



Ramón Carande Award

## Food Security, trade specialization, and violence in Colombia (1916-2016)

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### ABSTRACT

Socioeconomic and historical approaches can contribute to the understanding of the relationship between food security, agricultural trade, and armed conflicts in developing countries. While the market-based perspective advocates that trade is a useful way to maintain food security nationally, other works suggest that trade liberalization and agro-export specialization have threatened food security since the 1980s, especially the self-sufficiency capacity. In Colombia, this agrarian change to agro-export specialization and food dependence has also been linked to the surge of the second wave of violence (c. 1980). Is there a dichotomy between trade and self-sufficiency during the Colombian twentieth century? Did armed conflict contribute to the specialization in agro-exports during the Second Globalization? This work contributes to the dichotomous debate between food security and agricultural trade with a more nuanced view along throughout the twentieth century and confirms a long-term relationship going from violence and international prices towards tropical specialization.

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### Seguridad alimentaria, especialización comercial y violencia en Colombia (1916-2016)

### RESUMEN

Los enfoques socioeconómicos e históricos pueden contribuir a la comprensión de la relación entre la seguridad alimentaria, el comercio agrícola y los conflictos armados en los países en desarrollo. Mientras que la perspectiva basada en el mercado defiende que el comercio es una forma útil de mantener la seguridad alimentaria a nivel nacional, otros trabajos sugieren que la liberalización comercial y la especialización agroexportadora han amenazado la seguridad alimentaria desde la década de 1980, especialmente la capacidad de autosuficiencia. En Colombia, este cambio agrario hacia la especialización agroexportadora y la dependencia alimentaria también se ha relacionado con el surgimiento de la segunda ola de violencia (c. 1980). ¿Hubo dicotomía entre comercio y autosuficiencia a lo largo del siglo xx en Colombia? ¿Contribuyó el conflicto armado a la especialización agroexportadora durante la Segunda Globalización? Este trabajo contribuye al debate dicotómico entre seguridad alimentaria y comercio agrícola con una visión más matizada de su relación a lo largo del siglo xx y confirma la relación de largo plazo que va desde la violencia y los precios internacionales hacia la especialización tropical.

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## 1. Introducción

The sustainable development goal of zero hunger and assuring access to food as a main human right are among the major challenges of our contemporary societies, especially in developing countries where more than 800 million people still go hungry today (FAO, 2019). Food-security issues in developing countries, such as shortfalls, under-nutrition, food availability, and a lack of access to food of minimum quality are at the core of debates over economic development and international trade, since ensuring the availability of enough quality food is critical to human capital formation, individual productivity, and ultimately economic development, as it has been throughout human history (Fogel, 2004). Therefore, the multi-criteria evaluations of socioeconomic and historical approaches can contribute to the understanding of food insecurity (Porkka *et al.*, 2013; The Special Rapporteur, 2020). This work aims to integrate historical and empirical analysis of food security, agricultural trade, and violence in Colombia to shed some light on the relationship between food security and agrarian trade between 1916 and 2016 on the one hand, and to establish the role of armed conflict and international markets as drivers of the tropical trade specialization since the Second Globalization (c. 1980) on the other.

Market and non-market advocates stress the negative and positive effects of trade on food security. From a market-based perspective, trade is a useful way to maintain food security nationally. International trade can allocate food from countries with abundant food supplies to countries where the supply of food is scarce (Runge *et al.*, 2003). Trade openness has a positive impact on dietary energy consumption, as well as improving diet diversity (Dithmer and Abdulai, 2017), and short-term food security (Dorosh, 2001). Although imports of food can also alleviate food shortages in favourable policy environments, exports can negatively affect food security (Shettima *et al.*, 2019).

Focussing on self-sufficiency, some research suggests that trade liberalization and specialization in agro-exports threaten domestic food security in developing countries (Kumar Sharma, 2016; The Special Rapporteur, 2020). After the second World War and up to the 1970s, the promotion of national self-sufficiency became a worldwide political response, but since the 1980s the promotion of agricultural exports and trade liberalization in developing countries has changed this policy (O'Hagan, 1976). Since this moment, the food regimen literature emphasizes that international corporations connected fresh food production and cereal imports in developing countries with agricultural offshoring and the supermarket revolution in developed ones. The main mechanism for creating food dependence and agro-export specialization across the developing world was driven by the need to face the foreign debt crisis with relatively well-paid tropical and fresh products (McMichael, 2013).

Food security can be defined as food availability or self-sufficiency, given the greater relevance of the role of trade or the capacity to produce domestically. In this vein, Clapp (2017) argues that this debate between trade and self-sufficiency has been held under a false dichotomy. Following the author, self-sufficiency depends on the political orientations and indicators that are used. However, the decoupling of consumption and production is the current (and future) picture of the global dynamics of agriculture. While more than half of the food availability in Latin America relied on imports during the 2010s, 70% in the case of Colombia (Fader *et al.*, 2013), special-

ization in high-value agricultural exports has been created through favourable policies promoting the agro-export sector (Norberg, 2019; Patel-Campillo, 2010). Therefore, it seems clear that the food dependency on imports and trade export specialization compound the contemporaneous picture of agriculture across the developing world.

Beyond international explanations, agrarian change towards food dependency and agrarian specialization –for example, in the case of soya in Paraguay, Argentina, and Uruguay– have been linked to the long-term economic interests of the agrarian elites in international markets and state support of these interests (Norberg, 2019). In the case of Colombia, however, this agribusiness development of tropical agriculture has also been linked to the intensification of the armed conflict. Competition over land and territorial control to maintain cattle-ranching and the illegal economy (Richani, 2002) are closely related to the agrarian elites' direct participation in conflict (Gutiérrez-Sanín and Vargas, 2017) by legal (Peña-Huertas *et al.*, 2017) and illegal means, and together with the active role of the state (Ballvé, 2012; Grajales, 2011, 2013). The elites linked to commodity crops such as coffee, banana, or oil palm, who paid for security and fought peasant claims (Gutiérrez-Sanín, 2019), were the direct beneficiaries of land dispossession and the public policies to promote their agribusinesses (Maher, 2015; Vargas and Uribe, 2017). Therefore, in the case of Colombia, agrarian change towards tropical specialization and food dependence can be linked to international market forces, as well as to domestic and non-market forces such as the use of violence.

However, in contexts of a high risk of conflict farmers tend to produce more annual than permanent crops since they require less investment of time and capital, then increases the risks of food insecurity (Arias, Ibáñez and Zambrano, 2019). According to this approach, conflict would promote the increase in production of annual crops such as grains, while creating no incentives for permanent cropping such as tropical fruits, which is just the opposite of the argument for the use of violence in promoting tropical export specialization and food dependency on international markets. As a complement, armed conflict would hamper economic and trade development (Collier *et al.*, 2003).

I use the case study of Colombia between the First and the Second Globalizations as a remarkable example to analyse the relationship between food security and agricultural trade, and the role of armed conflict in the agro-export specialization. During the First Globalization (1910-1930), the country entered international trade with a progressive crop like coffee. Despite favouring the economic interest of the commercial classes, coffee expansion depended on the intensive use of labour and was rooted in medium-sized family farming (Ocampo, 1989; Palacios, 1983) due to the difficulties of increasing economies of scale on the slopes of Antioquia. In contrast, during the Second Globalization, increasing conflicts, land-grabbing, and expansions of regressive monocultures such as banana, sugarcane, and oil palm took place in the lowlands. These crops, which are intensive in their use of capital and easy to mechanise in large plots, contributed to land concentration and the displacement of family farming by both market and non-market mechanisms (Grajales, 2013, 2021; Maher, 2015; Peña-Huertas *et al.*, 2017; Vargas and Uribe, 2017).

Is there a dichotomy between trade and self-sufficiency during the Colombian twentieth century? Did armed conflict in Colombia contribute to the specialization in agro-exports during

the Second Globalization? To answer the first question, I build on time series from the early twentieth century to the present day on food availability, agricultural trade, self-sufficiency, and land-use changes. I analyse the evolution of these time series considering the policies from the First to the Second Globalization passing through the state-led growth period. To answer the second question, I test the long- and short-term relationships between tropical agro-export specialization, armed conflict, and relative international prices using a Vector Error Correction Model (VECM) for the period between 1961 and 2016.

