Growth and business cycle in Argentina. A long-run approach, 1870–2015

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Abstract

Purpose – The purpose of this study is to focus deeply on the short term to explain the relative long-term evolution of the Argentinian economy in the long and the short term.

Design/methodology/approach – The study of the long-term evolution of the Argentine economy and identifying the moment in which it began to lose ground compared to other developed economies, such as Australia and Canada, constitutes the central axis of the historiography of this country. However, an additional problem presented by the Argentine economy is its high volatility. For this reason, the long term should be influenced by the short term, an issue that requires a more detailed study of the cyclical behavior and a deep analysis of the relationship between the long and the short term.

Findings – The results obtained point to a cyclical development that influences the long-term evolution and, therefore, explains Argentina's convergence process with Australia and Canada. Frequent deep busts and short booms characterize the Argentine cycle, offsetting its long-term growth potential.

Originality/value – Although the long term has been profusely studied in Argentina, the short term has not been analyzed to the same extent, which is surprising given the extreme volatility of this economy (Prebisch, 1950). The studies performed on economic cycles have always been partial, disconnected from the long term and carried out without much technical rigor.

Keywords Business cycle, Argentina

Paper type Research paper

1. Introduction

The study of the long-term evolution of the Argentine economy and identifying the moment in which it started diverging from other developed economies constitutes the central axis of the historiography of this country. Comparisons have traditionally been made with Australia and Canada, territories of new settlements which shared similar economic characteristics with Argentina at the end of the 19th century.

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An analysis of the relative behavior in terms of GDP per capita shows a particular development of Argentina with these other two economies until the middle of the 20th century. As we can see in Figure 1, this process was very fast after 1870 but was followed by a smoother catching-up process after the end of the 19th century. During the first part of the 20th century, the Argentine economy kept pace with the other economies and, although it never managed to reach Australian levels, it surpassed the Canadian levels at times. In the second part of the 20th century, the catching-up process lost strength year to year, to the extent that there was a clear distancing between Argentina and these other economies after 1974.

It should be noted, however, that these long-term trends were accompanied by a peculiar cyclical component, given the high volatility of the Argentine economy, a characteristic shared with other countries in Latin America [1]. For Argentina, this was highlighted in the work of Prebisch (1950) in which he tried to find an explanation for the high fluctuations of Argentine economic cycles. His interest in the study of the short term was not in the cyclical behavior of this economy, considered inevitable and a "natural" economic phenomenon, but in the frequent and severe fluctuations experienced by Argentina during the 19th and 20th centuries attributable, according to this author, to external and monetary factors. Prebisch argued that the intensity of the phases of recession was dependent on the excesses derived from the expansive phases.

However, the problem that arises from the Prebisch's study is that, although it covers a broad phase beginning in 1820, it ends in 1944 when the short-run fluctuations of the Argentine economy continued to be a defining feature, while the economy was entering step by step into a phase of relative divergence. Intuition would tell us, therefore, that the long term could be influenced by the short term, a fact that would require a more detailed study of the cyclical behavior, something not yet done in the case of Argentina nor in any depth at the theoretical or empirical level within the macroeconomy field. How has the cyclical pattern been able to influence the relative evolution in the long run in Argentina? Are the peculiarities of its cyclical component responsible for the long-term behavior observed in this economy? Is the Argentine economy different in this sense from the economies of Australia and Canada?

The objective of this paper is not to find the reasons and the underlying factors that explain the cyclical component of these countries. It only tries to answer the above-
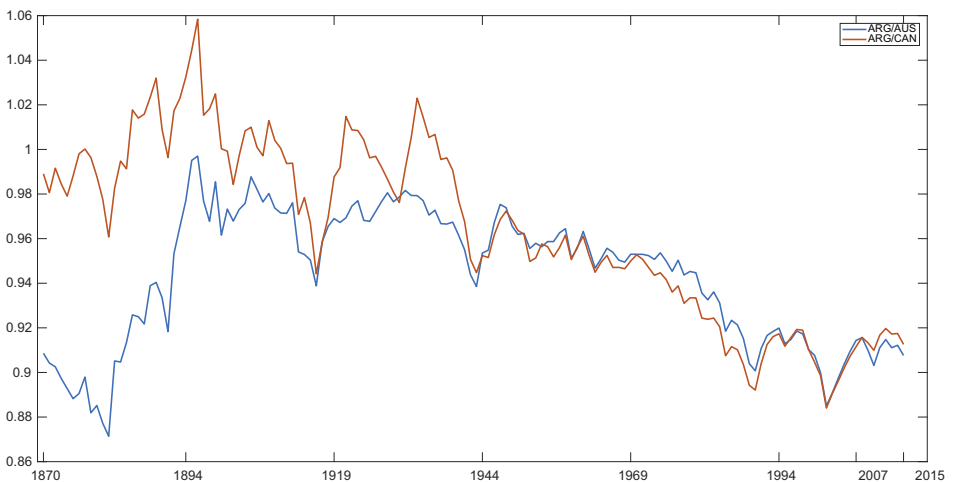

Figure 1.
Relative log real GDP per capita

mentioned questions. To do so, first we contrast the connection between the long-run performance and the short term for Argentina, Australia and Canada. Second, we compute the chronology of the business cycles for the three countries and analyze their characteristics with traditional and more recent and specific measures, calculated for expansions. The outcomes obtained confirm that there is a history of absolute and relative decay in the long run in the Argentinian economy that has a clear correspondence with the cyclical behavior exhibited by this country.

2. Argentine economy in the long run

The Argentine economy grew at very high rates during the Belle Epoque, a period between the mid-1850s and extending to the outbreak of the Great War. This glorious phase, which scholars attribute to the internationalization of the economy and the export boom, was followed by a period of lower growth once the isolation of the economy began. The implementation of inwards substitution industrialization policies after the Great Depression and their reinforcement during the period of Peronism enhanced this isolation. During the 1970s, coinciding with the international oil crisis, and the crisis of the 1980s which affected Latin American countries, especially Argentina, the economy began to show negative growth rates while entering a period of decreasing growth [2].

However, the growth in the first phase was intense in per capita terms, so much so that the economy was compared to other settled territories that shared with Argentina a series of economic characteristics. For this reason, the debate on the growth and convergence of the Argentine economy has attracted the attention of economics and history scholars. In fact, there are two closely related debates that constitute the central point in Argentine historiography. The first is about when Argentina's export-led growth came to an end. According to Di Tella and Zymelman (1967), Corés Conde (1997) and Taylor (1994), the end of this expansive phase occurred in 1913 as a consequence of the First World War, whereas Díaz Alejandro (1983) and Ferrer (1996) argue that 1929 is a more appropriate date. After reviewing both streams of thought, Sanz-Villarroya (2004) found that 1913 marked the first structural break in the economy which represented the end of the high-growth phase, contradicting, therefore, those who propose 1929 as a key date. According to Sanz-Villarroya's results, after 1913, the Argentine economy entered into a lower growth trend that would last until 1974 because although a significant change is found in 1929, this is only a change in the level of the GDP per capita. From 1974 on, the growth tendency of this economy was negative [3].

The other important debate concentrates on determining at what point in time Argentina started diverging from other developed countries. In this debate, comparisons have traditionally been made with Australia and Canada, two new settlement economies that, at the end of the 19th century, shared a similar situation with Argentina in terms of size, natural resources, production factors and income levels. According to Taylor (1994), the relative decline of the Argentine economy took place in 1913, coinciding with the end of its expansive phase. In a revisionist paper, Sanz-Villarroya (2005) analyzed the evolution of the relative series of GDP per capita of Argentina, Australia and Canada starting in 1875, noting a rapid catching-up between Argentina and the other two economies until the end of the 19th century. It then began to lose force from that moment on until a process of divergence emerged after 1974. Corés Conde (1997), however, argues that at some point around the middle of the 20th century, Argentina started falling behind Australia, the USA, Great Britain and Italy, a gap that has continued to widen as we approach the present day.

