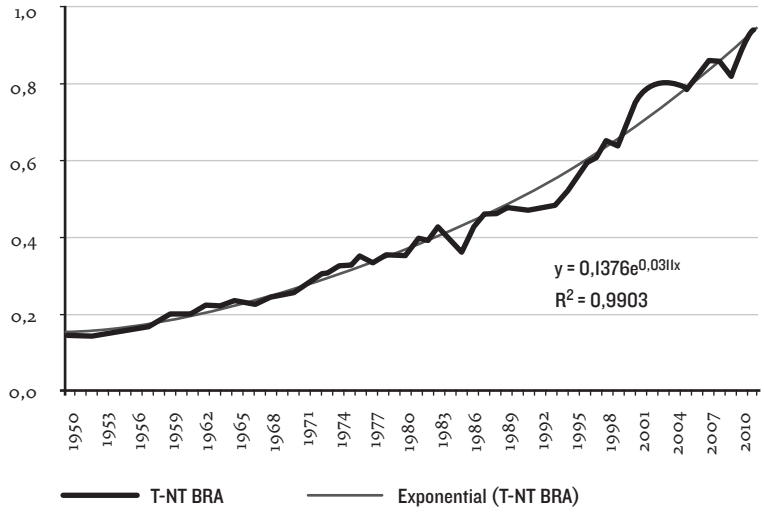
the traded sector increased exponentially at roughly 3% a.a. in both countries throughout the period under consideration. Toward the end of the series the productivities of the two sectors were roughly at the same level in both Mexico and Brazil. In Mexico, the productivity of the traded sector seems to be tapering off at roughly the same value as that of the non-traded sector, while in Brazil it continues to increase but not reaching the same value as that of the non-traded sector.

GRAPH 10

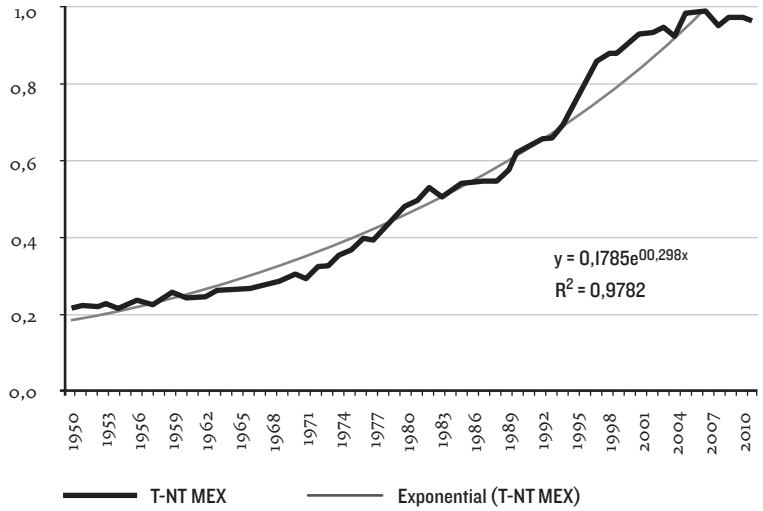
Brazil — Ratio of traded to non-traded sector productivities, 1950-2011



Source: GGDC database.

GRAPH 11

Mexico — Ratio of traded to non-traded sector productivities, 1950-2011



Source: GGDC database.

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The picture that emerges from this second exercise is only apparently at odds with our first exercise above. There we visualized a dispersion of sectorial productive levels. Here, we witnessed a convergence of productivity levels between the (less productive) traded and the (more productive) non-traded sectors. In fact, for the ten sectors as a whole there was almost no relationship between initial productivity levels and subsequent growth rates of labor productivity. The relevant point is that in both countries labor productivity in the three mainly traded sectors increased faster than in the remaining (mostly non-traded) ones.[28]

[28] In the 1950-2011 period productivities in Mexico increased by 1.8%, 2.3%, and 1.2% in agriculture, mining and manufacturing, respectively. The overall unweighted average was 1.2% p.a. for all sectors — thus, smaller than in each of the traded sectors. In Brazil, the corresponding figures were 3.2%, 5.1%, and 2.0%, and the overall unweighted mean was 2.1% p.a.

