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Structural change in a small natural resource intensive economy. Switching between diversification and re-primarization.

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Abstract

The increasing interest in economic diversification, technological sophistication and production specialization again place structural change at the centre of the analytical and empirical scene of economic development theory. However, efforts to measure structural change from a long-run perspective remain scarce. We aim to fill this gap using a synthetic indicator, based on a trigonometric approach, that represents the dynamics of structural change in the long run and allow us to identify different development patterns. We calculate this indicator including information of thirteen production sectors, for a small natural-resource intensive economy (Uruguay), over 1870-2017. Our results adequately describe the different development patterns that, according to the literature, characterize Uruguayan economic history. In the long run, economic growth causes structural change; only the First Globalization period has the opposite relation. In addition to this, the evolution of our indicator provides other interesting insights. The decline of the index –which indicates "backward movements" in the production structure– is found in periods of economic crisis and downturn cycles. This dynamic reflects critical time periods associated with the (relative) primarization of the economy. In other words, it seems evident that near to each crisis episode, the economy reacted by going back to primary production probably due to looking for traditional comparative advantages or because in such negative phases the weakest and most exposed sectors were those other than agriculture.

Keywords: structural change, long-run economic patterns, primarization, Uruguay

JEL Classification N16, O11, O47

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Resumen

El creciente interés en la diversificación productiva, la sofisticación tecnológica y la especialización sitúan, nuevamente, al cambio estructural en el centro del análisis de la teoría del desarrollo económico. No obstante, los esfuerzos por aportar mediciones empíricas del cambio estructural en el largo plazo siguen siendo escasos. Este trabajo procura contribuir en este ámbito, utilizando un indicador sintético, construido a partir de conceptos trigonométricos, el cual permite medir la dinámica del cambio estructural en el largo plazo y, al mismo tiempo, identificar distintos comportamientos entre patrones de desarrollo. Calculamos este indicador utilizando información de 13 sectores productivos para el caso de una economía pequeña e intensiva en recursos naturales (Uruguay), cubriendo un amplio período temporal (1870-2017). Los resultados son consistentes con los modelos de desarrollo que caracterizan la historia económica del país. A partir del análisis de causalidad, encontramos que, en el largo plazo, el crecimiento económico causa al cambio estructural. Cuando analizamos la causalidad por periodos, solo durante la Primera Globalización se observa el resultado opuesto. Además, se encuentra que el indicador de cambio estructural desciende –lo que sería reflejo de cambios "hacia atrás" en la estructura productiva– en periodos de crisis económica y reversión en el ciclo económico. Esta dinámica refleja la existencia de una asociación entre periodos de declive económico con una relativa primarización de la economía. En otras palabras, en periodos de crisis económica, la economía reacciona con un cambio estructural hacia la producción primaria debido, quizás, a la búsqueda de ventajas comparativas tradicionales o porque frente a una coyuntura negativa los sectores más afectados resultan ser los más alejados de la especialización primaria.

Palabras clave: cambio estructural; primarización; Uruguay; patrones de desarrollo económico.

Código JEL N16, O11, O47

1. Introduction

The growth performance of Latin American countries has long been a focus of interest for economists, policymakers and economic historians. Especially during the 1950s and 1960s, the subjects of discussion turned to economic development and the driving forces behind the region's deficient growth performance. The core of the discussion was about the better type of structural change –the transformation of the sectoral composition of GDP and employment– to promote economic growth and long-run sustainable expansion. Structural change –and more specifically industrialization– was seen as the driving force for growth and a precondition for sustained growth, as changes in technology, different income elasticities and international market conditions require structural changes to ensure a sustainable trajectory of expansion. However, the debate was less in focus in the 1970s and 1980s, making way for ideas and economic policies focused on other severe problems of the region: high and persistent inflation and external debt crises. The initial predominance of monetary perspectives[1] was followed, in the 1990s, by the increasing relevance of liberal policies in such areas as macroeconomic stabilization, economic opening of trade and investment, and the expansion of market forces within the domestic economy.[2] In other words, scholars and policymakers in at least the last 20 years of the 20th century paid little attention to discussing long-run economic performance and, as a consequence, structural change played a secondary role in the theoretical and empirical literature. However, and probably associated with the deep financial and economic crisis that dominated the region by the end of the 1990s and the beginning of the 21st century, the questions about growth, specialization, and development again placed structural change as a part of the debate.[3]

In Uruguay, this debate is expressed in a set of studies that claim the reduced diversification and sophistication of production structure –together with low technological adoption– are the main factors underlying the bad long-run economic performance of the country. In general, all studies discuss and argue about the nature

[1] This theoretical source of thought can be referred to as the Monetary Approach to Balance of Payments although the clearest applications as economic policy corresponded to the Southern Cone (Ramos, 1989). The rest of the region practised mixed policies in most periods.

[2] This framework can be referred to as the "Washington Consensus", a concept coined in 1989 by John Williamson to describe a set of ten relatively specific economic policy recommendations that he considered the "standard" reform package promoted for developing countries through institutions namely the International Monetary Fund (IMF), World Bank and the US Treasury Department.

[3] For instance, in 2012, ECLAC published *"Cambio estructural para la igualdad. Una visión integrada del desarrollo"*.

and the conditions required to promote structural changes for sustainable economic growth. However, most of them attempt to identify "the best" sector to promote without paying enough attention to structural change as an accumulative, sometimes locked-in, and long-run process. This paper aims to examine the long-term pattern of structural change and growth using techniques not often applied for economic historical research.

Structural change is a complex process where diverse forces interact and where transformations can take different –and sometimes contradictory– directions. We aim to construct a synthetic indicator that summarizes in a single index the evolution of the varied dimensions that integrate these specific transformations in the production structure of an economy. Building upon the work of Vikström (2001) and Lindmark & Vikström (2003), we introduce some innovations to their analytical frameworks –to propose considerations about the causal relations in the economic growth process and the cyclical evolution– and provide a long-run indicator of structural change for Uruguay that combines the movements of thirteen production sectors between 1870 and 2017.

Our results adequately describe the different development patterns that, according to the literature, characterize Uruguayan economic history. In this long-run evolution, economic growth causes structural change; only the First Globalization period has the opposite relation. In addition to this, the evolution of our indicator provides other interesting insights. The decline of the index –which indicates "backward movements" in the production structure– is found in periods of economic crisis and downturn cycles. In other words, it seems evident that "around" each crisis episode, the economy reacted by going back to primary production probably due to looking for traditional comparative advantages or because in such negative phases, the weakest and most exposed sectors were those other than agriculture.

After this introduction, the paper is organized as follows. In Section 1, we present a brief literature review about structural change, the theoretical framework, and the empirical approach. In Section 2, we present our working hypotheses and describe the empirical strategy. In Section 3, we present the data (annual sectoral value added for thirteen economic sectors); and novel information about the evolution (real and nominal) of some sectors (particularly services), which constitutes an additional contribution of our paper. In Section 4, we analyse our indicator of structural transformation of the economy and interpret the evolution in terms of change, path and reversal of the structure of the economy. In Section 5, we present a historical overview

of the long-run economic evolution of Uruguay from the end of the 19th to the beginning of the 21st century. With this evidence, we propose two empirical exercises: (i) we test the direction of the causality between economic growth and structural change for the entire period (1870-2017) and for three sub-periods: 1870-1929, 1930-1972 and 1973-2017, which are consistent with the historical characterization of the development patterns of Uruguay (Section 6); (ii) we analyse the evolution of structural change during the crises (Section 7). Finally, in Section 8, we share final remarks. The document has an online appendix with a detailed description of our sector estimates (Appendix A1), the database (Appendix A2) and the results of the econometric analysis (Appendix A3).

2. Structural change: literature review and theoretical framework

2.1 Background

Kuznets (1973) summarizes the six characteristics of modern economic growth and, notably, structural change constitutes one of the quantitative characteristics commonly observed in the growth of developed countries. The main features of structural change include a shift away from agriculture to non-agricultural activities, and from industry to services; modifications in scales of production, and a related shift from personal enterprise to an impersonal organization of the firms and the consequent change in the occupations. The author argues that "rapid changes in production structure are inevitable –given the differential impact of technological innovations on the several production sectors, the differing income elasticity of domestic demand for various consumer goods, and the changing comparative advantage in foreign trade" (Kuznets, 1973, p. 250). Three main causes of structural change can be identified in this quote, which has been essential components of the debate about structural change since the 18th century: the different sectoral impact of technological progress, the types of income elasticity of demand and the comparative advantage in foreign trade.

