

Structural change and economic growth: Advances and limitations of Kaldorian growth models

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1. Introduction

One of the most important issues in economic theory is why some developing countries were able to reduce the income gap with respect to developed economies and others were not. Economic historians present many examples of countries that were able to catch up and reduce the income gap, such as the United States of America, Germany and Japan during the nineteenth century and early-twentieth century (Gerschenkron, 1962) and, more recently, the “Asian Tigers”, such as South Korea, Taiwan, Hong Kong and Singapore (Amsden, 1989). However, more common are the cases of countries that have failed to reduce the income gap with respect to developed countries. Thereby, from a historical perspective, neither convergence nor divergence is the rule in economics.

Essentially, to understand why some countries were successful in this catching-up process (and why others have failed), one has to investigate the reason why growth rates differ between countries and regions in different stages of development. This issue has been addressed with many different approaches. On the one hand, neoclassical exogenous (Solow, 1956; Swan, 1956) and endogenous (Lucas, 1988; Romer, 1986; 1990) growth theories assert that the explanation for the differences between countries’ growth rates is related to the accumulation of production factors and their allocation, hence growth is uniquely supply-determined (demand-constraints do not play any role). On the other hand, the Keynesian perspective emphasises the relevance of effective demand as a primary driver of

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accumulation, thus it claims that the long-term growth rate is demand-driven (Dutt, 2006).

However, with some notable exceptions that will be discussed later, neither of these approaches considers explicitly one of the most evident characteristics of catching-up processes. Looking at the countries that were able to reduce the income gap with respect to the most developed economies, an evident similarity is the process of *structural change*. More specifically, structural change is the process of moving the structure of production and trade from some specific sectors to others. As Pasinetti (1993) has noted, although Classical authors have paid some attention to the importance of structural dynamics for economic growth, economists have neglected this aspect since the marginal revolution. Adam Smith, for example, stressed that an increase in the share of “productive” work (in contrast with “unproductive” work) was at the root of the process of the economies’ expansion. Marginalists and subsequent neoclassical models, on the other hand, considered factor allocation as the central explanation for differences in countries’ growth rates and, consequently, viewed structural changes and the learning process as secondary issues. Pasinetti also argued that even the modern dynamic macroeconomic models have tended to abandon any hypothesis of change in structure. According to him, early Keynesian growth models, such as the Harrod growth model (Harrod, 1939), and subsequent Post-Keynesian models hardly incorporate structural changes as a driving force for economic growth, even though they recognise their importance.

Despite having been neglected by the main currents of economic models, structural changes and their relation to economic dynamics are at the root of the views of those who accounted for historical facts to understand the process of a country’s development. Structuralist approaches, adopted by economists such as Lewis (1954) and Myrdal (1957) among others, present significant contributions in favour of the importance of diversification towards modern sectors in order to promote growth. They argue that the relation between structural change and economic growth is an important issue that cannot be neglected if aiming to understand countries’ growth in the long run.

Based on Sylos Labini's (1967) view of market structures, Kaldor (1972) too presents a sectoral approach to describe economic dynamics. He argues that because manufacturing industries are oligopolies, producers adjust production in response to changes in sales (instead of prices). Therefore, in this sector, demand stimulates output growth, which, in turn, induces investment, and hence the growth process is demand-led rather than supply-determined.

Nevertheless, the vast majority of economic growth models are constructed assuming a single sector.¹ Based on this assumption, they try to identify general factors that have led developing countries to achieve higher growth rates and reduce the income gap, such as R&D and educational spillovers. Although the importance of these general factors is not negligible, one important issue that has to be taken into account is that the potential of these factors to enhance growth varies between sectors. Spillovers from research activities, for example, might be more important in technology-intensive sectors than in sectors intensive in labour or natural resources. Therefore, in order to understand why some countries were able to reduce the income gap and others have failed, it is crucial to comprehend how different sectors play different roles in the dynamics of growth, focusing on their specific contributions to the different stages of development.

