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PATTERNS AND DETERMINANTS OF INTRA-INDUSTRY TRADE IN AGRI-FOOD PRODUCTS BETWEEN BOSNIA AND HERZEGOVINA AND CEFTA 2006

ABSTRACT: *The paper aims to identify patterns and country-specific determinants of intra-industry trade (IIT) in agri-food products between Bosnia and Herzegovina (BiH) and other CEFTA 2006 parties in the period 2008–2018. The purpose of the paper is to contribute to filling the gap in the empirical literature on IIT of the South East European countries, especially in regard to non-manufacturing sectors. To investigate IIT intensity and structure the analysis employed Grubel-Lloyd indices and GHM methodology based on relative unit values. In order to examine the impact of various determinants on IIT in agri-food products, a random-effects Heckman selection model was estimated, following a sector-level approach in the analysis. The analysis indicates a lower level of IIT than expected and a strong dominance of its vertical type in all BiH bilateral relations within CEFTA 2006. The empirical results also suggest that the major determinants positively affecting IIT in agri-food products include the size of the trading economies, the similarity in their ethnic structure, membership in the common regional trade agreement, and common borders. By contrast, the results indicate that IIT is negatively affected by differences between the trading economies in terms of productivity and gross domestic product per capita.*

KEY WORDS: *intra-industry trade (IIT), agri-food products, country-specific determinants, Bosnia and Herzegovina (BiH), CEFTA 2006*

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1. INTRODUCTION

After years of research into the intra-industry trade (IIT) phenomenon, the conditions under which IIT between countries will intensify and even predominate are by now well known. More intensive intra-industry trade is likely to occur between countries that are similar in the size of the economy, level of economic development, and culture, particularly if they form a common economic integration. Moreover, IIT occurs to a greater extent in industrial rather than primary products. Industrial products are more differentiated than primary products, and product differentiation spurs trade within industries between similar countries. Therefore, IIT in industrial products is much more often the subject of empirical research. Still, the effects of individual IIT determinants are occasionally unexpected, depending on the sample of countries or kind of products, which inspires new research and enriches the empirical literature.

Due to a lack of research into IIT in primary and food products, the question arises as to how important for agri-food products are IIT determinants based on similar characteristics of trading countries that were mostly studied in relation to industrial products. An increasing number of studies have attempted to answer this question, though less so regarding the less advanced transition countries of South East Europe (SEE). While there have been a few studies of IIT in SEE countries for the case of Croatia there has been little research specifically on IIT in agri-food products in the region.

Therefore our research is, in general, motivated by the gap in the empirical literature on IIT in agri-food products in the SEE region. An additional motivation is found in investigating whether theoretical statements concerning IIT of similar countries that are members of the same integration are also valid in the case of countries of the region that experienced conflicts in the recent past. Particular attention is paid to investigating the significance and impact of an IIT determinant which is a specificity of this region and which is especially connected with habits in consumption of agri-food products – namely ethnic similarity.

The paper focuses on identifying the characteristics and determinants of IIT in the agri-food sector through the example of the intra-regional trade of Bosnia and Herzegovina (BiH). The research results should therefore contribute to

determining the position of the BiH agri-food sector in the country's bilateral relations within the SEE region. The time framework refers to the period 2008–2018. In this period, trade between BiH and most countries of the region occurred pursuant to the Agreement on Amendment of and Accession to the Central European Free Trade Agreement (CEFTA 2006), which was also signed by Albania, Montenegro, Croatia[1], Kosovo[2], Moldova, North Macedonia, and Serbia. This agreement and its additional protocols[3] significantly liberalised trade in agri-food products in the region.

Previous research focusing on the IIT of BiH can be found in several papers published mostly over the last decade (Domazet, 2008; Klimczak, 2012; Brkić, 2010, 2012a, 2012b, 2013, 2018; Mrdalj et al. 2017). Only one of them – Mrdalj et al. (2017) – analyses IIT in agricultural products, though without modelling IIT determination. So far, the determinants of IIT in agri-food products have not been studied using the example of BiH.

Considering the geographic proximity and similarities between BiH and most of the listed CEFTA 2006 parties in the context of already existing trade liberalisation, we tested the hypothesised impact of the trading countries' characteristics on the resulting patterns and intensity of IIT in their mutual trade in agri-food products. We hypothesised that a significant and positive impact on IIT in agri-food products would come from bilateral economic size, trade liberalisation (in the form of the common economic integration), common

[1] Croatia was a member of the 'old' CEFTA and later of CEFTA 2006 from its establishment to mid-2013, when the country joined the European Union; however, due to its strong intra-regional ties this country is included in the research in the whole observed period.

[2] The name does not prejudge the status of Kosovo and is in line with the Resolution of the United Nations Security Council (UNSC 1244) and the opinion of the International Court of Justice (ICJ) on the Declaration on Kosovo's Independence of 2008. The United Nations Interim Administration Mission in Kosovo (UNMIK) signed the CEFTA agreement on behalf of Kosovo. For the purpose of this research, Kosovo is treated as a separate customs territory.

[3] The additional protocol signed between most CEFTA 2006 parties on 23 February 2011 established free trade in agricultural products within CEFTA 2006. From the start, BiH negotiated free trade in agricultural products with almost all CEFTA 2006 signatories, and it was fully implemented after the period of temporary asymmetry in favour of BiH expired. It was subsequently implemented only with Albania, by an additional protocol signed on 23 November 2013. However, the trade regime between Croatia and other CEFTA 2006 parties became less liberal for some kinds of products when the country joined the EU in 2013.

border, the common state and ethnic similarity. On the other side, we expected a negative impact of geographic distance, income inequality, and differences between trading partners in the endowment of agricultural land and in the productivity of agricultural production[4].

In order to identify the determinants of IIT and their effects, we use an econometric analysis that encompasses a larger number of variables pertaining to country characteristics than the other studies focusing on transition countries. The use of the random-effects Heckman selection model allowed us to account for the missing data for the dependent variable in the case of absence of trade. Due to its comprehensiveness and elimination of selection bias, such an analytic approach is a new and significant contribution to the earlier related empirical literature.

The paper is structured as follows. Following the introduction, the second section of the paper presents the conceptual framework which explains the theoretical foundations of IIT determination. The third section describes the research methodology and data used. Research results are presented and discussed in the fourth section, while the conclusions derived from the results are presented in the final, fifth section.

2. CONCEPTUAL FRAMEWORK

The main hypothesis tested in this research is that similarity between countries in terms of economic performance and the communication proximity expressed through geographic, historical, and ethnic factors contribute to a greater intensity of mutual IIT in the agri-food sector, particularly if the trade is significantly liberalised. Some additional determinants specific to IIT in agri-food products, such as arable land and agricultural productivity, are also considered.

[4] The two determinants – trade intensity (TI) with the expected positive sign and differences in foreign direct investment stock (DFDI) with the expected negative sign – have been included in the preliminary specification of the model but because of their high correlation with almost all other variables and, at the same time, an insignificant impact on IIT, they have not been further elaborated.

H1: *Economic integration increases IIT intensity in agri-food products between member countries.*

The experiences of more-developed economic integrations in the world, such as the European Union (EU), lead to the conclusion that economic integration primarily results in the increase of intra-industry rather than inter-industry trade. Starting from the 1960s and 1970s, studies of the effects of economic integration mostly focused on the European Community (Drèze, 1961; Balassa, 1963, 1966; Grubel and Lloyd, 1975) and then on the correlation between IIT and economic integration, i.e., trade liberalisation in general[5] (Drabek and Greenaway, 1984; Greenaway, 1987; Bergstrand, 1990; Torstensson, 1996; Kandogan, 2003; Sharma, 2004; etc.). All of them confirmed the positive effect of economic integration on the intensity of IIT. Brkić (2010) also established the positive effect of trade liberalisation in the SEE on BiH IIT in all products. According to the theoretical concepts on relations between economic integration and trade flows as well as most empirical findings on IIT, we hypothesised a significant and positive impact of trade liberalisation within the CEFTA 2006 framework on IIT in agri-food products between BiH and other CEFTA parties.

H2: *The bilateral economic size of countries has a positive effect on their mutual IIT in agri-food sector.*

Country size pertains to economic size, i.e., the ability to produce with economy of scale and absorb a large number of differentiated products (Lancaster, 1980). The greater the average market size of two countries, the greater the IIT share in their mutual trade. With respect to agri-food products, the positive effect of bilateral economic size on IIT was established by Jing et al. (2010), Jambor (2013), Jambor and Torok (2013), Bojnec and Ferto (2016), and Chakraborty (2017).

H3: *Income inequality between trading countries negatively affects their mutual IIT in agri-food products.*

Similarity between countries in the level of economic development will positively affect the intensity of their mutual IIT. The theoretical reasons underlying this

[5] Trade liberalisation pertains to lowering or removing trade barriers, which can be unilateral, bilateral, regional, or multilateral.

claim differ depending on whether it is viewed from the standpoint of demand (effect of the structure of demand on IIT) or from the standpoint of supply (effect of the factor endowment on IIT). According to Linder's (1961) hypothesis on overlapping demand, countries with similar levels of per capita income have similar structures of demand, which create a market for differentiated products and the possibility of increased IIT. On the other hand, per capita income reflects a similarity or a difference in capital and labour between trading partners. Helpman (1981), Krugman (1981), and Helpman and Krugman (1985) established that IIT will be greater if the ratio between two countries' capital and labour is more similar, i.e., if the countries are more similar in their respective factor endowments. By analogy, differences in per capita GDP should have a negative effect on IIT. Jing et al. (2010) on the case of IIT in the U.S. agricultural sector and Leitao (2011) on the case of China's IIT in agricultural products confirmed the negative effect of the difference in GDP per capita.

H4: *Differences in factor endowment between trading countries i.e. differences in arable land and productivity in agricultural production have a negative impact on IIT.*

Differences in arable land should affect IIT in the case of agri-food products. A country with a large area of fertile arable land is able to produce a greater quantity of high-quality products, which ultimately leads to greater IIT, and vice versa (Chakraborty, 2017). Jambor (2015), Jambor et al. (2016), and Chakraborty (2017) established that greater differences in arable land between partner countries will result in a lower share of IIT. Similarly, IIT is affected by agricultural productivity. Jambor (2015) analysed the effect of productivity on IIT in the agri-food products in Visegrad countries and established a negative effect.

This research also examined the significance of some other non-economic factors for IIT in BiH intra-regional trade, specifically communication proximity expressed through three dimensions – geographic, historical, and cultural.

H5: *The intensity of IIT between two countries decreases with the geographic distance between them.*

Geographic distance represents transport costs, and the availability and costs of information necessary for trade in differentiated products. According to

Krugman (1980), there is always a negative correlation between transport costs and IIT. Krugman's thesis and its theoretical rationale have been confirmed in many empirical studies: Bergstrand (1983), Balassa (1986), Balassa and Bauwens (1987), Stone and Lee (1995), and Amiti and Venables (2002). On the other hand, geographic proximity decreases transport costs, which positively affects any form of trade.

H6: *Adjacent countries will have more intensive IIT in agri-food products.*

Although the determinant 'common border' could apparently be considered as a separate case within the determinant 'geographic distance', econometric models approximate them separately, since it is believed that a common border has an additional and independent effect on IIT intensity.

H7: *If countries used to belong to the common state in the past, they would have greater IIT in agri-food products.*

Historical, political, and cultural 'affinity', which is particularly important for lowering the costs of 'unfamiliarity' in international trade, highly correlates with geographic proximity. In this group of characteristics we include shared or colonial history, in terms of the existence of a common state and a single market of individual countries in the past. Countries being in a common state or in a colonial relationship in the past, share a number of economic, cultural, ethnic, and other characteristics and ties, which are important for the mutual trade in general, and for IIT in particular. Effects of political and historical factors on bilateral trade were studied by Mansfield and Bronson (1997), Gowa and Mansfield (2004), and on the example of intra-regional trade in SEE by Trivić and Klimczak (2015).

H8: *Ethnic similarity positively affects IIT in agri-food products between two countries.*

Ethnic ties are a distinctive synthesis of identical language, religion, tradition, social values, and other socio-cultural features. Rauch (1996, 1999) underlined the significance of ethnic ties in international trade, particularly trade in differentiated products. Jing et al. (2010) confirmed the positive effect of language similarity on IIT but in less differentiated – agricultural – products. This research

also starts from the hypothesis that the greater ethnic similarity between BiH and its regional trading partners leads to the greater intensity of IIT in agri-food products.

3. APPLIED METHODOLOGY

The analysis of the intensity and structure of BiH's IIT was performed on trade data of the Agency for Statistics of BiH (BHAS), grouped in the three-digit levels of Standard International Trade Classification (SITC). According to the classification used by the World Trade Organization (WTO), the agri-food sector includes 42 product groups in the following SITC sections/divisions: SITC section 0 – Food and live animals (excluding SITC division 03), SITC section 1 – Beverages and tobacco, SITC section 4 – Animal and vegetable oils, fats and waxes, and SITC division 22 – Oilseeds, oleaginous fruits.

For the purpose of this research, IIT intensity has been measured by standard and aggregate Grubel-Lloyd indices (Grubel and Llyod, 1971, 1975), which are the most commonly used IIT measures in the empirical literature.

The standard Grubel-Lloyd index is calculated as follows:

$$GL_{ij} = \frac{\left(X_{ij} + M_{ij}\right) - \left|X_{ij} - M_{ij}\right|}{X_{ij} + M_{ij}} \quad 0 \leq GL_{ij} \leq 1 \tag{1}$$

where GL_{ij} is the standard Grubel-Lloyd index (IIT share) for the given industry i in trade between the given country and another country/country group j; X_{ij} is exports of industry i from the given country to another country/country group j; M_{ij} is imports of industry i of the given country from another country/country group j.

