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Does International Trade Affect Structural Change?

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We analyze the effects of international trade on structural change. We show a positive correlation between openness and the share of the agricultural sector for developing economies and present a model to rationalize this stylized fact. We built a two-sector model to compare the autarky and open economy equilibrium. The results indicate that, for developing economies, international trade may delay structural change. If the comparative advantage is in agricultural goods, trade leads to greater specialization in this kind of goods and lower participation of other goods.

Keywords: Structural change, international trade, economic growth.

JEL Classifications: C02, E10, F10, O40, O41

1 Introduction

This article takes a unique theoretical approach to exploring the connection between structural change and international trade. We construct a demand-driven structural change model and scrutinize autarkic and open economy equilibrium. The key contribution is the provision of an analytical framework that delineates the dynamics of structural change in closed and open economies, with a specific focus on developing economies.

We construct a static model with two productive sectors, each utilizing a Cobb-Douglas technology for production. The model includes a necessary and non-essential good, with non-homothetic demand. This means that consumers with a low-income level only demand essential goods, while consumers with a high-income level demand both goods. On the supply side, sectors determine the quantity of labor and capital that maximizes profits. We then analyze the model's results in the context of both closed and open economies.

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In general, an increase in the capital-labor ratio of an economy generates a decrease in the share of essential goods (i.e., agriculture) and an increase in the share of other sectors. In other words, capital accumulation produces structural transformation. However, for developing economies, foreign trade can discourage growth in non-agricultural sectors and, in this way, slow down structural change.

One of the most common definitions of structural transformation is the process that shifts the shares of the economy from the agricultural sector to the manufacturing and services sector, which implies a dynamic context (Acemoglu, 2008). However, given that the model takes place in a static environment when we talk about the effect of international trade on structural transformation, we refer to the impact that openness has on the share of the non-essential sector.

The model is built to capture the evidence that structural transformation is slower when the income is low in open economies. It is also consistent with three stylized facts: (i) In the last decades, countries have increased their openness to trade (i.e. The United States increased its imports from 4% of GDP to 17%, and its exports from 4% to 11% between 1950 and 2006 (Barro, 2008)); (ii) for low-income economies, the share of the agricultural sector is higher than in developed economies (see table 1 below); (iii) Trade between low-income and high-income economies is related to developing countries maintaining a high share of the agricultural sector (see table 4 below).

These facts suggest that poor economies have slow structural change. These countries have specialized in producing agricultural goods whose prices are subject to exogenous shocks, so the relative welfare from international trade is lower than in developed economies where the specialized sectors are in industry and services (Bourguignon, 2017). For developing economies, higher exposure to international trade may lead to a higher share of agriculture and a slower step into structural transformation. The reason is that low-income economies have a comparative advantage in producing agricultural goods. Therefore, they import goods from other sectors and lag in structural transformation.

The other side of the analysis is the small share of manufactures and services in poor economies. Foellmi and Zweimuller (2002) argued that international trade has led developing economies to import more innovative manufactured goods, which replaces their low productivity in these sectors. This phenomenon explains how structural change is linked to international trade and is slow in developing countries.

The model can also be understood as how international trade affects the relationship between the mining and industrial sectors. In general, there is a primary sector and a secondary sector, and in developing countries, the international economy affects their performance. We contribute to the discussion about the effects of global trade on low-income countries and their productive sectors by providing a theoretical open-economy model of structural transformation.

The article has five sections, including this introduction. The second part briefly reviews the literature. Then, we motivate the paper with a brief revision of the data. The fourth part

develops the theoretical model. The conclusions finalize it.

2 Literature review

Our article relates to two literature lines: structural change and international trade, which are explained by many factors. The first line of literature was inaugurated in the late 1950s and early 1960s by Kuznets (1966), Chenery (1960), Rostow (1959). The second line originates from the Hecksher-Ohlin model and has been developed by multiple authors, including Ray (2008) and Krugman and Obstfeld (2016).

Structural change models are classified into two types: demand-driven and supply-driven. Within the former, structural change is driven by Engel's law; that is, income increases translate into greater demand for goods from the services and manufacturing sectors (Acemoglu, 2008; Kongsamut et al., 2001; Buera and Kaboski, 2009, 2012a,b). The supply-driven models emphasize capital intensity differences as the driving force of structural change (Acemoglu and Guerrieri, 2008; Zuleta and Young, 2013).

Literature has also focused on the effects of changes in the productivity of specific sectors on the economy's overall productivity. Maroto-Sánchez and Cuadrado-Roura (2009), using data from 37 OECD countries, argues that productivity growth in the services has an essential effect on productivity growth in the rest of the economic sectors. Hence, the tertiarization of an economy brings a higher level of productivity overall sectors. Lee and McKibbin (2014), show that productivity growth in the services sector contributes to sustained economic growth in Asia because higher productivity expands the demand for capital stock provided by the manufacturing sector. These results suggest that a delay in the structural transformation process may negatively affect productivity and growth.

Regarding the relation between international trade and structural transformation, Uy et al. (2013) find that increasing trade costs changes the specialization pattern and increases the share of services. We analyze the same relationship but from the point of view of developing economies.

Other empirical approaches study the effect that structural change has on the composition of exports for Turkey (Saygılı and Saygılı, 2011), for some Latin American countries (Gouvêa and Lima, 2010) and developed countries in Asia (Gilbert, 2013). Mainly, literature has been focused on empirical approaches. These researches relate the data of structural change with variables of international trade (exports, imports, trade costs, duty fees).

To the best of my knowledge, there is no theoretical model that explains the results conceptually. We need a simple previous model that captures, in a general structure, the effects of international trade on sectorial transformation and, even more, that considers the income differences among countries.

3 Motivation

3.1 Structural change and international trade in the long term: historical perspective.

The process of structural change happens in all the economies. Economic history provides examples of how the stages of human development have gone through different sectors and how the changes from one stage to the other are related to international trade [1].

In Medieval Europe (XI and XII centuries), the feudal agricultural systems gave way to the first urban centers. These cities were commercial ports of the Mediterranean where the population and income grew to allow a greater demand for the agricultural sector and the development of the industry (Neal and Cameron, 2014).

As history well points out, in Europe, in the modern age, the transition from agriculture to industry was mainly due to the increase of the income of the nobles and merchants in front of agricultural households and the development of international trade[2]. Comín (2014) argues that the rise in demand for the noble class allowed the exchange of essential goods for manufactured goods between Europe and the colonies.

There are many other examples in history. However, this connection among income, international trade, and structural change deepened in centuries nineteen and twenty with the Industrial Revolution. In recent years, the income gap between countries has become more pronounced, as has their participation in international trade and the pace of structural change.

Acemoglu (2008) shows that in the United States, structural change started in the early nineteenth century and has been extended until the twentieth century. At the same time, Comín (2005) argues that the increase in international trade and globalization was significant in the countries' economic growth and structural change.

Bértola and Ocampo (2013) argue that in the case of the Latin American countries at the end of the 19th century and the beginning of the 20th century, they profited from international trade to export primary goods and import industrial goods. Still, the process of structural change was not significant, and the economy of these countries was mainly agricultural.

In this case, during the first half of the 20th century, low-income countries such as Latin America lagged in productivity. At the same time, advanced economies enjoyed rapid technological progress and a large manufacturing sector expansion: "Consequently, specialization in agricultural products was detrimental to the industrialization of any country" (Comín, 2005).