The results tell a story of success in improving per capita consumption of calories in the long-term and an impoverishment of diet that parallels the shift in agricultural trade. Colombia moved from being an exporter of tropical foodstuffs to becoming a food-dependent importer of cereals from the 1990s. This transformation did not mean reducing or ending tropical exports but increasing imports of staple foodstuffs. The growth in regular imports allowed some gains in per capita consumption, while also eroding the self-sufficiency capacity of the domestic agricultural system to provide staple foods. Regarding the empirical testing, there is a positive long-term relationship going from violence and international prices towards tropical specialization, which is in line with the argument that violence is a tool of agribusiness development rather than a hindrance. However, in the short-term the lagged values of specialization and the relative prices are positively associated with the rise in violence. These results open a window to exploring the role of commodity crop specialization as a cause of violence in the short-term.

The paper discusses some of the implications for food security that can be drawn from the historical evidence beyond the dichotomic debate and sets out some framework lines for understanding the long and short-term interactions between international and domestic actors involved in tropical specialisation based on the literature on the political economy of violence in the country.

The following section deals with the sources, data, and methodology used. Section three presents the main results, namely the evolution of the time series on food security and agricultural trade on the one hand, and the dynamics between tropical specialization, armed conflict, and international prices in the VECM on the other. The discussion in section four is split between the historical lessons of the relationship between food security and agricultural trade, and a sketch of the framework to understand the relationship between tropical specialization and violence. Finally, some concluding remarks are provided.

## 2. Data and methodological approach

I propose two methodological approaches: the historical description of the relationship between food security and agricultural trade from 1916 to 2016, and the empirical testing of the long- and short-term interactions between tropical specialization, violence, and relative prices.

### 2.1. Food security and agricultural trade time series (1916-2016)

The data before 1960 is from official records available in the historical archives of the statistical bureau of Colombia (DANE) and the archive of statistics of Latin America in Casa-América at Barcelona University (Urrego-Mesa and Fuentes, 2016). I

harmonized these historical data with the series of production and trade of crops and livestock products available in FAOSTAT (2021) for the period 1961-2016. These series are grouped in eight vegetal food products (Urrego-Mesa, Infante-Amate and Tello, 2019, Table S3) and three animal food products.

Firstly, I convert the physical output in trade and production into kilocalories. The energy approach makes possible to relate the trade patterns with the indicators of food security, which tends to be mostly in units of matter rather than in value (FAO, 2012). This strategy allows to compute the per capita intake and diet composition. To do that, I use technical coefficients of gross energy for more than five hundred items in trade and production (Guzmán *et al.*, 2014; Urrego-Mesa, Infante-Amate and Tello, 2019, Table S2) and then its equivalent in kilocalories. Standardization of trade data before 1961 is based on the composition in 1961, 1962 and 1963 (FAOSTAT, 2021) and the average coefficient by groups of products (Appendix, Table 4). Trade information before 1961 was collected from the International Trade Yearbooks of 1916/23/29/38b/40/45/50 and FAOSTAT (2021) since then. The database contains data on all the agricultural trade filtered to collect food products and excluding seeds or animal feeding.

To track the trends in the food calories involved in international trade, I compute the trade balance (TB) (Soto *et al.*, 2016), which provides the net imports by subtracting the calories exported (X) to those imported (I):

$$TB_{ti} = I_{ti} - X_{ti} \quad (1)$$

In eq. 1 and onwards, the  $t$  refers to the specific year adopted as the time frame, and  $i$  represents the different products coming from each sub-sector of the agricultural system, e.g. the amount of production of maize, plantains, and livestock products. The TB is in deficit when the country exports more food than it imports. This difference is the final trade balance.

The classic definition of food security is based on three dimensions: availability, access, and utilization (Barrett, 2010). In accordance with this definition, this work focuses on the first dimension since it looks at the supply of food nationally. Therefore: the variables to assess food security are the domestic supply (DS) and the self-sufficiency index (SS).

The DS of food also excludes uses such as seed or feed and accounts for agricultural and livestock food products from domestic production (DP) and the TB (eq. 2).

$$DS_{ti} = DP_{ti} + TB_{ti} \quad (2)$$

Data on domestic production of primary crops before 1960 is from Urrego-Mesa, Infante-Amate and Tello (2019), but I figure sugar, molasses, and non-refined sugar by using the yields of production in the 1940s (Varela Martínez, 1949, p. 85). Vegetal data were completed by livestock production of meat, milk, fat, and tallow. In the case of meat, the estimation draws on the information of the number of slaughter cattle (male and female) between 1915 and 1950 (Kalmanovitz, López and Romero, 1999). The slaughter for small livestock (i. e. pigs, goats, and sheep) during 1915-1960 and the years lacking for cattle (1951-1960) were collected directly from the Statistical Yearbooks of 1918/28/35-38a/49. When carcass weight was not available, I computed the average living weight and applied the yields of 1950 (Varela Martínez *et al.*, 1952) to obtain the average yields of carcass (see Appendix Tables 1 and 2). It must be borne in

mind that higher yields in 1950 than 1916 can conduct to overestimation and misinterpretations. Finally, tallow and animal fat are proportional to the number of animals slaughtered.

In the case of milk, and given the fact that Colombia's dairy industry developed around the 1980s (Kalmanovitz and López, 2006), I took the data for cows older than two years (Kalmanovitz, López y Romero, 1999) and computed the yields with the amounts of milk recorded for 1961-1965 (FAOSTAT, 2021), thus obtaining a yield of 288 kg of milk per cow annually, which is lower than the yields in 1950 (Varela Martínez *et al.*, 1952) and 1961 (FAOSTAT, 2021). I used this lower value to avoid overestimates.

Food availability is the portion allocated for human food in the balance sheets (*id.*) and the global average of household wastages of food (FAOSTAT, 2021) (12%) (Porkka *et al.*, 2013) subtracted from the DS in eq. 2. Before 1961, I assumed that this portion was the same as the average percentage of 1961-1963 and apply this figure per categories of products (see Appendix Table 3). In the case of the TB, the portion of food was obtained with the same coefficients. Finally, the apparent daily per capita consumption is this availability divided by population and 365 days. The population between 1916 and 1949 is given by Flórez Nieto and Méndez (2000) and from 1950 by FAOSTAT (2021).

I compare the evolution of the daily per capita consumption with the minimum requirement of calories (1800 kcal/pc/d) given by Porkka *et al.* (2013). Note that the amount of food wastage may change across time, increasing with rising household income. Thus, I may underestimate the availability of calories consumed in the past and overestimate the contemporaneous calorific intake, but these changes do not primarily affect interpretation of the long-term. Conversely, the use of this threshold provides information on the quality of the sources and the role of non-market or subsistence agriculture as a source of food, especially before 1961.

The second variable of food security is self-sufficiency (SS). This index allows weighting the role of trade on domestic supply. I figure a self-sufficiency index of calories in a similar way to Falconí, Ramos-Martin and Cango (2017), but instead of imports in the numerator, I use the net imports. In this way, the index is also informative on the role of exports. The SS indexes for each of the groups of food (eq. 3) and for the whole agri-food system (eq. 4) are presented:

$$SS_{ii} = 1 - \left( \frac{TB_{ii}}{DS_{ii}} \right) \quad (3)$$

$$SS_t = 1 - \left( \frac{\sum_i TB_t}{\sum_i DS_t} \right) \quad (4)$$

The index reports on the full capacity of the agricultural system to provide the domestic supply when it is equal to one. If it is less than one this capacity deteriorates, which means that the availability of food relies on imports, and when the index is higher than one, it indicates that the agrarian system is not only capable of supplying the demand of the country, but it is also an international food supplier, giving some clues to the country's role in internationally traded food.

Finally, I analyse land-use changes (LUC) as the share of the tropical products involved in the basket of agricultural exports

(CC) on the total area harvested, which includes the area allocated to staple crops (SC). In eq. 5, CC is the addition of fruits, oil crops, stimulants, and sugarcane represented with  $j$  and SC is composed by cereals, pulses, vegetables, roots, and tubers represented with  $k$ .

$$LUC_t = \frac{\sum_{jt} CC}{\sum_{jkt} SC + CC} \times 100 \quad (5)$$

## 2.2. Vector Error Correction Model (1961-2016)

The second approach of the methodology is the empirical testing of the interactions between tropical export specialization (SP), violence (V), and relative prices (P). The role of relative prices as incentive to specialization is a common place in economics (Feenstra and Taylor, 2017) and economic history (O'Rourke and Williamson, 1999), but this is not the case of conflict (Collier, 2003). The political economy literature of war on the second wave of violence in Colombia (c. 1980) has pointed out the use of violence by the agrarian elites and the state as a tool of land dispossession which has favoured the development of agribusiness rather than being a hindrance (Ballvé, 2020; Grajales, 2021; Gutiérrez-Sanín, 2019; Gutiérrez-Sanín and Vargas, 2017; Richani, 2002; Vargas and Uribe, 2017). Therefore, I propose to explore this idea by testing for the long-term co-integration of those three variables and modelling its short-term relationships in a VECM from 1961 to 2016.