The Grubel-Lloyd index can be calculated as an aggregate index for the total trade of all industries of a country, as follows:

$$GL_j = \frac{\sum_{i=1}^{n}\left(X_{ij} + M_{ij}\right) - \sum_{i=1}^{n}\left|X_{ij} - M_{ij}\right|}{\sum_{i=1}^{n}\left(X_{ij} + M_{ij}\right)} \quad 0 \leq GL_j \leq 1 \tag{2}$$

where GL_j is the Grubel-Lloyd index, i.e., IIT share in total trade (trade of all industries *i*) between the given country and another country/country group *j*; *i* = 1, … , n – the number of industries.

The GL index value 0 indicates purely inter-industry trade, while index value 1 means that the entire trade is of the intra-industry type. However, for trade in a given industry to be labeled as inter-industry or intra-industry, the cut-off value of IIT index should be determined, which was done following the approach by Qasmi and Fausti (2001).[6]

Industries with dominant horizontal IIT (HIIT) were separated from those with dominant vertical IIT (VIIT) using the methodology developed by Greenaway, Hine, and Milner (1995) and based on the pioneering paper by Abd-El-Rahman (1986). The so-called Greenaway-Hine-Milner (GHM) methodology is based on the assumption that the relative difference between the unit values of exports and imports reflects the difference in the quality of exported and imported products. GHM methodology uses the relative unit value (RUV) index, calculated as follows:

$$RUV_{ij} = \frac{UV_{ij}^{X}}{UV_{ij}^{M}} \tag{3}$$

where RUV_{ij} is the ratio between export and import unit values for industry *i* in trade with country *j*; UV^{X}_{ij} is the unit value of exports for industry *i*; and UV^{M}_{ij} is the unit value of imports for industry *i*.

Horizontal IIT exists when the unit values of exports are relatively approximate to the unit values of imports of a given product, i.e., when the ratio of the unit value of exports to the unit value of imports ranges within the interval ±0.15 or ±0.25, depending on the chosen dispersion factor (parameter α).

$$HIIT: 1-\alpha \le \frac{UV_{ij}^{X}}{UV_{ij}^{M}} \le 1+\alpha \Rightarrow 0.85 \le \frac{UV_{ij}^{X}}{UV_{ij}^{M}} \le 1.15 \; for \; \alpha = 0.15 \tag{4}$$

[6] For the interpretation of IIT levels see the Appendix, Table 1.

Trade in products whose unit values are beyond this interval is identified as vertical IIT.

$$VIIT: \frac{UV_{ij}^{X}}{UV_{ij}^{M}} < 1-\alpha \; and \; \frac{UV_{ij}^{X}}{UV_{ij}^{M}} > 1+\alpha \Rightarrow$$

$$\frac{UV_{ij}^{X}}{UV_{ij}^{M}} < 0.85 \; and \; \frac{UV_{ij}^{X}}{UV_{ij}^{M}} > 1.15 \; for \; \alpha = 0.15 \tag{5}$$

The hypothesis concerning the impact of individual determinants on the intensity of bilateral IIT as a dependent variable (expressed using the standard GL index) was tested by estimating an empirical model.

Ethnic similarity is not expressed using a dummy variable, as is usual in most empirical research,[7] but by using a special formula that has only been applied in a few studies on intra-regional trade, and, as far we know, never in modelling IIT determination. To express bilateral ethnic linkages between the given country and country *j* for ethnic group *k*, the following formula is used (Guo, 2004; Noland, 2005):

$$ETHNIC_{jk} = min\left(x_k, y_k\right) \qquad 0 \le x_k, y_k \le 1 \tag{6}$$

where min is minimization of the variables within parentheses; x_k is the share of population belonging to ethnic group *k* in the total population of the given country; and y_k is the share of population belonging to ethnic group *k* in the total population of country *j*.

[7] Some studies, such as Havrylyshyn and Pritchett (1991), suggest that the use of a binary variable does not measure the level to which countries are ethnically related, particularly if one of the countries is inhabited by several ethnic groups.

Table 1: Expected Impact of Determinants on the IIT Share in Agri-Food Sector

Variable	Variable description	Data source	Expected effect
$ASIZE_{jt}$	economic size expressed as the average of the nominal GDPs of BiH and country *j* (in current EUR) in year *t*	IMF[8]	+
$DGDPC_{jt}$	the inequality in per capita income measured as the absolute difference in GDP per capita (in current EUR) between BiH and country *j* in year *t*	IMF[9]	–
$DIST_j$	the geographical distance as a direct straight-line distance in kilometers between the capital cities of BiH and country *j*	CEPII	–
$BORDER_j$	the common border represented by a dummy variable that equals 1 if BiH and country *j* have a common border and 0 otherwise	CEPII	+
$DLAND_{jt}$	the difference in agricultural land expressed as the absolute difference between BiH and country *j* in agricultural land measured in 000 hectares in year *t*	FAO	–
$DPROD_{jt}$	the difference in productivity measured as the absolute difference of the value added by an agricultural worker in BiH and country *j* in year *t*	FAO	–
$ETHNIC_j$	the ethnic similarity between BiH and country *j*	UNSTAT/ BHAS	+
$STATE_{jt}$	the common history represented by a dummy variable that equals 1 if BiH and country *j* formed a common state in the past, and 0 otherwise	-	+
$LIBER_{jt}$	trade liberalisation represented by a dummy variable that equals 1 if BiH and country *j* have mutual free trade in agri-food products, and 0 otherwise	MoFTER	+

Legend: IMF – International Monetary Fund; CEPII – Center for Research and Expertise on the World Economy; FAO – Food and Agriculture Organisation; UNSTAT – UN Statistics Division; MoFTER – Ministry of Foreign Trade and Economic Relations of BiH.

Overall ethnic similarity between the given country and country *j* is expressed as follows:

[8] IMF, World Economic Outlook Database 2019

[9] IMF, Ibid.

$$ETHNIC_j = \sum_{k=1}^{n} min(x_k, y_k) \quad (7)$$

The value of the variable ranges between 0 and 1, 0 indicating the non-existence of ethnic similarity and 1 indicating complete ethnic similarity between the observed countries.

To investigate the effects of the previously discussed determinants on the intensity of IIT in agri-food products, we specified and estimated an econometric model. The focus of this segment of the empirical analysis is the bilateral agri-food trade of BiH with CEFTA 2006 economies. As there is no single correct way of specifying the model, the modelling was guided by the related literature and the specification tests, while including the potentially relevant determinants. The descriptive statistics of the sample used are provided in Table 2.

Table 2: Descriptive Statistics

Variable	Observations	Mean	Std. dev.	Min	Max
IIT_{ijt}	2,285	0.178	0.272	0	0.998
T_{ijt}	3,234	0.707	0.455	0	1
$ASIZE_{jt}$	3,234	19490.86	10214.89	10133.13	44700.81
$DGDPpc_{jt}$	3,234	2357.331	2743.296	9.238	11218.51
$DIST_j$	3,234	346.79	224.935	171.89	883.068
$BORDER_j$	3,234	0.429	0.495	0	1
TI_{jt}	3,234	0.072	0.096	0	0.271
$DLAND_{jt}$	3,234	1115.462	528.103	89.3	1971.7
$DPROD_{jt}$	3,234	5078.758	6675.239	131.663	31720.46
$ETHNIC_j$	3,234	0.145	0.155	0.004	0.389
$STATE_{jt}$	3,234	0.714	0.452	0	1
$DFDI_{jt}$	3,234	8945.706	9547.068	428.148	35778.67
$LIBER_{jt}$	3,234	0.87	0.336	0	1

Source: Authors' calculation. Note: T refers to dummy variable, which takes a value of 1 if there is any trade in a particular observed 3-digit SITC product group between the countries, and 0 otherwise. TI_{jt} refers to trade intensity calculated as the share of trading partner's market in the foreign trade of BiH in agro-food products in year *t*. $DFDI_{jt}$ refers to absolute difference between foreign direct investment stock in BiH and in country *j* in year *t*, calculated on UNCTAD data. TI and FDI were included in the selection, but not in the IIT equation in the empirical model.

A notable feature of our sample is that the observed countries do not trade at all in certain product groups and years. In these instances, which make up 29.34% of our sample, the value of our dependent variable (IIT_{ijt}) cannot be determined. As noted by Helpman et al. (2008), these observations cannot simply be excluded, as such an approach would lead to selection bias, loss of information, and erroneous conclusions. To avoid this, these missing observations need to be explicitly factored into the model. To achieve this, we used Heckman's (1979) sample selection model. As the preliminary statistical analysis indicated the significance of individual and time effects, a random-effects variant of Heckman's sample selection model was used. This allowed us to factor in the unobserved heterogeneity in the analysis.

Our model consists of two equations: the selection equation determining the propensity to trade and the equation describing the intensity of IIT, provided the countries do trade. This can be represented as:

$$IIT_{ijt}^{*} = x_{ijt}\beta + u_{ijt} \tag{8}$$

$$T_{ijt} = z_{ijt}\gamma + v_{ijt} \tag{9}$$

where:

$$IIT_{ijt} = IIT_{ijt}^{*}\ if\ T_{ijt} = 1 \tag{10}$$

$$IIT_{ijt} = \varnothing\ if\ T_{ijt} = 0 \tag{11}$$

and:

$$T_{ijt} = 1 if\ Trade_{ijt} > 0 \tag{12}$$

$$T_{ijt} = 0 if\ Trade_{ijt} = 0 \tag{13}$$

The dependent variable (IIT_{ijt}) takes a non-negative value of the determined GL index (IIT^{*}_{ijt}) if the economies trade in a particular product group and is unobservable if the economies do not trade. Whether the economies trade or not

is determined by a Probit model, where the dependent variable (T_{ijt}) takes a value of 1 if the trade value between the countries in a particular product group is positive, and the value of 0 if the trade value is zero. The composite error terms u_{it} and v_{it} are assumed to be significantly correlated (the correlation is denoted by the parameter ρ). If the equations are related, i.e., if $\rho \neq 0$, estimating only the first equation would lead to sample selection bias. The preliminary analysis revealed this was the case, and to address this problem both equations were estimated using a maximum likelihood method (Wooldridge, 2002).

The selection equation includes the usual determinants of the propensity to trade. The same selection equation was used in all specifications of the IIT model. Using the Probit model we determined the Inverse Mills Ratio, which was used to correct for sample selection bias in the IIT equation.

Initially, all the theoretically and empirically relevant variables previously described were considered. However, we detected multicollinearity issues with some of the variables.[10] The results of the correlation analysis used for this purpose are presented in Table 2 in the Appendix. Due to the aforesaid issues, we specified three concurrent IIT models. In all three specifications the linear-logarithmic functional form was used, as it was a better fit for the data, as well as reducing the potential problem of heteroskedasticity and balancing the different scales in which the continuous variables of the model are measured. In all specifications, time effects were encompassed by dummy variables, whereas the individual effects were treated as components of the error term.

4. RESULTS AND DISCUSSION

With respect to BiH trade in agri-food products, the significance of the region viewed as 'CEFTA 2006' until 2013 and 'CEFTA 2006 plus Croatia' thereafter is considerable. CEFTA 2006 participation in BiH agri-food product exports is 60.4% on average and in imports is 48.0% (with 72.1% in exports and 50.1% in imports until Croatia's exit in 2013). The export share of CEFTA 2006 decreased significantly, from 75.4% (2008) to 49.2% (2018), while the import share

[10] Due to the multicollinearity problem, i.e., a high correlation with almost all other variables, and due to the insignificant impact on IIT, variables TI_{jt} and $DFDI_{jt}$ were excluded from the IIT model specification.

decreased only by a couple of percentage points, from 48.2% to 45.3%.[11] BiH trade is also highly concentrated geographically within the integration, as both exports and particularly imports are mostly with Serbia and Croatia, followed by Montenegro and North Macedonia. Compared to these countries, trade with other CEFTA 2006 parties – Kosovo, Albania, and particularly Moldova – is negligable.

The countries with which BiH trades most within CEFTA 2006 are also the ones with which it has the greatest intensity of IIT in agri-food products. In 2018 the most intensive IIT was with North Macedonia (0.42), followed by Croatia (0.38), Serbia (0.22), and Montenegro (0.19). On average, IIT is the largest with Croatia (0.35) and the smallest with Moldova (0.1), since the entire trade with the latter is of the inter-industry type. The greatest increase in IIT was registered in trade with North Macedonia, from an initial level of 0.20 to the level of 0.42 at the end of the period. The intensity of IIT with the other countries was fairly even, i.e., with few oscillations, except with Albania where, from having totally inter-industry trade, the intensity of IIT grew to a level of 0.28 in 2013, and then decreased again to 0.06. (Table 3)

In the trade in agri-food products with all CEFTA 2006 signatories, inter-industry trade prevails, viewed both by the aggregate GL index and by the number of product groups where GL≤0.50. Intra-industry trade is of lower intensity and predominantly of the vertical type. The average vertical IIT index for the three countries that had the most intensive IIT with BiH is a few times higher than the horizontal IIT index: VIIT amounts to about 0.29 with Croatia (a growing trend), 0.25 with North Macedonia, and 0.16 with Serbia (a stable trend), while HIIT is at the level of only 0.05, 0.04, and 0.07 respectively (Table 4).