5.3 Tradability Dimension

In this subsection, we use a more disaggregated dataset recently produced at the International Monetary Fund (IMF)[29] to investigate in more detail the behavior of labor productivity in the traded and non-traded sectors of Brazil and Mexico in the 1989-2009 period. The data originates from a 35-industry series, with tradability defined by a minimum of 10% of exports in gross valued added. Productivity is measured as real value added per worker in constant 2005 Purchasing Power Parity (PPP) US dollars. Hence, productivity levels (and not only their growth rates) can be compared across countries.

[29] Mano; Castillo, 2015. We used the data made available by the authors at: https://sites.google.com/site/ruimano/home/ManoCastillo2015.

The two lines in Graph 12 display the evolution of the ratios between the labor productivities of the traded and non-traded sectors for Brazil and Mexico. The top line shows the evolution of the productivity ratio (trade to non-trade) in Mexico. In 1989, the two sectors had a similar productivity level, but the traded sector labor productivity grew faster than in the non-traded sector so that by 2009 it was 70% higher than the later (in contrast, in the Groningen dataset the respective productivities were at a similar level by this date). The second line shows a similar traded/non-traded productivity ratio for Brazil. Initially, the productivity of the traded sector was at 80% of the non-traded sector. But the tendency was for convergence, so that by 2009 the productivities in these two sectors became equalized in Brazil.

For Brazil this dataset confirms the tendency for sectorial productivity convergence (although at a lower speed than in the Groningen project data), whereas in Mexico the trend was one of divergence, with the non-traded sector lagging well behind the traded sector. This result is consistent with the view that in Mexico the traded sector is very dynamic but this dynamism does not spread to the non-traded sector. Meanwhile, in Brazil the traded sector struggles to reach the productivity level of the non-traded sector. Although agricultural productivity increased rapidly since after 1970 its productivity still lags behind those of the other economic sectors; it is this that explains the relatively lower productivity of the traded sector in Brazil.

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Since this dataset is in comparable 2005 PPP US dollars, we also compared the productivities of each sector in Brazil and Mexico. We found that in both sectors Mexico's productivity was higher than Brazil's, with its advantage being more pronounced in the traded sector. We also checked that this is not only because of the importance of agriculture in Brazil's traded sector. A comparison only for the manufactured sector also indicated a higher productivity in Mexico. Moreover, in both sectors the productivity of Brazil relative to that of Mexico remained more or less at the same level throughout the 1989-2009 period.

5.4 Firm Size Dimension

In this subsection, we investigate the behavior of labor productivity of small-and-medium-sized vs. large firms. For this, we use the results of a recent McKinsey Global Institute[30] report on Mexico. For Brazil, we use special tabulations for the industrial sector from the Instituto Brasileiro de Geografia e Estatística (IBGE).[31] The data for Mexico is for the years of 1998 and 2008 and covers manufacturing, services, and wholesale and retail commerce.[32] The data for Brazil covers a more extended period, 1996-2013, but it is only for manufacturing.

Table 7 shows the yearly average productivity growth by firm size in Mexico from 1998 to 2008, summarized from the McKinsey study.[33]The data exhibits a very clearly pattern: productivity growth rates increase very substantially with establishment size. The smallest firms in the sample, those with up to ten employees, saw their

[30] McKinsey Global Institute, 2014.

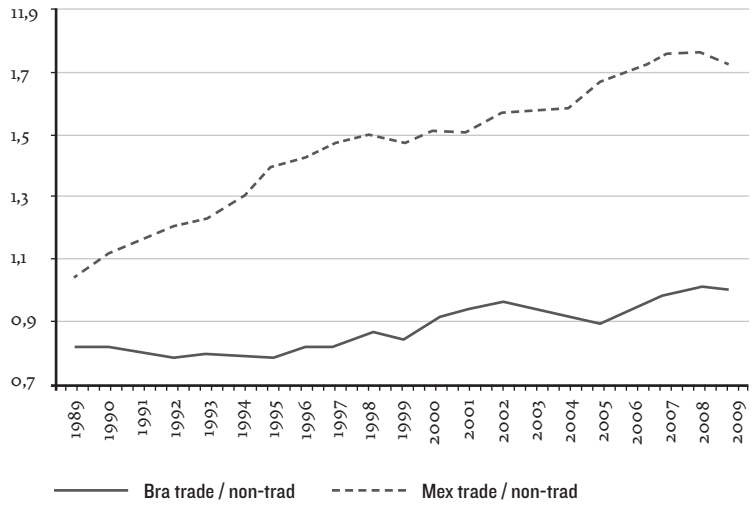
[31] We are thankful to Jaana Remes, from McKinsey, for additional Mexican data, and to Silvio Sales, from IBRE/FGV, for the special tabulations for Brazil.