Another example is given by Inikori (2014), who studies the reverse of fortune in Africa and America between 1400 and 1850. The development of international trade in the Atlantic Ocean

[1]For example, the transition from the neolithic era to the metal age (3000 BC) represents the sectorial transformation from the agriculture sector to the metallurgic sector, that occurred, among other things, because there was an increase in the demand for manufactured goods, which led cities to increase their foreign trade (Comín, 2014).

[2]Mesa and Zuleta (2019) explore inequality and structural change relationships.

during the 19th century (along with other demographic and institutional variables) slowed growth in West Africa, leading to its production being concentrated in the agricultural sector. This trade in America led to its specialization in exporting commodities, given its productivity and factorial resource endowment. So, these continents could not develop their industrial sector.

3.1.1 Diverse results and the implementation of policies.

It is essential to recognize that international trade accelerated the process of structural change in several developing countries, which is why there is a jump in productivity from sectors with low to high levels. McMillan et al. (2014) find these results, pointing out that they occur due to globalization and integration with international trade that developing countries have carried out since 1990.

Thus, in the case of developing countries, the evidence from the literature finds heterogeneous results when analyzing the sectoral change influenced by international trade: in some, it accelerates, and in others, it slows down. Indeed, McMillan et al. (2014) point out results where, in Asian countries, there was a shift to the industrial sector with high productivity, while in Latin America, the opposite occurred: "the very diverse outcomes we observe among developing countries suggest that the consequences of globalization depend on the manner in which countries integrate into the global economy. In several cases—most notably China, India, and some other Asian countries—globalization's promise has been fulfilled. High-productivity employment opportunities have expanded and structural change has contributed to overall growth. But in many other cases—in Latin America and Sub-Saharan Africa—globalization appears not to have fostered the desirable kind of structural change. Labor has moved in the wrong direction, from more productive to less productive activities, including, most notably, informality".

Part of the explanation for the phenomenon in countries that place a greater emphasis on agriculture lies in their dependence on raw materials as an export sector, which in many cases leads to a Dutch disease characterized by fluctuating prices for these products and the resulting appreciation of the real exchange rate. Similarly, sectoral transformation in an open economy is subject to countries' labor qualifications and factor endowments, which allows for greater or lesser transitions between sectors.

Bradford and Branson note that Asian economies have adopted various economic policies aimed at fostering growth through international trade, many of which emphasize openness and export promotion. For instance, certain policies establish a minimum threshold for exports as a percentage of GDP, facilitate exchange rate liberalization, and implement targeted subsidies for specific sectors intended to thrive in international markets (Bradford and Branson, 2007). Foster-McGregor and Verspagen (2016) argue that for Asian countries experiencing structural transformation amid globalization, it is challenging to pinpoint the specific policies that facilitated this change. They assert that policy design is influenced by the countries' current development circumstances, their size, and their resource endowments.

McMillan et al. (2014) contend that while developing countries exist within a globalized context and have consequently adapted their policies to evaluate tariffs, foreign direct investment, capital flows, and exports, the sectoral changes also stem from variations in productivity levels and limitations in job creation within the dominant sectors of the economy, specifically agriculture and mining. Changes in productivity within these countries are closely linked to the transfer of technology and knowledge facilitated by the growth of international trade. This development has resulted in increasingly complex and fragmented production and knowledge chains, allowing for a diversification of goods and services production across multiple nations. Consequently, these countries are becoming more exposed to international trade, capital flows, and foreign direct investment (Perez Villar, 2017).

3.2 Recent process of structural change and international trade.

This section explores recent data on structural change and international trade. The data comes from DataBank and covers the period 1960 - 2017. We consider two periods: 1960-1970 (the oldest decade in the sample) and 2010-2017 (the most recent decade). The data are country-level, but not all the countries report data yearly, so the panel is unbalanced. We classify countries according to their income per capita level, according to World Bank thresholds[3]. We compare these two decades to understand the evolution of the relationship between structural change and international trade.

Table 1: Share of agriculture by income levels and decades. (%).

Level of income	**1960-1970**	**2010-2017**
Low	50.02	29.45
Low-middle	36.08	15.22
Upper-middle	24.85	6.7
High	21.23	2.25

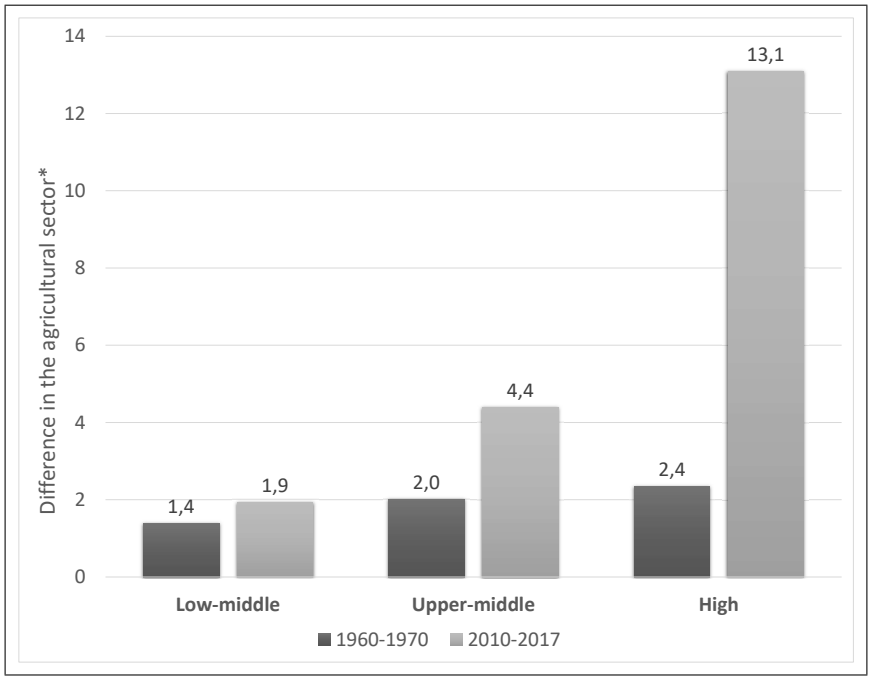
Data: World Development Indicators.

Table 1 shows the mean of the share of the agricultural sector (% of GDP). It is clear that when the level of income increases, the share in this sector is reduced. Also, the share of agriculture seems to be decreasing, a well-known stylized fact of structural change. Furthermore, the differences between one decade and another show that low-income and lower-middle-income countries have had the most remarkable drop in the agricultural sector (difference between columns 2 and 3 of table 1): 20.57 % and 20.86 % respectively. Upper-middle and upper-middle-income countries reduced the share of the agricultural sector by 18.15% and 18.98%.

[3]See World Bank web page (World, 2019)

Figure 1 shows that the relative size of their agricultural sector remains high in poor countries. For each decade, we divide the share of the agricultural sector in low-income countries by the share of the agricultural sector in lower-middle, upper-middle, and high-income countries[4]. The results reflect that the lower-income economies remain relatively large in their agricultural sector. In the last thirty years, the difference in the relative size of the agricultural sector between rich and developing countries has increased.

Figure 1: Difference in Agricultural share of low-income countries with other income levels.



The difference in the agricultural sector is measured as the agricultural share of low-income countries/the Agricultural share of countries with other income levels. Data: World Development Indicators.