BiH has no trade with Moldova, Albania, and Kosovo* in a large number of product groups (on average in 35, 22, and 15 respectively), while in most remaining groups the trade is one-way (OWT). IIT dominates only in a few groups (on average in 0, 2, and 3 respectively). The patterns do not change significantly before the end of the observed period. Trade with Montenegro also

[11] The share of agri-food products almost doubled in the observed period: it increased from 20.9% to 40.7%. Agri-food products were more important in imports (an average share 33.6%) than in exports (an average share 14.9%). (Authors' calculation based on data from BHAS.)

includes a large number of groups with OWT (20 on average) and with strong inter-industry trade (12 on average). IIT dominates only in 3 to 4 groups. The greatest changes occurred in IIT with North Macedonia. From 2013 on, IIT intensity increased incessantly, while the number of groups with OWT decreased in favour of the categories with the highest GL index and with a GL index up to 0.25. In 2018 the strongest IIT was in fruit and fruit preparations (SITC 058), chocolate and cocoa preparations (SITC 073), vegetable fats and oils (SITC 422), cheese and curd (SITC 024), and other meat (SITC 012). Trade with Croatia also experienced changes, though mostly in IIT categories rather than in the overall intensity of IIT. Compared to 2008, the number of groups with OWT doubled, but the number of groups with the strongest IIT also increased. In 2018 the highest GL indices were in fruit, fruit preparations and nuts (SITC 058, 057), vegetables (SITC 054), cereals and preparations (SITC 048), and non-alcoholic beverages, n.e.s. (SITC 111). A decade earlier the list was very different: dairy, meat, and tobacco products prevailed. It is therefore assumed that the less liberal trade regime with Croatia, compared to when it was a CEFTA 2006 member, contributed to the change in the IIT structure. Viewed by trade category, the situation in trade with Serbia is very similar to that of Croatia: a low number of groups with OWT (8 compared to 11 for Croatia), the same number with dominant IIT (9 on average), and dominant VIIT in the groups where IIT occurs (24 and 25 respectively). However, IIT with Serbia is characterised by the most stable patterns. In both 2008 and 2018, GL indices are the highest in dairy products (SITC 02), meat products (SITC 016,), and eggs (SITC 025).

Table 3: Intra-Industry Trade between BiH and CEFTA 2006 Parties

	Aggregate GL index											
CEFTA 2006 party	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**Average**
Albania	0.00	0.01	0.00	0.00	0.00	0.28	0.22	0.11	0.07	0.06	0.06	0.07
Croatia	0.34	0.37	0.35	0.36	0.36	0.34	0.32	0.28	0.33	0.37	0.38	0.35
Kosovo*	0.02	0.02	0.03	0.04	0.05	0.05	0.06	0.05	0.06	0.07	0.09	0.05
Moldova	0.00	0.00	0.00	0.00	0.03	0.03	0.00	0.00	0.00	0.00	0.04	0.01
Montenegro	0.23	0.24	0.25	0.27	0.26	0.20	0.20	0.18	0.16	0.17	0.19	0.21
North Macedonia	0.20	0.26	0.23	0.21	0.22	0.24	0.33	0.32	0.36	0.36	0.42	0.29
Serbia	0.20	0.24	0.25	0.22	0.22	0.25	0.23	0.23	0.23	0.21	0.22	0.23

Source: Authors' calculation on the basis of data from BHAS.

Table 4: Intra-Industry by Type between BiH and the Selected CEFTA 2006 Parties

CEFTA 2006 party	**IIT type**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**Average**
Croatia	HIIT	0.10	0.09	0.06	0.08	0.10	0.03	0.05	0.00	0.00	0.03	0.06	0.05
	VIIT	0.24	0.28	0.29	0.28	0.26	0.31	0.27	0.28	0.33	0.34	0.32	0.29
North Macedonia	HIIT	0.02	0.11	0.07	0.03	0.05	0.06	0.01	0.00	0.02	0.03	0.02	0.04
	VIIT	0.18	0.15	0.16	0.18	0.17	0.18	0.32	0.32	0.34	0.33	0.40	0.25
Serbia	HIIT	0.07	0.08	0.10	0.06	0.06	0.12	0.08	0.07	0.04	0.05	0.06	0.07
	VIIT	0.13	0.16	0.15	0.16	0.16	0.13	0.15	0.16	0.19	0.16	0.16	0.16

Source: Authors' calculation on the basis of data from BHAS.

Legend: HIIT – horizontal IIT; VIIT – vertical IIT.

Table 5: Estimation Results

Model	**Model (1)**		**Model (2)**		**Model (3)**	
Variable	**Dependent variable**		**Dependent variable**		**Dependent variable**	
	T	IIT	T	IIT	T	IIT
$\ln(ASIZE_{jt})$	1.818***	0.215***	1.841***	0.264***	0.550*	0.099**
	(0.208)	(0.023)	(0.295)	(0.030)	(0.295)	(0.043)
$\ln(DIST_j)$	–1.406***	–0.016	–0.815***		–1.289***	
	(0.241)	(0.021)	(0.246)		(0.323)	
$BORDER_j$		0.054**				
		(0.025)				
$\ln(DPROD_{jt})$	0.104	–0.013**	0.187**		0.185**	0.009
	(0.071)	(0.006)	(0.075)		(0.083)	(0.010)
$LIBER_{jt}$	0.235	0.039***	0.452**	0.039*	0.306	0.040*
	(0.175)	(0.013)	(0.197)	(0.023)	(0.195)	(0.024)
$\ln(DGDPpc_{jt})$				–0.009		–0.022**
				(0.009)		(0.009)
$\ln(DLAND_{jt})$				0.004		
				(0.013)		
$\ln(ETHNIC_j)$				0.023***		
				(0.007)		
$STATE_{jt}$						–0.021
						(0.025)
$\ln(DFDI_{jt})$	0.175		0.470***		0.338**	
	(0.114)		(0.145)		(0.162)	
$\ln(TI_{jt})$	0.394***		0.376***		0.399***	
	(0.063)		(0.073)		(0.098)	
Constant		–1.851***		–2.357***		–0.697
		(0.218)		(0.359)		(0.431)
Total observations	3,234		3,234		3,234	
Selected observations	2,285		2,285		2,285	
Log-likelihood	–349.689		–445.851		–377.033	
Wald test	356.213		124.904		22.711	
	(0.000)		(0.000)		(0.009)	
ρ	–0.251		–0.342		–0.329	
	(0.038)		(0.025)		(0.007)	
λ	0.777		0.836		0.373	
	(0.000)		(0.000)		(0.000)	
RESET test (p-value)	0.422		0.807		0.312	

Source: Authors' calculation.

Note: Robust standard errors are presented in the parentheses. ***, **, and * denote coefficients significant at 1%, 5%, and 10% significance levels, respectively. Wald denotes the Wald test statistics and the corresponding p-value, provided in the parentheses. ρ and λ refer to the estimates of the corresponding parameters and the values in parentheses underneath represent the corresponding p-value. Time dummies were estimated but not reported.

The remainder of this section presents and discusses the estimation results of the econometric model, which are presented in Table 5. Three columns denoted by 'IIT' signify the estimation results of the three specifications of the IIT trade model, mentioned in the previous section. 'T' columns denote the estimation results for the selection equation jointly estimated with the IIT models.

Every specification was estimated using all 3,234 observations (the entire balanced panel), where the number of selected observations was 2,285. Wald test results show that each of the presented specifications is statistically significant as a whole at the 1% significance level. The results of the Ramsey Regression Equation Specification Error Test (RESET) show no evidence of misspecification for the presented estimated models. Both correlations between the error terms in the selection and IIT equation and the Inverse Mills Ratio differ from zero by at least a 5% significance level, implying the existence of sample selection bias and the appropriateness of applying Heckman's model in the analysis.

The estimation results of the selection equation are in line with the theoretical expectations of the gravity trade model (Tinbergen, 1962), which say that the size of an economy positively affects the propensity to trade, whereas the effect of geographic distance is significantly negative. Finally, general openness to the trade of a trade partner, encompassed by the TI, was also shown to significantly and positively affect the likelihood that the two economies will trade. DFDI and DPROD, as well as the variable LIBER, were all shown to positively affect the propensity to trade, although the result is not robust in all specifications.

The major determinant of IIT is trading economies' size. The results indicate a statistically significant and positive effect of the $ASIZE_{jt}$ variable at at least a 5% significance level in all presented specifications, thus substantiating our hypothesis H2. Another variable statistically significant at at least a 10% significance level is $LIBER_{jt}$. As it has been expected according to the hypothesis H1, the results imply that membership in the common economic integration affects IIT intensity in the agri-food products trade between BiH and its partner economies from the CEFTA 2006. The empirical results also confirm the hypothesis H6 indicating that the bordering economies have a higher share of IIT in agri-food products. Furthermore, the ethnic similarity between the trading

economies[12] significantly and positively affects their mutual IIT at the 1% significance level, as assumed in the hypothesis H8. The same key determinants of IIT were recently emphasised by the results of the study conducted by Brodzicki et al. (2020).

Differences between the economies in terms of agricultural productivity and GDP per capita significantly and negatively affect IIT in agri-food products, thus confirming partly our hypothesis H4 and fully our hypothesis H3, respectively. However, the aforementioned effects of differences in economic characteristics are not robust to changes in specification. Similar indices of negative effects of differences in GDP per capita were reported by Jing et al. (2010).

The hypothesis H5 related to the geographic distance, the hypothesis H7 related to the common state in the past as well as the part of hypothesis H4, related to the differences in agricultural land, have not been verified by this research. In contrast to the selection equation, distance was not found to be a significant determinant when it comes to IIT. The same is true for differences between countries in terms of agricultural land endowments, which contrasts with the findings related to the IIT of Visegrad countries reported by Jambor (2015). Finally, belonging to the same country in the past does not significantly affect IIT between BiH and its CEFTA 2006 trading partners.

5. CONCLUSION

Despite expectations due to the similarity of the economic and non-economic characteristics of BiH and other countries of the region, it turned out that the inter-industry component dominates in BiH intra-regional trade in agri-food products. The identified IIT characteristics of the country's agri-food sector primarily indicated a low level of convergence with the agri-food sectors of its regional trading partners. Viewed both by country and by product group, the intra-regional IIT of BiH is at a relatively low level, and predominantly of the vertical type. Bilateral IIT patterns were relatively stable in most of the observed period. The exceptions are trade with North Macedonia, where a growing IIT trend was observed; trade with Croatia, where some changes by IIT categories

[12] Values of the ethnic similarity variable are presented in the Appendix, Graph 1.

appeared; and trade with Albania, where a short-term reversal in IIT trend was registered. In all three cases, these changes occurred after 2013.

The empirical results also suggest that the country-specific determinants mostly show the expected impacts on IIT intensity, even in less differentiated products such as agri-food products. The most significant determinants positively affecting the extent of IIT in agri-food products include the size of the trading economies, the similarity in their ethnic structure, the presence of a common border, and their membership in a common economic integration, while IIT is negatively affected by differences between the trading economies in terms of productivity and per capita gross domestic product. The presented empirical results support the initial hypotheses and the underlying theory. With some aforementioned exceptions, the results are also in line with the findings of the most closely related empirical studies.

However, although the country-specific determinants indicate the existence of the potential for BiH having more intensive IIT with the region, this potential has not been sufficiently exploited to date. The observed IIT patterns and performance of BiH in its bilateral trade in agri-food products within the region can broadly be treated as indicators of competitiveness, and demonstrate some concerns regarding the international competitiveness of the BiH agri-food sector. Some general recommendations could be proposed, arising from the fact that BiH's IIT with CEFTA 2006 mostly consists of vertically differentiated products. Future efforts in the sector should be oriented to the supply-side measures for raising productivity and economies of scale (affecting price competitiveness). They should also be oriented to some demand-side measures, giving more attention to macromarketing activities (such as geographical indication, branding and promotion) for those domestic products that successfully compete on the basis of their quality in the regional market.

In order to fully determine BiH agri-food sector's position in its important trade relations and to give specific policy recommendations, some further research should be carried out in the future. This should focus a more comprehensive sector-specific analysis of BiH international competitiveness, conducted on more disagreggated data and by employing additional indicators of specialisation (including differentiation between high and low vertical IIT by product groups to

separate quality competitiveness from price competitiveness, and revealed comparative advantages indices), as well as an analysis of BiH' IIT determinants based on sector-specific characteristics. Such an in-depth analysis could provide more precise conclusions which would contribute to developing an appropriate sectoral policy.

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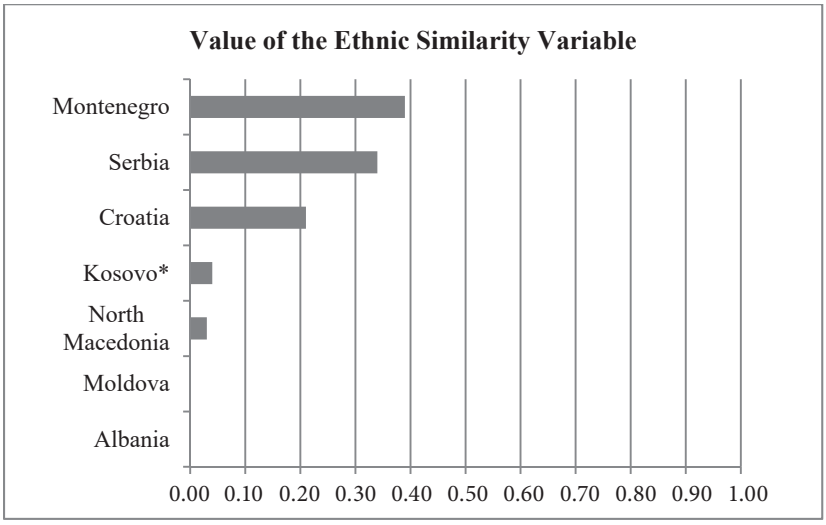
APPENDIX

Table 1: Interpretation of IIT Index Levels

IIT index value	Interpretation
0.75<GL≤1.00	Strongly dominant intra-industry trade
0.50<GL≤0.75	Moderately dominant intra-industry trade
0.25<GL≤0.50	Potential for intra-industry trade
0.00<GL≤0.25	Strongly dominant inter-industry trade
GL=0.00	Complete inter-industry trade, i.e., one-way trade

Source: Prepared by author, following Qasmi and Fausti (2001).