[32] The original sources are the Mexican Economic Censuses of 1999 and 2009, with data collected respectively in 1998 and 2008. For details, see Busso; Fazio; Levy, 2012.

[33] Productivity is defined as value added (revenue less purchased raw materials and intermediate products) per worker, using "deflators from Instituto Nacional de Estadística y Geografía" (McKinsey, Global Institute 2014, p. 20).

GRAPH 12

Ratio of traded to non-traded sector productivities — Brazil and Mexico



Source: Mano and Castillo (2015).

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productivity decrease by 6.5% per year (this implies that their productivity at the end of the period was only one-half of its initial level — which if true is very impressive indeed). The productivity of the next size group (firms with eleven to thirty employees) also fell in the period. Productivity growth then becomes increasingly more positive as size grows, reaching a respectable 5.9% a.a. for firms with more than 500 employees.

The picture that emerges seems clear: in Mexico the biggest firms display much higher productivity growth rates than smaller firms — the productivities of the smallest of which, little as they are, fell substantially in the period. According to McKinsey, the sample of firms under consideration comprises 41% of the economy's valued added. If they are a representative sample of the whole economy the implication is that Mexico's low productivity growth problem resides squarely with its small and medium size firms (those with up to 500 employees), that are responsible for 42.5% of total value added and 80% of total employment.

At the lower end, a sizable proportion of these firms is informal, and this leads to a point raised by Busso, Fazio and Levy,[34] to the effect that for productivity comparisons firm type (formal or informal) is more important than firm size. With an upper size group aggregating firms with fifty or more employees, they find from the 2008 Census that, for the same size, formal firms are more productive than informal ones; and that formal firms with 0-5 employees are more productive than informal firms with fifty or more employees.

[34] Busso; Fazio; Levy, 2012.

TABLE 7
Mexico — Productivity growth by firm size, 1998-2008

Firm size	Employment share (%)	Productivity growth (%)
	1999	1999-2008
0 - 10	40	-6.5
11 -30	11	-2.2
30 - 100	12	0.2
101 - 250	10	2.9
251 - 500	8	2.4
501 +	20	5.9
Total	100	2.0

Source: McKinsey Global Institute, 2014.

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In Brazil, productivity by firm size for long periods is available only for the manufacturing sector.[35] Table 8 contains a computation for the 1996-2013 period. Figures for the smallest firms (zero to 29 employees) are available only for the 2007-2013 period. For the whole 1996-2013 period we have comparable data only for firms with more than thirty employees, which are shown in the last column of the table.

Results for both 1996-2013 (30+ employees) and 2007-2013 (all firms) indicate that productivity growth rates decreased with firm size. This is not exactly true in the 1996-2007 period (for firms with 30+ employees only). But even in this case the differences in productivity growth are much smaller than in Mexico.

These results are supported by Gomes and Ribeiro's[36] microdata analysis of firms in Brazil's manufacturing sector with thirty or more employees. With firms aggregated in twenty sectors at the two-digit SIC level, they find (to their own surprise, as they expected the opposite result) that in the 1997-2010 period the covariance between firm size and labor productivity growth was negative in no less than eighteen out of these twenty sectors.

[35] Results for a more limited period of time, covering nearly 3 million firms and 31.5 million persons employed in the extractive, manufacturing, construction, services and wholesale and retail trade in 2009-2011 show that productivity growth for the micro firms reached 8.6% p.a.; for the small firms the rate was 7.6% p.a.; for medium-sized firms, 5.9%; and for large firms 6.3%. The average rate in the biennium was 7.1% p.a. We thank Cláudio Considera for making these (unpublished) research results available to us.

[36] Gomes; Ribeiro, 2014.