This work will adopt the theoretical basis of the Kaldorian approach for the purpose of this analysis, seeking to explain how this issue was addressed in this current of economic literature.² The aim of this theoretical review is to emphasise the limitations of the Kaldorian models, and to address what should be considered in a Kaldorian model in order for cumulative causation to emerge from structural change in open economies. According to Kaldor (1966; 1970), structural change towards specific sectors increases countries' growth

¹ Palma (2005) presents a distinction between sector-specific and activity-specific models. According to the author, in endogenous growth models increasing returns may be generated by research-intensive activities, but they are not explicitly associated with the size, depth or strength of one specific sector.

² Arena and Porta (2012) and Silva and Teixeira (2008) provide a broader description of the approaches on the relationship between structural change and economic growth. This paper embraces mainly the Kaldorian view.

rates continuously, through a cumulative causation process. Although the author stressed this exhaustively, only recently have Kaldorian models incorporated this feature explicitly (as it will be discussed in the next sections). Nevertheless, these models still face significant limitations in showing how a cumulative causation process takes place in an open economy.

2. Moving labour towards modern sectors: a shortcut for growth

Since Lewis (1954) published his paper on the importance of inter-sectoral transfer of labour to increase productivity, the possibility of achieving faster growth rates in a short time through structural changes became an important issue in economic theory. According to the author, by assuming an unlimited supply of labour, workers can be transferred from traditional sectors to modern sectors, where productivity is higher, thereby increasing aggregate productivity.³ Therefore the promotion of structural changes is an important source of productivity growth for developing economies, which have large traditional sectors and significant productivity gaps.⁴

Although Lewis's paper was originally published six decades ago, this issue is still addressed by many authors nowadays. McMillan and Rodrik (2011) make a distinction between the process of increasing productivity by promoting structural changes and the process of productivity growth within a sector. According to them, through capital accumulation, technological change or reduction of misallocation, productivity can grow within economic sectors; alternatively, labour can move from low-productivity sectors to high-productivity sectors and increase the productivity of the economy as a whole. The authors compared the successful case of Asia, where

³ Denison (1967) incorporates inter-sectoral movements of labour into neoclassical models. He shows that this reduces the Solow residual significantly.

⁴ Cornwall (1977) has extended Lewis's model to advanced economies. He argues that when the demand for labour in high-productivity sectors will increase faster than the rest of the economy, this sector will face a perfectly elastic labour supply. Therefore, labour is not a constraint for growth even in developed economies.

productivity grew around 4% per year between 1950 and 2005, to the cases of Latin America and Africa, where productivity growth was around 1% per year. Although the *within* component of productivity growth has played an important role in all cases (it explained around 2% of aggregate labour productivity growth in Africa and Latin America, and more than 3% in Asia), the *structural change* component has contributed positively only for Asia's productivity growth. In Latin America and Africa, the contribution made by structural change was negative, which reduced the positive impact of the *within* component. By splitting the results for Latin America in sub-periods, McMillan and Rodrik verified that both components were equally important in increasing productivity between 1950 and 1970, each one contributing by around 2% per year. The *within* component contributed by the same amount between 1990 and 2005 as during the previous period, however the *structural change* component contributed negatively. Consequently, productivity grew only by around 1.5% per year in Latin America.

Following McMillan and Rodrik's (2011) approach, in order to analyse the contribution of each component and each sector, total productivity growth is split in these two components. Labour productivity growth can thus be approximated as:

$$\frac{\Delta Q}{Q_{t=0}} = \underbrace{\sum_{i=1}^K \Delta Q_i \frac{(N_i/N)_{t=0} + (N_i/N)_{t=1}}{2Q_{t=0}}}_{\text{within}} + \underbrace{\sum_{i=1}^K \Delta \left(\frac{N_i}{N} \right) \frac{(Q_{i,t=0} + Q_{i,t=1})}{2Q_{t=0}}}_{\text{structural change}} \quad (1)$$

where Q and Q_i are respectively the labour productivity of the economy and of sector i , and N_i/N is the share of labour in sector i .⁵ The term on the left represents the contribution of changes in productivity within a sector to the change in the productivity of the

⁵ This expression breaks down total productivity growth into two components: the growth of productivity within sectors (first term) and the growth of productivity originated from transferring labour from sectors with low productivity to ones with high productivity (second term). Essentially, the first term corresponds to technological changes that increase productivity within firms or due to the firms' interactions (McCombie and Spreafico, 2016), while the second term corresponds to labour movements across sectors.

economy as a whole. The term on the right presents the direct contribution of structural change to the growth of productivity.