Graph 1: Value of the Ethnic Similarity Variable



Source: Authors' calculation.

Table 2: Correlation Matrix

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) IIT	1											
(2) ln(GDP)	0.226*	1										
(3) ln(DGDPpc)	0.042*	0.391*	1									
(4) ln(DIST)	−0.085*	−0.196*	−0.002	1								
(5) BORDER	0.176*	0.601*	0.538*	−0.598*	1							
(6) ln(TI)	0.267*	0.713*	0.105*	−0.709*	0.712*	1						
(7) ln(DLAND)	−0.001	−0.035*	−0.133*	−0.902*	0.311*	0.523*	1					
(8) ln(DPROD)	−0.065*	−0.308*	0.478*	−0.103*	0.268*	−0.096*	0.091*	1				
(9) ln(ETHNIC)	0.186*	0.453*	0.303*	−0.756*	0.893*	0.828*	0.554*	0.297*	1			
(10) STATE	0.176*	0.282*	−0.007	−0.703*	0.548*	0.808*	0.639*	0.238*	0.857*	1		
(11) ln(DFDI)	0.197*	0.879*	0.511*	−0.185*	0.669*	0.650*	−0.043*	−0.179*	0.549*	0.345*	1	
(12) LIBER	−0.006	−0.255*	−0.168*	0.009	−0.056*	−0.049*	0.077*	0.000	0.105*	0.183*	−0.182*	1

Source: Authors' calculation.

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AN ANALYSIS OF THE PERFORMANCE OF THE AGRO-FOOD INDUSTRY IN THE DOMESTIC AND INTERNATIONAL MARKETS OF CÔTE D'IVOIRE

ABSTRACT: *Since its independence in 1960, Côte d'Ivoire has opted for an industrial policy that has given rise to two major types of agro-food industry. The first is small-scale units owned by nationals and the second is agro-food industries owned by large international firms that mainly export their products. This strategy has led to commodity specialisation that deteriorates the terms of trade. Thus, despite a significant industrial sector, the country suffers from deteriorating trade terms due to an overly extroverted economy, the corollary of which is over-indebtedness. This paper compares the performance of domestic and international markets of Côte d'Ivoire to identify the type of agro-food industry that should be promoted for development. The ripple effects in domestic and international markets are estimated and compared using the Leontief model and data from the Côte d'Ivoire Input-Output Table of 2018. We show that the cocoa and coffee processing branch of the agro-food industry is commercially outward-oriented, the oilseed industry is commercially mixed or dual-oriented, and the other branches are commercially inward-oriented. The ripple effects of the domestic market are almost four times higher than those of the external market. The high rate of population growth, galloping urbanization and the social nature of food are key determinants of the findings. We conclude that the domestic market better stimulates the development of the agro-food industry. We therefore recommend a strategy of orienting products towards domestic and West African markets, which could lead the country to sustainable economic development more rapidly.*

KEY WORDS: *Côte d'Ivoire, agri-business, agricultural policy, trade ripple effect, agricultural trade.*

JEL CLASSIFICATION: Q13

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1. INTRODUCTION

Upon accession to independence in 1960, Côte d'Ivoire showed a willingness to industrialise its economy and opted for an industrial policy of import substitution and exports. This choice enabled it to experience remarkable economic growth during its first two decades of independence. The aim of this industrial policy was to reduce manufactured imports through local manufacturing, significantly reducing the import bill while enhancing the development of local agricultural resources. This justifies the attention given to the agro-food industry in view of the massive investments it received in the 1970s and multiple government interventions, starting with the Investment Code Act of September 1959. The main objective of this Code was to attract foreign capital by offering various advantages (customs, tax, and administrative), thereby laying a foundation for liberalism in Ivorian industry (Ministry of Industry and Mines, 2017). This has enabled Côte d'Ivoire to have a larger industrial sector than other countries in the sub-region.

This industrial policy has given rise to two main types of agro-food industry (AFI): the first is small-scale units owned by nationals, and the second is agro-food industries owned by multinationals that mainly export their products and make large profits. The latter are also likely to have a considerable impact on the development of Ivorian agriculture.

This strategy limited the country to commodity specialisation, according to Ricardo's theory of openness and liberalism. In terms of production, the country is first in the world for cocoa, first for cashew nuts, seventh for rubber, eleventh for oil palm, and fifteenth for coffee. Moreover, commodity specialisation further deteriorates the terms of trade. These two obstacles to increased international trade in developing countries are strongly linked because the deterioration of trade terms is often explained by low commodity prices. Today, according to the Ministry of Agriculture and Rural Development (2020), Ivorian cocoa producers receives only 6% of the international price. The terms of trade deteriorate because import prices increase faster than export prices, leading to an unfavourable imbalance for the country. Despite a significant industrial sector, the country has always suffered from deteriorating terms of trade as a consequence of an overly extroverted economy, the corollary of which is over-indebtedness (11,000 billion CFA francs, or about 48% of GDP).

The deterioration of trade terms is a real problem for developing countries and runs counter to liberal economic principles, according to which trade leads to automatic enrichment. In fact, products that developing countries export (commodities in general) do not earn them the income necessary to meet the cost of imports (manufactured products in general) since the latter are much more expensive than the exports. This creates a significant imbalance, illustrating the existence of an unequal and asymmetrical exchange between developing countries and industrialised countries (Atse, 2007). At the same time, domestic and sub-regional consumption demand for local goods is growing because of galloping demography (3.3%), and the volume of food crop production rose from 2.6 million Tons in 1975 to 11.13 million Tons in 2010 and 18.84 million Tons in 2018, of which 49% was yams, 21% cassava, 15% plantains, 6.4% rice, and 5.9% corn (LSCC, 2019).

Given the strong growth in domestic demand for local consumer products, in the interest of better business orientation it seemed important to conduct a comparative analysis of the ripple effects of domestic and international markets on the domestic economy. Therefore, the objective of this study is to identify whether the domestic or international market has the greatest impact on the Ivorian domestic economy, particularly the agricultural sector.

2. AGRICULTURAL TRADE AND ECONOMIC DEVELOPMENT

International trade appeared in Truman's 1949 discourse on development because according to liberal theses, international trade, or more precisely free trade, is the cornerstone of development and poverty reduction (Atsé, 2007). Indeed, the French Justice and Peace Commission (1990, p.132) mentions that liberal thought on development is based on two certainties: that free trade is the guarantor of the enrichment of each of the partners, and that according to the postulate of the universal validity of the theory of growth, free enterprise and the functioning of markets will solve the problem of underdevelopment.

Classical economists such as Smith (1723–1790), Ricardo (1772–1823), Mill (1806–1873), and more recently development economists Rostow (1988), Brasscul (1989), Friedman (1912–2006), and Krugman (1979, 2003) proposed theories that demonstrate the advantages of liberalism. International institutions such as the International Monetary Fund (IMF) and the World Bank (WB), the

main donors to developed countries, adopted these liberal theories. It is in this context that the Côte d'Ivoire subscribed to the theory of comparative advantage and specialised in the export of agricultural and agro-industrial products (ATSE, 2007).

According to economic development theory, as a country develops its service sector expands faster than its primary production sector. The total resources devoted to marketing agricultural products tend to increase faster than the resources allocated to the production of the products. This trend becomes more pronounced when a country begins to transition from a subsistence economy to a market or monetary economy. Agricultural development, like economic development in general, must be based on a division of labour into specialised functions, and the growth of the economy reflects this specialisation. The specialisation must be progressively associated with the expansion of the marketing system and its ability to move commodities from one region and community to another. Economic development raises incomes and thereby diversifies the diet. In this context, the marketing system must expand to provide a greater variety of foods and ensure food security (CIRES, 2014).

An effective trading system not only serves as a link between producers and consumers, but also makes an active and positive contribution to development. Marketers work to increase their turnover and sales, and their efforts to do so stimulate economic activity in both the production and service sectors. Embracing the idea of Stiglitz (1989), Loy and Wichern (2000) assert that economic growth in the least developed countries is not primarily related to lack of physical or human capital, but rather to lack of efficiency in the functioning of markets.

A good trading network stimulates consumption and helps to increase production by seeking additional supplies. If the price system works properly, it provides an incentive to increasingly meet (consumer) demand in terms of type, quality, and delivery time. In this way, production adapts to demand by reacting to price signals from the marketing system, allowing us to argue that the marketing of agricultural and agro-industrial products generates three main utilities (LSCC, 2019):

1) Place utility is when products are moved from the place of production to the places where they are sought. It therefore includes the transport and spatial distribution of the product.
2) Time utility is when products are stored for a period of time and made available for several weeks, months, or years.
3) Form utility is when products are processed or turned into new products to reflect consumer tastes and preferences.

Besides stimulating research on techniques for the preservation, sale, and preparation of various types of food to satisfy different consumer tastes and needs, the marketing of agricultural products has an impact on the domestic economy: it stimulates the development of agro-food industries and creates new income-generating opportunities. In order to identify the means and items of an adequate trade policy it is therefore necessary to reflect on the logic, ripple effect, and current dynamics of the different types of agro-industrial market.

3. AGRO-FOOD INDUSTRY AT THE HEART OF THE GLOBAL FOOD SYSTEM

Today, the agro-food industry is at the heart of a major economic complex, the food system, whose purpose is to feed people, most often through market relations (Rastoin and Ghersi, 2012). The position of the agro-food industry in sectors that make up the food system varies from country to country. However, there is a global convergence towards a tertiary agro-industrial model in which the agro-food industry is global, involves sophisticated technology, is financed by multinationals, and occupies a strategic pivotal position. In 2009 the agro-food industry accounted for 10% to 30% of total manufacturing industries, nearly USD 4 trillion of production, and over 25 million employees (Rastoin et al. 2012).

Ten countries account for 85% of the agro-food industry's global production and 70% of its employees. Remarkably, at the beginning of the 2000s the absolute supremacy of developed countries (United States, Germany, France, and Japan) was replaced by a shared global leadership with the emerging economies of China, Russia, Brazil, and India. In industrialised food systems the agro-food industry market consists mainly of mass distribution, itself highly concentrated and constituting over 80% of food purchases in Western European households. Competition between mass distribution firms is mainly through consumer prices and therefore through net prices paid to food suppliers. Thus, in the agro-food

industry there is an obsession with productivity gains, pushing players to reduce the fixed unit cost by increasing the size of factories (economies of scale, replacement of labour with mechanisation and robots). Technological advances have made it possible to significantly reduce losses and to improve product quality controls. Finally, concentration ensures the financing of intangible investments (innovation and communications) that enable the company to gain market share through a leverage effect enabled by size. The investments are considerable. In 2008, research and development accounted for approximately 1.5% of the turnover of large agro-food companies in the OECD, while, depending on the product, advertising represented 5% to 15% of the final price. Here again the scale effect favours large firms.

Most big agro-food companies use the stock market, where hedge funds are active, to finance themselves. This financing requires high returns in the short term and has an amplifying effect on price volatility. It causes enormous problems for farmers and small businesses, and forces firms to use sophisticated production and marketing technologies and to intensively harness biological resources, leading to major new challenges: climate change; controlling greenhouse gas emissions, waste production, and soil pollution; improving energy efficiency through bioenergy production; conserving biodiversity; using bio-recyclable raw materials and controlling food waste; improving nutritional quality, food biosecurity and certification, and information on manufacturing conditions (and consumer confidence in such information); and digitising information for traceability and developing e-commerce using barcodes, QR codes, and block chain technology.

Technologies being developed that combine digital and bio technologies will allow specific knowledge of manufacturing and transport conditions, especially cold-chain compliance, provided that the deployment of such technologies is properly organised and regulated. As in other industrial sectors, digital technology in the agro-food industry will allow further productivity gains through the organisation of production chains from the primary producer to the end consumer, with even the prospect of optimising logistics chains by using drones for home deliveries.

3.1 Agro-food industry and the ripple effect

Bernade and LeClercq (2005) define the agro-food industry as any industry that processes plant- or animal-based raw materials into products intended for human or animal consumption. In its narrowest sense this definition does not include either raw material producers or peripheral activities (fertilizers, agricultural machinery, and specific services). In the Côte d'Ivoire the agro-food industry comprises eight branches, according to National Accounts product classification (INS, 2020), as follows:

- Meat and Fish Production (MFP)
- Grain Processing and Starchy Product Manufacturing (GPSPM)
- Cocoa & Coffee Processing (CCP)
- Oilseed Industry (OI)
- Bakery, Pastry and Pasta (BPP)
- Dairy Industry and Fruit & Vegetable Industry (DIFVI)
- Beverage Industry (BI)
- Tobacco Industry (TI).

The agro-food industry is the industrial sector that offers the greatest opportunities in terms of sustainable growth, employment, and poverty reduction in Africa (UNCTAD, 2010). The strategic role of agro-food industry activities in development can be explained by several factors. First, technology and innovation are essential for economic development, and the agro-food industry has traditionally been the primary source of innovation in modern economies (Gault et al. 2010). The research and development activities of agro-food enterprises have been key to technological advances in the global economy (Shen et al. 2007).