SP is the interaction between the LUC (eq. 5) and the amount of tropical products involved in agricultural exports given above as CC (Table 1). I use its interaction due to the LUC and the supply of exports does not necessary occur at the same speed. LUC use to be slower than the supply of markets, especially when the commodity can be stored as in the case of coffee for example. In this sense, the interaction of these two variables will capture better the phenomenon of specialization and its direct links with international markets. The sources for this variable are the same as for the time series of agricultural trade and food security.

In the case of violence, the limits of the temporal coverage of massacres and displacement prevent the use of this information for the model proposed. Therefore, to capture the phenomenon of violence I use the number of deaths derivate from the fighting between the state forces, paramilitaries, and guerrillas during 1961-2016 (CNMH, 2018). I measure the dimension of conflict by the total number per year (V) and approximate the intensity of the conflict as the mean of victims in each case per year ( $\bar{V}$ ). Although these two measures perform so different, the expected outcome is the positive relationship with specialization.

To explore these two measures of violence, I build model 1 and model 2 for V and  $\bar{V}$ , respectively<sup>1</sup>. The underlying idea is that violence does not act through direct murdering but rather by the fear of the armed fighting and its intensification, which in turn would lead to land abandoning and displacement making easier dispossession and tropical specialization in hands of the rural elites.

<sup>1</sup> The detailed notation, outputs, and robustness checks for the models are in Appendix, Section B.

This measure, however, has two drawbacks. I am capturing the total effect of violence on tropical specialization instead of the direct violence perpetrated by paramilitaries and the state, as would be captured if I used the massacres as the literature on violence suggests. However, if violence does not act as a tool in favour of tropical specialization, we expect a negative or no relationship at all. This lack of relationship, therefore, would validate the armed conflict as an obstacle to the development of tropical exports, in other words, violence as a market distortion rather than the engine of agribusiness. Additionally, the analysis does not include the role of the state in promoting violence and the agro-export sector, which is central in the hypothesis of violence as a tool of agrarian capitalism formation. To offset this lack, I provide qualitative information of this relationship in the discussion, while also stress the need to extend the work in this direction.

Finally, I use relative prices (P) for tropical commodities to cereals (Geronimi, Anani and Taranco, 2017) as the market incentives. Comparative advantages and factor endowments are the main factors of productive specialization of a country when opens to trade (Feenstra and Taylor, 2017, Ch 2-5). If prices act as an incentive, it should affect the decisions on increasing exports and devoting more land to the profitable crops. Tropical prices include coffee, oil palm, banana, and sugarcane, and cereals wheat and maize. This decision was based on the trade basket composition of agricultural products in imports and exports of Colombia. In volume, cereals have been two-thirds of imports since the 1960s of which wheat and maize were more than 70% during 1940-1990 and since the 1990s, respectively. Regarding exports, coffee and banana dominated with more than 90% during 1929-1955, but this percentage has been completed with sugar, fruit, and oil crops since the 1990s.

**Table 1**

Descriptive statistics of the time series for the VECM, ADF and I(d) tests

Variables	N	Mean	St. Dev.	Min	Max	ADF P-value	I (d)
Tropical crops <sup>1</sup>	56	55.50	6.25	45.62	67.16	0.63	1
Tropical crops (Exp.) <sup>2</sup>	56	6.42	3.46	1.78	13.07	0.48	1
Num. of fatalities	56	813.91	927.94	39	4.520	0.98	1
Mean of fatalities	56	1.74	0.94	0.36	6.50	0.57	1
Relative prices (log)	56	10.62	1.18	8	12.58	0.41	1

**Notes:** <sup>1</sup> Percentage of the area harvested under tropical crops: stimulants, sugarcane, fruits, and oil crops. <sup>2</sup> Exports in trillion of kcal of tropical crops. Augmented Dickey-Fuller (ADF) and Integration order (I(d)) tests were conducted with the variables in logarithms.

Source: see Section 2.

Table 1 also shows that the time series used for modelling fulfil the requirements for co-integration testing and VECM, which are the non-stationary condition and the same integration order. VECM does not account for independent variables, but the main assumption is that the variables compose a stable system of equilibrium where stronger variables are marking the trends of the system and weaker variables

adjusting to these trends (ECT). In our case, the system is composed of three variables: (SP), (V) –both total and mean– and (P), thus composed by three equations (6, 7, 8). The model gives information on the direction of the relationship between the variables and the effects coming from the past, which is also known as Granger Causality (Lütkepohl, 2005).

$$\Delta SP_t = \theta_1 + \sum_{i=1}^p [\delta_{1i} \Delta SP_{t-i} + \beta_{1i} \Delta V_{t-i} + \varphi_{1i} \Delta P_{t-i}] + \mu ECT_{t-1} + \epsilon_{1t} \tag{6}$$

$$\Delta V_t = \theta_2 + \sum_{i=1}^p [\delta_{2i} \Delta SP_{t-i} + \beta_{2i} \Delta V_{t-i} + \varphi_{2i} \Delta P_{t-i}] + \mu ECT_{t-1} + \epsilon_{2t} \tag{7}$$

$$\Delta P_t = \theta_3 + \sum_{i=1}^p [\delta_{3i} \Delta SP_{t-i} + \beta_{3i} \Delta V_{t-i} + \varphi_{3i} \Delta P_{t-i}] + \mu ECT_{t-1} + \epsilon_{3t} \tag{8}$$

Therefore, if the  $\mu$  of the ECT is significant for our variable of interest (SP) (eq. 6), it means that there is a long-term relationship going from V and P to SP.  $\delta$ ,  $\beta$  and  $\varphi$  denote the coefficients of the lagged values of  $SP_{t-i}$ ,  $V_{t-i}$  and  $P_{t-i}$  and inform on the

short-term effects. The negative and significant values for  $\beta$ , for example, would indicate that the variations on lagged periods of violence are associate with a decrease of the tropical specialization or the opposite in case of positive sign.

### 3. Results

This section analyses the relationship between food security and agrarian trade during the twentieth century, and delve into the interactions between V, P and SP during 1961–2016.

#### 3.1. Food consumption

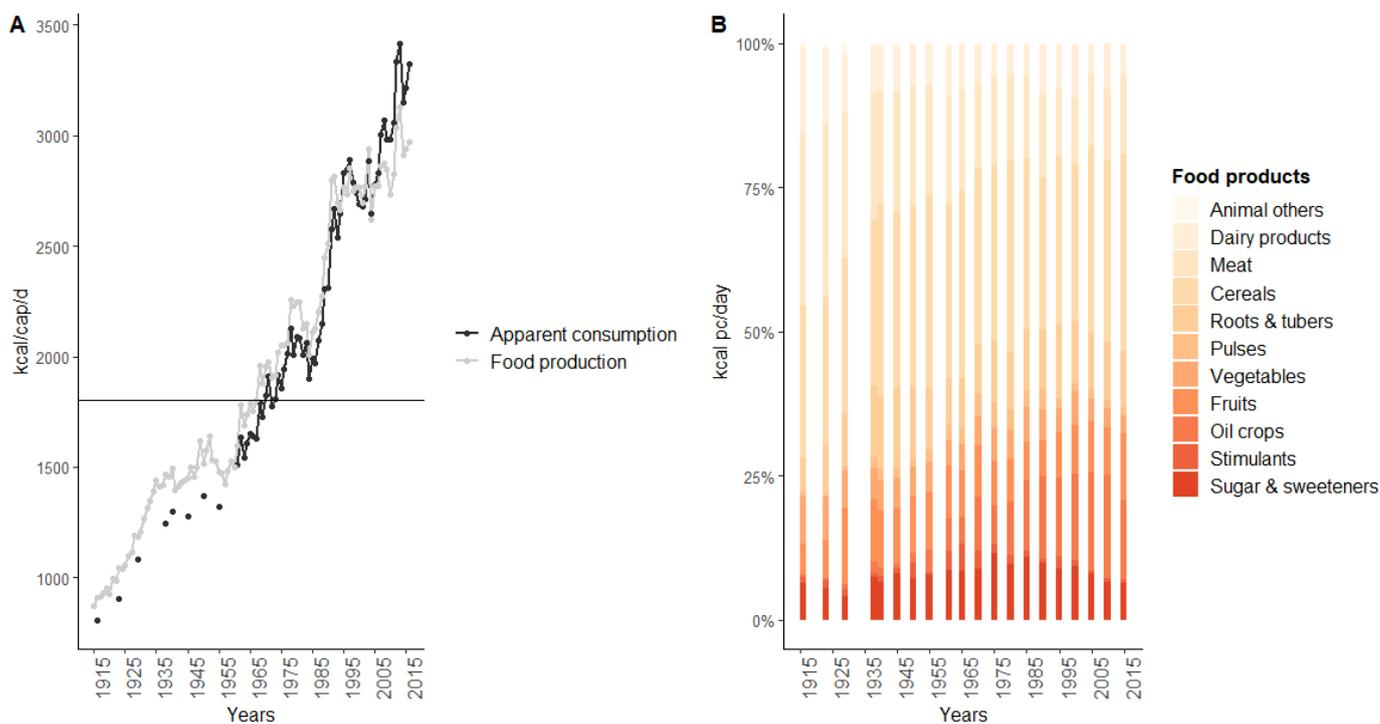
Figure 1a plots the domestic production of food and apparent consumption of kilocalories per person and day (kc/p/d). In the long-term, this figure depicts two main features. First, the per capita domestic production of food products was higher than the apparent consumption until 1994, which means that most of the century the country produced more than its imports and, thereafter, international trade has played an especial role in the provision of calories. Second, there is a lack of kc/pc/d to achieve the minimum threshold up to the late 1960s.