The Groningen Growth Development Centre (GGDC) database for sectors (Timmer et al., 2014) was employed as an analytical tool to split countries' productivity growth from 1995 to 2008 into these two components. Table 1 presents the results for the two largest developing countries where data is available (Brazil and China) and for South Korea, a largest developed country that presented high growth rates in the last decades.

The breakdown of these two components of average productivity growth shows that structural changes are relatively important in explaining productivity growth of the economy only in the Brazilian case, but in terms of total contribution, this component is very limited for all countries. The direct impact of structural change contributed to Brazilian aggregate productivity growth by only 0.46 percentage points (p.p.). For China and especially for South Korea, the *structural change* component is relatively irrelevant. This component explains 1.50 p.p. of the Chinese total productivity growth per year, whilst the *within* component explains 12.66 p.p.; in the case of South Korea, the *structural change* component has virtually null impact both in relative and absolute terms.

Some sectors are especially relevant in explaining productivity growth in these countries. Manufacturing represented a positive contribution in both components for China and Brazil, and a negative contribution in the *structural change* component in Korea. In Brazil and China, the share of employment in this sector has increased, and, since this sector is large and its productivity is higher than the average, aggregate productivity has increased. This explains why in China, where the share of this sector in employment grew from 15.4% to 18.7%, the *structural change* component contributed by 0.97 p.p. to aggregate productivity growth. In Korea, however, the share of employment in this sector decreased by 6 p.p., and thus manufacturing contributed negatively by 0.92 p.p. to aggregate productivity growth due to the *structural change* effect. Nevertheless, the contribution of manufacturing goes beyond the *structural change* effect. In all cases, the increase in

Table 1 – Sectoral breakdown of average productivity growth into “within” and structural change components, % annual growth (1995-2010)

	Brazil		China		South Korea	
	Within	Str.ch.	Within	Str.ch.	Within	Str.ch.
Total	0.33%	0.46%	12.66%	1.5%	2.96%	0.03%
Agriculture	0.31%	-0.19%	1.25%	-0.6%	0.23%	-0.21%
Mining	0.09%	-0.03%	1.1%	-0.33%	0.01%	-0.02%
Manufacturing	0.17%	0.01%	3.94%	0.97%	2.23%	-0.92%
Utilities	0.09%	-0.05%	0.47%	0.08%	0.14%	0.01%
Construction	-0.08%	0.09%	0.69%	0.22%	0.08%	-0.16%
Trade, restaurants and hotels	0.07%	0.09%	1.34%	0.43%	0.42%	-0.1%
Transport, storage and comm.	-0.2%	0.13%	1.15%	0.22%	0.35%	0.12%
Financial and business services	0.01%	0.21%	1.04%	0.18%	-0.20%	0.44%
Government services	-0.1%	0.16%	1.35%	0.19%	0%	0%
Social and personal services	-0.03%	0.06%	0.32%	0.15%	-0.31%	0.87%

Note: “Within” denotes the contribution of changes in productivity within a sector to the productivity of the economy; “Str.ch.” the contribution of structural change to the growth of productivity. The total is calculated as the sum of sectoral contributions for each component (within and structural change).

Source: author’s elaboration on the Groningen Growth Development Centre (GGDC) database for sectors (Timmer et al., 2014).

productivity within this sector is among the most important explanations for aggregate productivity growth between 1995 and 2010. Productivity has grown significantly in the manufacturing sector and, because the share of this sector in total employment is very high, its impact on aggregate productivity has been very important. Manufacturing contributed in absolute terms to China's and Korea's growth by respectively 3.94 p.p. and 2.93 p.p. In relative terms, it contributed significantly in all three cases. This component explains around 20% of Brazilian aggregate productivity growth, as well as 28% of Chinese and 75% of Korean increase in productivity.