In this section, we present a brief review of some of the main contributions of the literature on structural change since the second half of the 20th century. However, it is important to emphasize that the fundamentals of the analysis may, possibly, already be present in the works of classic economists of the 18th century, such as Turgot (1766) and Smith (1776), later in Ricardo (1817) and Marx (1885), and in the beginning of the 20th century in Schumpeter (1928, 1939). In the mid-20th century, between the 1940s and

the 1960s, the pioneers of theories of economic development emphasis on industrialization as the main strategy to promote the economic growth of developing regions. Authors such as Nurkse (1953, 1962), Lewis (1954), Myrdal (1957), Hirschman (1958), Rostow (1960), Rosenstein-Rodan (1961) and Gerschenkron (1962) introduce analytical approaches where structural change is a central topic. Meanwhile, in Latin America, the characteristics of the structure of production were the main focus for ECLAC (Economic Commission for Latin America and the Caribbean)'s studies, especially concerning some specificities of developing regions such as the "structural heterogeneity", the economic role of manufacturing and the specialization of Latin American countries. Authors as Prebisch (1951), Furtado (1969) and Cardoso & Faletto (1971) insist on the role of industrialization as the main economic growth driver and understood economic development as a process of diversification towards higher productivity levels, with backward and forward linkages, technological and pecuniary externalities and spillovers that lead to increasing returns.

Another important (and heterodox) theoretical contribution –with clear contact points with the Latin American thought– is Pasinetti (1981), who considers structural change as the main characteristic of economic growth. In this sense, growth and structural change are the results of the diverse consequences of technological progress and transformations in patterns of demand, and learning –individual and social– was understood as the main engine of economic change. It was not until the 1980s when new attempts were introduced to explain the micro-foundations of agents' decisions and the patterns of demand within a specific theoretical framework such as New International Trade Theory (Grossman & Helpman, 1994; Krugman, 1986, 1991), Endogenous Growth Theory (Aghion & Howitt, 1992) and New Development Theory (Ray, 2000; Ros, 2000). In their views, despite recognizing the role of different actors and sectors, the chief cause of economic growth is fundamentally technological progress, i.e., gains in productivity; the sectoral composition is not a constitutive part of the analysis.

In the meantime, within the heterodox tradition, authors such as Kaldor (1956, 1957), Nelson & Winter (1982) and Pasinetti (1993) made important contributions since the 1960s, and two approaches may be clearly identified. On the one hand, Neoschumpeterians and Evolutionists are concern with innovation and technological change and, on the other hand, Post Keynesians and Postkaldorians deal with demand and structural change. Within Latin-American structuralism, in the 1990s there was a renewed interest in the traditional problems, heterogeneity and structural change,

introducing some elements from the evolutionist and endogenous growth theory (Fajnzylber, 1990, 1987; CEPAL, 1992, 2012).

2.2 Which is the direction of causality?

The existence of interrelations between economic growth and structural change is widely accepted by scholars but the particular channels connecting both processes are of a very complex nature, and the direction of causality –whether structural change determines economic growth or vice versa– is still an open question. Recently, there have been attempts to integrate structural change into formal growth theory (see, e.g., Echevarria, 1997; Kongsamut et al., 2001; Meckl, 2002; Ngai & Pissarides, 2007; Foelmi & Zweimüller, 2008; Bonatti & Felice, 2008) but, most often, the direction of causality is basically taken as given (Dietrich, 2012).

In structural change theory, the transformation of the production structure is explained by two components: sector-specific productivity gains and changes in demand preferences. On the supply side, different types of technological progress across sectors are decisive for promoting changes in the economic structure. Some theoretical models assume either non-homothetic preferences as a driving force for structural changes in the sectoral composition (e.g., Echevarria, 1997; Kongsamut et al., 2001; Meckl, 2002) or they assume differentiated productivity growth by sector to be responsible for a changing economy (e.g., Ngai & Pissarides, 2007; Krüger 2008). In terms of demand, Engel's law prevails. That is, a higher income per capita results in a shifting structure of demand from food and basic goods to more sophisticated products (income elasticity of demand differs, and increases, with the increasing sophistication of goods). Changing consumption behaviour due to rising income as explained above leads to an adjustment process of supply in terms of labour input and real value added. These effects imply that economic growth causes structural change due to adjustments in the production process and that a higher rate of economic growth increases the speed of structural change due to dissimilar income elasticities across sectors (Curtis & Murthy, 1998; Rowthorn & Ramaswami, 1999; Möller, 2001).

When the direction of causality is reversed, changes in the structure of the economy influence aggregate economic growth due to sectoral specificity in productivity gains. This would then lead to an adjustment of the aggregate economic growth rate depending on the productivity gains or losses accompanying these changes. If demand increases faster in sectors with low productivity growth, changes in the sectoral structure negatively affect aggregate economic growth. For instance, these negative

feedback effects on economic growth would happen in the process of tertiarization (Baumol, 1967, Baumol et al., 1985; Nordhaus, 2008).

The absence of most traditional views of the 1950s and 1960s, in this recent literature, is well-known, with respect to the the rational for the State to push for structural transformation based on the existence of idle capacity. Additionally, declining population growth rates in developed nations and the arguably significant income and price inelasticity of primary goods made this policy essential for developing nations in pursuit of growth. However, the withdrawal of the State from markets and the increasing trade and financial liberalization of the ensuing decades in many periphery regions significantly reduced the interest in these issues. Although structuralism has in recent years undergone some changes, the basic tenets remain intact. Nowadays, neo-structuralists include in their analyses a role for technology and also selective import protection to encourage the development of industries that are subject to returns to scale and, in fact, this view implicitly reflects the hypothesis that structural transformation causes growth.

Last, Saviotti & Pyka (2004a and 2004b, 2008, 2010) argue that structural change and aggregate growth are not independent of each other and that there is a coevolution of both processes. Following their argumentation, structural change is needed to reach sustainable growth, while economic growth is needed to reach new levels of aggregate demand and changes in the structure of demand.

2.3 Empirical findings

The empirical findings are not conclusive, however. Some studies prove that structural change is a significant and positive explanatory variable in economic growth while others find it to be insignificant or negative or, even, find evidence of the converse relation where economic growth is a significant determinant of structural change. Empirical results seem to be influenced by model specifications and the choice of indicators, on the one hand, and different estimation techniques and the characteristics of the sample, on the other.

Stamer (1998) analyses the interrelation between subsidies, structural change and economic growth for West Germany, over 1970-1993, with sectoral data for 41 industries and by testing for causality between a modified Lilien index (MLI) and GDP growth. By applying Granger causality analysis, he finds strong evidence that growth has an impact on structural change as well as vice versa but the second effect has

weaker results. Using impulse response functions, he finds that growth accelerates structural change and that structural change, in turn, slows down growth.

Aiginger (2001) proposes a similar exercise using the norm of absolute values (NAV) as an index for structural change and considering a disaggregation level of either 23 sectors (NACE 2-digit) or 99 industries (NACE 3-digit) based on data from 1985 to 1998 for 14 European countries, the U.S. and Japan. A simple time-lagged correlation test indicates that structural change has a stronger impact on growth than vice versa.

Aiming to shed more light on the interrelation between the two processes, Dietrich (2012) proposes two structural change indices (NAV and MLI) to reflect the speed of changes either in terms of employment shares or real value added shares as an appropriate measure of the transformation of the economy. He used a Granger causality test on a panel of seven OECD countries (France, Germany, Italy, Japan, the Netherlands, the U.K. and the U.S.) for the 1960-2004 period. Regarding the direction of causality from economic growth to structural change, results show that economic growth slows down structural change in the very short run but has an accelerating effect in the long run. Here the underlying variables measuring structural change are decisive for the inference of an aggregate effect. The main result for the causality from structural change to economic growth is that structural change has a positive, or at least a non-negative, effect on economic growth. This result holds for the case of employment as well as for that of real value added.

Analogously, Cortuk & Singh (2011) use a NAV and an MLI to study the relation in the case of India and carry out a Vector Auto Regression (VAR) analysis using the two indices and the GDP growth. The analysis is done for 1951-2007. They find that 1988 marks a break in the time series of growth and structural change. There is one-way causality from structural change to growth in the 1988-2007 period, whereas there is no evidence for this linkage before 1988. Cortuk & Singh (2015) undertake a similar analysis of the linkage between structural change and growth for the 16 states of India for the 2000-2006 period. The authors find there to have been a one-way positive impact from structural change to growth.

Dong et al. (2011) look for empirical evidence in the case of China (31 provinces) from panel data using a unit root test, cointegration test, and Granger causality test suggest that economic growth (GDP growth) and industrial structure are order-1 integrated, that economic fluctuation is a cause of industrial structure disproportion in the short-run, and that in the long-run there is bidirectional causality.

Recently, Vu (2017) has also found a positive relationship between structural change and economic growth in the case of 19 Asian countries from 1970 to 2012. This paper introduces a new approach to measure structural change called "effective structural change" (ESC) –taking nine economic sectors as reference– and use the panel data to examine the effect of ESC on growth (considering labour productivity, TFP, GDP per capita, wage and employment). Among its main findings, the paper shows that effective structural change has a strong impact on the growth of labour productivity, TFP, GDP per capita, GDP and wages. This impact is transmitted through two channels: the delayed effect of effective structural change in the previous year and the contemporaneous effect of effective structural acceleration. These findings reveal several insights that are relevant to policy. Most notably, fostering productivity-enhancing structural change is an effective way to promote economic growth. However, the short-term cost of this process in terms of rising unemployment could be formidable, which policymakers may hesitate to accept. This explains why structural reforms tend to be sluggish in many countries.