Between 1916 and the 1930s, there were improvements in the number of available calories. Despite food production increased (880 kcal/pc/d in 1915 to 1450 in 1935), this was not enough due to more land was ploughed to grow coffee (Urrego-Mesa, Infante-Amate and Tello, 2019). To solve this, the Emergency Law of 1927 opened the door to imports of cereals (Kalmanovitz and López, 2006), but apparent consumption stagnated and the difference between production and consumption rose (1938–1955). More coffee was exported and food shortages took place again in 1940–1945 and 1950–1955 (Safford and Palacios, 2002, p. 320), though, no famines were recorded. Even, there were increases in living standards be-

tween 1905 and 1985 with only punctual reductions (Meisel and Vega, 2007).

Although the strategy of facing food shortages with imports of cereals reported positive, the difference between the consumption and the minimum threshold remained substantial. How was this gap filled? If we assume that the minimum requirements were fitted, which seems plausible in the absence of famines, the difference between this minimum and the official numbers could be a proxy of the weight of subsistence agriculture. In this vein, subsistence agriculture would have provided a maximum of 54% of the calories to fit the nutritional requirements in 1916, an average 25% during 1938–1955, and 5% till 1970. Increasing production, international trade, or simply statistics improvements were probably intertwined throughout this success story; in any case, this is a first and raw estimation of the ranges of the contribution of the subsistence-style family-farming to the diet during the first half of the century.

After the collapse of the export-led growth model during the Great Depression (Cárdenas, Ocampo and Thorp, 2000b), the supply of food continued rapidly growing during the state-led growth, but there are two different sub-periods. First, from 1938 to 1955 the slow growth of food production (0.3% annual rates) and the dynamism of population increase (2.6% annual rates) hindered the improvement of food consumption. However, from 1955 to 1975, and despite population register its highest growth (2.8% annual rates) and structural change took place (Flórez Nieto and Méndez, 2000), food production expanded faster (1.5% annual rates) and the country overcame the minimum food security threshold due to the improvements on the yields of crops such as cereals, roots and tubers (Urrego-Mesa, Infante-Amate and Tello, 2019).



**Figure 1.** a) Apparent consumption and production of food in kcal/pc/d and b) the composition of consumption (1916–2016). The black line indicates the minimum requirement of calories (1800 kcal/pc/d).

Source: see Section 2.

However, the leading role of production as the primary source of food provision began to stall, even the yields became stuck (Urrego-Mesa, Infante-Amate and Tello, 2019), and a little reverse in the caloric intake took place during the so-called Lost Decade of the 1980s (Bértola and Ocampo, 2012). After that, a quick recovery began till 1997. A mid-term reading from 1997 to 2016 shows the stabilization of per capita consumption near to 3000 kcal/pc/d, though, this process involved a key transformation in the role of food production which fell below the apparent consumption thus stressing the role of international trade as sources of domestic food provision.

Up to this point, we can infer that domestic production drove these gains in food consumption during a large part of the twentieth-century, but this changed from the 1980s. During the First Globalization (1916-1930), food production exceeded the number of calories consumed by more than 10%, but that was reversed during the Second Globalization. Therefore, in addition to the success story of escaping from hunger, there is another telling story of the displacement of domestic production as the leading supplier of food. We shall deal with this process in section 3.3, but let us see the implications of this story for diet composition before.

The main consumption of food in Colombia have been by far that of cereals, which have remained around one-third of the total consumption (Figure 1b) and if we add some crops like pulses, roots, and tubers, this share almost reached half of the consumption. More interesting, in the long-term these foods moved from supplying 33% in 1916 to 48% in 1940 and have stayed at around 43-45% of consumption until today. In contrast, animal and oil vegetal sources of calories were half of the total consumption at the beginning of the twentieth century, but declined to a third in 1940, recovered from the late 1980s to 2013 reaching 40%, and currently represents 30% of consumption. Meanwhile, fruit, vegetables, sugar, and stimulants have remained around 20-25%. This sharp reversal of the nutritional transition perhaps is associated with the estimation of meat and the lack of records for vegetal output, especially during 1916-1961, as declared (Section 2). However, the reversal trend also holds when we look at the more solid data from FAOSTAT (2021) and is particularly evident since the 1980s.

Although the rise of available calories during the Second Globalization is a story of success, the diet composition reveals an unclear nutritional transition or poorer diet started by more consumption of cereals. The products associated with the nutritional transition or richer diets decreased in relative terms or remained stable. Is there a relationship between the starred role of trade as provider of food and the rise of cereals in diet composition? Now let us analyse the long-term role played by trade in this story.

### 3.2. *Calories in trade*

In the 1990s, and since 2000, Colombia's agri-food trade balance profile was quite the opposite of the exporter profile for the entire Latin America region (Falconí, Ramos-Martin and Cango, 2017; Infante-Amate, Urrego-Mesa and Tello Aragay, 2020). But before the 1990s the trade balance was also in deficit, around 1.6 Tkcal in 1961-1993 and 0.8 Tkcal during the first half of the century (Figure 2a). Although the export of higher caloric foods like sugar, fruits, and oil crops expanded after the economic opening (1991), since the 2000s the calories of

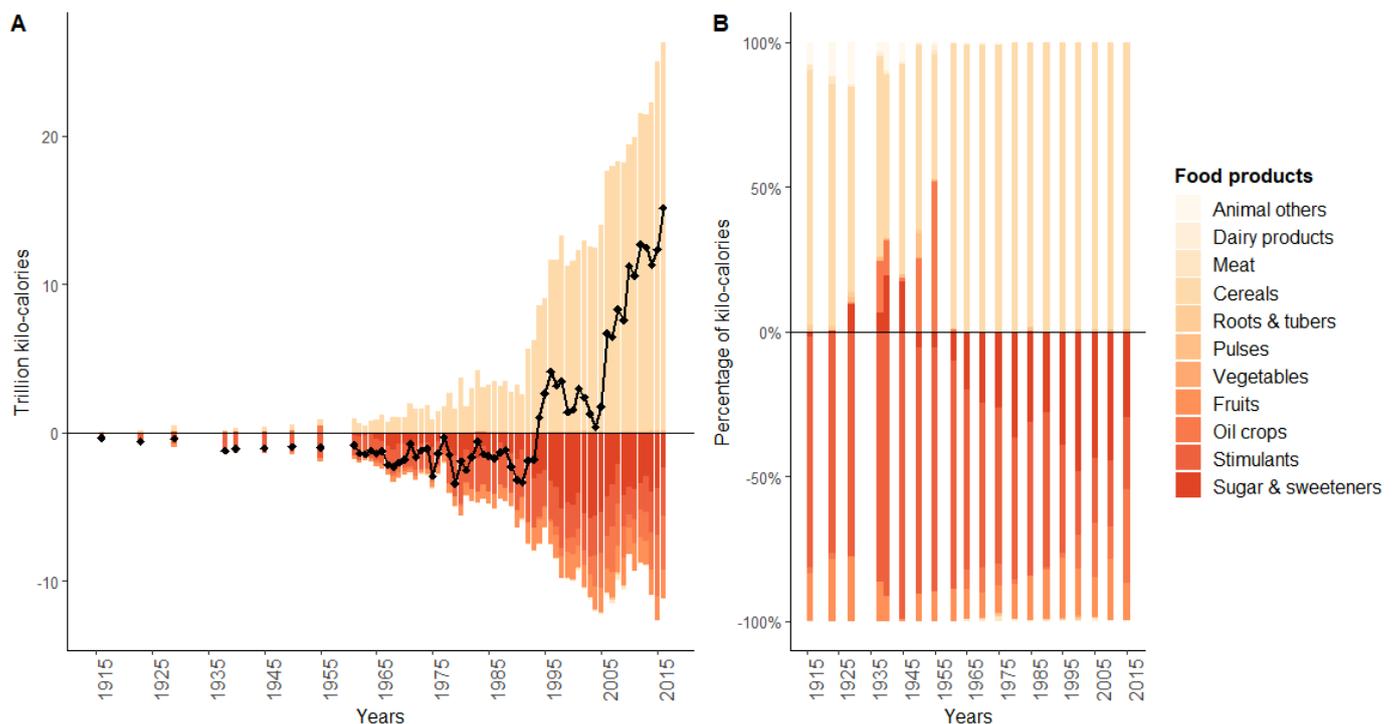
cereals imported were larger, thus changing the country's profile of the food trade. Understanding the continuities and changes in the food trade involves a look at the history of its domestic policies and international frameworks.