It seems that, although structural changes towards sectors with higher productivity may explain aggregate productivity growth for low-income economies,⁶ the main explanation for aggregate productivity growth in the cases of Brazil, China and South Korea (middle-income countries), is rather related to the productivity growth within sectors, which is the main focus of this work.

Productivity growth within sectors is basically attributable to increases in the capital-labour ratio and to technological changes (even though these two components cannot be separated). According to Rodrik (2013), the *within* component of productivity growth can be interpreted as the result of improvements in the "fundamentals". He argues that it is a consequence of accumulating skills and broadening institutional capabilities. Therefore, if we follow Rodrik's view, it would be reasonable to conclude that the main explanation for Chinese and Korean productivity growth is their improvement in these fundamentals, because the *within* component is the most important component of productivity growth.

Nevertheless, although Kaldor (1966) argued that the direct impact of the *structural change* component is important for less "mature" economies (the economies located below Lewis turning point), the author went further than the static analysis according to which structural changes only promote growth through the transfer of

⁶ In low-income countries, the traditional sector is large and there is a significant productivity differential.

labour towards high-productivity sectors. In his view, the growth in productivity through the *within* component is also explained by the faster growth in output in modern sectors (in his analysis, manufacturing). According to Kaldor-Verdoorn's law,⁷ the faster the output growth in manufacturing, the faster labour productivity in the overall economy will grow, due to the existence of static and dynamic increasing returns to scale. Consequently, boosting the *within* component of productivity growth depends on promoting specific sectors (such as manufacturing) that are able to boost all other economic activities.

The Kaldorian approach to the relation between sectoral productivity growth and structural changes brings some features to the debate that go further than the explanation given by the fundamentals, which are the object of study in the next sections. The aim of these sections is to show how structural changes are important in explaining why some middle-income countries were able to keep growing after crossing the *Lewis turning point*⁸ (when the possibility of promoting productivity growth by transferring labour from low productivity sectors to high productivity sectors had been exhausted), and others were not.

3. Scale economies in a sector-specific demand-driven approach

One of the most important explanations for productivity growth within sectors is the existence of economies of scale (or increasing returns to scale). This concept is definitely not a cutting-edge idea in

⁷ Kaldor-Verdoorn's law is also known as Kaldor's second growth law. Kaldor's first growth law theorizes the positive relation between GDP growth and manufacturing output growth, whereas his third law states the positive relation between non-manufacturing productivity growth and the growth of manufacturing output (Kaldor, 1966).

⁸ The Lewis turning point is the situation in which a country starts facing labour shortage. From this point on, it becomes hard to increase productivity by transferring labour from traditional sectors to modern sectors because the productivity differential is low and the traditional sector is not as large as before.

economic theory. In 1776, using a pin factory as an example, Adam Smith suggested that inventions are stimulated by internal division of labour, which, in turn, depends on the size of the market. Many authors have extended this concept beyond the limits of firms. Alfred Marshall, for example, distinguished internal from external economies of scale. Rather than remaining internal to individual firms, economies of scale may be found at the regional level due to *economies of localisation*.

Based on Smith's approach, Young (1928) advocated that division of labour is constrained by the size of markets, but the main source of market expansion is the division of labour itself. According to him, an increase in the supply of commodities enlarges markets *when demand is elastic*. However, Young says, this process cannot be seen at the industrial level, because an increase in the supply of a commodity increases demand for other commodities. Consequently, the demand generated by an increase in supply does not take place in the same industry, but in the overall economy, thus the forces of economic progress are endogenous due to the increasing returns at the macroeconomic level.

Young's approach on increasing returns is at the root of Kaldor's (1966) explanation for productivity growth within manufacturing. Kaldor stressed three main points regarding Young's view. First of all, he argued that scale economies must be seen as a dynamic process, rather than a static relation between an increased demand and higher productivity. The main sources of technological progress are not related to the size of firms and markets, but to the growth rate of these markets. This process, which is called of *dynamic increasing returns to scale*, is related to Arrow's (1962) notion of learning by doing, and it implies that a faster productivity growth is strictly associated with a faster output growth.