Olczyk et al. (2018) empirically test the relationship between structural change (considering two indicators: SCI and MLI) and economic growth in a panel Granger-causality analysis based on annual data for eight transition countries (Czech Republic, Estonia, Hungary, Lithuania, Latvia, Poland, Slovakia, and Slovenia) considering the 1995-2011 period. The main finding is that the causality relations analysed are heterogeneous processes and are identified more often when measuring structural changes by value added than by changes in employment. Some countries show a very strong bilateral causality, others do not show evidence of causal relationships and, finally, in other a one-directional relationship is observed.

One of the main messages of this short literature review is clear: the relationship between economic growth and structural change seems irrefutable but the direction of causality can vary between economies and regions and, probably –but this is difficult to demonstrate in short-term analysis as the previous one–, also in the long run. In other words, it is highly probable that this relationship changes over time, alternating between periods where economic growth causes structural change and others where the transformation of production in an economy promotes economic growth or, even, historical stages where bidirectional relations are observed. Additionally, in long-run and historical analysis, the demographic components prove to be relevant factors of economic expansion –they represent labour input and consumption units– and, as a

consequence, when we consider economic growth, we should take into account the effect of the population growth (i.e., growth of income per capita).

3. Hypotheses and empirical strategy

Are those concepts useful to understand the economic performance of Uruguay in the long-run? Previous explanations have introduced structural change as a central concept, although the analytical relevance has varied over time. According to views of the 1960s and early 1970s, the studies of CIDE (1963) and Faroppa (1965) –from a structuralist approach– and Instituto de Economía (1969) –from Dependency Theory– were relevant contributions among the contemporaneous Latin American economic thought. This can be contrasted with the work of the Oficina de Planeamiento y Presupuesto (1977) –from a liberal or neoclassical perspective– move away from the concept of structural change. It was not until the 1990s that a renewed interest in structural change reappeared with studies such as Bértola (1993) and Bértola & Porcile (2000) from a Postkaldorian and Evolutionist approaches and the contributions of Arocena & Sutz (1999, 2000a, 2000b) from a neo-Schumpeterian view. More recently, academic and political interest in the production specialization provides new contributions to the analysis of structural change. Studies such as Bittencourt (2006, 2014), Bértola & Porcile (2007), Bértola et al. (2014), Brunini et al. (2013) and Isabella (2014) have placed specialization and structural change at the centre of the analysis.

Recently, Bértola et al. (2014) state that Uruguay has experienced, in the long term, low economic dynamism and permanent backwardness relative to the world economy. This process has not been parsimonious but has been characterized by very strong cyclical fluctuations, which at times have generated expectations of catching up paths of sustained development and convergence, and at times comprised of deep crises that generated much discouragement and placed Uruguay on a systematic path of divergence. Supporting this dynamic of divergence and high volatility, two types of factors are found. On the one hand, there are economic policies that can amplify or mitigate fluctuations. On the other hand, there are those related to the structure of production, which concentrated the Uruguayan economy in a few primary-based export products exposed to the volatility of demand and prices, thereby weakened the long-term dynamics. The limited “depth” of production structure and the low generation of employment of the export sector stand in contrast with the expansion and diversification of the demand for consumption and capital goods at times when the expansionary cycle intensifies and, thereby placing pressure on imports. Thus, the

economy has, despite successive expansion cycles during which strong balances of payments are generated, experienced prior current account deficits, which lead to drastic times of adjustment with profound output declines.

The available studies agree in considering the weak process of structural change as one of the main determinants of the modest economic growth of Uruguay and, as a consequence, –more implicit than explicitly– the causal relation would go from the transformation of the economic structure to the economic growth. At the same time, this literature relates a poorly diversified production structure with the cyclical pattern of the economy and, in particular, with the occurrence of crises. These considerations will guide our reasoning and, consequently, we propose two working hypotheses: (i) structural change caused economic growth in the long run; and (ii) the pace of structural change has had consequences expressed in terms of crises. To test both hypotheses we propose four empirical stages:

a) We need historical data series of the GDP composition in terms of production activities. Official data statistics are available from 1955 onwards but, prior to this year, we make use of partial historical estimates. Therefore, we present novel estimations of sectoral outputs –at current and constant prices– and, in particular, new evidence for sectors related to services.

b) We propose a measure of structural change.

c) With our estimates of per capita GDP growth (item a) and structural change (item b), we test the direction of causality between the two processes –Hypothesis (1).

d) We explore the relationships between structural change and the occurrence of crises –Hypothesis (2)– from the analysis of each crisis episode faced by Uruguay from the 19th century to the beginning of the 21st century.

4. Data and sources

To compute our structural change indicator, we need annual information on value added by sector at current prices. The initial year of the official System of National Accounts (SNA) in Uruguay is 1955, and these first estimates were presented in BROU (1965). From 1967 forward, the Banco Central del Uruguay (BCU) undertook the task of preparing national accounts and providing annual data on GDP and its components, from the production, expenditure and income approaches. Official estimates are

available for several base years –1961, 1978, 1983, Revision 1988, 1997 and 2005– and each benchmark was constructed from different sources. Moreover, the newest measures of national accounts are inconsistent with the previous figures as they are based on different relative prices (that are used as weights) and use other sources of information, definitions and methodologies. Therefore, it is necessary to apply splicing techniques to obtain consistent long-run series. We use the estimations of Román and Willebald (2019) who propose annual time series for GDP and the value added by sector between 1955 and 2018 based on official sources (BROU, 1965, and different publications of BCU).

As for the pre-1955 period, two important previous contributions provided estimates of GDP and sectoral value added. Bértola et al. (1998) and Bertino & Tajam (1999) construct historical estimations of GDP using the production approach, which consists in calculating the sectoral value added in order to find the global value added. Bértola (1998) proposes series for 1870-1936 of the aggregate value of seven sectors: livestock, agriculture, manufacturing, construction, non-government traded services,[4] government and transport. The aggregate value of the economy is obtained by adding the former series using the weights of the 1936 sectoral structure (based on census data and other information) and using a Divisa index. Bertino & Tajam (1999) present estimations of GDP for 1900-1955 based on calculations of output and gross value added for eight sectors: livestock, agriculture, communications, utilities (electricity, gas and water), manufacturing, construction, transport and government. The base year for the calculations is 1925 and Laspeyres indexes are applied. The authors use these sectoral series to project backwards from the 1955 levels (figures from the national accounts corresponded to BROU, 1965). For our purposes, both studies have the same limitation:[5] some sectors are underestimated, mainly manufacturing and transport, and other sectors, such as the majority of services, could not be included.[6] The activities not covered account for almost 40 percent of GDP in 1955 (Bértino & Tajam, 1999, p. 15). Recently, Bértola (2016) presented a revision of both previous historical estimates. He proposes corrections and offers an updated series of GDP, and the sectoral value added, in real terms, for 1870-1955. From 1955 forward, he uses the series of sectoral value added based on the retropolation method (following Bonino et al., 2012). Bértola (2016) published an appendix with the sectorial value added at constant prices (index

[4] This sector includes potable water, electricity and telegrams.
[5] For a critical comparison of both estimations see Cáceres (2012).
[6] See Cáceres (2012) and Bértola (2016) for a comparison between the two series.

numbers, 1913 as the base year). The sectoral information at current prices was kindly provided by the author.

Summing up, the available information from previous research corresponds to seven sectors: agriculture (livestock and crops), manufacturing, construction, utilities (electricity, gas and water), transport, communications and government. However, for our study we need a more disaggregated structure of the sectoral value added for obtaining more representative results. Therefore, we propose new estimates about the dynamics of those sectors not covered in the available historical estimations. We should note that these series are instrumental rather than being completely new estimations of sectoral output. In the next steps of the research, we will move toward obtaining a complete historical national account system.

In Table 1, we present the sectors included in our analysis and the main sources used and, in Appendix A1, we detail the procedures followed. All the data is reported in Appendix A2, which becomes an additional contribution of our paper, as these long-run series (which cover 147 years) were not available previously. With all this information, we were able to compute a set of structural change indices between 1870 and 2017.