Is this pattern associated with international trade? As we noted before, during the XX and XXI

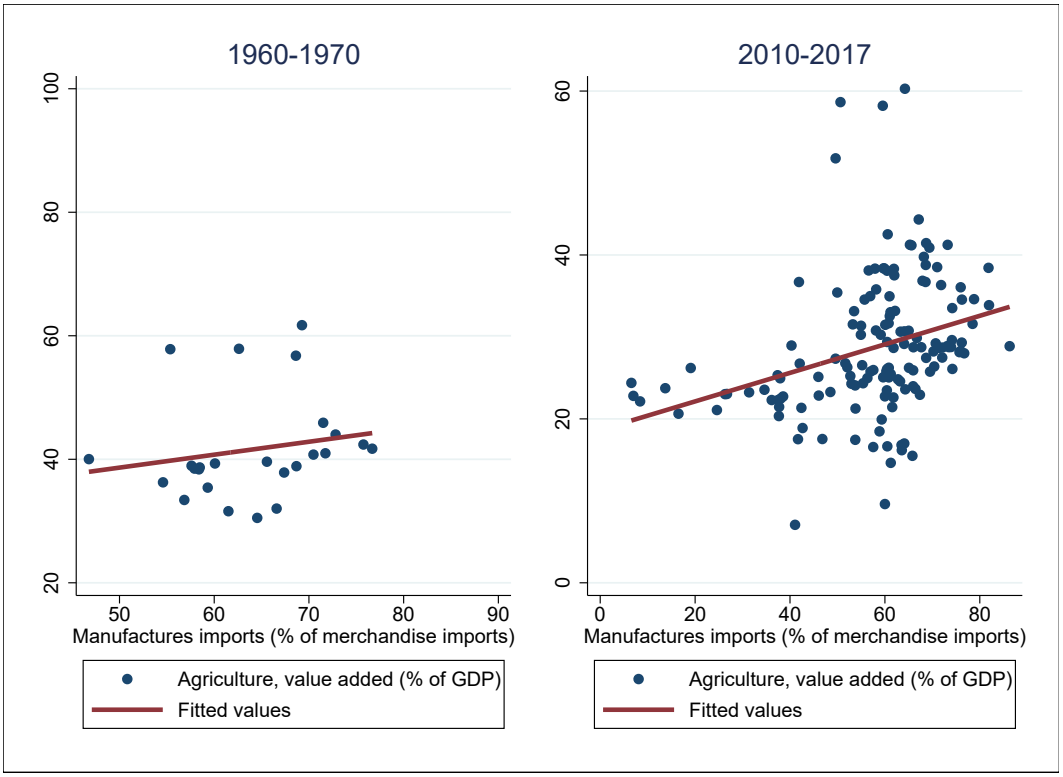
[4]Then, in figure 1, the relative difference in the agricultural share that low-income countries have concerning other income levels i (low-middle, upper-middle, high) in decade j (1960-1970 and 2010-2017) is:

$$DAS_j = \frac{share\ of\ agricultural\ sector\ in\ low\ income\ countries_j}{share\ of\ agricultural\ sector\ of\ income\ level_{i,j}}$$

Where DAS is the difference in the share of the agricultural sector. In particular, the results come from table 1 by dividing the data for each decade of the low-income countries by the data for the other countries corresponding to other income levels.

centuries, global trade has increased, so we connect the results showed in table 1 and figure 1 for the case of low-income economies. Figure 2 shows the share of the agricultural sector in low-economies and its relation to the share of import of manufactures in two decades: 1960-1970 and 2010-2017. This figure suggests a positive correlation between agriculture share and imported manufactures.

Figure 2: Share of agriculture and manufactures imports. Low-income economies.



Data: World Development Indicators.

If we analyze this correlation for countries with different levels of income (table 2), we find that in the decade of the sixties, low-income countries with a high level of agricultural share: (i) imported less from developed economies and, (ii) imported more from low-middle income countries. Five decades after, with a consolidated globalization process, low-income countries remained with a relatively high agricultural share, and now it is correlated with more imports from developed countries.

We observe the relationship between agricultural share and exports for low-income countries. Table 3 shows the correlation between agricultural share and exports in low-income countries. In the two periods, the results are positive (an increase in agricultural share would be

Table 2: Correlation matrix between agricultural share in low-income countries and imports from high and low-middle-income countries by decades.

Correlation matrix	**1960-1970**	**2010-2017**
Imports from high income countries	-0.5079	0.2186
	(0.0007)	(0.0013)
Imports from low-middle income countries	0.1510	-0.1556
	(0.3865)	(0.0231)

Data: World Development Indicators. P-Values in parentheses.

associated with an increase in agricultural exports). Still, it is higher in the 1960-1970 decade than in the 2010-2017 period. However, correlations are not statistically significant. These results imply that there is a persistence of relatively high levels of agricultural share in a world where global trade is more significant for developing countries.

Table 3: Correlations of agricultural share in low-income countries and their agricultural exports by decades.

Correlation matrix	**1960-1970**	**2010-2017**
Agricultural exports (raw materials)	0.1147	0.0436
	(0.5850)	(0.6009)

Data: World Development Indicators. P-Values in parentheses.

To further explore the relationship between structural change and international trade in the case of low-income countries, we performed an econometric approximation using the database. In the model, the dependent variable is the share of agriculture ($y_{i,t}$) of low-income countries. The model for country i at time t is:

$$y_{i,t} = \beta_0 + \beta_1 Hexports_{i,t} + \beta_2 Himports_{i,t} + \beta_3 Lexports_{i,t} + \beta_4 Limports_{i,t} + \beta_5 GDP_{i,t} + \epsilon_i + u_{i,t}$$

Variable $Hexports$ is the percentage of goods exported concerning GDP to developed countries. $Himports$ is the imported goods (% of GDP) from developed countries. $Lexports$ and $Limports$ measure the rate of exports and imports concerning lower-middle-income countries. The GDP variable is used as a control. (constant dollars of 2010).

The database structure is data panel type; therefore, in the model, we consider country-fixed effects (ϵ_i) that affect the behavior of the agricultural sector, such as geographic structure. We present a set of regressions for the sixties decade (1960-1970), the last decade (2010-2017), and all the samples (the combination of the two periods).

The endogeneity problem arises in this model because although the international trade carried out by a country affects agricultural production, the effect can also be the opposite. In a developing economy, consolidating its agricultural sector will generate greater dependence on

international trade to obtain products from other economic sectors and countries. To avoid this problem, we instrumented the variables $Hexports_{i,t}$, $Himports_{i,t}$, $Lexports_{i,t}$ and $Limports_{i,t}$ with their first lag $(t-1)$ in each case. These instrument variables are unrelated to the error term $u_{i,t}$ at moment t, explains the degree of exports and imports of the moment t, is weakly related to $y_{i,t}$, and does not present endogeneity.

However, one of the problems with the regression is that for the decade 1960-1970, the number of observations is tiny, given that most low-income countries did not report information on their variables. Consequently, the results obtained from this decade do not allow conclusions for that period. Table 4 reports the results.