5.5 Informality Dimension

In this subsection, we investigate aspects of the evolution of labor market informality in Brazil and Mexico. Informality is defined as the ratio of informal workers to total employment. In both coun-

TABLE 8
Brazil — Productivity growth in manufacturing by firm size, 1996-2013

Firm size	Employment share (average 2007-13)	Average Productivity Growth Rates (% p.a.) 1996-2007	2007-2013	1996-2013
Less than 10 employees	9.5	--	3.8	--
10 to 29	13.5	--	1.5	--
30 - 99	16.4	-2.3	0.5	-0.7
100 - 249	11.1	-1.3	-0.2	-1.2
250 - 499	8.6	0.0	-3.2	-1.3
500 +	40.8	0.0	-2.8	-0.7
Total	100.0	-0.3	-1.6	-0.7

Source: Pesquisa Industrial Anual (PIA), IBGE.

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tries, the definition of informal workers follow the International Labor Office (ILO) norms.[38]

We perform two exercises. The first is a regression, shown in Table 9, in which the dependent variable is the rate of informality in 2012 in each of the 59 states of Brazil and Mexico combined, and the independent variable is the per capita income level of these states. Two dummy variables are included. One is for Mexico, to test if this country has a different informality rate than Brazil. The other is for the southern Mexican state of Campeche, which proved to be an extreme outlier because oil extraction artificially raised its per capita income.

The regression shows a clear inverse relationship between informality and income. For each 10% increase in per capita income, the informality rate declines by 2.28 pp. More importantly from our point of view, the regression shows that Mexico has an informality rate that is 10.5 pp higher than Brazil's despite being 15% richer.

The second exercise is summarized in Graph 13 that describes the evolution of the informality rate in the two countries. Three lines are shown. The bottom line is for a very restrictive definition of informality that was previously adopted by the Instituto Nacional de Estadística y Geografia (INEGI) in Mexico. It covers the

[38] See International Labor Office (2014) for comparative data on informality in the G20 countries, including Mexico and Brazil. For Brazil, informal workers are: non-registered employees, non-registered domestic servants, self-employed workers, workers in the production for own-consumption, workers in the construction for own-use, unpaid workers. This classification is not official, but it is that generally adopted by researchers and by the ILO. In Mexico, there is an (ILO compliant) official definition of informal workers which is: "[...] besides the component that works in non-registered economic units or informal sector, other analogous modalities such as those employed in paid domestic work without social security, self-employed workers in subsistence agriculture, and unpaid workers, as well as paid workers without social security whose services are used by registered economic units". Freely translated from Instituto Nacional de Estadística y Geografía, 2014, p.36.

TABLE 9
Regression results, informality rate 2012

Variables	
Constant	266.80
(t-ratio)	(-15.01)
Log PIB pc PPP	-22.77
(t-ratio)	(-12.04)
Dummy Mexico	10.49
(t-ratio)	(-6.26)
Dummy Campeche	49.97
(t-ratio)	(-6.74)
Adjusted R-squared	0.73
S.E. of regression	6.21
Number of observations	59
F-statistic	53.29

Sources: Authors' elaboration.

09_Bacha_105_p150a181.indd 175 7/18/16 4:32 PM

1995-2012 period. The other two lines are in compliance with the ILO definition of informality. The middle one is for Brazil and covers the 1992-2013 period. The upper one is for Mexico and covers the 2005-2014 period.

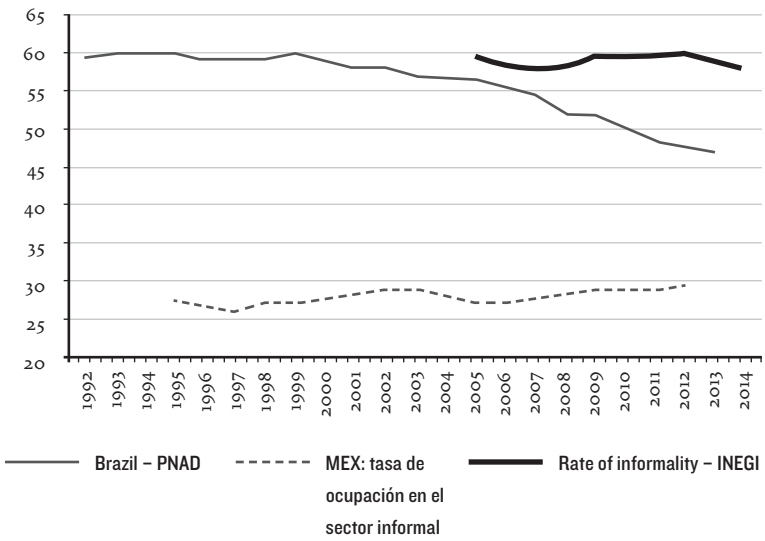
This data confirms that Mexico has a higher informality rate than Brazil. Moreover, the impression arising from both the earlier restrictive definition and the more recent ILO compliant definition is that informality in Mexico remained roughly constant throughout the period. This is in contrast to Brazil, where the informality rate declined substantially: from 60% of total employment in 1999 to 47% in 2013. This is only in part due to a higher GDP growth rate. Other factors, such as enhanced labor law enforcement and rising credit availability for formal firms and employees also seem to have contributed to reduce informality.