Table 1. Sources for sectoral value-added estimates, 1870-1955

Sectors		**Sources**	
		Current prices	Constant prices
1.	**Agriculture**	1870-1899: Bértola (2016). 1900-1936: Bértola (1998). 1936-1955: Bértola (2016).	1870-1955: Bértola (2016)
2.	**Manufacturing**	1870-1899: Bértola (1998) 1900-1955: Bértola (2016)	1870-1955: Bértola (2016)
3.	**Construction**	1870-1899: Bértola (1998) 1900-1955: Bértola (2016)	1870-1955: Bértola (2016)
4.	**Utilities (electricity, gas and water)**	1870-1899: Bértola (1998) 1900-1954: Bértola (2016)	1870-1874: own calculation 1874-1955: Bértola

			(2016)
5.	**Transport**	1870-1899: Bértola (1998) 1900-1955: Bértola (2016)	1870-1955: Bértola (1998) 1874-1955: Bértola (2016)
6.	**Government**	1870-1954: own estimates based on Siniscalchi & Willebald (2019), Bértola (1998) and Bertino & Tajam (1999)	1870-1954: own estimates based on Bertino & Tajam (1999).
7.	**Fishing and sea hunting**	1870-1954: own estimates.	
8.	**Mining**	1870-1954: own estimates.	
9.	**Communications**	1870-1899: own estimates. 1900-1955: Bértola (2016)	1870-1899: own estimates. 1900-1955: Bértola (2016)
10.	**Financial intermediation**	1870-1954: own estimates.	
11.	**Wholesale and retail trade**	1870-1954: own estimates.	
12.	**Real estate activities**	1870-1954: own estimates.	
13.	**Education, health, social work, and other community, social and personal service activities**	1870-1954: own estimates.	

5. Structural change: concept and measure

The literature offers several options to conceptualize and describe, statistically, changes in the sectoral structure of an economy. In the three-sector hypothesis, the evolutions of the shares of the three main sectors –primary, secondary and tertiary– are described to enable statements about the development of an economy. In this case, the main focus is on a sectoral driving force at a particular stage of development. However, since the aim of this article is to identify the relationship between economic growth and structural change, this approach is not adequate. Therefore, we propose a Structural Change Index (SCI) which is used to summarize the changes in the sectoral

composition between two points in time or, more specifically, our SCI is conceived as a measure of the similarity between a given structure and another, which is taken as a point of reference. There is a set of indicators that may be applicable.

Dobrescu (2011) discusses ten of the most used structural change coefficients according to certain rules (incongruity and permutation rule) and select five indices that not present problems: norm absolute value, the indices of Bhattacharyya, Hellinger and also Jaccard as well as cosine.[7] We have chosen the last index because the calculation is easy, the economic intuition is clear and it has been previously used in historical analysis, which would facilitate for comparisons.

Following Moore (1978), the output structure can be described as a vector whose coordinates are the sectoral shares of total output. Moore's measure of structural change is then defined as the cosine of the angle between two vectors measured at two different points in time. The angle θ is the one that verifies equation (1):

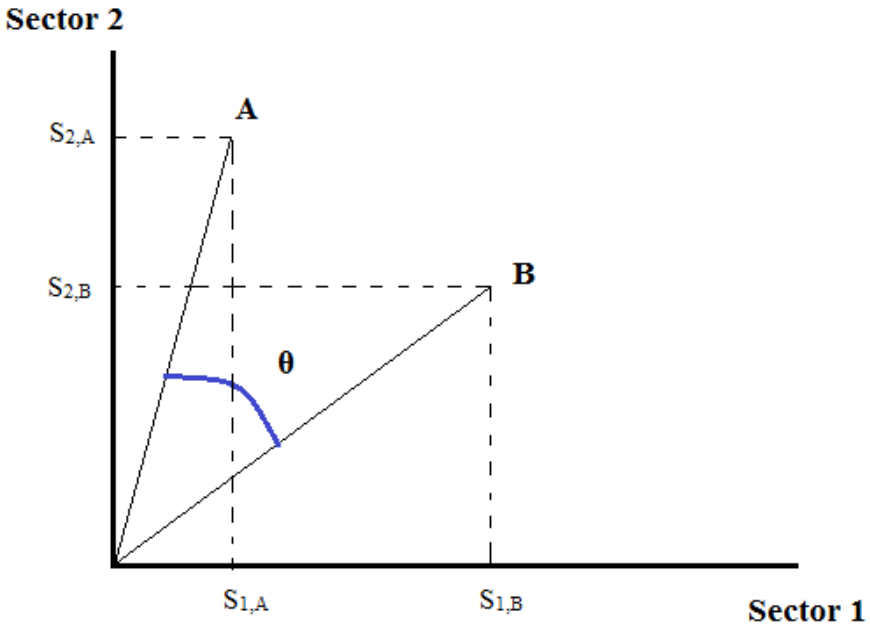
$$\cos(\theta) = \frac{\langle A, B \rangle}{\|A\|.\|B\|} \quad \text{where } 0 \leq \theta \leq \pi \qquad (1)$$

The symbol "‹ . ›" represents the inner product of two vectors, while "||.||" represents the Euclidean norm of a vector.

In the specific case of an economy with two sectors, the economic structure and its change between two points in time, A and B, can be illustrated as in Figure 1.

[7] The author discards: Canberra distance, Lilien index, (modified) Galton-Pearson correlation, Herfindahl-Hirschman index and Kullback-Leibler divergence.

Figure 1. The principle for the angular measure of structural change



Source: Vikström (2001).

Then, in this case, taking into account that the two vectors are $A=\left(s_{1,A},s_{2,A}\right)$ and $B=\left(s_{1,B},s_{2,B}\right)$, the angular measure of structural change would be calculated as follows:

$$\cos(\theta)=\frac{\langle A,B\rangle}{\|A\|.\|B\|}=\frac{\left\langle\left(s_{1,A},s_{2,A}\right),\left(s_{1,B},s_{2,B}\right)\right\rangle}{\left\|\left(s_{1,A},s_{2,A}\right)\right\|.\left\|\left(s_{1,B},s_{2,B}\right)\right\|}=\frac{s_{1,A}.s_{1,B}+s_{2,A}.s_{2,B}}{\sqrt{\left(s_{1,A}\right)^2+\left(s_{2,A}\right)^2}.\sqrt{\left(s_{1,B}\right)^2+\left(s_{2,B}\right)^2}} \quad (2)$$

The measure can be generalized for an n-sector economy, as it is stated below. We must use then vectors in n-space [8] (where *t* and *t´* are two different points in time):

$$\cos(\theta)=\frac{\sum_{i=1}^{n}s_{i,t}.s_{i,t'}}{\sqrt{\sum_{i=1}^{n}\left(s_{i,t}\right)^2}.\sqrt{\sum_{i=1}^{n}\left(s_{i,t'}\right)^2}} \quad (3)$$

[8] Moore (1978) shows that the vector of coordinates can consist of commodities expressed in physical or monetary values instead of sectoral shares.

As Vikström (2001) states, the angular measure of structural change can be calculated in two different ways, either as a change from year to year or as the change relative to a base year. The yearly measure reflects the short-term dynamics of the structural change but can mislead when we are interested in the long-term evolution. The point is that it is not certain that year-to-year changes imply permanent transformation in the structure. A large change in one year can be balanced by another large change in the opposite direction in the next year which cancels out the effect. So, the option is to compare each year's structure with the structure of a benchmark year. The benchmark year cannot be from the middle of the period, because the angle θ cannot take negative values, meaning that the resulting series would have an inverted-V shape and would be difficult to interpret. The inverted-V shape would mean that in the period before the benchmark year the slope of the cosine coefficient would be positive, as the structure is approaching the one taken as reference, whereas in the period after the benchmark year the slope is negative, as the structure is moving away from the reference structure. In this sense, the point of reference plays an "attractor" role (Dobrescu, 2011). Therefore, Vikström (2001) suggests choosing the first year being studied as the reference year, in which case the structural change process will be understood as a transition from one state to another. In our study, we select 1870 as the benchmark year.

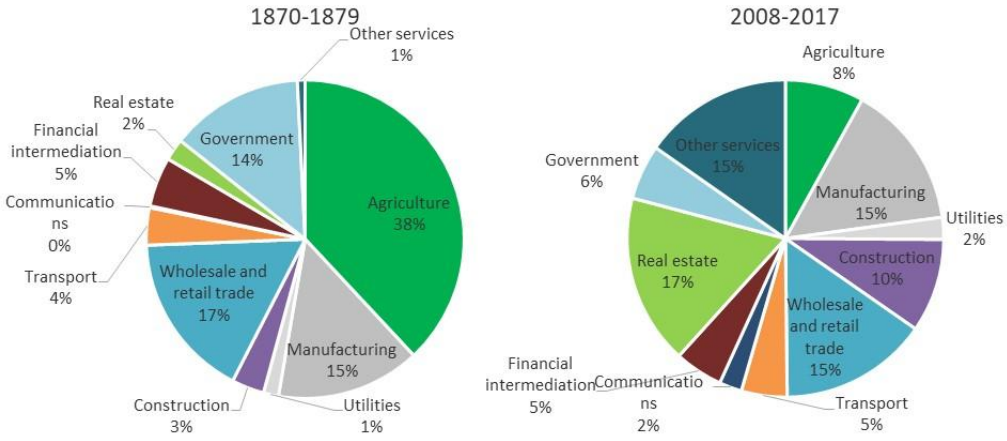
6. Economic structure and structural change. A historical overview

6.1 Sectoral shares: three-sector hypothesis

We discuss the historical evolution of the economic structure from 1870 to the present. Initially, we compare the extremes of the period of analysis and contrast the average economic structure of 1870-1879 with that corresponding to 2008-2017 (Figure 2). The changes are very clear. Currently, as is well-known, the structure is more diversified, and the relevance of the services (communications, financial intermediation, real estate, other services) in the economy increased substantially in the long run.