The increase in the amount of coffee (labelled as a stimulants) in exports characterized the overall trend until World War II, accounting for almost the entirety of net exports in 1945 (Figure 2b). From the end of the Thousand Days' War in 1902 until 1910, Colombia's regional elites were still seeking potential export businesses, including in cattle, sugar, gold, bananas, and rubber, but the regional interests of the coffee elites took national priority (Safford and Palacios, 2002, p. 275), becoming the national economic project supported by the state and the main driver of the economic surge (Ocampo, 1994). This state support of coffee exports served as the main tool to capture foreign exchange and increasing the purchasing capacity to import agricultural implements and machinery.

After 1945 the share of stimulants in total exports began to drop drastically and was replaced by sugarcane first and oil crops thereafter. The International Coffee Agreement (1962-1989) helped to stabilise coffee's prices (1950-1972) (FNC, 2020), but the negative impact of La Violencia (1948-1958) on the growing of coffee became more visible (Bejarano, 2011). The yields of sugarcane grew (Urrego-Mesa, Infante-Amate and Tello, 2019) and the number of sugar calories exported surpassed that of fruits in the early almost attaining the volume of stimulants in 1968, which was possible because of the new opportunities in international sugar markets that opened after the Cuban revolution (1959), especially in the United States.

The rise in coffee prices during 1975-1985 created new incentives to the promotion of technical improvements helping the recovery of the exports of coffee until the early 1990s, though, after 1972 the domestic policy also aimed to transfer public resources to capitalize the agro-exports through infrastructure and credit (Bejarano, 2011, p. 203). At the aggregate level, however, there was a short period of stagnation of exports during the 1980s. Thus, the surge of the new tropical agro-export model clearly began after the 1990s economic openness with the replacement of coffee by sugar, oil crops, and fruits. Once again, the biased allocation of public credit and labour reforms aimed at increasing Colombia's competitiveness of the agro-export sector (Espectador, 2009; Patel-Campillo, 2010) together with the international price increases for tropical commodities in 2000-2010 (IMF, 2020) played a critical role.

Regarding imports, since the First Globalization cereals has shared most of the food imports, but the actual increase began during the Golden Age (1950-1972) and since the 1980s. Although the flows of wheat were not big enough to change Colombia's exporter profile, the upward trend is consistent with the emergence of the domestic food industry and its historical disconnection with the agrarian sector (Machado, 1991) on the one hand, and the intensification of agriculture and the beginning of food-aid policy in the United States on the other (McMichael, 2013). The entering of cereals during this period was compatible with the promotion of domestic food production up to the beginning of the 1990s. After this date, however, the imports of cereals moved from 2.5 Tkcal in 1991 to 27 in 2016, thus changing the trade profile of the country to food dependency. At the same food-usage ratio used for production (Appendix, Table 3), cereal imports shared 12% and 22% of the food consumption in 1994 and 2016, respectively.



**Figure 2.** a) Food trade balance in trillion kilocalories; and b) composition (1916–2016). The black line indicates the final trade balance.

Source: see Section 2.

Did this tropical specialization in exports and cereal imports affect somehow the domestic capacity of agrarian systems to produce food? Is trade responsible for the poorly diet registered in food composition? In the next section, I shall deal with these questions by relating trade and domestic supply and analysing the land-use changes.

### 3.3. Food dependence and tropical specialization

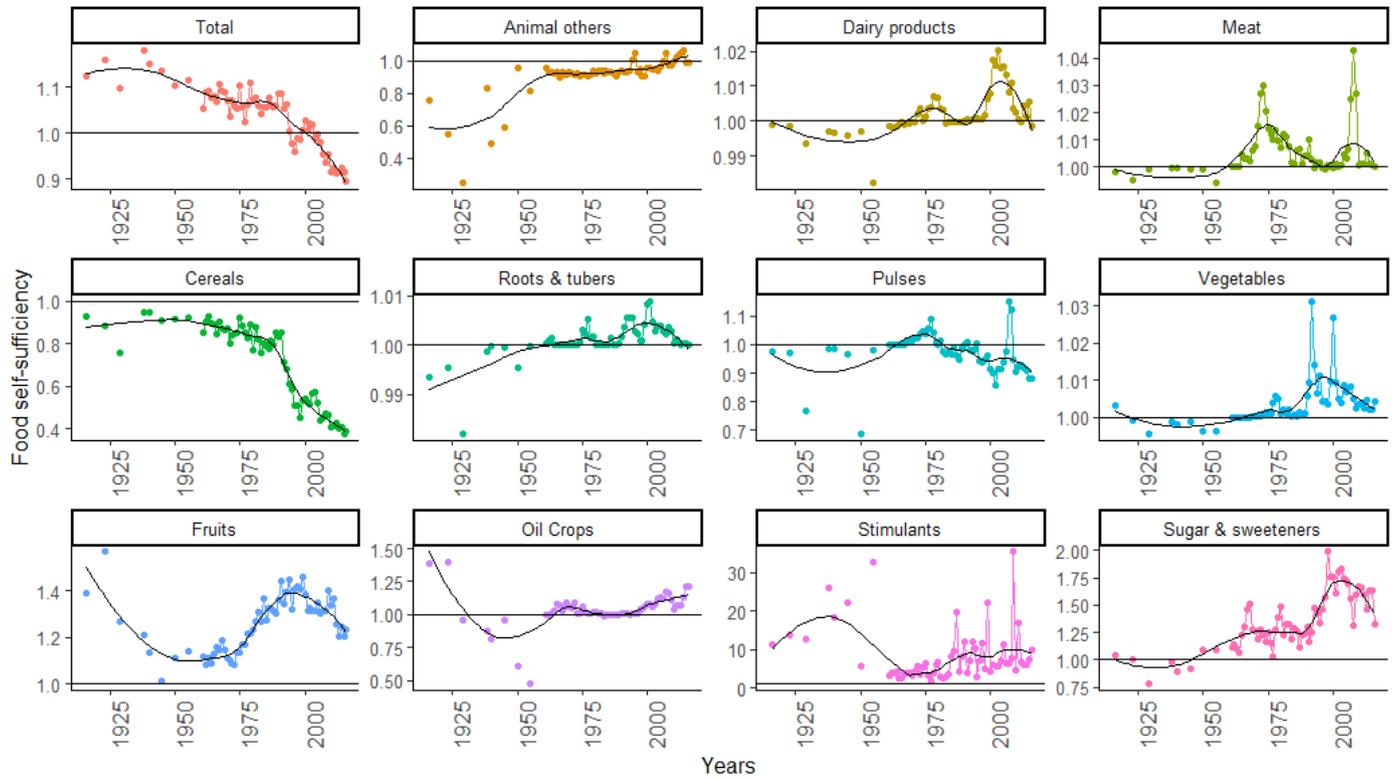
Figure 3 plots the SS index for the whole agri-food system and by groups of crops. The total self-sufficiency deteriorated by more than 25% in the long-term. The country was a global supplier of food calories until the 1990s with a notable difference between 1916–1950 and 1960–1990. During the first period, around 15% of production was exported, except for the periods of food shortage, while during the second period, just over 5% of domestic production formed a part of the exported food calories. The mixed model of the state's maintenance of domestic provisioning and export promotion highlighted in the context of the whole economy (Cárdenas, Ocampo and Thorp, 2000a), helps us understand the improvements in food calorific intake between 1955/60 and 1980. A decade later, however, the country lost both its global role as a net provider of food and its capacity to provide calories domestically.