Figure 1 shows the relative evolution of Argentina with Australia and Canada. The positions of the aforementioned authors are observed, especially the very different relative

behavior after 1945. Around that date, Argentina ceased to exceed the levels of GDP per capita of Canada and its relative position with both Australia and Canada began to widen, so much so that in the 1970s, a clear process of distancing can be observed [4].

What occurred from the middle of the 20th century onwards that can explain this relative behavior? The historiography focuses on highlighting the role that applied economic policies played in explaining the long-term evolution of the Argentine economy. Obviously the issues of growth and convergence are long-term concerns, but we might ask whether short-term behavior has had something to do with the long-term dimension given that some economic policies have greater effects in the short term, affecting the cycle.

Although the long term has been profusely studied in Argentina, its short-term evolution has not been analyzed to the same extent, which is surprising given the extreme volatility of this economy (Prebisch, 1950). The studies performed on economic cycles have always been partial, disconnected from the long term and carried out without much technical rigor. Díaz Alejandro (1983), Di Tella and Zymelman (1967), Ferrer (1996) and Corés Conde (1997) present a traditional cycle analysis in which attempts are made to study the causes of cyclical movements. These studies are not based on precise econometric techniques such as those used in Sanz-Villarroya (2006) and Sturzenegger and Moya (2003), but even in these two analyses, the short and long term remain unrelated in this country.

This disconnection is common in the literature where business-cycle theory and growth theory have traditionally been treated as uncorrelated areas of macroeconomics (Ramey and Ramey, 1995). It would be desirable to investigate this link to explain the above-mentioned relative evolution of Argentina vs Australia and Canada. Perhaps the volatility and the cyclical characteristics of this economy explain much of what happened in the long run. Whereas little attention has been paid to the effect of business-cycle volatility on growth, as said before, there are some works in which this relationship has been studied that can help us to link both dimensions, the long and the short run. For example, Nelson and Plosser (1982), Kyndland and Prescott (1982) and De Long and Plosser (1983) offer models to analyze economic fluctuations wintegrate growth and business cycles theories. King et al. (1988) incorporate endogenous growth in a real business-cycle model showing that temporary shocks can generate permanent effects on the growth trend of output. These effects are usually negative, as Ramey and Ramey (1995) confirm in a seminal paper using an empirical cross-section analysis. They demonstrate a strong negative link between volatility and growth, as do Fatás (2002), Acemoglu et al. (2003) and Hnatkovska and Loayza (2005), among others. All these authors agree that macroeconomic volatility is a fundamental concern for developing countries and they highlight Argentina as one of the most volatile countries.

In another sense, there are some works that make connections between the long and the short term. For example, Broadberry and Wallis (2017), using annual data from the 13th century to the present for 14 European countries, show that the improved long-run economic performance has occurred through a decline in the rate and frequency of shrinking, rather than through an increase in the rate of growing. Easterly et al. (1993) demonstrated for a sample of 100 countries during the decades of the 1960s, 1970s and 1980s, the low persistence of growth rates, because of the fact that shocks in the short run play a large role in explaining variance in growth, so they are important in determining long-run growth. Pritchett (2000) remarks that a single time trend does not adequately characterize the evolution of GDP per capita, especially in developing countries because their volatility is much greater than in industrial countries. A rapid growth process in developing countries is followed by stagnation. To demonstrate this hypothesis, Pritchett (2000) used the Penn World Table 5.6 database which includes a huge sample of countries, 113, for a very long period starting in 1960.

Although the above-mentioned works are very useful for helping us to answer our questions, all of them consider cross-section data. However, we need to use time series data because we want to analyze the case of only three countries: Argentina, Australia and Canada. For this reason, and recognizing the above-mentioned ideas that highlight characteristics of the short run such as shocks, volatility and persistence, we use the work of Harding and Pagan (2002) to link the long and the short run.

Harding and Pagan (2002) state that "trend and cycle are inextricably entwine" and design a methodology able "to dissect cycles in terms of the contributions made by trend growth, volatility, serial correlation, and nonlinear effects." Furthermore, they propose a set of measures to dissect business cycle characteristics. This framework is useful for identifying differences in the nature of the forces that account for the cycles and the observed evolution over time of GDP per capita in Argentina, Australia and Canada. These authors define the cycle as a pattern in the level of aggregate economic activity and propose a model in which they relate the short and the long term starting from the following equation:

$$\Delta y_t = \mu_y + \sigma_\varepsilon \varepsilon_t \tag{1}$$

where μ_y represents the mean growth in the long run and σ_ε represents the volatility of all the period.

The business cycle characteristics deriving from dating algorithms are a function of these parameters, the $-\mu_y/\sigma_\varepsilon$ ratio being crucial because there is an exact mapping with the duration of the cycle, such as $Pr(\Delta y_t < 0) = Pr[\varepsilon < -\mu_y/\sigma_\varepsilon]$. Therefore, the combination of both parameters determines the intensity and duration of expansions and recessions. This model can be extended introducing serial correlation, a habitual feature of GDP growth and what may play a role in explaining cycle length:

$$\Delta y_t = \mu_y(1 - \rho) + \rho \Delta y_{t-1} + \sigma_\varepsilon \varepsilon_t \tag{2}$$

where the parameter ρ captures the persistence of the process and the presence of positive serial correlation in the long-run growth rate yields longer cycles because it increases the probability of getting two consecutive positive or negative rates, reducing the number of turning points.

If we analyze Table 1, which displays resulting parameter estimates for this model across the three countries in different periods of their histories, we see that the μ_y/σ_ε ratio

	μ_y	ρ	σ_ϵ	μ_y/σ_ϵ
Argentina				
1870–1945	1.51	−0.07	7.56	0.20
1946–2015	1.15	0.14	5.16	0.22
1870–2015	1.34	0.00	6.44	0.20
Australia				
1870–1945	1.00	−0.01	5.32	0.19
1946–2015	1.98	0.33	1.72	1.15
1870–2015	1.45	0.05	4.00	0.36
Canada				
1870–1945	1.86	0.25	6.43	0.29
1946–2015	1.84	0.33	2.28	0.81
1870–2015	1.84	0.26	4.81	0.38

Table 1.
Moments of growth
rates

has been lower in Argentina than in Australia and Canada during the entire period covered by our analysis. This is a consequence of both a lower growth rate μ_y and higher volatility σ. In addition, we verify that the growth in Argentina has less persistence, as evidenced by the outcomes estimated for the parameter ρ. That is, the GDP per capita series for Argentina has less memory indicating that what happens in one year has less to do with what happened in the past, something expected in a country with a higher volatility. By periods, we see that during 1870–1945, this ratio in Argentina is similar to that in the other two economies. However, after 1945, we see that in the case of Argentina both the ratio and the persistence are much lower, indicating that the behavior of this economy is different in this second period. In this phase, the Argentine economy presents a lower growth rate, higher volatility and a lower degree of autocorrelation, that is, a lower persistence too. The measure for volatility is lower in this second period than that of the previous period but it is almost double than that of Australia and Canada.

What these results make clear is that the dynamics of the short term, measured by volatility and persistence, is an intrinsic part of the long term so we can deduce that the latter is affected by the former. We can also notice in this relationship a different pattern before and after 1945 in the three countries, at which time Argentina begins to lose its position with respect to Australia and Canada, as shown in Figure 1. Moreover, these outcomes lead us to focus on the analysis of the short term and ask ourselves: What can the study of the short term teach us in the case of the Argentine economy? Was the trend of this economy conditioned by its cyclical component? That is, have the cyclical characteristics of this economy been able to influence its long-term evolution and therefore its relative position? Are there differences between the cyclical components in these three countries that could explain the relative evolution of Argentina?