The second point he stressed is that increasing returns to scale are intrinsic to processing or transformation activities, thus they are a sector-specific factor. An empirical relationship between the growth of manufacturing output and the growth of productivity, known as

Verdoorn's law,⁹ is presented by Kaldor to argue that dynamic increasing returns to scale are not a generalised process, but are restricted to processing activities. Kaldor, however, took a further step and established a causal relationship in Verdoorn's law, by which the growth of manufacturing output is the determinant of productivity growth. According to him, the alternative causality relationship, by which productivity induces a faster growth of demand via cost and price reduction, is flawed because it does not give an explanation for productivity growth differential between countries. The remaining explanation has to be given by autonomous progress in science and technology, but how does this explanation account for verified large sectoral productivity growth rate differentials?

Furthermore, a third point that Kaldor stressed is at the root of the distinction between the Kaldorian approach on increasing returns and the one presented by the neoclassical endogenous growth theories. Although in both cases productivity growth is determined by output growth, in Kaldor's view the ultimate determinant of output is demand. Hence, although as a phenomenon it is induced by the supply side, technological change is demand driven. In the neoclassical growth theory, on the other hand, output is ultimately determined by factors of production, which are exogenously given.¹⁰ Hence, in these models, although technological changes are endogenous to output due to the existence of increasing returns to scale, they are also supply-constrained.

Kaldor (1972) argues that rather than "competitive" markets, such as those for most primary products, manufactures face an "imperfect" competition where, in response to changes in sales, producers adjust stocks and production instead of prices. According to him, in manufacturing, an increase in demand stimulates output growth, because output is not constrained by production factors, such as primary sectors' output. The growth in output, in turn, induces

⁹ In recognition of Verdoorn's (1949) investigations into this issue.

¹⁰ Dutt (2006) argues that, in these models, the economy is always in full employment and thus all savings are invested. Thus, investment, in the long run, is not determined by aggregate demand, but exclusively by savings.

investment. Consequently, capital accumulation is endogenous to demand rather than to savings, the hypothesis backed by neoclassical growth models. In this sense, besides being sector-specific due to the characteristics of the manufacturing production, the process of increasing returns to scale is demand-driven, due to characteristics of manufacturing market structure.

Since Verdoorn (1949) published his paper on the relationship between manufacturing output growth and productivity growth, a large number of studies addressed this issue through different perspectives, with very controversial results.¹¹ These results were different because the studies varied in terms of the econometric technique employed, the unit of analysis (cross-country, cross-region, cross-industry or single countries), and the different methods employed to control for the productivity growth due to capital deepening, such as estimating multifactor productivity rather than labour productivity. Moreover, another important difference is the approach these studies are based on. Some of them address this law from a demand-side perspective, based on the Kaldorian approach, and others from a supply-side perspective.

Among these various studies, the one conducted by Angeriz et al. (2008) is especially interesting because it presents a technique to estimate the supply and demand versions of Verdoorn's law separately. Based on the idea that in the supply approach inputs are exogenous and in the demand approach outputs are exogenous, the authors weigh these two versions of Verdoorn's law against each other. They conclude that manufacturing presents a significant degree of dynamic increasing returns if demand is considered as exogenous, such as assumed by Kaldor; on the other hand when inputs are considered as exogenous the degree of dynamic increasing returns to scale is not significant, as assumed by the neoclassical growth theory, suggesting constant returns to scale. Angeriz et al. (2009) expanded their study to evaluate whether these results also hold for more

¹¹ McCombie et al. (2002) presented a survey on many of these studies, focusing on the results and techniques employed.

disaggregated industrial data, and concluded that all industries are subject to increasing returns. However, similar to what has been found in earlier studies, such as McCombie (1985), there is a significant variation in the degree of increasing returns among sectors: the lowest coefficient was found in textiles and the largest in electronics.

These results suggest that once it is assumed that output is induced by demand through capital accumulation, the existence of dynamic increasing returns to scale can be an important explanation for productivity growth within sectors. Furthermore, they suggest that this phenomenon is intrinsic to manufacturing activities and it is especially relevant in some industries, as demonstrated by McCombie (1985) and, more recently, by Angeriz et al. (2009).