Figure 2. Production structure, 1870-1879, 2008-2017.

Sectoral shares of total value added (in percentage)



Source: own elaboration. Appendix A2

Then, to facilitate the analysis, we group the thirteen sectors[9] into three categories: Agriculture (primary activities, including livestock, crops and fishing), Industry (secondary activities that include manufacturing industry, construction, mining and utilities) and Services (tertiary: the rest of the sectors).[10]

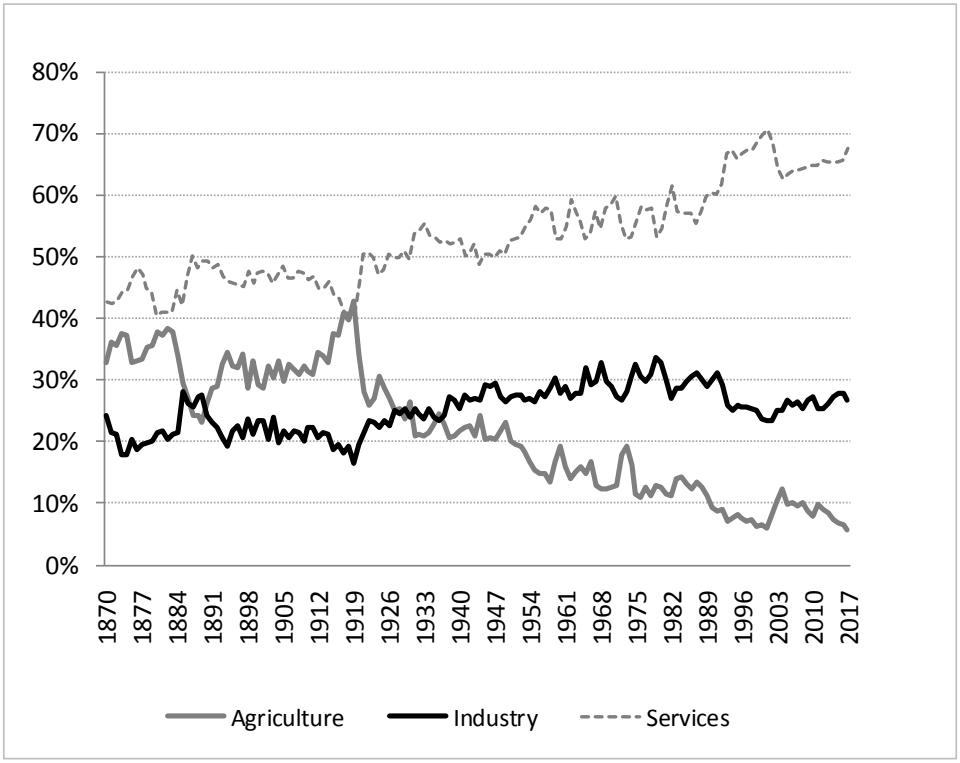
In Figure 3, we present the resulting sectoral evolution. In the 19th century, the economy was specialized in primary activities –essentially livestock– and based on an economic development strategy which can be classified as an export-led growth model. In this economic context, manufacturing played a secondary role, whereas services performed much better and were more than 40 percent of total GDP during the last third of the 19th century. The main changes happened after the First World War.

[9] In Figure 2, we present eleven sectors because fishing is considered within agriculture and mining is considered part of manufacturing.

[10] A first attempt for representing this long-run evolution is presented in Bonino et al. (2012) where the authors propose several scenarios. Following this work, Alvarez (2014), p. 79, proposes a different evolution of the economic structure similar to Hypothesis 1 and 2 of Bonino et al. (2012), p. 33-34.

Figure 3. Evolution of production structure, 1870-2017

Sectoral shares of total value added (in percentage)



Source: own elaboration. Appendix A2

The primary sector declines rapidly in relative terms and, in the 1930s, when the economy evidenced the first steps to a new strategy based on the import substitution industrialization (ISI), the secondary sector overtook the primary activities and achieved proportions of around 30 percent up to the 1980s. As for the share of the tertiary sector, it grew constantly, representing two-thirds of the economic structure at the beginning of the 21st century alongside significant decline in the other sectors. In sum, and in a stylized manner, Uruguay evolved according to the three-sector hypothesis.[11]

6.2 General trends and economic growth patterns

As was described in Figure 1, we interpret the difference –or distance– between structures –or vectors– via the angle between these vectors, and its evolution over time

[11] Our estimates of the contribution of services to total GDP are in line with previous estimations for countries where the economic conditions make the comparison reasonable. The average share of services in Uruguay over 1870-1900 was 45%, a ratio consistent with European countries abundant in natural resources –Sweden (46%)– or open economies where *entrepôt* activities featured heavily –Netherlands (44%) and Belgium (43%) (Source: Groningen Growth and Development Centre).

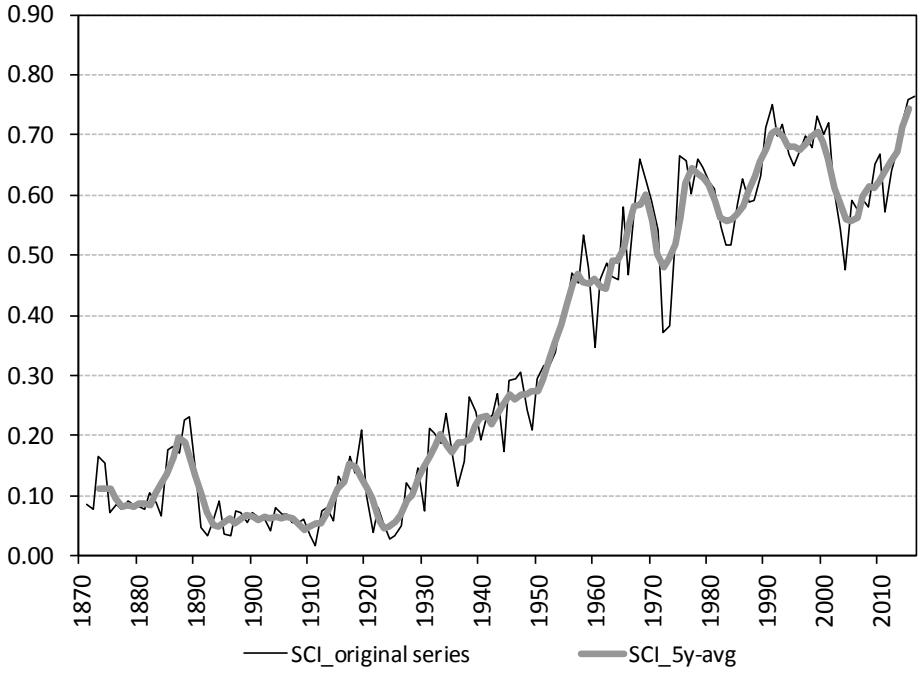
allows us to understand the dynamics of structural change. We can obtain the angle θ in equation (3) by applying the inverse trigonometric function of $\cos(\theta)$ (that is, the arccosine function) which yields θ expressed in radians, with a range of $0 \leq \theta \leq \pi$. π radians are equivalent to an angle of 180°. According to our concept, the maximum change with respect to the initial structure corresponds to an angle of 90° –vectors with negative shares do not make sense– and therefore our indicator of structural change moves from 0 –absences of change– to $\pi/2$.

As before, the slope or the growth rate of our indicator will give us a measure of the structural change rate; an increasing long-run trend of the coefficient is evidence of a sustained structural change and a negative slope indicates a process of reversion toward the initial structure. Our emphasis is on the long-term dynamics of structural change, but we also study the trend and breaks of the time series. Our structural change coefficient is the inverse trigonometric function of this indicator or, in other words, the evolution of the angle θ (measured in the n-dimensional Euclidean space). Figure 4 shows the structural change indicator (taking the production structure of 1870 as a reference).