The answer to these questions is an issue that has not yet been addressed in the historiography of Argentina, at least from the following approach presented below. However, to find the relationship between the short and the long run is a crucial point of study for any economy and, obviously, is fundamental for those who make economic policy because the short-term effects on the cycle may affect the way to achieve wealth and growth in the long run. It is also crucial to have an exact knowledge of the path and nature of recoveries as this undoubtedly affects long-term activity, especially in the case of a volatile economy such as Argentina. If the expansion is rapid, the effect of the recession could be transitory, and the economy would be able to continue its long-term growth trend. In contrast, a slow recovery could have permanent negative effects on the economy and affect its long- term evolution.

The analysis presented in this article tries to see if this hypothesis is confirmed in the Argentine cycles obtained, to study both expansions and recessions and thus be able to establish a relationship between the short and the long term. To this end, additional measures are proposed to supplement those used in traditional cycle analysis, which is the main contribution of the paper. The objective is to carry out an exhaustive analysis of the expansions of the cycles obtained because, as we will see later, the biggest difference observed in the cyclical pattern lies in the behavior of recoveries, which marks the difference with Broadberry and Wallis' (2017) work where the shrinking is the key.

2.1 Methodology
The first step in analyzing business cycle characteristics is to date the cycle as accurately as possible. This involves pinpointing the turning points of an aggregated macroeconomic series, the GDP per capita in our case. Having defined the series of reference, we identify turning points with the non-parametric framework of Bry and Boschan (1971), which

basically consists of locating local maxima (peaks) and minima (troughs), while imposing a set of filters and restrictions [5]. Note that annual data is not the most suitable for analyzing the business cycle, but the long-run approach adopted in this paper conditions the frequency of the data. Figures 2–4 display the results of the business cycle identification for Argentina, Australia and Canada, respectively. A glance at these figures shows that the high volatility of the Argentine GDP per capita is associated with a frequent succession of peaks and troughs that mark very volatile expansions and recessions. This behavior is especially marked after the Second World War when the volatility of the business cycle in Australia
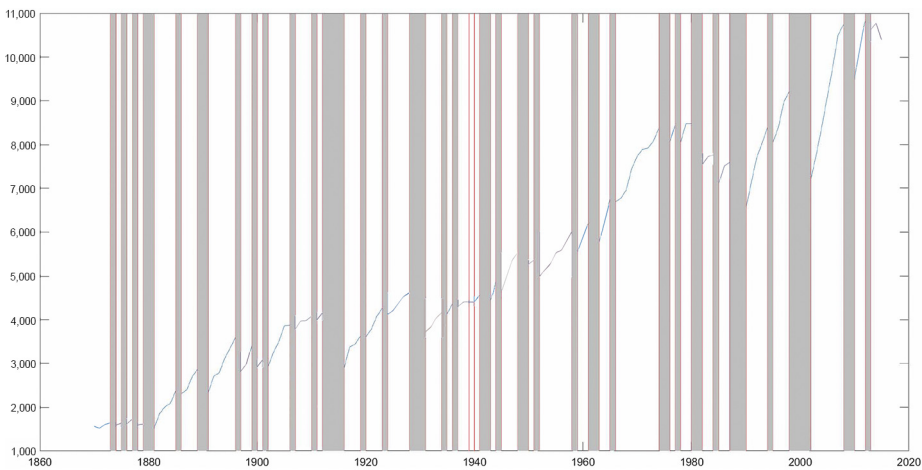

Note: The shaded areas represent the periods when the economy is in recession
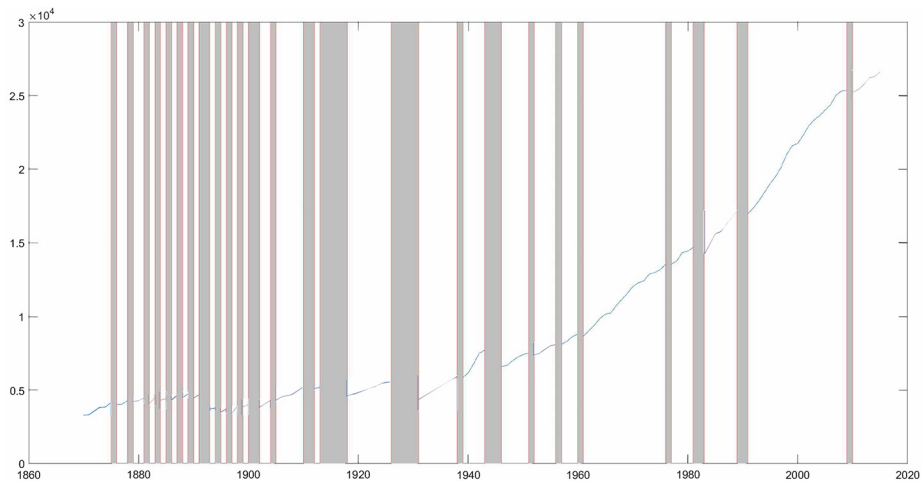
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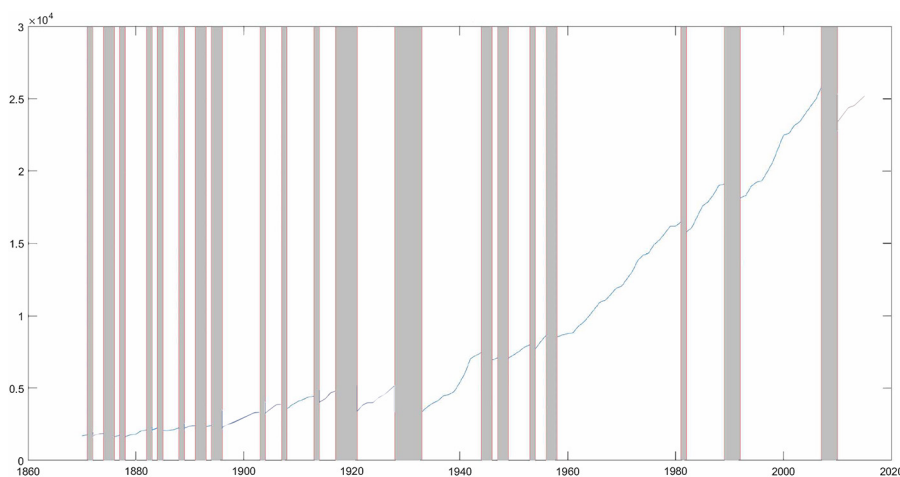
Figure 4.
Business cycle
(Canada)

Note: The shaded areas represent the periods when the economy is in recession

and Canada decreases dramatically, following the common path of other developed countries (Figures 3 and 4). These two countries carried out not only institutional reforms, as Broadberry and Wallis (2017) point out, but also implemented policies with the short-term aim of controlling the evolution of economic cycles and macroeconomic imbalances associated with such evolution. In Argentina, the opposite occurred. The inward substitution industrialization policies were reinforced and the isolation of the economy was evident. These policies, far from solving the problems in the short term, exacerbated them [see, for example, Sanz-Villarroya (2009), Prados de la Escosura and Sanz-Villarroya (2009) and Gerchunoff and Fajgelbaum (2018)]. However, finding the ultimate causes that explain the behavior in the short and the long run of these economies lies outside the scope of this paper which only intends to analyze how the cyclical characteristics could influence the long-term evolution. The former would be the subject of future research.

The differential behavior of Argentina before and after the Second World War is not only manifested in the greater frequency of recessions but also in their intensity. As can be seen in the second column of Table 2, the fall in recessions is very similar in the three countries during the first period. However, in the second, while in Australia and Canada, the intensity of recessions is reduced dramatically, the same does not happen in Argentina where they remain almost at the same level. On the contrary, expansions continue to be very dynamic in Argentina while in Australia and Canada they slow down. These results lead us to analyze both expansions and recessions more deeply.

For that, once the turning points have been located, we examine the business cycle and calculate some outcomes such as the frequency of recessions, measured as the number of periods in recession over the total, and compute the measures proposed by Harding and Pagan (2002), *duration*, *amplitude*, *cumulation* and *excess*, which are explained in the next section.