Araujo (2013) took this concept that increasing returns vary across sectors to understand how a cumulative process takes place in a Pasinettian framework (Pasinetti, 1981; 1993). In Pasinetti's Structural Economic Dynamics (SED), sectors grow at different rates because the income elasticity of demand is different. Pasinetti's approach, however, cannot take cumulative causation into account because it considers sectoral technological progress as exogenous. By considering technological progress as induced by output rather than as exogenous, Araujo explains the Kaldorian process of cumulative causation in a multi-sectoral framework, based on Verdoorn's law and the SED approach. A faster growth in output induces productivity growth in different degrees of sectoral increasing returns, which increase income. A faster growth in income, in turn, induces growth in output according to sectoral income elasticity of demand, and thus it perpetuates a process of cumulative causation. Therefore, countries' long-term growth rates depend on their specialization in sectors with high degrees of increasing returns and high income elasticity of demand.

4. Cumulative causation in open economies

The demand-driven approach for dynamic increasing returns is at the root of the Export-Led Cumulative Causation model (ELCC), developed by Kaldor (1970) and formalised by Dixon and Thirlwall (1975). According to the model, any exogenous shock in the autonomous demand will set up multiplier and accelerator effects¹² in local production, triggering a process of cumulative causation due to the existence of increasing returns to scale. In every region, exports are a major component of autonomous demand. Hence, a faster growth of exports will stimulate output growth, and, due to Verdoorn's law, productivity growth as well. In the ELCC model, competitiveness in external markets is essentially a function of unit labour costs, which is determined by wages and productivity. A relatively faster growth of productivity promotes the expansion of efficiency wages in the region, and thus the region's share of the world market increases. Consequently, a faster productivity growth stimulates exports, which, in turn, stimulates output and productivity, thus establishing a circular and cumulative process.

The ELCC model is very vague in terms of showing how a cumulative process takes place in an open economy. It is also important to note that it has some drawbacks. First of all, although Kaldor has stressed the importance of manufacturing, as the sector where dynamic increasing returns occur and where growth in demand is reflected in output growth, the model does not *explicitly* consider a multisectoral approach. Although it is implicitly considered because this cumulative process only takes place in industrialised economies, by considering different sectors explicitly (the way Araujo, 2013, proposed for a closed economy) it is relevant to explain how structural changes towards sectors with the highest increasing returns stimulates a process of cumulative causation.

¹² Kaldor refers to Hicks's super-multiplier to account for the effects on induced investment. This effect goes beyond the income-effect given by the traditional Keynesian multiplier.

Another important issue is the fact that the mechanism behind cumulative causation in this model is price-competitiveness. Nevertheless it is important to remember that there is a large body of literature arguing that non-price competitiveness is the most important determinant of long-term growth of exports (Fagerberg, 1988; Kaldor, 1978; McCombie and Thirlwall, 1994). Technological factors, product quality, reliability and speed of delivery are considered far more important to explain export growth in the long run than costs. Kaldor (1978), for example, found that the countries that had the greatest increase in their market share were those that experienced the greatest growth rates in prices, in contrast to what is predicted by the ELCC model. The “Kaldor Paradox”,¹³ as it is known, is explained by the fact that the increase in prices is not the cause, but the consequence of changes in non-price competitiveness, such as improvements in the quality of goods.

One of the main critiques to this model, however, is based on another strong assumption made by Kaldor (1970). According to the model, both the level and the growth of imports will adjust to accommodate the growth of exports. This assumption implies that a faster growth in exports will increase imports at the same rate as exports, through multiplier effects; hence countries’ capacity to import is not a constraint. However, it does not take into account the fact that income elasticity of demand for imports might be different from unity, and thus a faster growth in output might increase imports at a faster rate than exports, leading countries to a balance-of-payment crisis.

Important changes have to be made to this model to “temper” this strong assumption; once output growth will be determined not only by export growth, but by the growth rate of imports as well, this balance-of-payment crisis can be avoided. Thirlwall (1979) formalised

¹³ According to Kaldor (1978), one could expect that the higher a country’s market share, the lower the production costs (and hence prices) would be, due to static and dynamic increasing returns to scale. However, he shows that the higher market share is correlated with higher prices, which suggests that non-price competitiveness is more relevant than price-competitiveness.

this approach by considering that exports and imports have to grow at the same rate to avoid balance-of-payment constraints. Based on the assumption that, in the long run, prices measured in the same currency cannot grow at different rates, the growth rate of a given country is determined by the growth rate of world income multiplied by the income elasticity ratio,¹⁴ which are both exogenously given.