Table 4: Dependent variable: agricultural share

	(1) 1960-1970	(2) 2010-2017	(3) All sample	(4) 1960-1970(IV)	(5) 2010-2017(IV)	(6) All sample(IV)
Hexports	2.965*	0.118*	0.0170	-2.780***	0.0877	0.0485
	(1.98)	(1.87)	(0.23)	(-3.40)	(0.64)	(0.33)
Himports	-1.372*	0.224***	0.282***	4.623***	0.543**	0.824***
	(-1.92)	(3.61)	(3.33)	(3.74)	(2.06)	(2.75)
Lexports	2.054*	0.0822*	-0.00141	-6.851***	0.200	0.00432
	(1.90)	(1.90)	(-0.02)	(-4.18)	(1.16)	(0.02)
Limports	1.990**	-0.120***	-0.273***	-5.831***	-0.444***	-0.585***
	(3.11)	(-2.78)	(-4.79)	(-4.31)	(-3.04)	(-3.57)
GDP	2.45e-11	-1.54e-10**	-3.25e-10***	-9.06e-11***	-1.08e-10	-1.44e-10
	(0.36)	(-2.52)	(-4.99)	(-3.16)	(-1.25)	(-1.58)
N	17	208	225	9	205	214
Groups	5	32	34	3	32	33
R^2	0.223	0.0840	0.0279	0.971	0.0702	0.0770

t statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

IV: regression with instrumental variables

All sample refers to the sum of 1960-1970 plus 2010-2017

The results suggest that for low-income countries, imports related to high-income economies have a positive relationship with the share of the agricultural sector. In this sense, the magnitude of the estimated coefficients changes between one decade and another. Using instrumental variables, the coefficient of imports with developed countries in the 1960s was 4.623; in the

last decade, it was 0.546. So, this association has decreased but remains significant. On the other hand, exports to developed countries in the 1960s were significant and had an inverse relationship with the agricultural share. Currently, that relationship is not significant.

The agricultural share of low-income countries concerning imports from lower-middle-income countries is inversely related. When instrumental variables are used (columns 4, 5, and 6), the regression coefficients are lower between the 1960s and the 2010s. Exports are inversely related in the 1960s but not statistically significant in the 2010s.

The results suggest that developing countries have increased their international trade in the last fifty years, and its effects on sectoral change are mainly related to their imports. The increase in the agricultural sector is related to a rise in imports from developed countries, which suggests that low-income countries specialize in the production of primary goods and import goods from other sectors from high-income countries. This result makes the process of structural change slow.

On the other hand, the increase in merchandise imports from low—and middle-income countries is related to a decrease in the agricultural sector's participation. In this case, this type of international trade favors sectoral change.

4 Model of structural change in open economy

This section develops a model to connect structural change with international trade. The first step is to define the concept of structural change, then, setting up a country in autarchy that has two sectors, showing that structural change depends on both the level of income and the demand [5]. Second, we compare the closed economy equilibrium with the economy's open situation.

4.1 Basic model in closed economy

We start with a basic closed economy model with two sectors: (a) produces subsistence goods, and sector (s) produces other goods. We can think of sector (a) as agricultural goods and sector (s) as manufactured goods. For example, they can also be defined as the mining and industrial sectors. One way or the other, c_a and c_s are the levels of consumption of goods (a) and (s), respectively.

For simplicity, we assume that the economy is in a steady state and has no depreciation. This economy does not have investment, so all production is consumed. This simplification does not affect the results of the model.

The representative household maximizes the utility function:

$$u(c_a, c_s) = \begin{cases} log(c_a) + log(c_s) & \text{if } c_a > \gamma \\ log(c_a) & \text{if } c_a \leq \gamma \end{cases} \tag{1}$$

[5]The structure of this part is similar to the model of Herrendorf et al. (2014) and Acemoglu (2008).

The parameter $\gamma \geq 0$ is the subsistence level of consumption. If the agent does not cross this threshold, his utility depends only on the consumption of the subsistence good. The representative household sells labor and capital in the factor market at prices w and r.

The aggregate income of the economy is $Y = wL + rK$. The economy has a fixed amount of labor L where $L = L_a + L_s$ (and is equal to the population) and a fixed stock of capital K, where $K = K_a + K_s$. Therefore, the capital-labor ratio of the economy, k, is fixed and constant in the model. The budget constraint in per capita terms is $y = w + rk$ where $k = \frac{K}{L}$ is the capital per capita and $y = \frac{Y}{L}$ is the income per capita. The price of good (s) is normalized to one, $p_s = 1$, and the price of c_a is $p_a > 0$, in this way, the budget constraint is:

$$w + rk = p_a c_a + c_s \tag{2}$$

With the equations (1) and (2), we can solve the problem of the household[6]. From the first order conditions we find consumption (a) and (s), so we have:

$$c_a = \begin{cases} \frac{w+rk}{2p_a} & \text{if } c_a > \gamma \\ \frac{w+rk}{p_a} & \text{if } c_a \leq \gamma \end{cases} \tag{3}$$

$$c_s = \begin{cases} \frac{w+rk}{2} & \text{if } c_a > \gamma \\ 0 & \text{if } c_a \leq \gamma \end{cases} \tag{4}$$

Equations (3) and (4) imply that when $c_a \leq \gamma$ then good (s) is not consumed by the household, and all the income is expended in c_a. In other words, γ is a threshold level of income that permits consumption of other goods[7].

The production of each sector $j \in \{a, s\}$ is modeled with a Cobb-Douglas function. The production Y_j depends on the total factor productivity $A_j > 0$, capital $K_j > 0$ and labor $L_j > 0$. Also, each sector has a different capital share, α_j, which defines which sector the economy is intensive.

$$Y_j = A_j K_j^{\alpha_j} L_j^{(1-\alpha_j)} \tag{5}$$

Dividing by L, we get the per capita production function:

[6]Notice that we assume that the prices of labor and capital in the two sectors are equal: $w = w_a = w_s$ and $r = r_a = r_s$. This condition implies that the household is indifferent to which sector gives the production factors.

[7]If $c_a \leq \gamma$ then sector (s) is not turn on, and all the income is for the consumption of the good of sector (a): $p_a c_a = w + rk$, so $\frac{w+rk}{p_a} \leq \gamma$.

$$y_j = A_j k_j^{\alpha_j} l_j^{(1-\alpha_j)} \tag{6}$$

Where $l_j = \frac{L_j}{L}$ is the share of labor employed by sector j, and $k_j = \frac{K_j}{L}$ is the capital per capita in sector j. Also, $y_j = \frac{Y_j}{L}$ is the income per capita in sector j.

Using equation (6), and assuming competitive factor markets, the marginal product of each factor equals its price:

$$w = p_j A_j \left(1 - \alpha_j\right)\left(\frac{k_j}{l_j}\right)^{\alpha_j} \quad \text{and} \quad r = p_j A_j \alpha_j \left(\frac{l_j}{k_j}\right)^{1-\alpha_j} \tag{7}$$

Using equation (7) and assuming factor mobility ($w = w_a = w_s$ and $r = r_a = r_s$):

$$\frac{l_s k_a}{l_a k_s} = \frac{(1-\alpha_s)\,\alpha_a}{(1-\alpha_a)\,\alpha_s} \tag{8}$$

Since $1 = l_a + l_s$ and $k = k_a + k_s$, we rearrange the last equation:

$$k_s = \frac{l_s k\,(1-\alpha_a)\,\alpha_s}{l_s\,(\alpha_s - \alpha_a) + \alpha_a\,(1-\alpha_s)} \tag{9}$$

Equation (9) defines capital per capita of sector (s) as a function of the capital-labor ratio of the economy k and the labor share of the sector, l_s. Thus, if capital-labor k increases, *ceteris paribus*, then k_s increases in the same proportion; and if l_S increases, k_s increases but with diminishing returns[8].

4.1.1 Interior solution

We now consider the interior solution under a closed economy. This solution happens when the consumption of good (a) is greater than the level of subsistence ($c_a > \gamma$).