2.1.1 Traditional business cycle measures. Harding and Pagan (2002) dissect the business cycle phases and suggest four measures. These are *duration*, *amplitude, cumulation* and *excess*. A graphical representation of the cyclical phase as a triangle, where the height is the *amplitude* and the base is the *duration*, facilitates the analysis of the cyclical phase. The area

|	Prob. recession	Mean growth	Duration (years)	Amplitude (%)	Cumulation (%)	Excess (%)
Argentina						
1870–1945	0.39	1.31				
Recession		−5.66	1.38	−7.81	−7.47	−0.71
Expansion		5.93	2.33	13.83	24.69	2.40
1946–2015	0.34					
Recession		−4.76	1.71	−8.25	−10.11	0.85
Expansion		4.44	3.07	12.76	30.91	2.92
1870–2015	0.37					
Recession		−5.29	1.51	−8.00	−8.53	0.09
Expansion		5.19	2.63	13.40	27.18	2.61
Australia						
1870–1945	0.39	1.45				
Recession		−4.12	1.72	−7.13	−10.36	1.08
Expansion		4.41	2.50	11.03	22.33	0.32
1946–2015	0.14					
Recession		−1.02	1.29	−1.09	−0.89	0.04
Expansion		2.48	7.50	18.41	120.37	14.65
1870–2015	0.27					
Recession		−3.29	1.60	−5.44	−7.70	0.79
Expansion		3.31	4.04	13.30	52.50	4.73
Canada						
1870–1945	0.32	1.86				
Recession		−5.85	1.79	−10.23	−17.85	1.79
Expansion		5.57	3.64	20.29	68.80	3.61
1946–2015	0.19					
Recession		−1.85	2.00	−4.09	−4.90	0.23
Expansion		2.72	8.14	21.95	167.34	4.01
1870–2015	0.19					
Recession		−4.38	1.85	−8.39	−13.97	1.32
Expansion		4.08	5.14	20.85	101.65	3.74

Table 2.
Characteristics of
business cycle

of the triangle is an approximation to the accumulated gains or losses in output from trough to peak and peak to trough, respectively. In these calculations, we have used logs of the series to obtain more representative figures, such as growth rates. The scheme in Figure 5 represents the definition of the different measures and their relationship with long-term growth.

Duration computes the number of periods (years) that the country is in recession or expansion. *Amplitude*, expressed in percentages, shows the gains or losses in GDP per capita as a result of expansions or recessions. *Cumulation* is a measure used to identify the cumulated gain or loss, calculated as the sum of the *amplitude*s for each period of the phase. This is very useful as it can be interpreted as the gain or loss in wealth in the economy, and sums up the previous measures by combining *duration*, *amplitude* and the shape of the business cycle. However, it is normally calculated by the triangle approximation and differs from the actual *cumulation*, which requires computing the integral, because the path through the phase may not be well estimated by a triangle. The difference between the actual shape and its triangle approximation is known as *excess*. This measure calculated for expansions has a great importance in the long-run growth.

A positive *excess* (concave path) means that the recovery starts with a high growth rate and goes on slowly, whereas a negative *excess* (convex path) is produced when the opposite

How economies grow?

Figure 5.
Scheme of long-term
growth and cycles
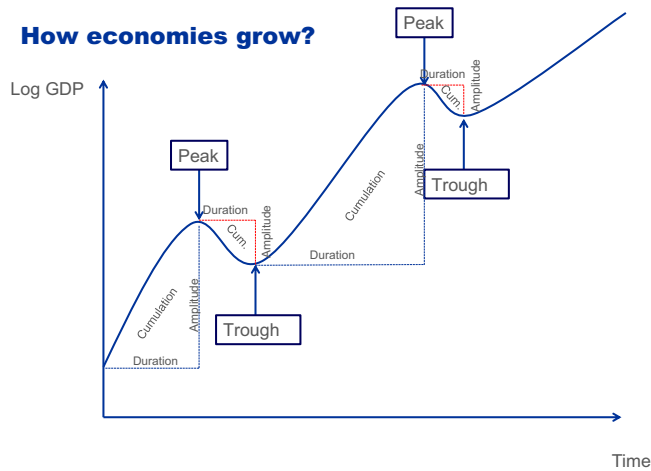
happens. Finally, if the growth is uniform in all the period, the *excess* is zero. During recessions, a positive *excess* (concave path) means gradual changes at the beginning of the phase that become sharp at the end. In contrast, a negative *excess* (convex path) reflects an intense fall at the beginning of the recession.

Excess would be a good measure to characterize the shape of expansions if they had a clear concave, convex or linear form but, in practice, the cyclical phases are not always so stylized and this measure is not completely accurate.

2.1.2 Recovery measures. To solve the difficulty of capturing the cycles depicted by the data, Gadea *et al.* (2017) propose a set of indicators that identify the evolution of the pattern of the expansions more comprehensively. If a recovery is quick (a V-shaped recovery), the effect of the recession is transitory and the economy continues its long-run growth trend. However, if the improvement occurs slowly, it may have permanent effects on the economy (an L-shaped recovery). Specifically, they propose four types of measures: the first captures the evolution over time of the shape of expansion, the second captures the early stages of expansions, the third focuses on the middle of the expansionary path and the fourth shows the long-run consequences of the recoveries for future economic growth. All of them express the speed of recoveries:

(1) *Time varying measures* analyze the path of the expansion in each moment of its *duration* and have a graphic representation. These measures are *pointwise excess* that computes the excess at each point in time and *acceleration of excesses* defined as the difference of *pointwise excess* between two consecutive periods.

(2) *Early stages measures* give information about the behavior at the beginning of the expansionary phase. We propose two measures in this sense. The first one is *early shape*, which is defined as the number of consecutive positive excesses at the beginning of the expansion or minus the number of consecutive negative excesses at the beginning of the expansion, in relation to the total *duration* of the expansion. The second additional measure is *inshape* that computes the number of consecutive periods with excess positive and increment of excess positive or minus the number of consecutive periods with excess negative and increment of excess negative. This measure captures changes in the shape, from concave to convex or from convex to concave [6].

(3) *Middle of expansion measures* provide information about the expansion in the middle of its path. This includes *half life* defined as the number of periods τ needed to obtain half of the *cumulation*, relative to the total *duration*. A value of $\frac{1}{\sqrt{2}}$, (≈ 0.70) is equivalent to a triangular path. A higher value means that it has taken longer to recover the total area, while a smaller value corresponds to fast expansions. It also includes *medium area*, which is the area obtained in the middle of the *duration* of the expansion in relation to the hypothetical triangle. We normalize the measure so that a value of 1 is equivalent to a linear path, and a value below (above) 1 means a growth slower (quicker) than linear.

(4) *Long-run trend measures* comprise *welfare* that calculates the number of periods to recover the level of GDP per capita previous to the recession in relation to the total *duration* of the expansion. Notice that this measure takes into account the depth of the recession.

To help understand these measurements, we use the scheme in Figure 6, in which a complete expansion from the trough T to the peak P is represented. In that figure, the X-axis displays the time (years in this case) and the Y-axis displays a function of time, $f(t)$, which corresponds to the logarithm of GDP. Representing by τ the point of the expansion where we are located, we can analyze its evolution from the beginning of the recovery until its end. The form of this recovery is related to the deviations in relation to linear growth, the measure that Harding and Pagan globally call *excess*.

3. Results

### 3.1 Cyclical characteristics of the Argentine economy: a comparative analysis

If we focus our attention on the information contained in Table 2, we notice that the probability of entering into a recession is higher in Argentina, especially after 1945 (0.34 vs 0.14 and 0.19 for Australia and Canada, respectively), which is consistent with the results presented in Table 1. From this information, we can say that a more volatile and less persistent economy would be expected to present a more changeable cyclical pattern and, therefore, be more likely to enter into recession.