The balance-of-payment-constrained growth (BPCG) model, also known as Thirlwall's law, despite its simplicity, provides an interesting explanation for countries' growth rate divergence. First of all, a large number of studies tested this law empirically and most of them confirmed its importance in explaining countries' growth rates.¹⁵ Secondly, because of its simplicity, this model enables an incredible number of extensions to explain why countries' growth rates diverge.

Some specific extensions of this model are especially interesting for the analysis undertaken in this work. Araujo and Lima (2007) extended Thirlwall's model to a multisectoral framework to understand how sectoral changes in the composition of imports and exports explains countries' growth rates. The multisectoral version of Thirlwall's law, as the authors named it, asserts that sectors present different income elasticity of demand for imports and exports and countries' BPCG rates are given by the weighted income elasticity ratio. Although sectoral elasticity is exogenous, promoting structural changes towards sectors with high elasticity increases countries' growth rates in the long run. This approach is especially interesting because it brings the debate back to the importance of structural change, which cannot be seen explicitly in Thirlwall's original model.

Gouvea and Lima (2010, 2013), Romero et al. (2011) and Tharnpanich and McCombie (2013) tested this multisectoral version empirically with different econometric approaches and found that manufacturing products, with special regards to high-tech and capital goods products, present higher income-elasticity than primary

¹⁴ Elasticity of demand for imports in relation to the country's income divided by the elasticity of demand for exports in relation to world income. As discussed in McCombie and Thirlwall (1994), these elasticities reflect non-price competitiveness.

¹⁵ Thirlwall (2011) presents a systematisation of many of these studies.

products. Moreover, Gouvea and Lima (2010) argued that, unlike South American countries, Asian countries have managed to change the composition of their exports and imports in a way that increased the weighted income elasticity. Hence, the different growth rates in Asian and Latin American economies depend on the composition of exports and imports.

Both the original and the multisectoral version of Thirlwall's law made important contributions to growth theory, but they do not incorporate an important aspect of the Kaldorian approach that was exhaustively discussed before: the existence of increasing returns to scale in manufacturing and its importance for a cumulative causation process. In order to incorporate cumulative causation in the BPCG models, Setterfield (2011) extends Thirlwall's original model to consider that output growth promotes productivity improvements due to Verdoorn's law, but, rather than reducing prices, it increases the quality of products. Because income elasticity of demand for imports and exports measures non-price competitiveness, there is a clear causal relationship between this elasticity and output growth. The higher output growth rates are (in relation to world output growth), the faster the income-elasticity ratio increases. An increase in the elasticity ratio, in turn, affects output growth positively due to Thirlwall's law, thus allowing a process of cumulative causation through a Kaldorian mechanism to take place. Therefore, Setterfield's approach is capable of explaining cumulative causation even in a BPCG model. However, because it does not consider a multisectoral approach, divergence in countries' growth rates are explained by past growth rates rather than by the sectoral structure of production and trade.

Fiorillo (2001) presents an export-led model with cumulative causation in a multisectoral framework. To explain the coevolution of structural change and growth, the author proposes that output growth has a feedback effect on exports. Based on the sectoral version of Verdoorn's law and its effects on income elasticity, Fiorillo shows that the cumulative process takes place because sectoral specialisation determines aggregate growth, while the latter modifies sectoral

specialisation. Although his model does not take an explicit multisectoral BPCG framework into account, it is capable of showing how sectoral specialisation determines countries' growth rates, and how growth rate divergence reinforces the process of sectoral specialisation, thus triggering a cumulative process. Differently from Setterfield (2011), however, the causal relationship between output growth and income elasticity ratio is not direct, but is determined by the increase in sectoral profit rate. In this sense, sectoral profitability has to increase indefinitely to maintain the cumulative causation process, which has never occurred in an empirically verifiable form.