The agro-food sector has another advantage over other sectors: since agro-food companies are particularly heavy consumers of banking, transport, insurance, and communication services, the sector is an essential source of demand for other sectors. The agro-food sector also boosts the growth of the agricultural sector by creating demand. The sector therefore has significant downstream and upstream ripple effects and thus contributes to domestic investment, employment, and production for development purposes.

The agro-food sector is also attractive because, according to Engel's law, as per capita income rises the share of agriculture in total household expenditure declines and the share of processed products increases. As a result, agro-food products offer significant opportunities for export expansion and are therefore key drivers of growth in merchandise trade (UNCTAD and UNIDO, 2011). Ripple effects can also be assessed for markets using Leontief's model (Coulibaly and Ghersi, 1993). This justifies the relevance of analysing the ripple effects of domestic and international markets and ascertaining which one better drives the development of the agro-food industry. Ripple effects are defined as actions whereby an increase in the growth rate of production (or productivity) for activity A causes an increase in the growth rate of profit (or productivity) for activity B (Coulibaly and Ghersi 1993). According to Leontief's model, the driving unit A acts on unit B through a set of dimensional effects. That is to say, unit A causes additional production for B by the size of the purchases made from B.

Some studies similar to ours have focused on ripple effects. Bojnec (2016) uses an input-output table of the Slovenian economy with 60 branches to analyse direct and indirect effects by economic activity, technological intensity of products and services, and statistical region in Slovenia. Comparisons with alternative non-dual-use high tech are analysed by economic activity in terms of value-added and labour productivity. Dual-use exports are associated with technologically intensive suppliers and sub-suppliers of defense/civilian goods and services. Bojnec argues that empirical estimations can serve as a guide when comparing alternative economic policy designs in the investigation of trade-offs between expenditure allocation for defense equipment and the opportunity costs of non-dual use of high-tech products and services. Bojnec and Ferto (2015) use a gravity trade model to assess the effects of institutional drivers of trade in agricultural and food products. The focus is on the effects of institutional quality and similarity among OECD countries when explaining variation in bilateral agricultural and food exports. The empirical results confirm that institutional similarity and institutional quality have separate effects on agro-food export patterns. Institutional similarity has significant but mixed associations with agro-food exports in similar institutional frameworks, while the effect of institutional quality on agro-food exports varies: different institutions have different impacts. A good quality institution reduces the effects of distance, which, jointly with the level of economic development in importing OECD countries, promotes

international agro-food trade. Coulibaly et al. (2019), based on the input-output table (IOT) of the Ivorian economy, show that all agro-food industry branches have lower-than-average ripple effects of 0.132%. This low agro-food industry power and sensitivity is a result of low integration between branches and with the agricultural sector, in particular with the food agriculture branch, and of the obsolete technologies used. These results are in line with those of Koko (2013).

3.2 Hypotheses

Since its independence in 1960 the Côte d'Ivoire has willingly industrialised its economy and has opted for an industrial import substitution and agro-export policy model. In terms of economic theory, external openness influences economic growth through the expansion of the market, the acquisition of new technologies, and the acceleration of capital formation (CIRES, 2014). Faced with the deterioration of the terms of trade and the strong growth in domestic demand for consumer products, this study tests two hypotheses:

H1: The international market has greater trade ripple effects than domestic or local markets.

H2: The domestic market has greater trade ripple effects than the international market.

4. METHODOLOGY

Leontief's input-output model (Leontief, 1936) is a tool for analyzing inter-sectoral exchange flows that uses data from the Supply Use Table (SUT), or Input-Output Table (IOT) (also called the Flow Table) provided by national accounts (Coulibaly et al., 2019).[1] The Input-Output Table (IOT), the Economic Overview Table (EOT), and the Social Accounting Matrix (SAM), are key instruments of economic analysis. Leontief (1936) first used the input-output table, commonly referred to as IOT or SUT (Supply Use Table). The analysis of the IOT is based on a linear equation system showing the distribution of an industry's production

[1] The United Nations System of National Accounts was established in 1993 (SNA93) and set out the reference nomenclature by which countries define institutional units and sectors and their economic accounts, and the three types of economic transaction (goods and services, income distribution, financial transactions) that constitute the major economic aggregates.

across the economy (Yu et al., 2010). It is a double entry table that tracks all economic transactions in goods and services. It describes the structure of the domestic economy and of product flows, which makes it useful for prioritising activities and highlighting the driving and driven branches of the economy. It is considered not only as a forecasting tool for predicting the effect of a given policy on the production of the branches, but also as a tool for economic impact analysis because it allows measuring the effects of variation in an item of final demand for a strategic product on the entire economy (Zaoujal, 2016). We consider Leontief's model as a particular case of the general equilibrium theory, which aims to overcome the contradictions of prices and quantities equilibrium analysis in partial equilibrium. In fact, IOTs were conceived as an accounting matrix twinned with a mathematical model of general economic equilibrium. The scheme was designed as an alternative to econometrics, as Leontief considered the latter ill-equipped to link economic theory with statistical measurement. We chose Leontief's model because of its robustness in assessing ripple effects. It allows us to identify the type of market that is most stimulating for the agro-food industry. However, it should be noted that Leontief's model provides an essentially static image that does not explain changes and evolution. It ignores technical progress, changes in behaviour, and everything that constitutes structural change. Such a model is acceptable only for small variations and for a short term. Nor are climatic hazards or training and production technologies included in the IOT, and the functions of the model are assumed to be linear. However, structural changes are weak and slow in Africa and the model remains well suited to developing economies like Côte d'Ivoire.

This paper applies three steps to identify the commercial orientation of the branches, to analyse the trade ripple effects of the domestic and international markets, and to recommend a commercial orientation for the agro-food industry.

4.1 Identifying the trade orientation of the economy's branches.

Leontief's model makes it is possible to simulate expenditure related to different types of final demand and to follow the shock wave that this creates in the economy. For every expenditure made by an economic agent, the economy adjusts to the increase in demand by increasing the branch's production (Zaoujal, 2016). According to Coulibaly and Ghersi (1993), in Leontief's model the total

production of a sector is equal to the sum of the intermediate uses and final consumption of the products. Mathematically, this can be written as:

$$\sum Xij + Yi = X_J \tag{1}$$

Where *Xij* represents the purchases of sector *j* from sector *i*; *Yj* the final demand for goods of sector *j*; and *Xj* is the total gross production of the sector. Leontief's model is a representation of an economy's Input-Output Table (IOT) that is based on calculated indicators, called 'technical coefficients', which express the participation of other industries in the production of a given industry. In other words, the technical coefficients of an industry *(j)* present the purchases made by that industry from other industries *(i)* in order to produce one unit of production. The technical coefficients *aij* are determined as follows:

$$aij = \frac{Xij}{Xj} \tag{2}$$

Hence $Xij = aij^{*}Xj$ (3)

Equation (1) can be re-written as

$$\Sigma aij^{*}Xj + Yj = Xj \tag{4}$$

For an economy with *n* sectors, all of the technical coefficients *aij* form Matrix A below:

$$A = \begin{bmatrix} a_{11}\ a_{12} \ldots a_{1i} \ldots & a_{1n} \\ a_{21}\ a_{22} \ldots a_{2i} \ldots & a_{2n} \\ \vdots\ \ \vdots\ \ \ldots\ \vdots\ \ \ldots & \vdots \\ a_{n1}\ a_{n2} \cdots a_{ni} \ldots & a_{nn} \end{bmatrix}, \tag{5}$$

This matrix is commonly referred to as the technical coefficient matrix. In Leontief's model, *aij* is assumed to be fixed and stable because production techniques are complementary factor techniques, returns to scale are constant,

the model is short term, and it is stable because it is not significantly affected by technological change. In an economy with *n* sectors the coefficients form a matrix called *A*. A simplified form of the system of equations representing the economy leads us to the following equation:

$$X=AX+Y \tag{6}$$

Where *X* is the gross production of the economy, *A* is the matrix of technical coefficients for the overall economy, and *Y* is the final demand vectors. Note that the final demand consists of several components: household consumption (*Cm*), exports (*E*), gross fixed capital formation (*GFCF*), and variation of stock (*VS*).

$$Y= Cm + E +GFCF + VS \tag{7}$$

An arrangement of Equation (6) gives:

$$X= (I-A)^{-1}*Y \tag{8}$$

Where $(I-A)^{-1}$ is called Leontief's inverse matrix. Equation 8 summarises the Leontief model.

Before analyzing the performance of the domestic and international markets, we first identify the current market orientation of the branches; i.e., whether the sub-sectors are oriented towards the domestic market, the international market, or both at the same time. To do this we use a classification scale developed by Coulibaly and Ghersi (1993). A sub-sector is said to be inward-oriented if its domestic consumption (*Cm*) is greater than or equal to 75% of final demand.

$$(Cm/Y)*100 \geq 75\% \tag{9}$$

However, if its external consumption (exports) is higher than 75% of the final demand the branch is said to be outward-oriented.

$$(E/Y)*100 \geq 75\% \tag{10}$$

If its internal and/or external consumption is between 25% and 75% the branch is said to be dual-trade (Coulibaly and Ghersi, 1993).

4.2 Measuring the trade ripple effects of markets

After classifying the various industries according to markets, we simulate a 10% increase in domestic demand and then a similar increase in foreign demand and compare the ripple effects on the economy. The second step will consist in assessing the trade ripples from the equations below:

$$Y = Cm + E + GFCF + VS \tag{11}$$

The impact of internal market demand on final demand can be seen by simply increasing household consumption (*Cm*). At the same time, acting on exports (*E*) and seeing the effects on final demand will act on international market demand. We note that the production variation of an industry leads to a variation in value added, which in turn induces a variation in wages, which will also impact final demand. The ripple effect of a market is its ability to stimulate the production of an industry in order to increase its value added.

We simulate an increase of 10% in both the domestic and international market and assess the rate of variation in final demand (*Y*). These simulations enable us to compare the performance of the two markets and deduce which performs better. Final demand (*Y*) is composed of household consumption (*CM*), exports (*E*), gross fixed capital formation (*GFCF*), and variation of stock (*VS*). For the domestic market we vary final demand (*Y*) by positively variating household consumption (*CM*) by 10%. This enables us to write that:

$$Y1 = 10\%Cm + E + GFCF + VS \tag{12}$$

Therefore:

$$\Delta Y1 = Y1 - Y \tag{13}$$

The trade ripple effect of the domestic market is K1 and is assessed as follows:

$$K1 = \frac{\Delta Y1}{Y} \tag{14}$$

A 1% growth in domestic demand (household consumption) allows K1% growth in the domestic economy in terms of financial resources. K1 is the trade ripple effect of the domestic market.

For the international market we vary final demand (Y) by positively varying exports (E) by 10%. This enables us to write that:

$$Y2 = Cm + 10\%E + GFCF + VS \tag{15}$$

Therefore:

$$\Delta Y2 = Y2 - Y \tag{16}$$

The trade ripple effect of foreign market *K2* is assessed as follows:

$$K2 = \frac{\Delta Y2}{Y} \tag{17}$$

A 1% growth in international demand (exports) allows K2% growth in the domestic economy in terms of financial resources. K2 is called the trade ripple effect of the international market.

K1 and K2 represent the trade elasticity of the domestic and international markets respectively, according to the Leontief model.

4.3 Criteria for recommendations

We can compare K1 and K2 and see which of the two markets provides a higher ripple effect. If K1 > K2 the domestic market provides a better stimulus to growth in the agro-food industry. If not, the international market provides a better stimulus to growth in the agro-food industry, and in turn to the domestic economy. These results allow us to make recommendations, taking into account the political and economic implications.

5. EMPIRICAL ANALYSIS AND RESULTS

The study takes place in the Côte d'Ivoire, a forested country in West Africa. The data used for our study are secondary quantitative data from the most recent

National Accounts (2018). They are produced by the Ministry of Planning and Development every three years. This national database contains several tables, including the Input-Output Table (IOT). The Ivorian IOT is divided into 44 branches. However, the 44 branches have been aggregated into 21 sub-sectors in order to study the performance of the agro-food industry markets. And this because policies are drawn up by sector or sub-sector for more efficiency. The sub-sectors are:

1 – Food Agriculture (FA), 2 – Industrial or Export Agriculture (IEA); 3 – Livestock and Hunting (LH); 4 – Fisheries (F); 5 – Meat and Fish Production (MFP); 6 – Grain Processing and Starchy Product Manufacturing (GPSPM); 7 – Cocoa and Coffee Processing (CCP); 8 – Oilseed Industry (OI); 9 – Bakery, Pastry and Pasta (BPP); 10 – Dairy Industry and Fruit & Vegetable Industry (DIFVI); 11 – Beverage Industry (BI); 12 – Tobacco Industry (TI); 13 – Wood Industry (WI); 14 – Chemical Industry (CI); 15 – Construction and Public Works (CPW); 16 – Energy and Water (EW); 17 – Miscellaneous Industries (MI); 18 – Oil Extraction/Mining and Refining Industry (OEMRI); 19 – Public Services (PuS); 20 – Private Services (PrS); 21 – Other Sectors (OS).

The two main sectors are: Agriculture (sub-sectors 1 to 4) and the Agro-Food Industry (sub-sectors 5 to 12).