The cyclical characteristics and the information collected in Table 2 show that the expansions are much shorter in Argentina during the entire period (*duration* is 2.63 in Argentina, 4.04 in Australia and 5.14 in Canada). By periods, we can see that although the expansions are somewhat shorter during 1870–1945, the difference in relation to expansions is greater in the second period between 1946 and 2015 with *duration* of 3.07 years in Argentina vs 7.50 in Australia and 8.14 in Canada. As for recessions, there are no marked differences in terms of *duration*, neither for the entire period nor by subperiods. These outcomes tell us that the greater volatility experienced by Argentina after the Second World War is partly explained by these results, which leads us to focus on the detailed study of cyclical expansions. It would seem that in Australia and Canada, the greater persistence obtained, a measure represented in Table 1, is in line with the higher *duration* of expansions in those countries.

Table 2 also shows the *amplitude* measure, which we must remember has a positive value in expansions and a negative value in recessions. This measure exhibits similar figures both in expansions and recessions before 1945 in the three countries but presents lower negative values for Argentina after 1945 in recessions (-8.25 vs -1.09 and -4.09). This table also informs us that the *amplitude* is lower in expansions (12.76 vs 18.41 and 21.95) during this second subperiod.
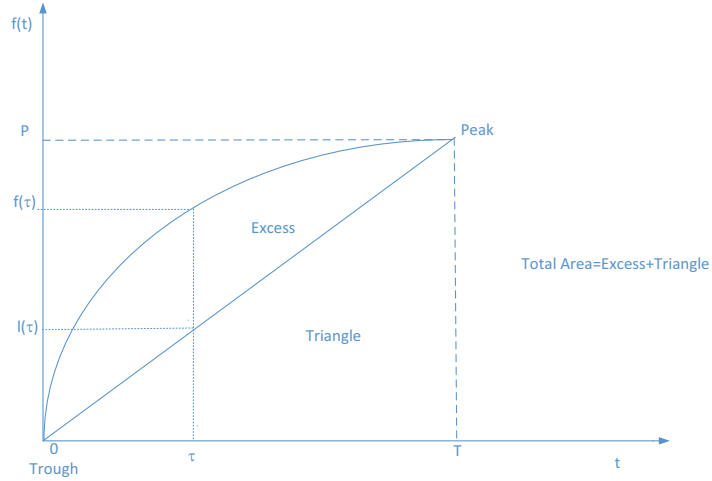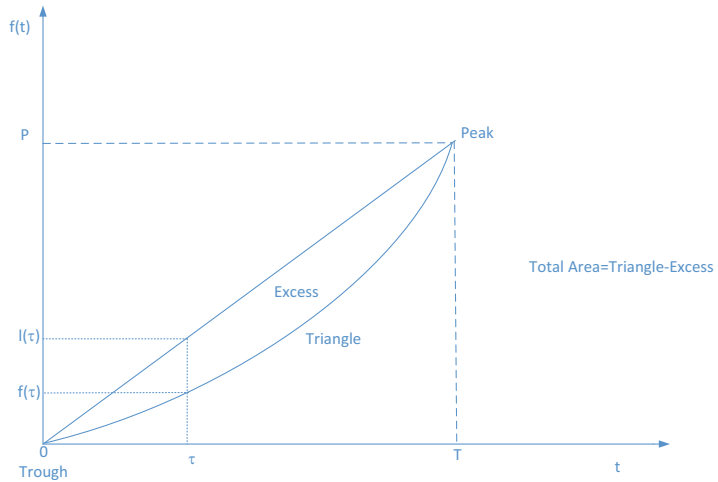
Notes: (a) Concave; (b) convex. *Duration*: $\overline{0T}$; *Amplitude*: $\overline{0P}$;
Cumulation: $\int_0^T f(t)dt$; and *Excess*: $\int_0^T f(t)dt - (\overline{0T} * \overline{0P})/2$

Figure 6.
Shape of recoveries

Therefore, by combining the two measures analyzed so far, we can say that the recessions present a similar *duration* in the second period but are more virulent in Argentina, which would also explain the greater volatility registered for this economy in that period. This is verified by shorter *duration* of the expansions.

The *cumulation*, a measure that summarizes the two previous measures, *duration* and *amplitude*, is obviously much smaller in Argentina during the second period. This is due

both to the shorter *duration* of the expansions and to the greater *amplitude* and therefore the greater intensity of the recessions, as previously mentioned.

The last measure of cyclical behavior shown in Table 2 refers to the *excess* shown by the cycles obtained and, as explained in Section 3, shows the hypothetical difference that could have occurred with a linear growth during the cyclical phase and the real GDP growth. The *excess* can be concave (defined with a positive sign) or convex (defined with a negative sign). The greater the *excess* in number (more concave), the more likely the recovery phase will reach (resume) the path of long-term growth. If we look at the values obtained for the entire period, we see that they are small in both recessions and expansions in the Argentine case. That is to say, the falls in activity are greater in this country and it shows less capacity for long-term reversal given its lower degree of concavity compared to the other two countries. Before 1945, there is even a negative *excess* in recessions in Argentina of −0.71 compared to 0.04 in Australia and 0.23 in Canada, which shows that the falls in GDP per head were more pronounced, while the expansions have a concavity superior to those of Australia and similar to those of Canada (2.40 vs 0.32 and 3.6, respectively). Again, the greatest differences are observed after 1945, where recessions and expansions show positive values, reflecting concavity both in recessions and expansions. However, the values for Argentine expansions are much lower (2.92 vs 14.65 and 4.01). This shows that the capacity for long-term reversal is lower in Argentina and confirms that the problem is present in the expansions after 1945 because recessions in Argentina are more concave after this date. It is therefore desirable to study the peculiarities of expansions in more detail. The next section describes this analysis.

3.2 Dissecting the expansions

All the previous results reveal that the expansions in Argentina have been different from those of the other two countries, especially in the second period, and this leads us to analyze them in greater detail. The measures relating to expansions described in Section 2 have been calculated. Table 3 summarizes the results for scalar measures and Figures 7–9 display the time-variant measures for Argentina, Australia and Canada, respectively [7]. A first look at the figures immediately reveals one of the main characteristics of the Argentine expansions compared to the Australian and Canadian: expansions begin with great dynamism but are quickly frustrated. The excess generated for expansions in Argentina is lower at all times. The first panel in the figures shows *pointwise excess* and, as we can see, it starts with

	Early shape	Inshape	Half-life	Medium area	Welfare
Argentina					
1870–1945	0.16	0.50	0.60	1.57	0.67
1946–2015	0.60	0.93	0.38	1.41	0.72
1870–2015	0.36	0.69	0.50	1.50	0.69
Australia					
1870–1945	0.00	0.35	0.75	1.53	0.82
1946–2015	0.09	3.50	0.50	1.11	0.32
1870–2015	−0.01	1.23	0.66	1.37	0.66
Canada					
1870–1945	0.46	1.38	0.544	1.45	0.64
1946–2015	0.15	−1.00	0.56	1.20	0.47
1870–2015	0.34	0.52	0.57	1.38	0.58

Table 3.
Measures of
recoveries by periods
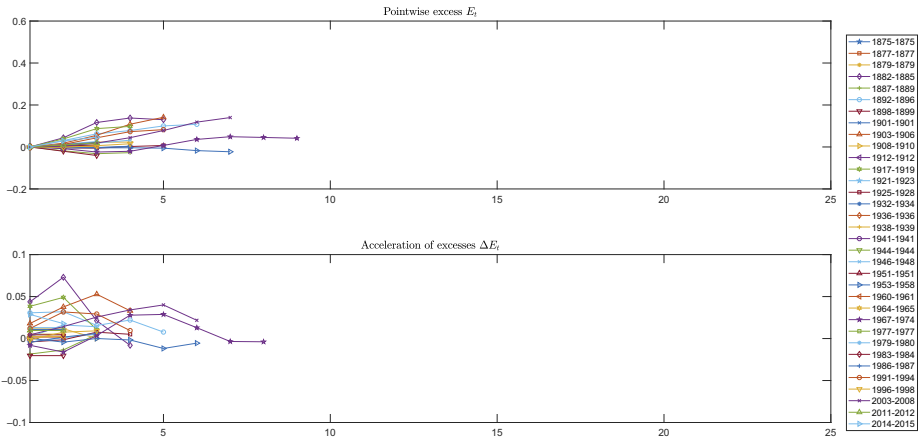
Figure 7.
Characteristics of
recoveries
(Argentina)