Early years in the figure do not show a clear trajectory (which is consistent with the comment about the stability of the production structure during the 19th century). At the end of the 1880s, the economy appears to show some signs of transformation, but the changes did not consolidate. It is not until the 1920s when an increasing trajectory of the indicator shows evidence of structural change. In this period, the indicator achieved levels as high as in the 1880s, when a peak of structural change happened, but this time the transformation consolidated and, through the rest of the century, the levels of the indicator exceed the previous data. However, this upward trend slowed at the beginning of the 1930s. During the 1940s, we see a recovery and, after 1949, the indicator shows an increasing trend with a sudden break in 1958 to a new decreasing period up to 1964. The structural change index presents a renewed dynamic in the second half of the 1960s that stops in 1971 with the economy showing a strong backward alteration. From the mid-1970s to the end of the period, in general, there are important signs of structural change, although the process suffered two important reversals in 1982 and 2001; both are periods of crises in which the original series present deep falls.

Figure 4. Uruguay Structural Change Index. 1870 production structure as a benchmark

Original series and 5-year average series *



* Data corresponding to each year represents the last 5-year average.

Source: own elaboration based on Vikström (2001).

Is this trajectory consistent with the economic history of the country? We present a historical overview of the economic performance of Uruguay to identify some relevant stylized facts that give robustness to these results.

According to our indicator, the economy evidenced the first upward movement of structural change during the 1880s, when the economy was "prepared" to take off in terms of production and infrastructure. However, this process did not result in a significant expansion of new production activities and, despite some irregularities, the economy did not change its initial production pattern until the 1910s. After the First World War, the economy begun a progressive and sharp structural change process that seems to corroborate the recent literature that discusses the "early manufacturing" (*industria temprana*) before the 1930s (Bértola, 2000) and a strong expansion of construction (especially in infrastructure) (Caetano & Jacob, 1987). The Great Depression and the subsequent years meant lower dynamism during which multiple difficulties were faced to undertake modifications in the production structure. This

stagnation is in contrast with the post Second World War period identified with ISI or state-led industrialization (Bértola & Ocampo, 2012). Our indicator is very precise in identifying "the end" of the ISI in 1958 (as other authors have suggested previously; Arnábal et al., 2013), and the beginning of a stagnation phase. The evolution of GDP during the 1960s shows a similar slowdown for the aggregate economy, but our indicator reflects some movements within the production structure in the second half of the 1960s. However, the early 1970s represented a period of a strong reversal in the production structure at a particular time in international commodity markets with meat prices reaching record levels. The new economic growth pattern in the mid-1970s with increasing financial liberalism, openness, regional integration and a new export-led strategy meant renewed strength for changes in the production structure. At the beginning of the 1980s, Uruguay achieved the highest levels of the indicator, but it could not afford to maintain the previous dynamic and the "lost decade" also affected structural change. In the 1990s, the economy showed important production transformations which were suddenly interrupted by the deep crisis of 2001-2002. Overall, in the long run, the index of structural change shows an increasing trend, but it also presents important breaks, evolving with a modest economic growth trajectory that includes alternating between periods of substantial expansion with other deep declines. These facts are the subject of the next sections.

7. A causal relation between structural change and economic growth

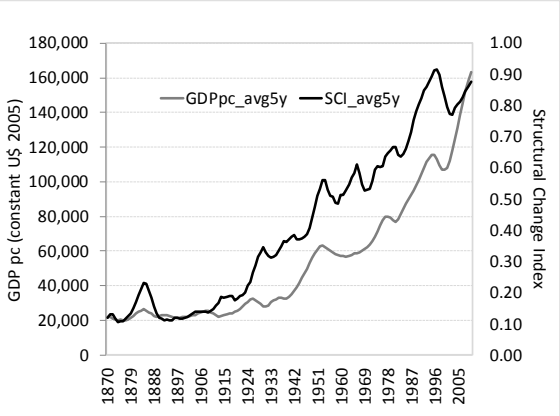
7.1 Some stylized facts

The long-run evolution of real GDP per capita and the SCI is very close (Figure 5, Panel a) evidencing comparable fluctuations. As a result, the correlation between the two variables is very high (Figure 5, Panel b).

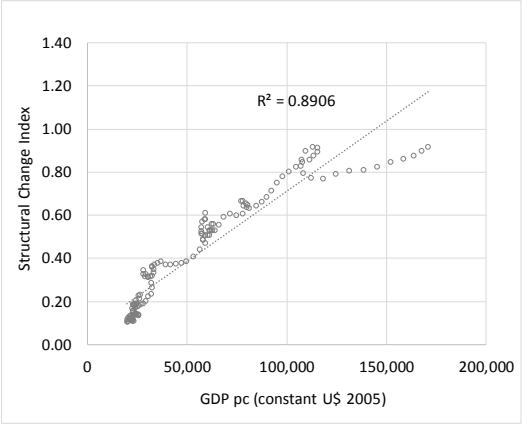
In the long run, the Uruguayan economy has exhibited an irregular trajectory that alternates between periods of large production expansion and others of deep depressions, also, there are periods of openness and others of constrained international trade. While growth episodes and recessions occurred in both open and closed periods (Bértola & Porcile, 2000), the local historiography has traditionally split the contemporary history of Uruguay into three phases associated with different "development patterns" (Bértola, 2008; Oddone, 2010). These phases are linked to the changes in the production structures and trade regimes, i.e. to the different sectorial driving forces and degrees of integration in international markets.

Figure 5. Uruguay: economic development and structural change

Panel a: GDPpc and SCI; time evolution



Panel b: GDPpc and SCI; correlation



Sources: own elaboration.

First, from the last quarter of the 19th century to the 1920s, the economy showed increasing exports and the formation of a domestic market (Bulmer-Thomas, 2003). This growth model, based on the production of a few primary products, was rather successful and allowed the country to obtain welfare levels close to those of the core economies. This favourable period came to an end with the Great Depression which had severe adverse effects on an open economy such as Uruguay, and the meagre performance lasted until the middle of the 1930s.

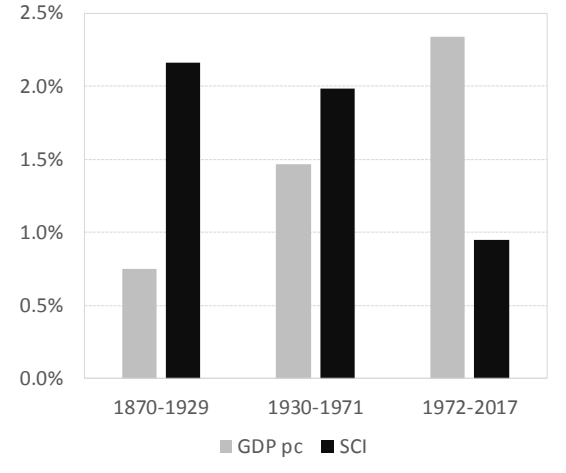
After the Second World War (WWII), the economy experienced a new period of steady economic growth characterized by increasing participation of the State in the economy, the implementation of a (truncated) process of ISI, and improvements in personal income distribution. However, the positive evolution came to an end by the late 1950s, and the economy entered a long period of "stagflation" that lasted until the beginning of the 1970s.

During the first half of the 1970s, in a context of deep social and political change, the economy experienced major adjustments that resulted in a new development pattern. Increasing trade openness, financial liberalization and new regional trade agreements gave rise to a new phase of economic expansion that extended until the end of the 20th century in a sort of re-globalization period. The beginning of the 21st century was, however, dominated by one of the deepest crises in Uruguay's history. Since 2003, the economy has nonetheless strongly recovered with a strong involvement in international commodities markets and important changes in the organization of primary production.

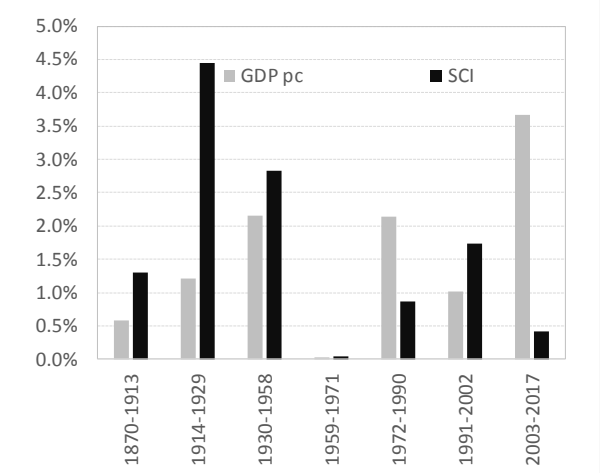
The annual rate growth of GDP pc and SCI for the three stages –1870-1929; 1930-1971; 1972-2017– is presented in Figure 6, Panel a. Economic growth accelerated during these three stages and structural change moderated the pace of the transformation. However, the stages were not homogeneous. They combine transitional periods such as 1913-1929 –the end of the agro-exporter model and the shift toward the industrialization period–, 1958-1973 –decline of ISI period, very low economic growth and inflation– and two additional periods that resulted from one of the deepest crises of the 20th century (2002). Then, we divide the previous three stages into seven periods (Figure 6, Panel b). The stagflation period (1959-1971) was a real watershed in the long-run evolution of the economy, with practically zero economic growth and an absence of structural change. Previously, the economy grew (1.2% per year) showing a substantial pace of economic transformation (2.4% per year) and later, the economic growth (2.3%) was faster than the structural change (1%) (especially so in the last period). However, these findings nothing say about causality. This is a matter of the next section.