Araujo (2013) attempted to reconcile the multisectoral version of Thirlwall's law with his Pasinettian approach to cumulative causation. Nevertheless, the author maintains that dynamic increasing returns to scale only affect price competitiveness, and since the main determinants of international competitiveness are non-price factors, the mechanism with which cumulative causation is presented in Araujo's model plays a very limited role in the multisectoral version of Thirlwall's law. In Araujo's model, cumulative causation emerges from the fact that countries have different sectoral elasticity of demand according to their per-capita income. As countries grow, the demand shifts towards products with higher income elasticity, and this has an impact on the BPCG rate. Therefore, in Araujo's model countries' long-term growth rates are determined *virtually* only by the exogenous weighted income elasticities, while endogenous technological change plays a limited role.

Proceeding along these lines, a model that considers a combination of different sectoral degrees of increasing returns, different sectoral income elasticity of demand for imports and exports, and the notion of cumulative causation is fundamental to understand the dynamics of countries' growth rates divergences and their origins through a sectoral perspective. Fiorillo (2001) and Araujo (2013) have attempted to do this, but their models do not incorporate Setterfield's (2011) approach, which relates increasing returns to scale to non-price-competitiveness; hence in their models, the relationship

between cumulative causation and structural change is very limited (see table 2).

Table 2 – *Systematisation of the Kaldorian approaches to the relation between cumulative causation, non-price competitiveness and structural changes*

	Structural change	Non-price competitiveness	Cumulative causation
Araujo and Lima (2007), and Fiorillo (2001)	yes	yes	no
Setterfield (2011)	no	yes	yes
Araujo (2013)	yes	no	yes

5. Conclusions

There is clear evidence that countries' long-term economic growth is directly related to structural changes. The reasons behind this relation, though, are much less clear. An important explanation for aggregate productivity growth is the impact of transferring labour from sectors with low levels of productivity to high-productivity sectors. However, the strategy of increasing productivity through this process has shown relevant results only for countries in the early stages of development. For middle-income countries, the main source of productivity growth derives from productivity growth within sectors.

In contrast with the traditional view that explains productivity growth within sectors through fundamentals, some heterodox approaches advocate that structural changes are also an important source of sectoral productivity growth. First of all, some sectors present higher degrees of increasing return than others, thus the promotion of structural changes towards these sectors is an important source of productivity growth within sectors. Secondly, sectors present different income elasticity of demand for imports and exports. For an open economy, promoting exports in sectors with high-income

elasticity of exports and reducing imports of sectors with high-income elasticity of imports is essential to avoid balance-of-payment constraints. Furthermore, it is expected that specialisation in sectors with higher income elasticity and higher degrees of increasing return will promote a cumulative process. Faster output growth in these sectors increases productivity, which, in turn, increases income growth due to the reduction of balance-of-payment constraints, thus reinforcing the initial stimulus.

Kaldor exhaustively stressed a cumulative process along these lines. However, modelling it from a multisectoral perspective is not a simple task. Some models, such as the one proposed by Setterfield (2011), take balance-of-payment constraints and cumulative causation into account, but not in a multisectoral framework. Other models, such as the ones presented by Araujo and Lima (2007) and Fiorillo (2001), consider balance-of-payments constraints in a multisectoral framework, but cumulative causation does not emerge from sectoral specialisation (or, in the case of Fiorillo's model, the emergence of cumulative causation depends on implausible assumptions). A third group, represented only by Araujo (2013), considers cumulative causation in a multisectoral framework. However, this model is very limited in the context of an open economy because it assumes that increasing returns only impact price-elasticity.

Therefore, a model that combines different sectoral income elasticities, different sectoral increasing returns and the notion that sectoral growth rates affect non-price-competitiveness, as Setterfield (2011) stressed, is essential to understand the relationship between countries' long-term economic growth and structures of production and trade. A sectoral model that incorporates these features will be capable of explaining the interaction between structural change and cumulative causation, and will be useful to identify the sectors that are able to guarantee the highest growth rates, based on sectoral degrees of increasing returns to scale and income elasticity of demand.

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