6 CONCLUSIONS

It has become a cliché for economists to paraphrase Tolstoy's *Anna Karenina*'s first paragraph that all happy families are alike; each unhappy family is unhappy in its own way. But the quotation agrees well with Brazil's and Mexico's experiences since the early 1980s. This is not true from a macro perspective, as GDP growth rates and capital accumulation sink nearly synchronically in both countries. They experienced a similar lost decade in the 1980s, and introduced liberalizing economic reforms in the 1990s. The rise of China made their economic fortunes differ in the first decade of the century. Af-

GRAPH 13

Labor informality rates, Brazil and Mexico, selected years (%)



Source: IBGE (PNAD), INEGI and Ros (2013).

09_Bacha_105_p150a181.indd 176 7/18/16 4:32 PM

ter the Great Recession they both are finding it difficult to resume growth. Despite these macro similarities, when we analyze the evolution of their respective economic structures we find that Brazil and Mexico have become unhappy each in its own way.

We identified in both countries contractions in capital accumulation that were both deep and lasting and were closely associated to the GDP growth collapses that started in the early 1980s. The slumps in capital accumulation were not, however, associated with declines in savings rates, as these increased after 1980. The culprits for the disaster were substantial increases in the capital-output ratio in Mexico and in the relative price of investment in Brazil. They coincided with the debt crisis of the early 1980s and the subsequent policy responses to it: inefficient capital goods import substitution in Brazil, informality-inducing social policies in Mexico.

We next drew attention to the evolution of aggregate output per worker as explained by capital deepening and total factor productivity (TFP). Our data showed the extraordinary loss of dynamism of the two economies after the early 1980s. Between 1950-1980/81 and 1981/82-2014, the yearly growth of output per worker fell from 4.2% to 0.4% in Brazil and from 3.4% to -0.2% in Mexico. Contractions in the growth rates of capital per worker and of TFP divide the responsibility for this collapse, with the former being relatively more important in Brazil and the latter in Mexico.

The story in the more recent 2011-2014 period was different. Growth of output per worker was equally mediocre in the two countries, but in Brazil capital accumulation recovered while TFP growth sank. In Mexico, on the contrary, capital accumulation dropped while TFP growth improved. The speculation is that, more recently, Mexico may be dealing with more success than in the past with the structural sources of its traditional low productivity, but seems unable to deal with a low propensity to invest. Meanwhile, in Brazil the end of the commodity boom and government mismanagement seems to have led TFP growth to become negative, even as capital accumulation at least temporarily recovered from the very low levels prevailing since the 1980s.

An econometric exercise suggested that the yearly changes in TFP in the 1981-2014 period could at least partially be explained by changes in the output gap and in the terms of trade.

The partial conclusion was that there are basic macroeconomic similarities in these countries' post-1980 experiences: because of policy failures or structural changes, Brazil and Mexico were unable to undo the increases in the relative price of investment and in the capital intensity of production experienced since the early 1980s. They were also unable to raise their savings rates suf-

09_Bacha_105_p150a181.indd 177 7/18/16 4:32 PM

ficiently high to compensate for such investment-depressing factors. The result was that investment contracted and growth lost strength after the 1980s.

Next we explored five disaggregated dimensions of the evolution of labor productivity in the two countries. The dimensions were: geopolitical units, economic sectors, tradability, firm size, and informality.