But if we look at the evolution of SS by group of crops, we observe three different trends. First, food products in which SS deteriorated such as cereals and pulses. Currently, imports provide more than 40% of the domestic supply of cereals for human nutrition and the capacity to produce pulses fell by more than 10%. The second group of products are those that reached or maintained the SS. Within this group were traditional roots and

tubers and products associated with the nutritional transition such as vegetables and animal products. Finally, in the third group, there are tropical food products oriented international markets, like stimulants, fruits, sugarcane, and oil crops, which attained a SS index higher than the domestic demand requirements. The relationship between the SS for tropical crops and international trade is clearly shown by the peaks experienced during the First and the Second Globalization. However, the loss of the productive capacity in staple crops only occurred after the 1990s, when the country became importer of cereals.

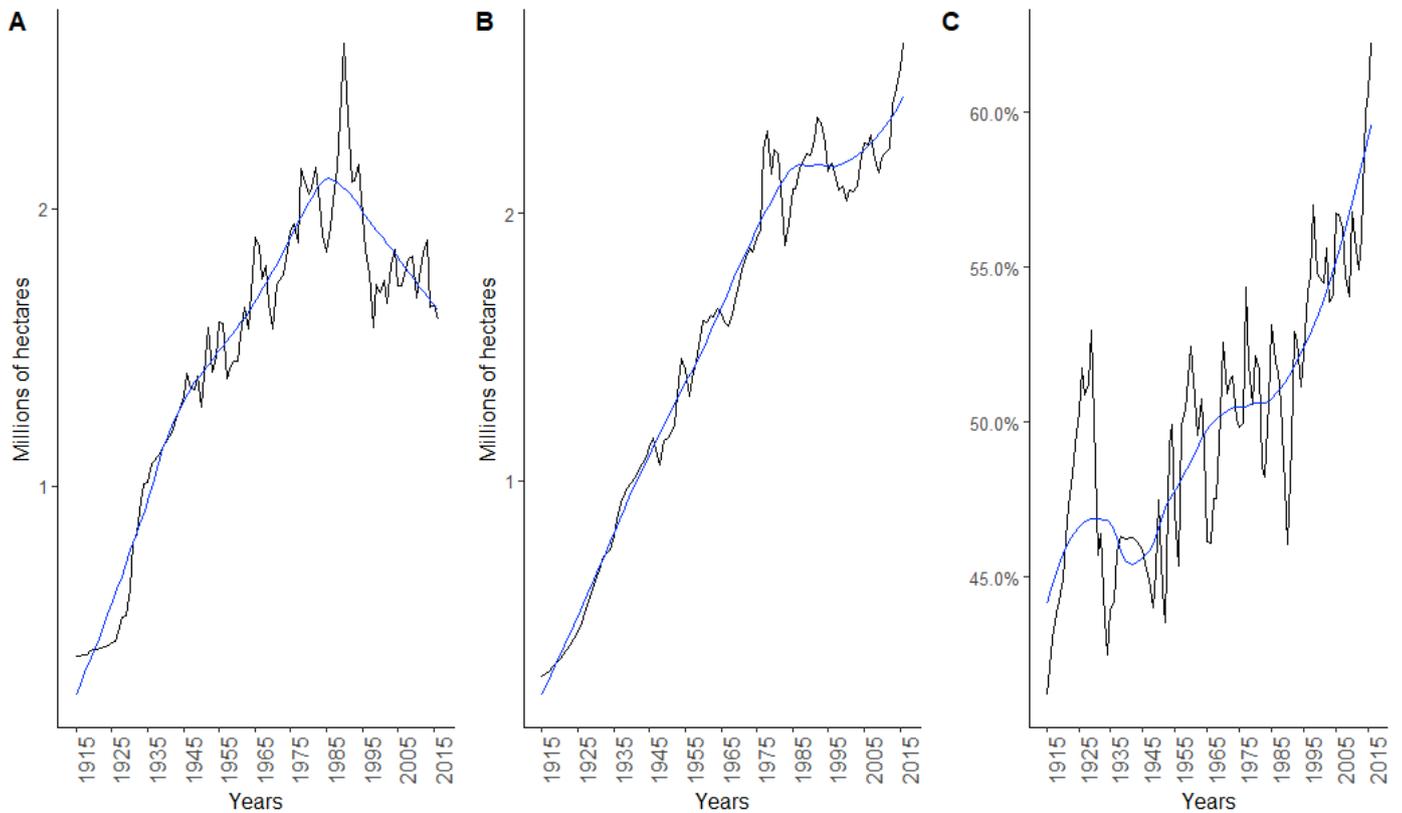
This shifting profile also involved changes in the landscape. Up to the early 1980s, the land-use devoted to SC (Figure 4a) and CC (Figure 4b) remained evenly distributed around 45% and 50%, but, thereafter, the portion of the area under CC climbed, and this share is currently higher than 60% of the total area harvested. Land specialization in exportable tropical crops was reverse during the 1930s and slowed around the 1970s, while the major accelerations took place during the periods of trade openness, especially the Second Globalization (Figure 4c).

Tropical specialization did not necessarily entail a loss of the self-sufficiency capacity during the Firsts Globalization, but it was the major trait of the second period of agricultural trade entering international markets. Clearly the geopolitical frames boosting agricultural trade and the international price incentives shaped these long-term trends, but the constrains of organic agriculture and the domestic agrarian policy also played critical during the twentieth century. Is there another factor to understand this transformation of the agri-food system towards specialization and dependence? The political economy of war literature argues that violence has contributed to the emergence of the renewed tropical agro-export model. The next section explores this hypothesis empirically.



**Figure 3.** Total self-sufficiency and by groups of crops (1916-2016).

Source: see Section 2.



**Figure 4.** Harvest area in millions of hectares of a) staple crops, b) tropical crops, and c) the share of tropical crops on the total area harvested (1916-2016).

Source: see Section 2.

### 3.4. Did armed conflict lead to tropical specialization?

The main hypothesis tested here is the role of violence in causing tropical specialization. Therefore, violence as a tool in the tropical specialization of agriculture and entering the international markets, rather than a hindrance for its development beyond the market forces.

The Johansen test for co-integration confirms at least one long-term relationship in the system of variables significant at 1% regardless of the variable of violence used, namely the total number of fatalities ( $V$ ) or the mean per case ( $\bar{V}$ ), (Table 2). However, the long-term directions of each of these variables performed differently in the VECM. While model 1 shows a positive relationship that goes from  $V$  and  $P$  towards  $SP$ , in model 2  $\bar{V}$  is negative in the long-term, and  $\bar{V}$  is the weak variable which converges towards the equilibrium system (ECT -0.99 [0.32] sig. at 1%). Despite this, and unlike model 1, model 2 does not fit well the robustness checks for the normality distribution of residuals.

**Table 2**

Maximum Eigenvalue and Trace statistics for violence ( $V$ ) and mean of violence ( $\bar{V}$ ) models

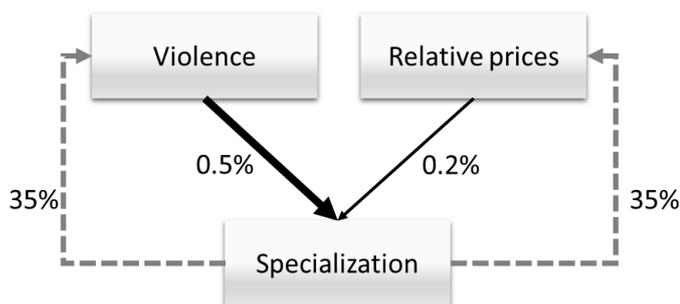
Eigen	test for $V$	test for $\bar{V}$	10pct	5pct	1pct
$r \leq 2$	4.76	4.80	7.52	9.24	12.97
$r \leq 1$	19.21	10.20	13.75	15.67	20.20
$r = 0$	38.09	42.87	19.77	22	26.81

Trace					
$r \leq 2$	4.76	4.80	7.52	9.24	12.97
$r \leq 1$	23.97	15	17.85	19.96	24.60
$r = 0$	62.06	57.87	32.00	34.91	41.07

Note: specification for constant deterministic terms.

Therefore, and based on the normalized co-integrating vector for model 1, 1% increases in  $V$  and  $P$  are related to 0.5% and 0.2% increases on  $SP$  in the long-term. Additionally, the coefficient of the ECT in eq.6 confirms that  $SP$  adjusts 35% to the system equilibrium during the first year (-0.35 [0.13], sig. 5%). In other words, changes in  $V$  and  $P$  lead the  $SP$  to move towards the new equilibrium (Figure 5).