Notes: In both graphs, the X-axis represents the different periods of evolution of the recovery.
On the Y-axis, the upper graph displays the excess at each point and the lower graph shows the
difference of the pointwise excess between two consecutive points
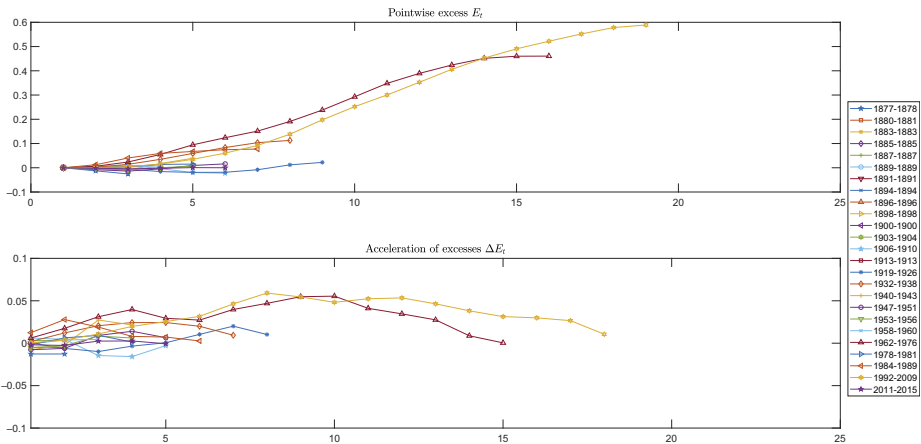
Figure 8.
Characteristics of
recoveries (Australia)

Notes: In both graphs, the X-axis represents the different periods of evolution of the recovery.
On the Y-axis, the upper graph displays the excess at each point and the lower graph shows the
difference of the pointwise excess between two consecutive points

forcefulness but, as the second panel shows, its *duration* is significantly shorter than in
Australia and Canada.

A result confirmed by the measures calculated and summarized in Table 3. The
recoveries, especially after 1945, start more vigorously in Argentina, as the *early shape*
measure shows (0.60 in Argentina vs 0.08 and 0.15 in Australia and Canada,
respectively). Recall that this measure represents the number of positive consecutive

Pointwise excess E_t

Acceleration of excesses ΔE_t

Notes: In both graphs, the X-axis represents the different periods of evolution of the recovery.
On the Y-axis, the upper graph displays the excess at each point and the lower graph shows the
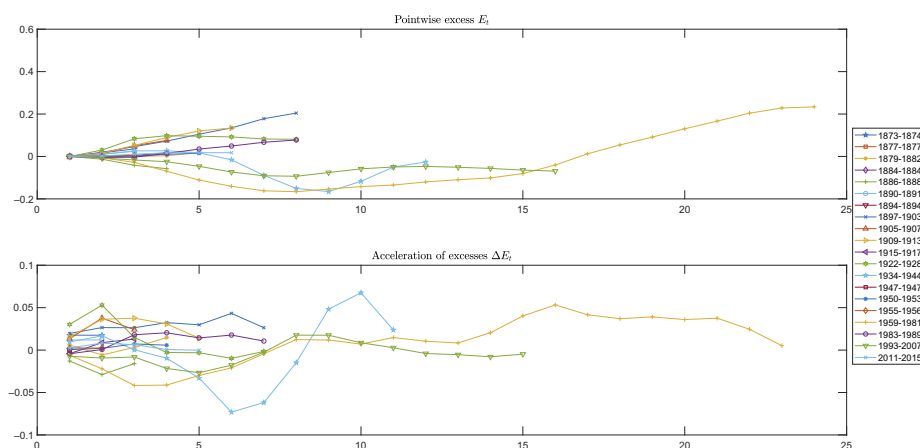difference of the pointwise excess between two consecutive points

Figure 9.
Characteristics of
recoveries (Canada)

excesses minus the number of negative excesses, being therefore a measure that
indicates how vigorous or how flat the expansions begin.

These expansions remain concave for less time in Argentina. *Inshape* shows positive
values and indicates that the expansions remain concave at the beginning of the recovery,
especially in the first period (0.5 is the value for Argentina, 0.35 for Australia and 1.38 for
Canada). The differences in the second period are especially pronounced between Argentina
and Australia (0.92 vs 3.5, respectively). That is to say, these expansions remain concave for
longer in Australia.

The *half-life* measure represents the number of periods it takes to recover half of the area
that makes up the entire expansive phase. A value greater than 0.7 indicates that the
expansions are slow as more time is needed to expand than if the growth were linear (in this
case, the measure would be 0.7). The opposite is the case when the value of this measure is
below 0.7. Except for Australia in the first period (value 0.74), the expansions are more
intense than if the growth had been linear (values below 0.7). The value is lower in
Argentina over the entire period and especially much lower after 1945. This means that the
growth in Argentina was faster at the beginning of the expansions, a fact also confirmed by
the measure *medium area*. Recall that this last measure indicates that the growth was linear
in the expansive phase if it adopts a value equal to 1. A value less than 1 would indicate
expansions with a lower growth than if it were linear, while a value greater than 1 would
indicate the opposite, that is, the growth of the expansion would be greater than that
registered if it were linear. This seems to be the case of all three countries as the calculations
are greater than one at all times. In addition, Argentina has the highest values, which
confirms the greater dynamism in the expansions mentioned above. There are no marked
differences between periods for this measure.

Finally, *Welfare* indicates the number of periods necessary to obtain the level of GDP per
head prior to the previous recession. Again, the differences between the three countries are
noticeable after 1945, a phase in which Argentina needed more time to recover in expansion

what it lost in recession (0.72 vs 0.32 and 0.46). This result is consistent with that obtained in Table 2, which indicated the greater severity of recessions after 1945 in the Argentine economy. It is also in line with the result of Table 1, which showed a lower persistence and greater volatility during that period. This produced a slowdown in the long-term growth of the Argentine economy and prevented it from continuing on the path of convergence and catching up with Australia and Canada.

In conclusion, using these measures to analyze the behavior of the expansions in detail shows that they begin vigorously, as shown by the measures of *early shape*, *half life* and *medium area*, but they vanish immediately, as indicated by the results obtained for *inshape* and *welfare*, especially after 1945. The outcomes shown in Table 2 and the parameters from equation (1) indicate that the expansions are also less durable, have less *amplitude* and are less concave in this second period. The expansions have less capacity to recover the losses caused by the previous recession in the cycles extracted after 1945. The expansions in Argentina thus begin with a certain degree of dynamism but soon fade away. This is related to the economic policies applied. While Australia and Canada continued to integrate into the world economy, benefiting from the era of post-war economic expansion and all the institutional advances that followed the signing of the Bretton Woods agreements, Argentina delved deeper into the path of isolationism initiated in 1929. The industrialization by import substitution stage began in the wake of the Great Depression but was intensified by the arrival of Peron in 1944. This involved a high level of government intervention in the economy and the disconnection of the economy from the international arena. The policies applied during the 1950s and 1960s, described as stop and go, as well as those applied after the oil crisis and the crisis of the 1980s, only served to complicate the situation of the country, placing it in a situation of permanent instability (Gerchunoff and Llach, 2003).

Nevertheless, finding the underlying factors behind the cyclical pattern obtained is not the objective of this paper. Linking the cyclical behavior with its underlying factors would be the subject of future research. This article only attempts to outline the cyclical characteristics of the Argentine economy and compare them with those of Australia and Canada. The ultimate purpose is to be able to affirm with greater certainty that the short term conditioned the long term in this country. The outcomes obtained in this analysis show a different cyclical pattern in Argentina after 1945, a subperiod in which it is more likely to enter a recession than the other two countries, and a subperiod that is more volatile and less persistent, and present a different cyclical behavior. The short term is characterized from then on by having shorter expansions and less *amplitude*, contrary to what happens with recessions. In addition, the concavity of the Argentine cycle is less, especially in expansions, which implies a lesser ability to resume the long-term trend after a recession.