Figure 6. Uruguay: economic growth and structural change

Panel a: GDP pc and SCI; growth (%)



Panel b: GDP pc and SCI; growth (%)



Sources: own elaboration.

7.2 Causal relations

The question of whether growth causes structural transformation or vice versa will be explored with standard exercises of time series: Vector Error Correction Models (VEC) and Granger causality tests. Initially, the time period for the analyses is from

1871 to 2017,[12] but we also include periods corresponding to the different "development patterns" that the national historiography identifies. First, using the Augmented-Dickey-Fuller (ADF) test that assumes the series to be non-stationary, we determine whether the series is stationary or integrated of first order. The null hypothesis is that there is a unit root (i.e. the series is non-stationary). If it is not rejected at the standard significance levels, then we should treat the series as integrated of first order. If the series are integrated, then the cointegration test could be conducted. If they are not, then Granger causality tests can be carried out in order to check for causality between the GDP pc and SCI. Table 2 shows the results by subperiod (ADF tests are presented in Appendix A3).

Table 2. Augmented Dickey-Fuller Test results for GDP per capita and SCI

Sample	***#obs***	**Null Hypothesis: log(GDPpc) is I(1)**	**Null Hypothesis: SCI is I(1)**	**Null Hypothesis: GDP pc is I(2)**	**Null Hypothesis: SCI is I(2)**
1871-2017	147	0.1697 (constant and deterministic trend)	0.0747 (constant and deterministic trend)	0.0000 (constant)	0.0000 (constant)
1871-1929	59	0.4187 (constant)	0.2083 (constant)	0.0000 (constant)	0.0000 (constant)
1930-1971	42	0.9729 (no constant nor trend)	0.0436 (constant and deterministic trend)	0.0000 (constant)	0.0000 (constant)
1972-2017	46	0.0540 (constant and deterministic trend)	0.0890 (constant and deterministic trend)	0.0050 (constant)	0.0000 (constant)

p-values of ADF test and specification of alternative hypothesis between brackets

Source: own elaboration.

Once we defined the integration order of the series, the second step checks for cointegration among the series to determine whether a long-run equilibrium relationship exists between the integrated variables. If a set of single time series, say GDP pc and SCI, are integrated of the same order, there may exist a linear combination

[12] By construction, the series corresponding to SCI starts in 1871.

of the series which is stationary, i.e. it is not integrated (Engle & Granger, 1987). We conduct the cointegration test following the Johansen procedure. This implies the construction of a vector error correction model (VECM), which can be expressed as follows (Enders, 2015):

$$\Delta x_t = \pi_0 + \pi x_{t-1} + \pi_1 \Delta x_{t-1} + \pi_2 \Delta x_{t-2} + \cdots + \pi_p \Delta x_{t-p} + \mu D_t + \varepsilon_t \quad (4)$$

Where (in our particular case with two variables):

x_t is a two-dimensional vector, consisting of GDP pc and SCI at each moment *t*.

Δ indicates the first difference of the column vector which it accompanies.

π_0 is is a two-dimensional vector of intercept terms.

π_i is a (2x2) matrix.

ε_t is a two-dimensional vector, consisting of the error elements which may be correlated across the variables but not between each variable across time.

D_t is a two-dimensional vector of *dummies*.

The Johansen procedure looks at the rank of the matrix π, which in this case is of dimension 2x2. The expression in which it appears represents a long-run equilibrium relationship between the two variables, and the rest of the model represents the behaviour of the variables in the case of a deviation from that long-run equilibrium. Depending on the rank of π, alternative specifications of this model are the ones valid for each case. We are particularly interested in the situation where the rank is equal to one: this means that there is a long-run equilibrium relationship between the GDP pc and the SCI, which means that there is a single common trend between those two series.

When a cointegration relation was found, a VEC model was specified. Tests of weak exogeneity were done in order to determine whether one of the variables included is not affected by the deviations from the long-run relationship. This test uses the information contained in the π matrix, which can be expressed as follows:

$$\pi = \alpha . \beta \quad (5)$$

Where α is a two-dimensional vector and represents the speed of adjustment of the system when there are deviations from the long-run equilibrium and β is the row two-

dimensional vector that contains the information on the possible cointegration relationships. In particular, weak exogeneity is tested by checking the statistical significance of the α coefficients. If one of the two is not significant, then the equation for the variable which is associated with that non-significant coefficient cannot be said to react to deviations from long-run equilibrium. In other words, that variable is weakly exogenous in the long-run relationship, not being affected by the behaviour of the other variable that it itself affects. In Table 3, the results of cointegration and weak exogeneity tests are summarized for each sample period. Full model outputs, cointegration and weak exogeneity tests are presented in Appendix A3.

Table 3. Cointegration analysis of GDPpc and SCI

Sample	***# obs***	**# of cointegration relations**	**Weakly exogenous variable**	**Causal relationship**
1871-2017	147	1	log(GDPpc)	from GDPpc to SCI
1871-1929	59	1	SCI	from SCI to GDPpc
1930-1971	42	1	log(GDPpc)	from GDPpc to SCI
1972-2017	46	0	-	to be determined

Source: own elaboration.

If the rank of matrix π is zero, then the series are not cointegrated, in which case the standard Granger bivariate causality test is performed within a vector autoregression model (VAR) taking the first differences of the variables (check the equation 1, when the expression with π is zero). SCI is said to Granger cause GDP pc, if GDP pc can be explained by using past values of SCI. We then check if the variable does indeed better explain by adding lagged values of the SCI. If the coefficients on the lagged values of the SCI are statistically significant, then the SCI is said to Granger cause GDP pc.

Testing Granger causality within a VAR model is done by checking the statistical significance of the lags of one variable included in the equation of other variables (Enders, 2015). This could be done without having previously performed a VAR model, but having that specification is useful for determining the correct lag specification for carrying out a Granger causality test. In this study, the only subsample where a long-run relationship was not found was 1972-2017. Therefore, the causality tests were done using the following model:

$$\Delta x_t = \pi_0 + \pi_1 \Delta x_{t-1} + \pi_2 \Delta x_{t-2} + \cdots + \pi_p \Delta x_{t-p} + \mu D_t + \varepsilon_t \quad (6)$$

where the meaning of each term is the same as in equation (1). The Granger causality test takes the rows of each π_p matrix associated with the variable other than the one that is assumed to be caused. The tests showed that, for the sample mentioned above, the first difference of the SCI is being caused by the first differences of the logarithm of GDPpc i.e. the change in the SCI is caused by the growth in GDPpc. All model outputs and Granger causality tests are included in Appendix A3. Table 4 summarizes the results of this section.

Table 4. Causal relationships between GDPpc and SCI, several samples

Sample	***#obs***	**Time series method**	**Causal relationship**
1871-2017	147	Cointegration (Johansen) and VEC model	from GDPpc to SCI
1871-1929	59	Cointegration (Johansen) and VEC model	from SCI to GDPpc
1930-1971	42	Cointegration (Johansen) and VEC model	from GDPpc to SCI
1972-2017	46	VAR in first differences and Granger causality tests	from GDPpc to SCI

Source: own elaboration.

7.3 Historical consistency of the results

During the First Globalization, as is well known, the consolidation and modernization of the State and several measures of economic policy had the objective of promoting the creation and consolidation of industries by protecting the domestic production from the external competition (Millot & Bertino, 1991). However, the economic evolution –and, in particular, the industrial performance– was determined by several other factors that were probably more important. Bértola (2000) mentions the expansion of external demand encouraged due to deep technological changes (transport, communications) and the income growth of core economies, the significant increase of population and urbanization, the flow of immigrants with technical and business skills and levels of human capital higher than the local population, as well as the locational advantages for different industries associated with low costs or larger markets. The economy was affected by these conditions and there was a transformation of the composition of the production to meet a new demand –external, but also domestic– and the creation of new activities determined by new skills and better conditions for production. Under these conditions, it seems reasonable to suppose that the structural change caused economic growth from 1870-1930. In other words, the "take-off" of the economy depended on a set of transformation that made possible economic growth.

The Great Depression had severe adverse effects on any open economy as was the case for Uruguay, and the meagre performance lasted until the middle of the 1930s (Jacob 1977, 1981). From the 1930s, the industrialization process began, initially in an unplanned manner, and later with the active participation of the State in different spheres of the economy (Azar et al. 2009). Import substitution industrialization (ISI) –or, more properly, state-led industrialization (Bértola & Ocampo 2012)– had a strong dynamism in the 1940s but soon faced many limitations (Arnábal et al. 2013; Bértola 1993; Finch 1980) that explain its decline in the second half of the 1950s.