5.1 Current commercial orientation of the economy's branches

Table 1 shows the trade rate of the economy's branches in domestic and international markets, estimated according to Equations 9 and 10. The Food Agriculture and Livestock and Hunting sub-sectors mainly target the Ivorian domestic market. Industrial and Export Agriculture is 72.61% oriented to the foreign market. The Fisheries sub-sector is mainly inward-oriented, as are Meat and Fish Production (89.47%), Food Grains and Starchy Product Manufacturing (84.82%), Bakery, Pastry and Pasta (92.31%), the Dairy Industry and Fruit & Vegetable Industry (84.64%), the Beverage Industry (95.76%), and the Tobacco Industry (84.91%). Only the Cocoa & Coffee Processing branch is outward-oriented, with a low domestic consumption rate (9.50%). This is explained by the fact that this sub-sector is mainly managed by foreign investors. The Oilseed Industry has a domestic consumption rate of 68.92% and an export rate of 29.86% and is therefore mixed or dual-traded.

Table 1: Trade orientation of sub-sectors of the domestic economy (%)

Component / Sub-sector of the economy	Domestic Consumption Cm/Y	Exports E/Y	Gross Fixed Capital Formation (GFCF), GFCF/Y	Variation of stock (VS). Vs/Y	Final Demand (Y) Y/Y	Orientation
1 – Food Agriculture (FA)	89.63%	0.49%	0.00%	9.87%	100.00%	Inward
2 – Industrial or Export Agriculture (IEA)	14.12%	72.61%	0.95%	12.33%	100.00%	Outward
3 – Livestock and Hunting (BH)	76.13%	0.22%	6.52%	17.13%	100.00%	Inward
4 – Fisheries (F)	20.62%	9.31%	0.00%	70.07%	100.00%	Inward
5 – Meat and Fish Production (MFP)	89.47%	8.25%	0.00%	2.28%	100.00%	Inward
6 – Food grains and Starchy Products Manufacturing (GPSPM)	84.82%	6.14%	0.00%	9.04%	100.00%	Inward
7 – Cocoa and Coffee Processing (CCP)	9.50%	75.00%	0.00%	15.50%	100.00%	Outward
8 – Oilseed Industry (OI)	68.92%	29.86%	0.00%	1.22%	100.00%	Dual-Trade
9 – Bakery, Pastry and Pasta (BPP)	92.31%	7.69%	0.00%	0.00%	100.00%	Inward
10 – Dairy Industry and Fruit & Vegetable Industry (DIFVI)	84.64%	11.25%	0.00%	4.11%	100.00%	Inward
11 – Beverage Industry (BI)	95.76%	3.11%	0.00%	1.12%	100.00%	Inward
12 – Tobacco Industry (TI)	84.91%	12.52%	0.00%	2.57%	100.00%	Inward
13 – Wood Industry (WI)	66.09%	27.26%	1.71%	4.94%	100.00%	Dual-Trade
14 – Chemical Industry (CI)	47.01%	38.50%	0.00%	14.49%	100.00%	Dual-Trade
15 – Construction Materials	31.03%	0.32%	68.65%	0.00%	100.00%	Dual-Trade
16 – Energy, Electricity, Water	74.67%	25.33%	0.00%	0.00%	100.00%	Dual-Trade
17 – Miscellaneous Industries	38.73%	22.53%	24.18%	14.57%	100.00%	Dual-Trade
18 – Oil Extraction/Mining and Refining	4.26%	62.05%	0.00%	33.69%	100.00%	Inward
19 – Public Services	99.85%	0.15%	0.00%	0.00%	100.00%	Inward
20 – Private Services	90.05%	9.95%	0.00%	0.00%	100.00%	Inward
21 – Other Branches	22.31%	13.28%	44.43%	19.98%	100.00%	Inward

Source: Authors' calculations based on IOT 2018 at current prices using Equations 9 and 10.

5.2 Trade ripple effects of the domestic and international agro-food industry markets

A market's ripple effect is its capacity to stimulate production in order to increase value added. Leontief's model makes it possible to determine the ripple effects of the domestic and international markets by simulating a 10% increase in demand in both. These ripple effects were estimated using Equations 14 for the domestic market ripple effect) and 17 for the international market ripple effect. The results are presented in Table 2.

Table 2: Trade ripple effects of the domestic and international markets (%)

Agro-Food Industry Branch	Domestic Market (K1)	International Market (K2)
5 – Meat and Fish Production	**11%**	0.99%
6 – Food Grains and Starchy Products Manufacturing	**14%**	1.10%
7 – Cocoa & Coffee Processing	1%	**9.72%**
8 – Oilseed Industry	**16%**	5.95%
9 – Bakery, Pastry and Pasta	**9%**	0.77%
10 – Dairy Industry and Fruit & Vegetable Industry	**12%**	1.55%
11 – Beverage Industry	**12%**	0.42%
12 – Tobacco Industry	**9%**	1.29%
AFI Trade Elasticity or Ripple Effect	84%	22%

Source: Authors' calculation based on IOT 2018 at current prices, using Equations 14 and 17.

To illustrate, the information contained in Table 2 on Meat and Fish Production means that a 10% increase in domestic demand for Meat and Fish Production causes an 11% increase in the production of Meat and Fish; on the other hand, the same 10% increase in demand, this time oriented towards the international market, leads to an increase of only 0.99% in Meat and Fish Production. The stimulus the domestic market provides to the development of the agro-food industry is almost four times higher that of the international market, with average performances of 84% and 22% respectively.

As domestic demand for agro-food products increases the agro-food industries are exploiting the strong potential of the domestic market. However, Coffee & Cocoa Processing is better stimulated by the international market.

5.3 Discussion

Our results show that the ripple effects of the domestic market are almost four times higher than those of the international market (84% vs. 22%). Our results are in the same direction as those of World Bank (Banque Mondiale, 2020) market competitiveness study Côte d'Ivoire using comparative advantage revealed (CAR), which shows that Côte d'Ivoire is more competitive in food products and vegetables (subsistence agriculture). Our results confirms a World Bank study (Banque Mondiale, 2015) according to which domestic and sub-regional (Mali, Burkina Faso, Niger, and Ghana) markets have become great opportunities thanks to demographic growth. This study of the World Bank in 2015, also reveals that exports from Côte d'Ivoire are not competitive because of the low prices of products on the international market, which does not allow capitalisation of production systems. These results confirm our hypothesis H2 that "The domestic market has a greater trade ripple effect than the international market". On the other hand, using the 1986 IOT, Coulibaly and Ghersi (1993) showed that the international market's ripple effect of 21.8% boosted the economy better than the domestic market's average ripple effect of 10% because the prices of agricultural raw materials were better on the international market than the domestic market.

The performance of the domestic market can be explained by the average rate of population growth in Côte d'Ivoire (2.59% per year) combined with the rate of urbanisation (from 32% in 1975 to 50.3% in 2014). One of the advantages of the domestic market for agro-food industries is the strong, partially satisfied demand for traditional local products, or products that have undergone artisanal processing. The social nature of food is also a factor, as each social group is identified by a consumption pattern. Traditional food products have a symbolic and cultural character, leading to a reluctance to switch to industrially processed foods. The early stages of agro-food processing require simple and low-cost technologies (threshers, cleaners, huskers, rollers, sifters, dryers, oil extractors, etc.), which makes them accessible to small-scale enterprises.

Moreover, given the advanced sophistication of processed products in developed countries there is not a sustained global demand for such products from African countries. Thus, the most attractive option for agro-food industries remains domestic and sub-regional markets that are characterised not only by proximity but also by similar food preferences, which constitute a source of competitive advantage. In addition, the African population growth rate and galloping urbanisation are opportunities for agro-food industry development. However, products need to be low cost and nutritionally adapted to people's needs. GIZ (2017) confirms the market opportunities for Ivorian AFIs in the sub-region. Mass-production industries are also more resistant to external shocks, although low purchasing power presents a risk for a domestic-market-oriented strategy.

The strategy of orienting products towards domestic and West African markets needs to be accompanied by policies to enlarge the African middle class that can consume the manufactured products, such as a savings policy, domestic investment by nationals, a tax policy, and an adequate supply chain policy.

Orientating commercial policy towards the domestic market will revitalise research on processing technologies for large consumption products such as food crops. Food agriculture produces approximately 18,842,420 tons of crops per year over an area of 2,448,000 hectares, constitutes 14.7% of GDP, and employs more than 2,500,000 agricultural workers, or about 90% of rural families (85% of the active agricultural population), and is mostly made up of women and the informal sector. The food agriculture sector is an important dormant source of increased employment and farm income that can provide food security and reduce rural poverty. In terms of income, food production has significant development potential, particularly for women and young people. Orientating to the domestic market is a more appropriate policy than liberalism because deteriorating trade terms generate an external debt (48% of GDP) that the economy cannot support. According to Atse (2007), poverty rates have not fallen despite the fact that Ivory Coast's trade with the rest of the world has increased; on the contrary, poverty has increased. An economic policy based on trade liberalisation has not automatically led to poverty reduction.

6. CONCLUSION

Our study shows that most agro-food industry categories (Meat and Fish Production; Grain Processing and Starchy Product Manufacturing; Bakery, Pastry and Pasta; Dairy Industry; Fruit and Vegetables; Beverages; Tobacco) are commercially inward-oriented. Only the Cocoa and Coffee Processing category is outward-oriented, while the Oilseed Industry is commercially mixed or dual-oriented.

The ripple effect, or trade elasticity, is almost four times higher in the domestic market than the foreign market, which is explained by the population growth in Côte d'Ivoire, the rate of urbanisation, and the social character of food. Thus, the domestic market better stimulates the development of the agro-food industry – and thus the economic development of the country – than the international market. On the other hand, the Coffee and Cocoa Processing branch is better stimulated by the external market. The rate at which the African population is increasing and the growing urbanisation present an opportunity for the development of the agro-food industry. However, products should be low-cost and nutritionally adapted to people's needs. Industries that produce most of their production for the domestic mass market are more resistant to external shocks, but an agro-food product marketing strategy oriented towards the domestic market faces the risk of consumers' low purchasing power.

We therefore recommend that the strategy of orienting products towards domestic and West African markets should be supported by policies aimed at enlarging the African middle class that can consume the products offered by manufacturers; for example, a savings policy, domestic investment by Ivorians, and adequate and efficient tax and supply chain policies. Thus, the analysed weaknesses could foster the development of a sound investment policy, and indirectly a sound economic policy.

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AN INDUSTRIAL ORGANISATION MODEL FOR THE VIETNAMESE FOOD RETAIL MARKET

ABSTRACT: *Using the case of Vietnam, this paper proposes an industrial organisation model of the food distribution system in developing countries. Since most work in this field has adopted an empirical approach, this paper will instead focus on a theoretical model based on the theory of imperfect competition applied in agricultural economics. We introduce two distribution channels of product differentiation linked vertically by demand, and study the quantity flow from small producers to consumers by means of a Nash equilibrium. We show that there is a Nash equilibrium of the food distribution system and market power, with effects on both farmers and consumers. The paper discusses the implications of these results and proposes policies to intervene in the market and mitigate its power to improve the wealth of both farmers and consumers. The competitive market model of the food distribution system presented in this paper is also important in analysing the policy implications of a food market with imperfect competition in developing countries.*

KEY WORDS: *food distribution system, imperfect competition, Nash equilibrium, Vietnam economics, agricultural economics.*

JEL CLASSIFICATION: C61, D43, Q13, Q18

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1. INTRODUCTION

The number of supermarkets has increased rapidly in developing countries, as studied in several papers (e.g., Reardon et al., 2003; Reardon, Timmer et al., 2012; Reardon, Minten et al., 2012). Since the first supermarket opened in Vietnam in 1993 the number of supermarkets has increased rapidly throughout the country. This introduction of supermarkets has offered consumers alternatives for buying foods and farmers the opportunity to supply their products to the supermarkets. By selling more standardised foods and offering better service, supermarkets overcome the weaknesses of the traditional retail system (Maruyama & Trung, 2012). According to the General Statistics Office of Vietnam (GSO), as of 31 December 2018, nationwide there were 8,475 markets, 1,009 supermarkets, and 210 commercial centres (GSO, 2018).

However, the duality of food processing in Vietnam has some peculiar features. Since supermarkets entered the Vietnamese food market the flow of foods has been transformed. In the upstream of the distribution system, middlemen and supermarkets buy food from farmers. In the downstream, the middlemen sell these products in traditional markets, without explicitly taking into account the quality of the products, while the modern distribution supply channel employed by the supermarkets sells food of a higher standard, based on a more efficient food-collecting system, at higher prices to wealthier consumers (Maruyama & Trung, 2007, 2010, 2012). As consumers can choose freely between the conventional and modern distribution systems for buying food, these two sectors compete with each other for consumers through product differentiation. This context in Vietnam clearly illustrates an interesting case study of industrial organisation.

Since imperfect competition is typical of the agricultural market (McCorriston, 2002; Sexton & Lavoie, 2001; Myers et al., 2010), the main objective of this paper is to study the food distribution system in Vietnam using the imperfect competition frameworks applied in agricultural economics. More precisely, we borrow several arguments based on the theory of imperfect competition in order to model the competitive relationship of food distribution channels. From this perspective we discuss the two different food distribution systems for low-quality and high-quality products as a product-differentiation argument. This is typical of the Vietnamese context, as supermarkets entering the distribution system sell

the same but better-quality foods as the market. Moreover, we assume that both middlemen and supermarkets have market power in each case of market competition. This case is typical of Vietnam, since both the middlemen and the supermarket buy foods from farmers and sell them to consumers. Since consumers can move freely between the traditional markets and supermarkets, we introduce a vertical differentiation choice model. We compute the inverse demand function of the low- and high-quality markets of the Mussa–Rosen type (Mussa & Rossen, 1978) and show that there is a Nash equilibrium between the two sectors, indicating that there is fierce competition between the traditional and modern food distribution channels. The comparative static result at equilibrium is interesting, since we can show all effects of all parameters of each sector's trade quantity. We show that the market power of both middlemen and the supermarket has effects on both farmers and consumers.