Definition 4.1. ***Equilibrium***.
The equilibrium in the economy is defined as the vector of production factors $[k_a,\ l_a,\ k_s,\ l_s]$*, such that firms maximize profits in sectors* $[a,\ s]$*, given factor prices* $[w,\ r]$*, the total supply*

[8]Namely, in equation (9):

$$\frac{\partial k_s}{\partial k} = \frac{l_s(1-\alpha_a)\alpha_s}{l_s(\alpha_s-\alpha_a)+\alpha_a(1-\alpha_s)}$$

and:

$$\frac{\partial k_s}{\partial l_s} > 0;\ \frac{\partial^2 k_s}{\partial l_s^2} < 0$$

of factors $[k,\ l]$*, and the productivities* $[A_a,\ A_s]$*. Consumers choose consumption,* $[c_a,\ c_s]$*, to maximize utility,* $[u(c_a, c_s)]$*, given income, goods prices,* $[p_a]$ *and factor prices. At equilibrium, goods prices clear the goods market, and factor prices clear factor markets.*

In interior solution the equilibrium is $y_a = c_a$ and $y_s = c_s$. Replacing equation (4) when $c_a > \gamma$, with equations (6) and (7) the optimal per capita labor in equilibrium in each sector are:

$$l_s = \frac{1-\alpha_s}{2-\alpha_a-\alpha_s} \tag{10}$$

$$l_a = \frac{1-\alpha_a}{2-\alpha_a-\alpha_s} \tag{11}$$

From equations (8) to (11), we can find k_j in each sector:

$$k_s = \frac{k\alpha_s}{\alpha_a+\alpha_s} \tag{12}$$

$$k_a = \frac{k\alpha_a}{\alpha_a+\alpha_s} \tag{13}$$

Using equations (7) and (10) to (13), the relative price of subsistence goods is:

$$p_a = \frac{A_s}{A_a}\frac{\alpha_s^{\alpha_s}}{\alpha_a^{\alpha_a}}\frac{(1-\alpha_s)^{(1-\alpha_s)}}{(1-\alpha_a)^{(1-\alpha_a)}}\left[\left(\frac{2}{\alpha_a+\alpha_s}-1\right)k\right]^{(\alpha_s-\alpha_a)} \tag{14}$$

The derivative of p_a with respect to k is:

$$\frac{\partial p_a}{\partial k} = (\alpha_s-\alpha_a)\frac{A_s}{A_a}\frac{\alpha_s^{\alpha_s}}{\alpha_a^{\alpha_a}}\frac{(1-\alpha_s)^{(1-\alpha_s)}}{(1-\alpha_a)^{(1-\alpha_a)}}\left(\frac{2}{\alpha_a+\alpha_s}-1\right)^{(\alpha_s-\alpha_a)}k^{(\alpha_s-\alpha_a-1)} \tag{15}$$

Since $2 > \alpha_a + \alpha_s$ and $\alpha_s > \alpha_a$, then the derivative is positive. In the following proposition, we establish the conditions under which consumption exceeds the subsistence level and the household is allowed to consume other goods.

Proposition 1. *If:*

$$k > \left(\frac{\gamma}{A_a}\right)^{\frac{1}{\alpha_a}}\left(\frac{2-\alpha_a-\alpha_s}{1-\alpha_a}\right)^{\frac{1-\alpha_a}{\alpha_a}}\left(\frac{\alpha_s+\alpha_a}{\alpha_a}\right) \tag{16}$$

and equations (1) *to* (14) *hold, then:*

$$c_a > \gamma \tag{17}$$

and sector (s) *is active.*

Proof. This result comes from equilibrium $y_a = c_a > \gamma$ replacing with equations (6), (11) and (13):

$$\begin{aligned} k^{\alpha_a} &> \frac{\gamma}{A_a}\left(\frac{2-\alpha_a-\alpha_s}{1-\alpha_a}\right)^{(1-\alpha_a)}\left(\frac{\alpha_a+\alpha_s}{\alpha_a}\right)^{\alpha_a} \\ \left(\frac{k\alpha_a}{\alpha_a+\alpha_s}\right)^{\alpha_a} &> \frac{\gamma}{A_a}\left(\frac{2-\alpha_a-\alpha_s}{1-\alpha_a}\right)^{(1-\alpha_a)} \\ A_a\left(\frac{k\alpha_a}{\alpha_a+\alpha_s}\right)^{\alpha_a}\left(\frac{1-\alpha_a}{2-\alpha_a-\alpha_s}\right)^{(1-\alpha_a)} &> \gamma \\ A_a k_a^{\alpha_a} l_a^{(1-\alpha_a)} &> \gamma \\ y_a &> \gamma \end{aligned}$$

The consumption and production of sector (a) must be higher than γ. Notice that $\gamma > 0$, $\left(\frac{2-\alpha_a-\alpha_s}{1-\alpha_a}\right) > 0$, and $\alpha_a < 1$ are necessary conditions for the interior solution and activate sector (s). ■

From equations (6) to (14), the relationship between the production of the two sectors is $p_a y_a = y_s$. Consequently, the production and consumption ratios between (a) and (s) in interior solution equilibrium are:

$$\frac{y_a}{y_s} = \frac{c_a}{c_s} = \frac{1}{p_a} \tag{18}$$

Where p_a is given by equation (14). Then, from equations (15) and (18), when k increases, the price increases, and the ratio $\frac{y_a}{y_s}$ decreases. Consequently, under a closed economy and interior solution, the ratio $\frac{y_a}{y_s}$ will fall when there is a higher capital per capita, which is consistent with the structural change we see today in different economies. Namely:

$$\frac{\partial \frac{y_a}{y_s}}{\partial k} = -\frac{(\alpha_s-\alpha_a)\,A_a\alpha_a^{\alpha_a}\,(1-\alpha_a)^{(1-\alpha_a)}}{A_s\alpha_s^{\alpha_s}\,(1-\alpha_s)^{(1-\alpha_s)}}\left[\left(\frac{\alpha_a+\alpha_s}{2-\alpha_a-\alpha_s}\right)\right]^{(\alpha_s-\alpha_a)} k^{-(1+\alpha_s-\alpha_a)} < 0 \tag{19}$$

Likewise, the total income of the household is $y = p_a y_a + y_s = w + rk = 2y_s$, replacing with equations under equilibrium, we get:

$$y = 2A_s\left(\frac{k\alpha_s}{\alpha_a+\alpha_s}\right)^{\alpha_s}\left(\frac{1-\alpha_s}{2-\alpha_a-\alpha_s}\right)^{1-\alpha_s} \tag{20}$$

Naturally, the income level is greater than the consumption of the sector's good (a): $y > p_a c_a > p_a\gamma$. Note that the income of the household under equilibrium must be greater than the level of

subsistence ($y > p_a\gamma$), and this is a necessary but not sufficient condition ($y > p_a c_a > p_a\gamma$) for sector (s) to be active.

In this economy, the share of the sectors is determined by the demand side. If the household's income exceeds the minimum consumption threshold in the primary sector, they would demand new goods from other sectors. In another sense, the economy has a threshold that is constant because in equation (16), k is constant, α_j and γ are parameters, and by proposition 1 this condition allows that the sector (s) is active.