The protectionist policy had a decisive role in the industrialization of Uruguay. In the 1930s, this policy more intensive employed import taxes and fiscal exemption and also increased the direct participation of the State in manufacturing and in monetary and exchange rate instruments. A multiple exchange rate system and control of external trade were the main tools of the protectionist policy until the end of the 1950s (Azar et al., 2004; Garcia Repetto, 2017). The industrial policy was supported by different social and economic groups such as industrial capitalist groups, rural and urban middle classes, and most salaried sectors. High levels of protection and

incentives for manufacturing and agriculture (industrial crops), increasing real wages, and the expansion of the public expenditure were typical characteristics of the ISI process in Uruguay (Bértola, 1993). This evolution was facilitated, in the second post-war era, by the accumulation of international reserves during the conflict and the impressive improvement in the terms of trade. Most measures adopted influenced the evolution of income in the economy, thereby affecting relative returns, increases and equalization of wages and improved income distribution. These changes promoted economic growth and, then, the structural transformation of the economy from the 1930s to the 1960s.

The 1960s were characterized by economic stagnation and high inflation which extended until the beginning of the 1970s when a coup d'état and the institutionalization of a military government promoted a renewed modality of development (Astori, 2001). Bilateral trade agreements with Argentina and Brazil and the liberalization of the financial market (exchange rates and capital) characterized a new growth strategy (Notaro, 1984). This strategy, which can be considered as a re-globalization or non-traditional export-led growth (Oddone, 2010), evidenced economic results that were in contrast with the previous 15 years: increasing production, restructuring of demand (with higher shares of external and public demands), trade restructuring (with permanent negative balances), income concentration (supported by a a persistent decrease in real wages), and increasing capital inflows (in a period of abundant international capital) (Notaro, 2001). The State intervention in the economy had the explicit intention of restructuring the economy,[13] but the measures were initially oriented to promoting economic growth, and then, toward obtaining a real transformation of the economic structure (as in fact happened as captured by our indicator). The progressively increasing openness of the economy, the promotion of international integration programs (Mercosur) and the financial liberalization continued, in general, in the 1990s (after the democratic restoration in 1985) until the end of the century.

8. Breaks, crises and reversal movements

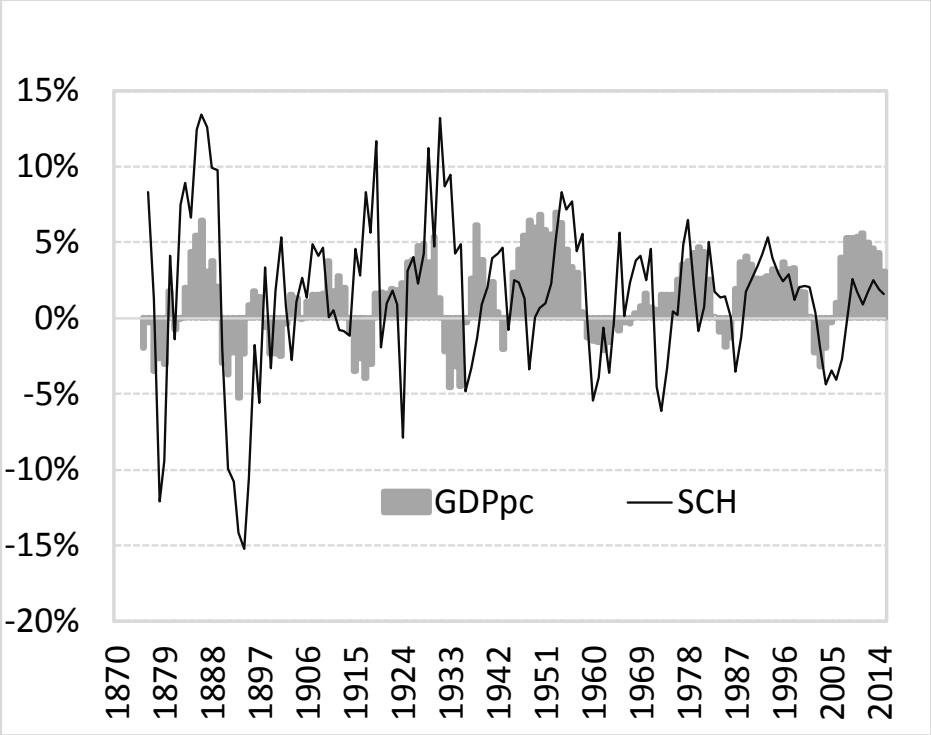
According to Bértola (2008), GDP growth features Kuznets-like swings (Bértola & Lorenzo, 2004), with extremely destructive downward phases and periodic crises. One of the most problematic features of the Uruguayan economy has been the lack of

[13] Notaro (1984, 2001) characterizes the economic policy as “restructuring intervention”.

continuity in the economic growth process more so than the low dynamism in the growth trajectory. The problem has been the impossibility of sustaining a stable pace of growth in the long run (Bértola & Bittencourt, 2005). This point has been recently emphasized by comparison with the (very) long-run evolution of developed economies. Broadberry & Wallis (2017) show that improved long-run economic performance has primarily occurred through a decline in the rate and frequency of shrinking, rather than through an increase in the rate of growth. Therefore, crises and cycles are important for understanding the evolution of the economy and, specifically, structural change is one of the proximate factors that both authors consider in their analysis.[14]

Figure 7. Uruguay: GDP per capita and Structural Change Index

Annual growth rates



Source: own elaboration.

Figure 7 presents the annual growth rates of GDP per capital and the SCI. It is focused on the occurrence of crises; i.e. we concentrate on periods with sustained negative rate of change. Table 5 shows the magnitude of each crisis and the length of the recessions in Uruguay. Following Broadberry & Wallis (2017, p. 34), we consider "crisis" as those periods with more than 3 consecutive years of negative per capita GDP

[14] The other factors considered are: technological change, demographic change, changing incidence of warfare.

growth. Table 5 also shows the evolution of structural change during –and close to– the critical periods. Looking at Figure 7 and Table 5, we see two stylized facts: (i) each crisis episode has been accompanied by a reversal in structural change; (ii) the predominant trend is that the falls in per capita GDP precede the reversal in structural change. The evidence shows that "around" each crisis episode, the economy reacted by a relative return toward primary production. The economy reacted by going back to primary production probably due to looking for traditional comparative advantages or because in such negative phases, the weakest and most exposed sectors were those other than agriculture.

Table 5. Falls, length of recession and structural change reversal (*)

GDP (pc)		**SCH**	
Period (years)	Fall (%)	**Period (years)**	Fall (%)
1875-1879	11%	**1878-1879**	20%
1890-1894	16%	**1890-1897**	52%
1898-1902	8%	**1899, 1903**	3%, 3%
1914-1918	13%	**1912-1914**	3%
1932-1936	14%	**1936-1938**	9%
1959-1967	10%	**1960-1964**	13%
1984-1986	4%	**1987-1988**	5%
2002-2005	7%	**2003-2008**	15%

Source: own estimates

(*) Rates were calculated using smooth series (5-year average)

9. Final remarks

In recent decades, there has been renewed interest in the study of economic diversification, technological sophistication and production specialization, which has placed structural change at the centre of the economic development theory and debate. However, the efforts to measure structural change from a long-run perspective are scarce and, in particular, are absent for the case of Uruguay. Our aim is to shed light on this question using a synthetic indicator to describe the dynamics of structural change

in the long run and to identify different development stages in Uruguayan economic history. We provide a long-run indicator of structural change based on a trigonometric approach to combine the movements of thirteen production sectors from 1870 to 2017.

We tested the direction of causality between economic growth and structural change. According to our exercises, economic growth caused the structural transformation of the economy in the long run (1870-2017) (in contrast with our working hypothesis); we obtain the same result for two subperiods: 1930-1971 and 1972-2017. For 1870-1929, however, we found evidence of causality in the other direction (from structural change to economic growth). The main difference between periods corresponds to the changes in international demand for raw materials and food. In the 19th century until the 1920s, the economy reacted positively to the deep changes in international markets and successfully entered into the capitalist expansion that characterized the First Globalization. This impacted the production structure and thus economic growth. In the following periods, economic policies, external incentives and the behaviour and actions of local agents impacted economic growth and, thus, structural change.

Finally, our results describe the different development patterns that, according to local literature, characterize Uruguayan economic history. In addition to this, the analysis based on these indicators provides other interesting insights. Periods of decrease in the indicator –which evidence "backward movements" in the production structure– reflect a dynamic where each negative period was associated with (relative) primarization of the economy. In other words, it seems evident that "around" each crisis episode the economy reacted by going back to primary production, probably looking for traditional comparative advantages or because in such negative phases, the weakest and most exposed sectors were those different from agriculture. This result drives us to reject our hypothesis referred to that the pace of structural change has had consequences expressed in terms of crises because the reversal relation seems more plausible

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