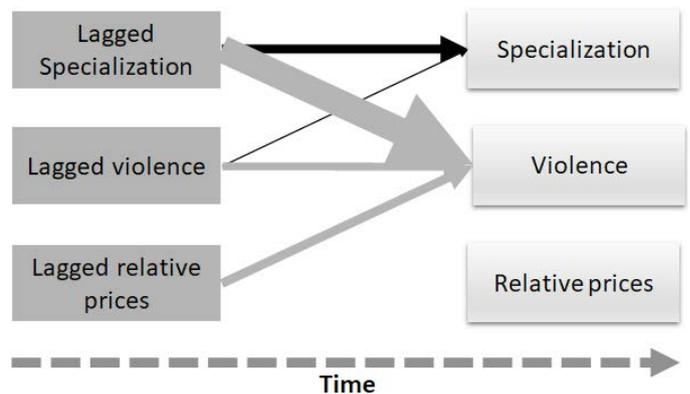
**Figure 5.** Long-term relationships between specialization, violence, and international prices. The black and solid lines are the effect in the co-integration equation to 1% increase. The grey and broken lines are the ECT of specialization to the equilibrium in the first year.

In the short-term, however, the relationships do not have to go in the same direction (Figure 6). As a general picture, there are not positive relationships, but negative ones, that go from the lagged periods of  $SP_{t-i}$ ,  $V_{t-i}$ , and  $P_{t-i}$  towards the current outcomes of  $SP$  in the eq. 6. Increases of  $SP_{t-i}$  and  $V_{t-i}$  in 1% nine and eight years before are related with reductions of 0.6% and 0.1% in  $SP$ , respectively. This does not mean that there is no positive relationship at all between  $SP$  and  $V$ .

The results for the equation of violence (eq. 7) confirm that the variations of  $V$  are positively associated with the variations of the lagged values of  $SP_{t-i}$ ,  $V_{t-i}$ , and  $P_{t-i}$ . A 1% increase in  $SP_{t-i}$  six to nine years earlier is associated with around 2% increases of  $V$  (sig. 1%). This process is reinforced by the system of prices whose variations in 1% of its lagged values ( $P_{t-i}$ ) are associated with a variation of  $V$  ranging between 0.56% and 0.75% during the third and fifth lagged year. These effects decline from 0.65% to 0.46% between the seventh and ninth years of lag. Despite the minor effect of  $P_{t-i}$  than  $SP_{t-i}$  during the fifth and seventh lagged periods, this association is significant at 0.1%.

Finally, violence is a self-reinforcing phenomenon. The past values of  $V_{t-i}$  are positively associated with its current outcomes, except for the first lagged period, which indicates that after a year of increase of violence there is a reduction in the next one. However, across the fourth to ninth lagged periods, this relationship is positive with an average effect of 0.52% per 1% variation (sig. at 5% and 1%). In the case of the equation of prices (eq. 8), there is only one negative relationship from the third lagged value of  $SP_{t-i}$ . Although theoretically solid the effect of this relationship is significant at the 10% level.

In a nutshell there is a positive and long-term relationship going from  $V$  and  $P$  towards  $SP$ . In this system,  $SP$  is the weak (or slave) variable adjusting to the equilibrium system. However, in the short-term are the past  $SP$  and  $P$  that shape  $V$ . Then, the empirical testing confirms the hypothesis of the use of violence as a tool of tropical specialization as an additional driving factor for market forces in the long-term, but this hypothesis does not hold in the short-term, which also invites us to think of violence as a consequence of agribusiness development and market incentives.



**Figure 6.** Short-term relationships between specialization, violence, and prices in VECM. The width of the arrows corresponds to the average size of the effects significant at the 5% or higher. The grey arrows depict positive relationships and the black ones negative. Time is represented by the broken line.

#### 4. What can be learnt from history?

This section discusses the results of the historical analysis on food security and agricultural trade in the light of the dichotomic debate during the fluctuations of the First and the Second Globalizations and introduces the role of the state in the long-term interactions between violence, prices, and tropical specialization.

##### 4.1. The dichotomy between agrarian trade and self-sufficiency

The long-term analysis of the Colombian case brings to light two basic ideas. The historical analysis allows us to rethink the relationship between trade policy and food security beyond the dichotomic debate as highlighted by Clapp (2017) and it also contributes to extending the time frame analysis of the world's self-sufficiency policies observed by O'Hagan (1976) back into the past in a developing country of Latin America.

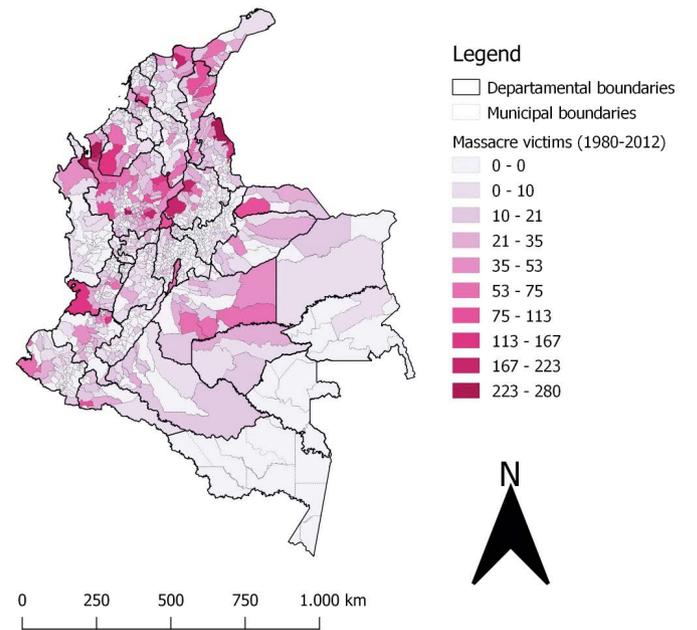
First, different food-security measures told us different stories considering the same policies and periods throughout twentieth-century Colombia. The availability of food and the per capita intake reflects a success story of increasing calories, regardless of the policies of promoting staple or tropical crops as the market-based approach advocates (Dithmer and Abdulai, 2017; Dorosh, 2001; Runge *et al.*, 2003; Shettima *et al.*, 2019). However, the self-sufficiency index and the land-use change demonstrates the declining productive capacity of staple crops and specialization in tropical crops for international markets, especially during the Second Globalization. These results agree with criticisms of food trade liberalization (Fader *et al.*, 2013; Kumar Sharma, 2016; Patel-Campillo, 2010; The Special Rapporteur, 2020). In this same vein, food dependence on imports of cereals has gone hand in hand with a relative decrease in the intake of animal products, which leaves a picture of a truncated nutritional transition or diet impoverishment.

Second, O'Hagan (1976) stated that national self-sufficiency is a political decision by governments in a global context. Therefore, state capture by elites in developing countries also implies self-sufficiency policies being determined by group interests and the power balances within them. As shown for Colombia, the changes in this index are consistent with the start of deterioration in developing countries of Latin America observed by O'Hagan (1976) in the 1970s and thereafter, but the long-term analysis also confirms there was a previous support for self-sufficiency within the frame of the First Globalization and the state-led growth periods. The results show a mixed model of trade integration and domestic production being promoted that maintained self-sufficiency until the 1980s. After this date, international trade openness under the Second Globalization led to the renewed agro-export model and food dependence on imports, as occurred around the developing world (Kumar Sharma, 2016; McMichael, 2013).