4.1.2 Corner Solution

In autarky, when the income is lower than γ, it is expended in sector (a). Thus, $c_a \leq \gamma$, and from equations (3) and (4), $c_s = 0$, we have a corner solution. Formally, we resume this idea in proposition 2:

Proposition 2. *If:*

$$k \leq \left(\frac{\gamma}{A_a}\right)^{\frac{1}{\alpha_a}} \tag{21}$$

and equations (1) *to* (7) *hold, then:*

$$c_a \leq \gamma, \ \ and, \ \ c_s = 0 \tag{22}$$

then, sector (s) *is not active.*

Proof. if: $k \leq \left(\frac{\gamma}{A_a}\right)^{\frac{1}{\alpha_a}}$, then we get: $A_a k_a^{\alpha} \leq \gamma$. So: $y_a \leq \gamma$.
In corner solution $c_s = 0$ so $y_s = 0$, it implies that sector (a) uses all the production factors. Thus, $l_a = 1$ and $k_a = k$. if $c_a \leq \gamma$, then $c_a = \frac{w+rk}{p_a}$, under equilibrium, using equation (7), we have $A_a k^{\alpha_a} \leq \gamma$. Proposition 2 tells us that per capita income is lower than the subsistence level, so it is impossible to demand goods from the sector (s). In this case, the total income of the household is $y = y_a = w + rk$ and is given by:

$$y = A_a k^{\alpha_a} \tag{23}$$

■

4.1.3 An intermediate configuration.

Propositions 1 and 2 determine the solutions in equilibrium to have the sector (s) active (or not). Now, let k_1 be the threshold in the inequality of proposition 1 (equation (16)):

$$k_1 = \left(\frac{\gamma}{A_a}\right)^{\frac{1}{\alpha_a}} \left(\frac{2 - \alpha_a - \alpha_s}{1 - \alpha_a}\right)^{\frac{1-\alpha_a}{\alpha_a}} \left(\frac{\alpha_s + \alpha_a}{\alpha_a}\right) \tag{24}$$

Equation (24) says that for any k greater than k_1, sector (s) is active ($k > k_1$). Now, let k_0 be the threshold in the inequality of proposition 2 (equation (21)):

$$k_0 = \left(\frac{\gamma}{A_a}\right)^{\frac{1}{\alpha_a}} \tag{25}$$

Equation (25) says that for any k lower than or equal than k_0, sector (s) is not active ($k \leq k_0$).

Note that for any value of α_a and α_s, the threshold k_1 is greater than the threshold k_0. So $k_1 > k_0$, we can have economies with capital-labor ratios of k between the two thresholds. For those values of k, what happens with the production of the two sectors is not established. To avoid this problem, we impose the following assumption:

We assume that for all k such that $k_0 < k \leq k_1$ the consumption of the necessary good is in the subsistence level, $c_a = \gamma$, and the rest of the income is dedicated to the consumption of the good (s): $c_s = w + rk - p_a\gamma$.

If $k_0 < k \leq k_1$, then $c_s = w + rk - p_a\gamma$, and:

$$k = \left(\frac{\gamma}{A_a l_a}\right)^{\frac{1}{\alpha_a}} \frac{(l_a(\alpha_a - \alpha_s) + \alpha_s(1 - \alpha_a))}{\alpha_a(1 - \alpha_s)} \tag{26}$$

then sector (s) is active. Equation (26) is a direct result of $c_s = w + rk - p_a\gamma$ and $c_a = \gamma$, using equations (6) and (8).

Equation (26) is the condition for equilibrium in the intermediate configuration. The labor amount l_a is determined by k, α_a, α_s, the technology A_a and γ.

As seen in the results, in a closed economy, when the level of capital per capita k exceeds a critical threshold, then in the economy sector (s) is activated. The next section will show how this process is affected by international trade. Now, given the results above, we define the concept of structural change:

Definition 4.2. ***Structural Change***.
If given an initial level of capital k, an increase in the capital stock generates an increase in the $\frac{y_s}{y_a}$ ratio, then we say that there is a structural change.

4.2 Open economy

In this section, we consider structural transformation under an open economy. Building on the model, we analyze how structural change and international trade are related. To simplify the analysis, we consider two countries: the home economy and the foreign one.

We also assume that the home economy is small, so international prices are exogenous, and model the case where the home economy has a comparative advantage in the essential good. In this context, if $p_a^* > p$, where p_a^* is the relative international price for good (a), the home economy has incentives to produce the good (a) for its consumption, export it, and import good (s).

To analyze the context of international trade, we start from the scenario in which the home economy is under interior solution. Then, both sectors (a) and (s) are active, and both goods are consumed. This simplification is adopted given that if the economy were in a corner solution, by definition, it would not be able to participate in international trade.

If $p_a^* > p$, then there is international trade. In this context, the home economy dedicates part of the production of good (a) for internal consumption, c_a, and export x_a, then $y_a = c_a + x_a$. Similarly, the production of good (s) in this trade is $y_s = c_s - m_s$, where m_s is the imports made.

Given that the optimal solution of households and firms does not change, using equations (3), (4), (7), (8) and (9) we have that the equilibrium production in the open economy for each sector are:

$$y_a = \frac{2x_a l_a(1-\alpha_s)}{1-\alpha_s - l_s(2-\alpha_s-\alpha_a)} \tag{27}$$

$$y_s = \frac{2m_s l_s(1-\alpha_a)}{1-\alpha_s - l_s(2-\alpha_s-\alpha_a)} \tag{28}$$

Where the amount of work l_s ends up expressing the equilibrium under an open economy using equation (6):

$$l_s = \frac{k(1-\alpha_a)\alpha_s}{(\alpha_s-\alpha_a)}\left(\frac{m_s A_a}{x_a A_s}\right)^{\frac{1}{(\alpha_a-\alpha_s)}}\left[\left(\frac{\alpha_a}{\alpha_s}\right)^{\alpha_a}\left(\frac{1-\alpha_a}{1-\alpha_s}\right)^{1-\alpha_a}\right]^{\frac{1}{\alpha_a-\alpha_s}} - \frac{\alpha_a(1-\alpha_s)}{\alpha_s-\alpha_a} \tag{29}$$

Notice that the derivative of l_s to k is greater than zero:

$$\frac{\partial l_s}{\partial k} = \frac{(1-\alpha_a)\alpha_s}{(\alpha_s-\alpha_a)}\left(\frac{m_s A_a}{x_a A_s}\right)^{\frac{1}{(\alpha_a-\alpha_s)}}\left[\left(\frac{\alpha_a}{\alpha_s}\right)^{\alpha_a}\left(\frac{1-\alpha_a}{1-\alpha_s}\right)^{1-\alpha_a}\right]^{\frac{1}{\alpha_a-\alpha_s}} > 0 \tag{30}$$

From equations (27) y (28), we obtain the production relations between the two sectors for the open economy case:

$$\left(\frac{y_a}{y_s}\right)^* = \frac{(1-\alpha_s)}{(1-\alpha_a)}\frac{x_a}{m_s}\frac{l_a}{l_s} \tag{31}$$

Equation (31) shows that the production ratio between the two sectors in an open economy is measured by the trade ratio between exports and imports and the allocation of labor involved in the production of each good. In particular, an increase in these ratios increases $\frac{y_a}{y_s}$. However, an increase in capital per capita in an open economy reduces the ratio $\frac{y_a}{y_s}$. That is, economies with higher capital per capita have a lower production ratio between the two sectors (their structural change is more accelerated):

$$\frac{\partial\left(\frac{y_a}{y_s}\right)}{\partial k} = -\frac{(1-\alpha_s)x_a}{(1-\alpha_a)m_s l_s^2}\frac{\partial l_s}{\partial k} < 0 \tag{32}$$

From the results in the open economy, we can establish proposition 3 about the effect of the open economy on structural change.