All these outcomes have led us to infer that the Argentine problem after the Second World War relates to expansions. Indeed, we have verified, through all the measures carried out, that these begin with much more dynamism than in Australia and Canada, but soon fade away. They remain concave for less time than in the other two countries under comparison. It takes more time for Argentina to recover the average area that constitutes the expansionary phase and it is also verified that this country needs more time to recover in expansion the GDP per capita lost in recession.

All of the above has clearly occurred after 1945, at which time, as shown in Figure 1, Argentina begins to lose position in terms of GDP per capita with Australia and Canada. We could infer from this that the evolution in the short run could explain, definitively, the long-term evolution of this country, explaining therefore the loss of position with respect to

Australia and Canada that has been observed in Argentina since 1945. So much so that the process of catching-up ends up becoming a divergence after 1974.

These results are reinforced with a simple counterfactual exercise. We simulate economic growth series with *duration* of 150 years according to certain characteristics of the cycle. The growth rates of expansions and recessions are generated from a normal distribution whose mean and variance correspond to the real data (kurtosis and skewness are also included) and the durations are calculated from a geometric distribution whose parameter is the inverse of the real *duration*. A total of 10,000 replicates are generated for each of the assumptions and the average of that is taken. The assumptions are:

- substituting the *duration* of cyclical phases (expansions and recessions) of Argentina in all periods with those of Australia and Canada, maintaining average growth rates;
- the same as in the previous item (i) but repeating the exercise only for the post-war period; and
- substituting the mean growth in each cyclical phase (expansions and recessions) of Argentina with those of Australia and Canada but maintaining the *duration*.

The results in Table 4 show that if we substitute the *duration* of expansions and recessions for those of Australia or Canada, both for the complete phase of the analysis (1870–2015) and only for that corresponding to the post-war period, the average economic growth for Argentina would rise above that of the other two countries. However, the substitution of the growth mean in each cyclical phase for those of Australia or Canada would result in a reduction in the average of the growth rate in the long run. Therefore, these outcomes confirm that the limited *duration* of the expansions and, consequently, the inability to maintain sustained periods of growth, the dynamism and the shape of their recoveries, are the cyclical characteristic that has most negatively influenced the long-term economic growth of Argentina and, therefore, its convergence process.

	Freq. of recessions	Total mean growth	Mean growth expansions	Mean growth recessions
Real data				
Argentina	0.37	1.31	5.19	−5.24
Australia	0.27	1.45	3.31	−3.29
Canada	0.25	1.86	4.07	−4.38
With other durations (total period)				
Australia	0.31	1.91	5.20	−5.23
Canada	0.27	2.32	5.19	−5.26
With other durations (post-Second World War period)				
Australia	0.23	2.64	5.06	−5.40
Canada	0.27	2.33	5.08	−5.30
With other cycle mean growth				
Australia	0.40	0.69	3.32	−3.28
Canada	0.40	0.71	4.07	−4.37

Table 4.
Counterfactual
exercise

4. Conclusions

The evolution of the Argentinian economy compared with the economies of Australia and Canada has been extensively studied and debated from a long-term perspective. The aim of the present study is to add to this debate focusing on the short term to see how it has been able to condition the long term. To this end, the cyclical characteristics have been studied using both the traditional measures of the analysis of cycles as well as additional innovative measures that focus primarily on studying expansions.

The results obtained indicate the following for the Argentine economy:

- There is indeed a relationship between the long and the short term.
- There is a different cyclical behavior before and after 1945. Expansions last less and recessions have more *amplitude* after that date. There is concavity in both expansions and recessions but to a lesser degree in expansions in the second phase.
- All the novel measures provided in this article and those that have been carried out specifically for expansions, suggest that after 1945, they begin to be dynamic but soon fade away.

A detailed analysis of expansions shows that they start more vigorously, with greater excesses and needing less time to recover half of the expansion area. However, they have less capacity to recover the losses caused by the previous recession in the cycles extracted after 1945. These also remain concave for less time. This cyclical behavior in Argentina helps explain its relative differences with Australia and Canada and therefore could explain why the catching-up process with them lost strength after 1945. With all the measures calculated for the cyclical pattern, both the traditional and the novel, we find that there is a clear correlation between the relative behaviors in the long term with that found for the short term. We therefore submit that the short term has conditioned the relative and long-term evolution of the Argentinian economy. A counterfactual exercise reinforces these findings.

Notes

1. Bértola and Ocampo (2010).

2. Sanz-Villarroya (2004).

3. His analysis ends in 1990.

4. Sources: 1870–2009: Ferreres, O. J. (2010): Dos siglos de economía Argentina. Edición bicentenario. Codirección de Editorial el Ateneo y Fundación Norte y Sur. Buenos Aires and 2010-2015: IMF. World Economic Outlook (October 2016). Statistical Appendix.

5. The original Bry-Boschan algorithm was designed for monthly data and Harding and Pagan (2006) extended the procedure to quarterly data. Some technical details allow us to apply the method to our historical annual data.

6. For both measures, positive (negative) values correspond to expansions with positive (negative) excesses at the beginning.

7. A detailed analysis of the expansions one by one, with both traditional and specific recovery measures is presented in the Appendix.

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Appendix

Measure	Duration	Amplitude	Cumulation	Excess
1872–1873	2.00	7.66	9.20	1.54
1875–1875	1.00	3.03	1.52	0.00
1877–1877	1.00	6.76	3.38	0.00
1879–1879	1.00	1.23	0.61	0.00
1882–1885	4.00	45.02	103.04	12.99
1887–1889	3.00	21.54	29.60	−2.71
1892–1896	5.00	42.90	118.06	10.80
1898–1899	2.00	18.46	14.39	−4.07
1901–1901	1.00	5.32	2.66	0.00
1903–1906	4.00	27.96	70.06	14.14
1908–1910	3.00	7.58	13.69	2.32
1912–1912	1.00	3.93	1.97	0.00
1917–1919	3.00	22.33	43.30	9.81
1921–1923	3.00	16.66	25.17	0.18
1925–1928	4.00	11.25	23.21	0.71
1932–1934	3.00	10.88	16.67	0.35
1936–1936	1.00	5.45	2.72	0.00
1938–1939	2.00	2.25	3.31	1.05
1941–1941	1.00	3.55	1.77	0.00
1944–1944	1.00	9.14	4.57	0.00
1946–1948	3.00	17.56	29.57	3.23
1951–1951	1.00	1.70	0.85	0.00
1953–1958	6.00	18.80	54.10	−2.29
1960–1961	2.00	11.19	11.54	0.35
1964–1965	2.00	15.53	16.04	0.51
1967–1974	8.00	22.43	93.85	4.15
1977–1977	1.00	4.68	2.34	0.00
1979–1980	2.00	5.23	7.84	2.60
1983–1984	2.00	2.71	3.60	0.89
1986–1987	2.00	6.50	8.66	2.17
1991–1994	4.00	25.16	58.57	8.24
1996–1998	3.00	13.49	21.76	1.53
2003–2008	6.00	39.83	133.49	14.01
2011–2012	2.00	13.59	15.50	1.92
2014–2015	2.00	−2.18	4.65	6.83

Table A1.
Measures of
expansions
(Argentina)