In the regional dimension, we observed a tendency for income inequality to increase in Mexico and to decrease in Brazil since the early 1990s. The speculation is that manufacturing activity blossomed in Northern Mexico, well integrated to the US but with few linkages to the rest of the country. In Brazil, on the contrary, manufacturing activity, which is highly concentrated in the country's richer state, lost dynamism. Meanwhile, agriculture and mining, which are better disseminated regionally, gained traction with the commodity supercycle. Additionally, cash transfers and minimum wage policies were more effective at income redistribution than in Mexico.

We considered next the evolution of labor productivity in ten economic sectors that cover the whole economy. The conclusion was that the heterogeneity of labor productivity at the sectorial level became more pronounced in both countries accompanying the slump in GDP growth rates after 1980. From a sectorial perspective — basically because of the oil sector — Mexico is structurally more heterogeneous than Brazil, but the difference between the two countries seems to have decreased recently.

Subsequently, we used a more disaggregated dataset to investigate in more detail the behavior of labor productivity in the traded and non-traded sectors in the 1989-2009 period. This dataset confirmed the tendency for sectorial productivity convergence in Brazil. In Mexico the trend was one of divergence, with the non-traded sector lagging well behind the traded sector. This result is consistent with the view that in Mexico the traded sector is very dynamic but this dynamism does not spread to the non-traded sector. Meanwhile, in Brazil the traded sector struggles to reach the productivity level of the non-traded sector.

The next exercise was a comparison of the evolution of labor productivity according to firm size. The picture that emerged for Mexico was clear: the biggest firms displayed a much higher productivity growth than smaller firms — the productivities of the smallest of which, trifling as they are, fell in the 1998-2008 period. The implication is that Mexico's low productivity growth problem resides squarely with its small and medium sized firms, a large number of which are informal. For Brazil, the picture was very different: the productivity growth rates of small and medium-sized firms in the manufacturing sector were

09_Bacha_105_p150a181.indd 178 7/18/16 4:32 PM

either similar to or higher than those of the largest firms — but they were all very low.

Finally, we confirmed that Mexico has more informality than Brazil in spite of its higher per capita income. Moreover, the impression is that informality in Mexico remained roughly constant since the mid-1990s. This is in contrast to Brazil, where the informality rate declined from 60% of total employment in 1999 to 47% in 2013.

We concluded that there are relevant "mesoeconomic" differences in these countries' recent slow-growth experiences. Mexico opened up its economy to trade with the outside world and thus succeeded in developing a first-class industrial sector in the country's richer Northern region. A similar domestic integration did not accompany this external integration. The dynamism of the large exporting firms in the North did not feed back to the non-traded, informal, small and medium-sized firms in the country's poorer Southern regions. Since the latter generate most of the country's jobs and also a substantial part of its output, the consequence was a very low aggregate labor productivity growth rate.

Thus, the disparity between "modern" and "traditional" sectors seems to have widened in Mexico. In Brazil, in several dimensions this dualism decreased: the poorer North grew faster than the richer South; the lower-productivity agriculture did better than the higher-productivity industry; bigger manufacturing firms did not outflank medium and small firms; informality decreased in the last decade. Brazil's problem seems to have been that in contrast to Mexico's its high-productivity large manufacturing firms did not integrate into the world economy and thus their productivity growth stagnated. This provided a weak lever to move the rest of the economy up. Therefore, the country lingered on in a low overall productivity path, except when the commodity lottery dictated otherwise.

Our survey remained incomplete because we did not discuss many issues that are present in the debate on the reasons for the near stagnation of Brazil and Mexico: lack of government investment in infrastructure; insufficient investment in human capital; distorting tax burdens; failed competition policies; labor market rigidities; poor governance and rule of law; overvalued real exchange rates; inadequate composition of foreign trade; deindustrialization; lack of bank credit to the private sector; and high real interest rates.

Pending a further analysis of these issues, the bottom line of our investigation is that overcoming the so-called middle-income trap seems to require both domestic and foreign economic integration. Brazil's and Mexico's growth collapses show that achieving them at the same time is not an easy task for big middle-income countries.

09_Bacha_105_p150a181.indd 179 7/18/16 4:32 PM

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NOVOS ESTUDOS
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