Proposition 3. *If $p_a < p_a^*$ then when the economy makes the transition from closed to open:*

1. *$\frac{c_a}{c_s}$ decreases, and*
2. *$\frac{y_a}{y_s}$ grows if the allocation of l_a is greater than $\frac{(1-\alpha_a)ms}{(1-\alpha_s)x_a+(1-\alpha_a)ms}$.*

Proof. In the case of the first item, if $p_a < p_a^*$ home economy has incentives to produce and export good (a) while import good (s). From equations (3) and (4), we get:

$$\frac{c_a}{c_s} = \frac{\frac{w+rk}{2p_a^*}}{\frac{w+rk}{2}} = \frac{1}{p_a^*} \tag{33}$$

Comparing this result with closed economy in equation (18), we have that $\frac{1}{p_a^*} < \frac{1}{p_a}$, and therefore the relationship $\frac{c_a}{c_s}$ is lower in the open economy.

For the second item, let us note that:

$$\frac{p_a\,(1-\alpha_s)\,x_a}{(1-\alpha_a)\,m_s} > 0 \tag{34}$$

$$\frac{p_a\,(1-\alpha_s)\,x_a}{(1-\alpha_a)\,m_s} + 1 > 1 \tag{35}$$

Likewise, we know that by definition, $l_a < 1$. Then, if the allocation of l_a is such that:

$$\frac{1}{\frac{p_a(1-\alpha_s)x_a}{(1-\alpha_a)m_s} + 1} < l_a \tag{36}$$

Then, using the last two inequalities:

$$\left[\frac{p_a\,(1-\alpha_s)\,x_a}{(1-\alpha_a)\,m_s} + 1\right] l_a > 1 \tag{37}$$

In this way, we get:

$$\left[\frac{p_a\left(1-\alpha_s\right)x_a}{\left(1-\alpha_a\right)m_s}+1\right]>\frac{1}{l_a} \tag{38}$$

$$\left[\frac{p_a\left(1-\alpha_s\right)x_a}{\left(1-\alpha_a\right)m_s}\right]>\frac{1}{l_a}-1 \tag{39}$$

$$\left[\frac{p_a\left(1-\alpha_s\right)x_a}{\left(1-\alpha_a\right)m_s}\right]>\frac{l_s}{l_a} \tag{40}$$

$$\left[\frac{\left(1-\alpha_s\right)x_a}{\left(1-\alpha_a\right)m_s}\frac{l_a}{l_s}\right]>\frac{1}{p_a} \tag{41}$$

from equations (18) and (31)

$$\left(\frac{y_a}{y_s}\right)^*>\frac{y_a}{y_s} \tag{42}$$

Where $\left(\frac{y_a}{y_s}\right)^*$ is the production ratio between the two sectors in an open economy and $\frac{y_a}{y_s}$ is the production ratio in a closed economy. ■

Proposition 3 clarifies that in an open economy, the home economy can consume both goods, and, in fact, the consumption of good (s) increases. Likewise, the structural change represented in relationship $\frac{y_a}{y_s}$ increases because the reallocation of productive factors leads to producing more good (a) than (s).

In an open economy, structural transformation is achieved through international prices. As in the traditional international trade theory, the difference between the internal and external price determines the productive specialization in one sector and defines the terms of trade (Krugman et al., 2017).

In this context, international trade through international price decelerates structural transformation because a country can specialize in producing one sector and will slowly develop other sectors to consume another kind of goods. This result supports the conclusion that we observe in the data analysis for low-income countries.

We can summarize the different results obtained as follows:

1. Under a closed economy, when the capital-labor ratio is low, the income level is low, and there is no demand for good (s). Home economy produces only in the sector of subsistence goods. In that case, we have a corner solution (proposition 2).

2. Under a closed economy, when the capital-labor ratio is high, the home economy produces only when the consumption is higher than subsistence, and a structural change occurs. In that case, we have the interior solution (propositions 1).

3. In an open economy, when international prices are high ($p_a^* > p_a$), the economy specializes in sector (a). The home economy exports good (a) and imports good (s). The economy reallocates the production factors to the sector in which it specializes, leading to the production ratio $\frac{y_a}{y_s}$ being more significant than in the closed economy case. On the other hand, the ratio of consumption $\frac{c_a}{c_s}$ is reduced.

4. In a closed economy and an open economy, it is concluded that an increase in capital per capita leads to a reduction in the $\frac{y_a}{y_s}$ ratio. Therefore, the model maintains that developed economies have a faster structural change than developing economies.

5. Considering the above, for labor-abundant economies, international trade slowcontinuouslys down structural change but does not prevent it.

5 Conclusions

The relationship between international trade and structural change has been always present in economic development. In recent decades, data suggest that global trade has increased worldwide, and poor countries continue with a slow process of structural change.

Exploring the data for low-income countries in the decade sixties and the period 2010-2017, we found the following stylized facts: (i) the share of the agricultural sector is negatively correlated with the income level. Controlling for the income level, (ii) The share of the agricultural sector is positively correlated with the imports of manufactured goods. (iii) The share of the agricultural sector is positively correlated with the exports of agricultural goods. Thus, trade with high-income countries affects structural change in developing countries because it is related to the persistence of the high share of the agricultural sector.

To explain this, we present a model where structural change depends on the share of capital in the production of each sector, the income of the household, and the consumption of subsistence. Under an open economy, international trade is given by international price that is now exogenous. If this price exceeds the internal price, the home economy specializes in agriculture and imports manufactures. Thus, structural change becomes slower. In this case, international price defines the whole process. However, international trade and structural change depend on the capital-labor ratio of the economy.

The model is compatible with the empirical results. Low-income economies can produce in new sectors when they increase their capital-labor ratio. However, the increase in the capital-labor ratio and international prices allow developing countries to enter international trade, leading them to specialize in producing a sector and reducing their structural change. The findings indicate that developing countries experience a sectoral growth curve in an open economy: they thrive when this environment enables significant capital influx. However, an oversaturation of capital, coupled with escalating prices for their traded goods, can result in sectoral stagnation.

In developing countries, the dynamics of globalization are influenced by external factors, particularly with regard to key variables like prices and trade volumes. As such, policy formulation should focus on enhancing sectoral productivity by facilitating the transfer of technology and knowledge, lowering tariffs on new technologies, and encouraging knowledge exchange through the education sector. Additionally, policies should aim to promote the retention of human capital.

Policies that promote sectoral growth and contribute positively to economic development depend heavily on institutional performance. Foreign direct investment evaluates factors such as market conditions, cost-benefit analysis, taxation, and political stability. The transfer of knowledge and technology is influenced by patent regulations, competitive wage structures, and tax incentives. The design of relevant policies can significantly drive sectoral transformation in an open economy.

There are more ways to explore. The effect of structural change on welfare and economic growth under the open economy. On the one hand, structural change comes with increased income and trade between countries. Thus, the effect of trade on structural change can affect income and its distribution. In the same context, economic growth rates vary due to international trade and sectoral change, so observing such dynamics becomes relevant. Finally, we can think of resolving the model through the unrestricted mobility of production factors between countries, so this modifies the ratio capital-labor and the production possibilities are different.