##### 4.2. Tropical specialization and armed conflict

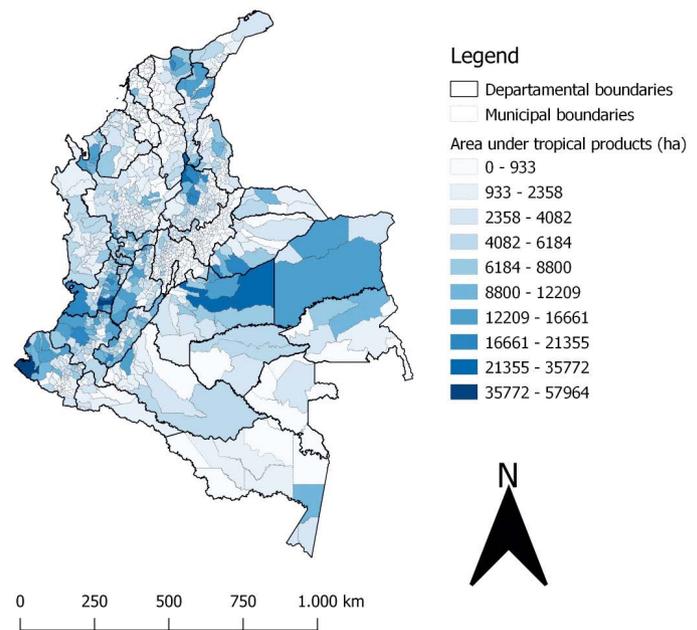
The spatial pattern of conflict overlaps with the regional distribution of tropical specialization. As Figure 7 shows, the accumulated victims of massacres (1980-2012) are spatially located in places where the density of the area under tropical crops is also greater, such as the banana in Urabá and Magda-

lena, sugarcane in the Cauca Valley, or oil palm in Meta (Figure 8). This distribution is according to the idea of the use of violence for the purpose of developing agribusiness projects for tropical products, tested in the VECM, and which was a result of the convergence between the counter-insurgency aims and the economic interests among regional agrarian elites, multi-nationals, paramilitaries, and the state during the second wave of violence (Ballvé, 2012; Grajales, 2011, 2013; Gutiérrez-Sanín, 2019; Gutiérrez-Sanín and Vargas, 2017; Peña-Huertas *et al.*, 2017; Richani, 2002, 2012; Vargas and Uribe, 2017).



**Figure 7.** Accumulated massacres during 1980-2012.

Source: based on data from CNMH (2018).



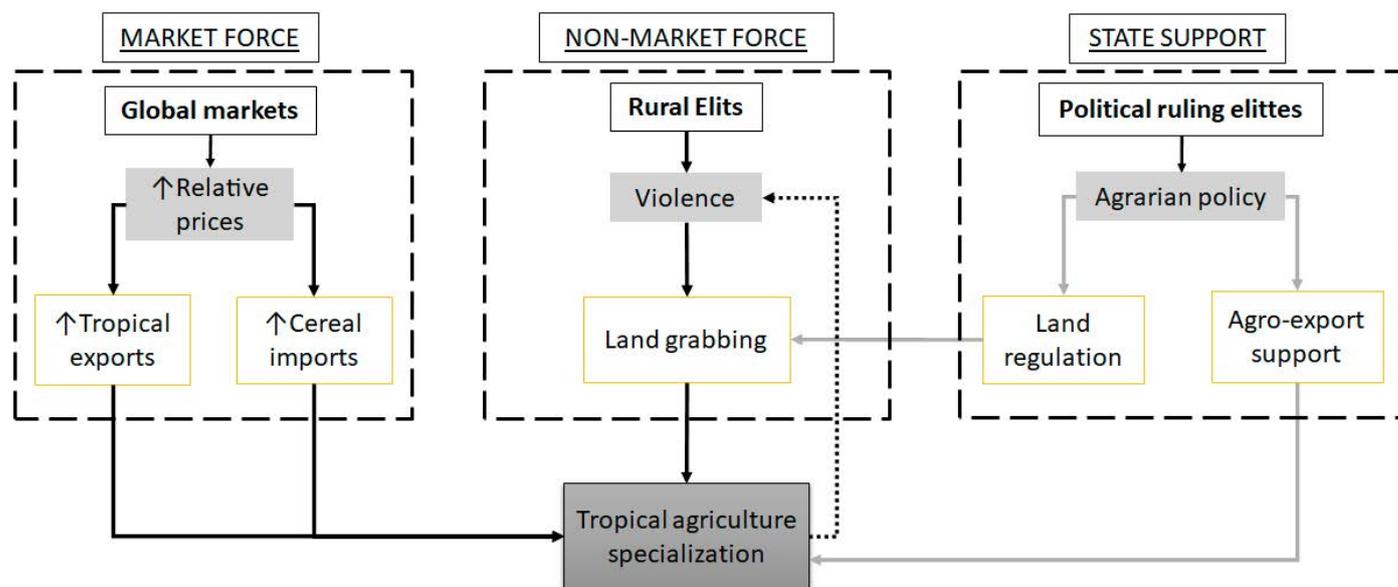
**Figure 8.** The sowed area in tropical products in 2013: fruits, seeds and oil crops, aromatic, beverages and spices, and fodder.

Sources: based on data from DANE (2014).

The massacres were used to intimidate the guerrillas' supporters and to recover territorial control. The paramilitaries and the state perpetrated on average 66% (sd. 18) of the massacres between 1980 and 2012, while the guerrillas committed 22% (sd. 16) (CNMH, 2018). Sometimes this was connected with the control of coca production, sometimes with guaranteeing the security and economic interests of the agrarian elites and multinationals, but in any event, it promoted land accumulation.

Land that had been forcibly abandoned was accumulated by exploiting the traditional bias of state institutions and the regulation of property rights to favour landowners (Richani,

2012). This traditional bias was reinforced by the emergence of new legal tools to promote massive dispossession. In this regard, Peña-Huertas *et al.* (2017) distinguish three types of legal dispossession during the second wave of violence: the threat of coercion in private transactions, underpayments in private transactions enforced by fear or for protection, and administrative dispossession by obtaining the land titles of persons expelled by violence. Cattle-ranchers, the narco-bourgeoisie, and urban elites bought land as an investment to launder money or to keep their patrimony safe under circumstances of currency devaluation (Richani, 2002), making less profitable to produce food (Rincón-Ruiz *et al.*, 2016).



**Figure 9.** The mechanisms of tropical specialization and its actors. The straight black lines and the dotted line are the long- and short-term relationships in VECM, the grey lines are the relationships identified in the literature.

Once coercion had been introduced and the purchases of abandoned land implemented, government policies promoted the implementation of agro-industrial projects (Figure 9). INCODER helped to ease foreign and local investment (Richani, 2012), while the “Agro Ingreso Seguro” would have granted cheap public credit to the narco-bourgeoisie and landowner families (Espectador, 2009), labour reforms aimed to guarantee international competitiveness (Patel-Campillo, 2010), and, eventually, favourable international prices (2000-2010) (IMF, 2020) created the incentives to revive tropical specialisation once again. Traditional organizations of the representation of the agrarian elites, such as the Colombian Agrarian Association, the Livestock Federation or the National Federation of Coffee Growers, which had been weakened during the 1980–1990s (Richani, 2002, pp. 141-45), recovered their political influence.

Thus, the use of violence has served as a tool to accumulate land in a few hands and protect agribusiness interests in respect of this land entering the global economy. This process occurred in a context of economic incentives from international markets and the support from the state. In the short-term tropical specialization also could act as a mean to sustain the civil war (Hendrix and Brinkman, 2013; Messer and Cohen,

2007; Messer, Cohen and Marchione, 2002; Segovia, 2017). Although tentative, this is a hypothesis which needs to be tested by more research.

## 5. Final remarks

The debate on food security and trade relations highlights the role of trade liberalization as a tool to improve food availability in developing countries against the negative impact of trade and agrarian specialization. The literature also underlines the possible relationship between commodity specialization and conflicts. This research article has contributed to these debates by providing new long-term time series for Colombia along throughout the twentieth century for food availability, agricultural trade, self-sufficiency, and land specialization. At the same time, the article has shed light on the interactions between tropical specialization, armed conflict, and international prices between 1961 and 2016.

The historical analysis shows a more nuanced way of dealing with the dichotomy between trade and self-sufficiency, while the quantitative analysis confirms a long-term relationship leading from violence and prices to tropical specialization,

as well as positive effects in the short-term going from the lagged values of specialization and prices to violence.

The historical analysis reveals a successful story of improving food availability between 1916 and 2016. There was a transition from food shortages and the key role of subsistence agriculture as food supplier, which dominated till the late 1960s, to the current achievement of a per capita intake of around 3000 kcal/pc/d. However, the quality of this diet is not clear at all since the proportion of the basic foodstuffs, especially cereals, also rose in the composition of consumption. The other side of the coin is the evolution of international trade. During the First Globalization, export-led specialization coexisted with domestic staple food production and imports to meet the demand for punctual food shortages, while during the Second Globalization tropical exports were expanded and the self-sufficiency in staple crops fell, risking the food security of the whole country.

The quantitative analysis on the drivers of this change to tropical specialization during the Second Globalization confirms a long-term relationship reflecting the role of violence and relative prices in creating the tropical specialization, but this analysis also stresses that violence appears to be a consequence of tropical specialization and international prices in the short-term. More than contradictory, these results highlight the argument regarding the use of violence by the agrarian elites and the state as a tool to promote tropical specialization and entry into the international markets, while calling for more research on the role of tropical specialization as a cause of violence.

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