The emergence of supermarkets in developing countries and their effect on the traditional retail system has been studied in several empirical works, such as Reardon et al. (2003), Reardon et al. (2009), Reardon, Timmer et al. (2012), and Reardon, Minten et al. (2012), while the transformation of the food system in the case of Vietnam has been analysed by Cadilhol et al. (2006), Moustier et al. (2010), and Maruyama and Trung (2007, 2010, 2012). To the best of our knowledge, most work in this field has adopted an empirical approach and has not used the theory of imperfect competition; our study will therefore focus on the theory. Based on the Vietnamese context, we propose an industrial organisation model to analyse the competitive relationships between the traditional and modern food distribution systems in developing countries.

This paper contributes to the literature on food distribution systems by studying the competitive relationship between traditional and modern distribution channels. Our work offers a significant contribution for policymakers and researchers to use in analysing the policy implications of this issue.

2. LITERATURE REVIEW

The effect of the emergence of supermarkets on the relationship with the traditional retail market has been studied in several papers. For example, Reardon et al. (2003), Reardon et al. (2009), Reardon, Timmer et al. (2012), and Reardon, Minten et al. (2012) study the rapid development of supermarkets in Asian and

other developing countries. They emphasize the effects of the 'supermarket revolution' in developing countries, particularly in Asia: the transformation of the food retail sector, substantial investment in technological change, and upgrading at the producer level. Other studies examine the expansion of supermarkets in developing countries. Traill (2006) examines the effects of the expansion of the supermarket as a driver of changes in income distribution, urbanisation, the female labour force, and openness to inward foreign investment, while Humphrey (2007) examines the effect of supermarket expansion on the food retail environment and small producers.

Related to the development of supermarkets and the competition between the traditional and modern food distribution systems, Goldman, Ramaswami, and Krider (2002) build a model of and examine the barriers to the advancement of modern food retail formats, while Goldman and Hino (2005) study supermarkets versus traditional retail stores, examining barriers to the growth of supermarkets' market share in ethnic-minority communities. In the case of Indonesia, Vetter et al. (2019) explore the phenomenon of the concerted effort of governments and corporate actors with regard to agrifood value, chain interventions, and market modernisation.

The vertical competition model has been studied in several well-known works. Shaked and Sutton (1982, 1983, 1987) characterise industry equilibrium under monopolistic competition where products are differentiated by quality, while Mussa and Rossen (1978) study monopolies by analysing the underlying utility function with a product differentiation hypothesis. Also emphasizing the quality choice model, Motta (1993) presents two versions of a vertical product differentiation model, one with fixed costs and the other with variable costs of quality, to study how the hypotheses of price versus quantity competition affect equilibrium solutions.

In the case of Vietnam, Maruyama and Trung (2007, 2010, 2012) describe the traditional and modern retail systems, analysing the barriers to the development of supermarkets in Vietnam and indicating important factors in the development of supermarkets. They also study the modern retail sector by analysing competitors' innovation, structure, and background and challenges to the development of this sector. Cadilhol et al. (2006) compare the performance of the

modern and traditional systems, arguing that the modern supply channel is more efficient than the traditional channel but its trade quantity remains limited, while Moustier et al. (2010) emphasize that farmer organisation plays an important role in delivering quality foods from farmers to consumers.

3. RESEARCH METHODOLOGY

Nourse (1922) was the first to discuss the imbalance in market power between farmers and the marketing firms buying products from them, by focusing on intermediaries and their power in the agricultural market. This work encouraged farmers to form cooperatives that could be beneficial to both farmers and consumers. Rogers and Sexton (1994), McCorriston (2002), Sexton and Lavoie (2001), and Myers et al. (2010) emphasize that market power attracts more attention in the agricultural market by economists. Other studies emphasize the behaviour of intermediaries when they have market power: for instance, Merel et al. (2009) argue that high transportation costs can be an important factor that increases the market power of middlemen. Xhoxhi et al. (2014), Fałkowski et al. (2017), Bonanno et al. (2018), and Malak-Rawlikowska et al. (2019) also address the question of market power and bargaining in agrifood markets. In the case of Vietnam, Thanh (2017, 2018) constructs an industrial organisation model for developing countries, analysing the market power of middlemen and their behaviour in the traditional food distribution system.

Since market power is an important consideration in the agricultural market, the strategy of this paper is to study the food distribution system in Vietnam using the imperfect competition frameworks applied in agricultural economics. In fact, the concept of imperfect competition has largely focused on the growth of market power and competition in the agricultural market. Since the objective of the paper is to understand how the market and competition behave, this framework is a critical tool for us not only to understand the situation but also to analyse the resulting policy implications.

The role of imperfect competition in the analysis of the food distribution system is particularly important in Vietnam where there is a market of imperfect competition. For example, the number of small-scale farmers is very large compared to their relatively small amount of market power. According to the GSO (2018), 36.1% of the households using agricultural land in Vietnam are using

under 0.2 hectares per household and only 2.3% are using 5.0 hectares or more. In addition, food is produced in locations far from the cities and urban areas that consume large quantities of food (Moustier, 2007; Moustier et al., 2010). As a consequence, small-scale farmers face high transaction costs and therefore have very little market power to bargain with the intermediaries who transport their products to the final consumers. The availability of new products and product differentiation are also food sector issues. This is the case in Vietnam, where food is distributed through different distribution channels with both low- and high-quality products.

Clearly, the imperfect competition theory is a significant tool for understanding market competition and analysing policy implications in Vietnam's food distribution sector. We assume that intermediaries have both oligopoly and oligopsony market power. This is typical in Vietnam, where food flows from farmers to consumers through several retailers. Because supermarkets entering the food supply have created a modern distribution system we introduce a product differentiation argument and two different channels for low- and high-quality foods. We characterise consumers using the vertical differentiation choice model of Mousa and Rosen (1978): consumers can choose to go to street markets or supermarkets and these two channels compete for consumers. Based on such considerations, we study the game between middlemen and the supermarkets in order to analyse competitive relationships at market equilibrium.

4. RESULTS

4.1 General assumptions and notation

Food distribution system

In this paper we introduce the two different distribution channels that have emerged with the introduction of supermarkets in Vietnam, and many middlemen who are competing among themselves and competing with one supermarket. This is a simplistic assumption, but at the town level there are only a few supermarkets, which often belong to the same company, and the data shows that there is a large difference between the number of traditional markets (8,475) and the number of supermarkets (1,009) in Vietnam (GSO 2019).

Table 1: Markets, supermarkets, and commercial centres in Vietnam 2010–2018

	2010	2015	2016	2017	2018
Markets	8,538	8,660	8,591	8,580	8,475
Supermarkets	593	832	865	958	1,009
Commercial centres	101	160	168	189	210

Source: General Statistics of Vietnam (2018)

Downstream, foods are distributed in a low-quality and a high-quality markets. There is, however, only one market: the food-supplying market driven by symmetric farmers in the upstream.

General notation

Using the context of the food distribution system in Vietnam, the paper proposes an industrial organisation model of the food distribution system in developing countries. The model variables are presented in Table 2.

Table 2: Equation notation in the model

Notation	Explanation
N	A variable, refers to the number of farmers, $N \to \infty$.
m	A variable, refers to the number of middlemen in the traditional food distribution system, $m \to \infty$.
λ	A variable, refers to the amount of labour used to transform foods in the production function, $\lambda > 0$.
α	A variable, refers to the value of land reform in the production function of farmers, $\alpha > 0$.
ℓ, h	A constant, refers to the quality index associated with low- and high-quality products, $\ell > 0$, $h > 0$.
K	A constant, refers to the population demand for the low-quality and high-quality markets, $K > 0$.
ℓK or hK	The willingness of consumers to buy a product of low or high quality
$\theta, \underline{\theta}, \overline{\theta}$	Constants: θ refer to each consumer who belongs to continuum $[0, K], \theta \in [0, K]$, $\underline{\theta}$ is indifferent between buying nothing or low-quality food, and $\overline{\theta}$ is indifferent between the low- and high-quality foods.

$\theta\ell, \theta h$	Reservation prices of low- and high-quality food products.
C_m, C_s	C_m, a variable, refers to a constant marginal cost that each middleman supports per unit of food delivered to a street market, while C_s, a variable, refers to the cost that the supermarket spends per unit of food. $C_m > 0$, $C_s > 0$.
$\ell K - C_m$	The quantity which measures the highest per-unit margin that can be obtained by a middleman
$hK - C_s$	The quantity which measures the highest per-unit margin that can be obtained by the supermarket.

Farmers and food production

We introduce a farmer who is characterised by the production function:

$$q = f(\lambda) = \sqrt{\lambda}$$

With λ denoting the labour used to transform foods in the production function, we set the normalisation rule with the wage $\omega = 1$. N is the number of farmers supplying the middlemen and the supermarket. Since both middlemen and the supermarket buy foods from farmers, the total supply of vegetables, $Q_m + Q_s$ for middlemen and the supermarket respectively, is given by

$$Q_m + Q_s = N\frac{P_{fm}}{2}$$

and the inverse supply function is defined by

$$P_{fm} = \frac{2(Q_m + Q_s)}{N} \tag{1}$$

We assume that the middlemen and the supermarket sell the total quantity they buy from farmers, implying that the trade quantity in the upstream must equal the trade quantity in the downstream. In other words, if we denote that Q_ℓ is the aggregate quantity selling in traditional markets and Q_h is the trade quantity in the supermarket, $Q_m = Q_\ell$ and $Q_s = Q_h$.

Middlemen versus supermarket: quantity competition and consumers

In the Upstream. Since we have introduced two different food distribution systems, we assume that middlemen and supermarket buy foods of the same quality from farmers in the upstream. We assume that both the middlemen (i.e., the traditional market) and supermarkets have oligopoly and oligopsony power. This assumption might be unrealistic for traditional markets if there are many street markets. However, the number of street markets decreased from 8,538 in 2010 to 8,435 in 2018. This implies that the number of street markets will decrease over time. To strengthen the model, we set $m \to \infty$, which presents the possibility of no oligopoly power. Since $m \to \infty$, we arrive at the special case of perfect competition, which, however, is a reality in the case of Vietnam: there is imperfect market competition in the Vietnamese agricultural market. In the upstream, we also assume that the food supply reaches a basic standard to access both markets. More precisely, we assume that the products supplied by farmers in the upstream of the food system are fresh fruits and vegetables. This gives supermarkets the opportunity to have a basic standard to which they can add more value.

In the Downstream. Middlemen sell foods to consumer markets without paying attention to the standard of the products but operating at a lower cost than supermarkets, while the supermarkets select products, including packaged and name-brand foods, and sell consumers a more standardised quality of products. This is the reason for our assumption that the products are differentiated.

Quantity Competition. We model the competition between traditional markets and supermarkets by quantity competition. More precisely, we study the quantity flow from small producers to the consumers by mean of a Nash equilibrium. This strategy is an appropriate choice for Vietnam, whose retail industry is in the process of transforming into a modern distribution channel. In fact, the emergence of this dual distribution system has a great deal to do with vertical differentiation: consumers with a higher concern for quality (e.g., freshness and safety) are more likely to shop at formal markets, while others buy their vegetables at street markets. In other words, consumers move from the traditional market to the supermarket largely because they are concerned about product quality. In reality, the issue of price may not completely reflect the competition between the two sectors, and the number of foods in supermarkets remains limited compared

to traditional markets (Maruyama & Trung, 2012). Therefore, the model using a Cournot competition framework is best for the food retail market in Vietnam.

The price of the food sold in the supermarket (i.e., the high-quality market) is denoted P_h, while the price in the low-quality traditional market is denoted P_ℓ. The difference between low- and high-quality products in the model is characterised by the low quality index, ℓ , and the high quality index, h. We assume that the low-quality index is smaller than the high-quality index, that $\ell < h$. Middlemen pay transportation costs, while supermarkets pay the cost of adding value and all services needed to sell the products. The cost of middlemen is denoted as C_m, while the supermarket spend cost is denoted as C_s. We naturally assume that the cost of middlemen must be smaller than the cost of the supermarket, so $C_m < C_s$. Since K denotes the population demand for the low-quality and high-quality markets, the willingness to buy a product of low or high quality is defined as ℓK or hK, respectively. The willingness to buy low- or high-quality foods in the market must be larger than the cost. This means that we have additional natural assumptions: $\ell K > C_m$ and $hK > C_s$.

We observe that for middlemen and the supermarket to be active, the willingness to buy high quality in the market must not be too high and the cost in the supermarket must not be too low in comparison with the low index in the low-quality market and the cost of middlemen. This condition leads to the technical assumption, which is given as:

$$\left(\ell K - C_m\right) < \left(hK - C_s\right) < 2\left(\ell K - C_m\right)$$

4.2 Computation of the demand

We use vertical differentiation to define consumer behaviour, which is characterized by h, the high-quality index, and ℓ, the low-quality index: $h > \ell$. Since farmers are symmetric, the difference between high and low quality is found where the supermarket, with its higher cost compared to middlemen, adds value to the products, including keeping fresh foods in good condition, refrigeration systems, and brand-name products. Consumers therefore have three choices: buying high-quality products, buying low-quality products, or buying nothing.