Measure	Duration	Amplitude	Cumulation	Excess
1871–1875	5.00	23.45	52.06	−6.57
1877–1878	2.00	6.52	3.98	−2.54
1880–1881	2.00	5.78	4.80	−0.98
1883–1883	1.00	9.68	4.84	0.00
1885–1885	1.00	2.73	1.36	0.00
1887–1887	1.00	6.74	3.37	0.00
1889–1889	1.00	5.26	2.63	0.00
1891–1891	1.00	4.58	2.29	0.00
1894–1894	1.00	1.55	0.78	0.00
1896–1896	1.00	5.50	2.75	0.00
1898–1898	1.00	12.93	6.47	0.00
1900–1900	1.00	4.43	2.22	0.00
1903–1904	2.00	11.64	12.26	0.61
1906–1910	5.00	19.62	46.80	−2.25
1913–1913	1.00	1.13	0.57	0.00
1919–1926	8.00	19.15	78.81	2.22
1932–1938	7.00	30.17	116.89	11.29
1940–1943	4.00	27.59	59.10	3.92
1947–1951	5.00	12.97	34.01	1.59
1953–1956	4.00	8.91	18.44	0.63
1958–1960	3.00	8.30	13.21	0.76
1962–1976	15.00	44.91	382.86	46.05
1978–1981	4.00	7.90	17.32	1.51
1984–1989	6.00	18.86	64.32	7.72
1992–2009	18.00	40.05	419.37	58.90
2011–2015	5.00	5.36	13.41	−0.00

Table A2.
Measures of
expansions
(Australia)

Measure	Duration	Amplitude	Cumulation	Excess
1871–1871	1.00	3.48	1.74	0.00
1873–1874	2.00	8.32	11.84	3.51
1877–1877	1.00	5.17	2.58	0.00
1879–1882	4.00	25.33	52.48	1.81
1884–1884	1.00	6.48	3.24	0.00
1886–1888	3.00	8.15	6.46	−5.76
1890–1891	2.00	7.28	9.66	2.38
1894–1894	1.00	3.66	1.83	0.00
1897–1903	7.00	37.62	152.11	20.44
1905–1907	3.00	16.67	32.54	7.52
1909–1913	5.00	21.89	68.15	13.43
1915–1917	3.00	17.61	28.17	1.75
1922–1928	7.00	43.20	159.29	8.08
1934–1944	11.00	79.22	433.12	−2.60
1947–1947	1.00	2.24	1.12	0.00
1950–1953	4.00	12.24	26.05	1.56
1955–1956	2.00	11.66	12.15	0.49
1959–1981	23.00	65.76	779.62	23.38
1983–1989	7.00	19.14	74.76	7.76
1993–2007	15.00	35.27	257.59	−6.90
2011–2015	5.00	7.34	20.11	1.77

Table A3.
Measures of
expansions (Canada)

Measure	Early shape	Inshape	Half life	Medium area	Welfare
1875–1875	0.00	0.00	1.00	2.00	1.00
1877–1877	0.00	0.00	1.00	2.00	1.00
1879–1879	0.00	0.00	1.00	2.00	1.00
1882–1885	1.00	3.00	0.39	1.52	0.25
1887–1889	−1.00	−2.00	0.40	0.80	0.33
1892–1896	1.00	4.00	0.48	1.30	0.60
1898–1899	−1.00	−1.00	0.20	0.56	1.00
1901–1901	0.00	0.00	1.00	2.00	1.00
1903–1906	1.00	3.00	0.42	1.40	0.25
1908–1910	1.00	2.00	0.30	1.72	0.33
1912–1912	0.00	0.00	1.00	2.00	1.00
1917–1919	1.00	2.00	0.29	1.86	1.00
1921–1923	−0.67	−1.00	0.38	1.05	0.33
1925–1928	−0.50	−2.00	0.46	0.90	0.50
1932–1934	−0.67	−1.00	0.38	1.02	1.00
1936–1936	0.00	0.00	1.00	2.00	1.00
1938–1939	1.00	1.00	0.13	1.94	0.50
1941–1941	0.00	0.00	1.00	2.00	0.00
1944–1944	0.00	0.00	1.00	2.00	1.00
1946–1948	1.00	2.00	0.36	1.27	0.33
1951–1951	0.00	0.00	1.00	2.00	1.00
1953–1958	0.17	1.00	0.53	0.97	0.50
1960–1961	1.00	1.00	0.16	1.06	1.00
1964–1965	1.00	1.00	0.16	1.07	0.50
1967–1974	−0.38	−2.00	0.56	1.03	0.13
1977–1977	0.00	0.00	1.00	2.00	1.00
1979–1980	1.00	1.00	0.13	1.99	0.50
1983–1984	1.00	1.00	0.14	1.66	1.00
1986–1987	1.00	1.00	0.14	1.67	1.00
1991–1994	1.00	3.00	0.42	1.35	0.50
1996–1998	−0.33	−1.00	0.37	1.16	0.33
2003–2008	1.00	5.00	0.53	1.15	0.67
2011–2012	1.00	1.00	0.15	1.28	1.00
2014–2015	1.00	1.00	0.00	Inf	1.00

Table A4.
Measures of
recoveries Argentina

Measure	Early shape	Inshape	Half life	Medium area	Welfare
1877–1878	−1.00	−1.00	0.23	0.22	1.00
1880–1881	−1.00	−1.00	0.19	0.66	0.50
1883–1883	0.00	0.00	1.00	2.00	1.00
1885–1885	0.00	0.00	1.00	2.00	1.00
1887–1887	0.00	0.00	1.00	2.00	1.00
1889–1889	0.00	0.00	1.00	2.00	1.00
1891–1891	0.00	0.00	1.00	2.00	1.00
1894–1894	0.00	0.00	1.00	2.00	1.00
1896–1896	0.00	0.00	1.00	2.00	1.00
1898–1898	0.00	0.00	1.00	2.00	1.00
1900–1900	0.00	0.00	1.00	2.00	1.00
1903–1904	1.00	1.00	0.16	1.11	0.50
1906–1910	0.40	2.00	0.50	1.07	0.20
1913–1913	0.00	0.00	1.00	2.00	1.00
1919–1926	0.13	1.00	0.60	0.90	0.63
1932–1938	1.00	6.00	0.55	1.20	0.86
1940–1943	−0.50	−2.00	0.46	0.93	0.25
1947–1951	−0.60	−2.00	0.51	0.93	1.00
1953–1956	−0.50	−2.00	0.47	0.82	0.50
1958–1960	−0.33	−1.00	0.37	1.15	0.33
1962–1976	1.00	14.00	0.61	1.26	0.07
1978–1981	−0.25	−1.00	0.43	1.11	0.25
1984–1989	1.00	5.00	0.50	1.42	0.17
1992–2009	1.00	17.00	0.63	1.28	0.06
2011–2015	−0.60	−2.00	0.50	0.94	0.20

Table A5.
Measures of
recoveries (Australia)

Measure	Early shape	Inshape	Half life	Medium area	Welfare
1873–1874	1.00	1.00	0.13	1.84	0.50
1877–1877	0.00	0.00	1.00	2.00	1.00
1879–1882	1.00	1.00	0.46	1.00	0.25
1884–1884	0.00	0.00	1.00	2.00	1.00
1886–1888	−1.00	−2.00	0.46	0.22	1.00
1890–1891	1.00	1.00	0.14	1.66	0.50
1894–1894	0.00	0.00	1.00	2.00	1.00
1897–1903	1.00	6.00	0.55	1.29	0.14
1905–1907	1.00	2.00	0.33	1.63	0.33
1909–1913	1.00	4.00	0.46	1.56	0.40
1915–1917	−0.33	−1.00	0.37	1.11	0.67
1922–1928	1.00	3.00	0.54	1.28	0.86
1934–1944	0.36	3.00	0.64	0.96	0.64
1947–1947	0.00	0.00	1.00	2.00	1.00
1950–1953	1.00	3.00	0.45	1.04	0.25
1955–1956	1.00	1.00	0.16	1.08	0.50
1959–1981	−0.65	−7.00	0.67	0.94	0.04
1983–1989	−0.29	−1.00	0.55	1.17	0.29
1993–2007	−1.00	−7.00	0.64	0.88	0.20
2011–2015	1.00	4.00	0.47	1.34	1.00

Table A6.
Measures of
recoveries (Canada)