Appendix

A Appendix: threshold of capital per capita in open economy

In our analysis, when the economy is closed, and sector (s) is active, the capital per capita k is established in proposition 1, and the internal price level p_a is determined by equation (14). When the economy is opened to international trade, it is established that:

$$p_a^* > p_a \tag{43}$$

$$p_a^* > \frac{A_s \alpha_s^{\alpha_s}}{A_a \alpha_a^{\alpha_a}} \frac{(1-\alpha_s)^{(1-\alpha_s)}}{(1-\alpha_a)^{(1-\alpha_a)}} \left[\left(\frac{2}{\alpha_a + \alpha_s} - 1 \right) k \right]^{(\alpha_s - \alpha_a)} \tag{44}$$

$$k < \left(\frac{\alpha_a + \alpha_s}{2 - \alpha_a - \alpha_s} \right) \left[p_a^* \frac{A_a}{A_s} \frac{\alpha_a^{\alpha_a}}{\alpha_s^{\alpha_s}} \frac{(1-\alpha_a)^{(1-\alpha_a)}}{(1-\alpha_s)^{(1-\alpha_s)}} \right]^{\frac{1}{\alpha_s - \alpha_a}} \tag{45}$$

As we showed before, this economy exports good (a) and imports good (s). Factors move from sector (s) to sector (a), the production of sector (s) decreases, and the output of sector (a) grows. As a result, the share of sector (s) in total output decreases. From $p_a^* > p_a$ in (43), we can reconsider the presence of international trade from a threshold of capital per capita given by equation (45).

References

Acemoglu, D. (2008). *Introduction to Modern Economic Growth*. Princeton University Press.

Acemoglu, D. and Guerrieri, V. (2008). Capital deepening and nonbalanced economic growth. *Journal of Political Economy*, 116(3):467–498.

Alvarez-Cuadrado, F. and Poschke, M. (2011). Structural change out of agriculture: Labor push versus labor pull. *American Economic Journal: Macroeconomics*, 3(3):127–58.

Barro, R. (2008). *Macroeconomics: A Modern Approach*. Thomson/Southwestern.

Bértola, L. and Ocampo, J. A. (2013). *El desarrollo económico de América Latina desde la independencia*. Fondo de Cultura Económica.

Bourguignon, F. (2017). *The globalization of inequality*. Princeton University Press.

Bradford, C. I. and Branson, W. H. (2007). *Trade and structural change in Pacific Asia*. University of Chicago Press.

Buera, F. J. and Kaboski, J. P. (2009). Can traditional theories of structural change fit the data? *Journal of the European Economic Association*, 7(3):469–477.

Buera, F. J. and Kaboski, J. P. (2012a). The rise of the service economy. *American Economic Review*, 102(6):2540–69.

Buera, F. J. and Kaboski, J. P. (2012b). Scale and the origins of structural change. *Journal of Economic Theory*, 147(2):684 – 712. Issue in honor of David Cass.

Chenery, H. B. (1960). Patterns of industrial growth. *The American Economic Review*, 50(4):624–654.

Chenery, H. B., Robinson, S., and Syrquin, M. (1986). Industrialization and growth. a comparative study. *Documents and Reports*, (74247).

Clark, G. (2008). *A farewell to alms: a brief economic history of the world*, volume 27. Princeton University Press.

Comín, F. (2005). La segunda industrialización en el marco de la primera globalización (1870-1913). In *Historia económica mundial: siglos X-XX*, pages 239–286. Crítica.

Comín, F., Hernández, M., and Agelán, E. L. (2010). *Historia económica mundial: siglos X-XX*. Crítica.

Comín, F. C. (2014). *Historia económica mundial*. Alianza Editorial.

Foellmi, R. and Zweimuller, J. (2002). Structural change and the kaldor facts of economic growth. *Zurich IEER Working Paper*, (111).

Foster-McGregor, N. and Verspagen, B. (2016). The role of structural change in the economic development of asian economies. *Asian Development Review*, 33(2):74–93.

Galor, O. and Tsiddon, D. (1997). Technological progress, mobility, and economic growth. *The American Economic Review*, 87(3):363–382.

Galor, O. and Zeira, J. (1993). Income distribution and macroeconomics. *The Review of Economic Studies*, 60(1):35–52.

Gilbert, J. (2013). International trade, growth and structural changes in employment in devel-

oping asia. *Trade, Labor and Inclusive Growth: Sustaining a Dynamic Asia. Manila: Asian Development Bank (ADB)*.

Gouvêa, R. R. and Lima, G. T. (2010). Structural change, balance-of-payments constraint, and economic growth: evidence from the multisectoral thirlwall's law. *Journal of Post Keynesian Economics*, 33(1):169–204.

Herrendorf, B., Rogerson, R., and Valentinyi, A. (2014). *Handbook of Economic Growth*, volume 2, chapter Chapter 6 - Growth and Structural Transformation, pages 855 – 941. Elsevier.

Inikori, J. E. (2014). *Reversal of Fortune and Socioeconomic Development in the Atlantic World*, page 56–88. Cambridge University Press.

Kongsamut, P., Rebelo, S., and Xie, D. (2001). Beyond balanced growth. *The Review of Economic Studies*, 68(4):869–882.

Kruger, J. J. (2008). Productivity and structural change: A review of the literature. *Journal of Economic Surveys*, 22(2):330–363.

Krugman, P. and Obstfeld (2016). *Economía Internacional: teoria y politica* . Pearson Educación.

Krugman, P., Obstfeld, M., and Melitz, M. (2017). International economics: Theory and policy, the latest edition.

Kuznets, S. (1966). *Modern economic growth: rate structure, and spread.* Yale University Press.

Landesmann, M. and Foster-McGregor, N. (2021). Trade liberalization, structural change, and economic growth. In *New Perspectives on Structural Change: Causes and Consequences of Structural Change in the Global Economy*. Oxford University Press.

Lee, J.-W. and McKibbin, W. J. (2014). Service sector productivity and economic growth in asia.

Maroto-Sánchez, A. and Cuadrado-Roura, J. R. (2009). Is growth of services an obstacle to productivity growth? a comparative analysis. *Structural Change and Economic Dynamics*, 20(4):254–265.

McMillan, M., Rodrik, D., and Íñigo Verduzco-Gallo (2014). Globalization, structural change, and productivity growth, with an update on africa. *World Development*, 63:11–32. Economic Transformation in Africa.

Mesa, C. A. and Zuleta, H. (2019). Structural change and inequality. *Working paper*.

Neal, L. and Cameron, R. (2014). *Historia económica mundial*. Alianza Editorial.

Pasinetti, L. (1983). *Structural Change and Economic Growth: A Theoretical Essay on the Dynamics of the Wealth of Nations*. Cambridge University Press.

Perez Villar, L. (2017). *Foreign Direct Investment, Trade and Development: Firm Linkages and Knowledge Transfer*. PhD thesis, Christian-Albrechts Universität Kiel.

Ray, D. (2008). *Development economics*. Springer.

Rostow, W. W. (1959). The stages of economic growth. *The Economic History Review*, 12(1):1–16.

Saygılı, H. and Saygılı, M. (2011). Structural changes in exports of an emerging economy: Case of turkey. *Structural Change and Economic Dynamics*, 22(4):342–360.

Uy, T., Yi, K.-M., and Zhang, J. (2013). Structural change in an open economy. *Journal of Monetary Economics*, 60(6):667–682.

World, B. (2019). World development indicators.

Wyszkowska-Kuna, J. (2019). Productivity performance of the service sectors in european union countries. *Comparative Economic Research*, 22(4):7–22.

Zuleta, H. and Young, A. T. (2013). Labor shares in a model of induced innovation. *Structural Change and Economic Dynamics*, 24:112 – 122.