Since the weight utility $\theta \in [0, K]$, we obtain that, if consumers buy high-quality foods, the choice utility is

$$U_h^\theta = \theta h - P_h,$$

while the choice to buy low-quality foods is given as

$$U_\ell^\theta = \theta \ell - P_\ell,$$

and the case that they buy nothing is $U_\phi = 0$.

From that argument, we now move to computing the demand for both low- and high-quality foods:

Case 1: Nobody wants to buy either low- or high-quality food.

Since $\theta \in [0, K]$, we immediately observe, for

$$(P_\ell, P_h) > (\ell K, hK),$$

for each individual θ, $\max\{U_h^\theta, U_\ell^\theta\} < U_\phi$. In other words, nobody wants to buy either low- or high-quality food. So let prices now take the property that

$$(P_\ell, P_h) \leq (\ell K, hK).$$

Case 2: There is a demand for both foods.

Since the utility of consuming high- and low-quality foods is increasing in θ, we should identify two agents, $\underline{\theta}$ and $\overline{\theta}$, such that $\underline{\theta}$ is indifferent between buying nothing or buying low-quality food and $\overline{\theta}$ is indifferent between buying low-quality and high-quality food. These quantities typically solve:

$$\left\{\begin{array}{l} U_{\phi}=U\dfrac{\theta}{\ell} \\ U\dfrac{\overline{\theta}}{\ell}=U\dfrac{\overline{\theta}}{h} \end{array}\right\} \Leftrightarrow \left\{\begin{array}{c} \underline{\theta}=\dfrac{P_{\ell}}{\ell} \\ \overline{\theta}=\dfrac{P_h-P_{\ell}}{h-\ell} \end{array}\right\}.$$

This requires that

$0 \le \underline{\theta} \le \overline{\theta} \le K$.

In other words, the price for high-quality food satisfies:

$$\frac{h}{\ell}P_{\ell} \le P_h \le P_{\ell}+K\left(h-\ell\right)$$

If we now bear in mind that the consumers are uniformly distributed in $\left[0,K\right]$, the demand $D_{\ell}\left(P_{\ell},P_h\right)$ and $D_h\left(P_{\ell},P_h\right)$ for low- and high-quality food respectively is given by:

$$\left(\begin{array}{c} D_{\ell}\left(P_{\ell},P_h\right) \\ D_h\left(P_{\ell},P_h\right) \end{array}\right)=\left(\begin{array}{c} \overline{\theta}-\underline{\theta} \\ K-\overline{\theta} \end{array}\right)=\left(\begin{array}{c} \dfrac{P_h-P_{\ell}}{h-\ell}-\dfrac{P\ell}{\ell} \\ K-\dfrac{P_h-P_{\ell}}{h-\ell} \end{array}\right)$$

Case 3: No consumers buy high-quality food.

This occurs when $\forall\theta$, $\max\left\{0,U_{\ell}^{\theta}\right\}>U_h^{\theta}$, which implies that because $h>\ell$, $\overline{\theta}>K$. In other words, this case occurs if the high-quality food is too expensive, e.g.,

$$P_h > P_{\ell}+K\left(h-\ell\right)$$

and the demand for low-quality food is given by

$$D_{\ell}\left(P_{\ell},P_h\right)=\left(K-\underline{\theta}\right)=K-\frac{P_{\ell}}{\ell}$$

Case 4: No consumers buy low-quality food.

This takes place when $\forall \theta$, $\max\left\{0, U_h^\theta\right\} > U_\ell^\theta$. Since $h > \ell$, this implies that the $\hat{\theta}$ for which $U_h^\theta = 0$ must be smaller than $\underline{\theta}$. In other words, this situation occurs when the high-quality food is cheap, e.g., $P_h < \frac{h}{\ell} P_\ell$ and its demand is given by:

$$D_\ell\left(P_\ell, P_h\right) = \left(K - \hat{\theta}\right) = K - \frac{P_h}{h}$$

In summary, we can see that in this vertical product differentiation setting the demand for both food qualities is given by D: $R_+^2 \to R_+^2$, which verifies $\left(P_\ell, P_h\right) < \left(\ell K, hK\right)$

$$\begin{pmatrix} D_\ell\left(P_\ell, P_h\right) \\ D_h\left(P_\ell, P_h\right) \end{pmatrix} = \begin{cases} \begin{pmatrix} 0 \\ K - \dfrac{P_h}{h} \end{pmatrix} if P_h < \dfrac{h}{\ell} P_\ell \\ \begin{pmatrix} \dfrac{P_h - P_\ell}{h - \ell} - \dfrac{P_\ell}{\ell} \\ K - \dfrac{P_h - P_\ell}{h - \ell} \end{pmatrix} if P_h \in \left[\dfrac{h}{\ell} P_\ell, P_\ell + \left(h - \ell\right) K\right] \\ \begin{pmatrix} K - \dfrac{P_\ell}{\ell} \\ 0 \end{pmatrix} if P_h > P_\ell + \left(h - \ell\right) K \end{cases}$$

and is $\left(0,0\right)$ for $\left(P_\ell, P_h\right) > \left(\ell K, hK\right)$.

In the rest of this section deals with quantity strategies. It therefore becomes important to define the inverse demand associated with this Mussa-Rosen type of demand for vertically differentiated products. In fact, if Q_ℓ and Q_h denote, respectively, the aggregate demand for low- and high-quality food, we can easily verify that:

Lemma 1: The inverse demand correspondence $P:\left\{\left(Q_\ell,Q_h\right)\in R_+^2:Q_\ell+Q_h\le K\right\}\to R_+^2$ is given by:

$$P(Q_\ell,Q_h)=\left(P_\ell(Q_\ell,Q_h),P_h(Q_\ell,Q_h)\right)=$$
$$\begin{cases}(\ell.(K-Q_\ell-Q_h),h(K-Q_h)-\ell Q_\ell)\ if\ Q_\ell>0\ and\ Q_h>0\\ \begin{cases}(P_\ell,P_h)\in R_+^2:P_h=h.(K-Q_h);\\ P_\ell\in\ ]\ell.(K-Q_h),+\infty[\end{cases}\ if\ Q_\ell=0\ and\ Q_h=0\\ \begin{cases}(P_\ell,P_h)\in R_+^2:P_\ell=\ell.(K-Q_\ell);\\ P_h\in\ ]\ell.(K-Q_\ell)+(h-\ell)[\end{cases}\ if Q_\ell>0\ and\ Q_h>0\\ \{(P_\ell,P_h)\in R_+^2:P_\ell>\ell K,P_h>hK\}\ if Q_\ell=0\ and\ Q_h=0\end{cases}$$

Proof: See Appendix.

Since we now have the inverse demand function in low- and high-quality markets, we can move on to study the game between middlemen and the supermarket in market competition.

4.3 The Nash equilibrium of the Vietnamese food distribution system

Let us now move on to the interesting case of the competition between middlemen and the supermarket when they have market power in both the upstream and downstream of the food distribution system.

Let us first set the strategy for the game played by n firms who compete in the food system. Depending on their market power in both the upstream and downstream of the food system, each player strategizes to maximise their profit and make decisions depending on the others. All players are incentivised to trade a quantity that maximises their profit by anticipating the effect of their choice on upstream and downstream prices. In the upstream, players anticipate supply quantities from farmers and set prices. Similarly, in the downstream they anticipate consumer demand and set prices for the final market. In the strategy sets of all players, we denote C_i the cost to firm *i* of delivering q_i units of food to the final market. P denotes the inverse demand function, while P_{fm} is the price in the supply market of N number of farmers. The payoff function for all players is given as:

$$\pi_i(q_1,\ldots,q_n) = \left(P(q_1,\ldots,q_n) - P_{fm}(q_1+\ldots+q_n,N) - C_i\right)q_i$$

Based on such considerations, we can now set the strategy of each player in the game played between middlemen and the supermarket, where middlemen and the supermarket have both market power and oligopsony power in both the upstream and the downstream of the distribution system. This means that the price affects both sides of the food distribution system. In the upstream, middlemen and supermarkets anticipate supply quantities from farmers and set prices. Similarly, in the downstream they anticipate consumer demand and set prices for the final low- and high-quality markets. At equilibrium, the price given to the farmers depends on the trade quantities of both low- and high-quality products and is defined as

$$P_{fm} = P_{fm}\left(Q_h^* + \sum_{j=1}^{m} q_i^*, N\right).$$

In the downstream, the price in the low- and high-quality markets is

$$P_\ell = P_\ell\left(Q_h^*, \sum_{\substack{j=1 \\ j\neq i}}^{m} q_i^*\right),\ P_h = P_h\left(Q_h^*, \sum_{i=1}^{m} q_i^*\right).$$

We define this case at equilibrium as follows:

Definition 1: At equilibrium, the quantities and prices $\left(Q_h^*, q_{\ell i}^*, P_\ell^*, P_h^*, P_{fm}\right)$ are given as follows:

(i) Middlemen maximize profit:

$$\forall i, q_i^* \in \max_{qi}\left(P_\ell\left(Q_h^*, \sum_{\substack{j=1 \\ j\neq i}}^{m} q_i^*\right) - P_{fm}\left(Q_h^* + \sum_{j=1}^{m} q_i^*, N\right) - C_m\right).q_i$$

(ii) Supermarkets maximize profit:

$$Q_h^* \in \max Q_h \left(P_h \left(Q_h^*, \sum_{i=1}^{m} q_i^* \right) - P_{fm} \left(Q_h^* + \sum_{j=1}^{m} q_i^*, N \right) - C_s \right).Q_h$$

(iii) Farmer supply and aggregate quantity on demand side:

$$Q_h^* = D_h\left(P_\ell, P_h\right); \sum_{i=m}^{m} q_{\ell i} = D_\ell\left(P_\ell, P_h\right); P_{fm} = P_{fm}^* \left(Q_h^* + \sum_{i=1}^{m} q_{\ell i}, N \right);$$

$$P_\ell^* = P_\ell \left(\sum_{i=1}^{m} q_i^*, Q_h^* \right); P_h^* = P_h \left(\sum_{i=1}^{m} q_i^*, Q_h^* \right)$$

We now have the price paid to the farmers at equation (1) and the inverse demand function of the low- and high-quality products in Lemma 1, which is:

$$P_\ell\left(q_\ell, q_h\right) = \ell.\left(K - Q_\ell - Q_h\right); P_h\left(q_\ell, q_h\right) = h.\left(K - Q_h\right) - \ell Q_\ell$$

We can now study the game played between the middlemen and the supermarkets. In the traditional sector, middlemen exert oligopsony power over the farmers who work for them and have an oligopoly power over the low-quality food market. In a Cournot tradition this means that each has an incentive to trade a quantity, *qi*, that maximizes its profit by anticipating the effect of its choice on the upstream and downstream prices. As defined, the first-order condition of a middleman is given by:

$$\forall i, \left(-\ell - \frac{2}{N} \right).q_i + \left(\ell \left(K - \sum_{i=1}^{m} q_i - Q_h \right) - \frac{2\left(Q_h + \sum_{i=1}^{m} q_i\right)}{N} - C_m \right) = 0$$

while the optimal condition for the supermarket is given by:

$$h\left(K - 2.Q_h\right) - \ell.\sum_{i=1}^{m} q_i - \left(\frac{4\left(Q_h + \sum_{i=1}^{m} q_i\right)}{N} \right) - C_s = 0$$

By summing over *i*, the system of equation condition for the middleman and the supermarket becomes:

$$\left(\frac{1}{m}+1\right)\left(\ell+\frac{2}{N}\right).Q_\ell+\left(\ell+\frac{2}{N}\right)Q_h-\left(\ell K-C_m\right)=0$$
$$\left(\ell+\frac{2}{N}\right)Q_\ell+\left(2h+\frac{4}{N}\right).q_h-\left(hK-C_s\right)=0$$

Proposition 1: *Under our assumptions, we obtain that this game admits a unique positive equilibrium* $\left(Q_\ell^*\left(m,N,C_s,C_m\right),Q_h^*\left(m,N,C_s,C_m\right)\right)$

Proof: See Appendix.

Result 1: *By our computation, at equilibrium, the trade quantities are given as*

$$Q_\ell=\frac{\left(\frac{N}{N\ell+2}\right)\left(\left(\frac{2\left(Nh+2\right)}{N\ell+2}\right)\left(\ell K-C_m\right)-\left(hK-C_s\right)\right)}{\left(\frac{2\left(Nh+2\right)}{N\ell+2}\left(\frac{1}{m}+1\right)-1\right)}>0$$

$$Q_h=\frac{\frac{N}{\left(N\ell+2\right)}\left(\frac{1}{m}+1\right)\left(\left(hK-C_s\right)-\left(\ell K-C_m\right)\right)}{\left(\left(\frac{2Nh+4}{N\ell+2}\right)\left(\frac{1}{m}+1\right)-1\right)}>0 \qquad (2)$$

These quantities are positive since we have a technical assumption that:

$$0<\left(\ell K-C_m\right)<\left(hK-C_s\right)<2\left(\ell K-C_m\right)$$

to solve this system (see Appendix).

Thus, we obtain that since middlemen and the supermarket have market power on both sides of the food system, both sectors are active without additional

conditions. Let us now move to a comparative analysis to observe the relationship between the result of the model and the particular situation in Vietnam.

Proposition 2: We can show that:

(i) When there is more competition between middlemen, due to the substitution effect, the supermarket trades less and middlemen sell more, i.e., $\left(\frac{\partial Q_h^*}{\partial m}\left\langle 0, \frac{\partial Q_\ell^*}{\partial m}\right\rangle 0\right)$

(ii) When the cost of middlemen increases, middlemen trade less and the supermarket sells more, i.e., $\left(\frac{\partial Q_h^*}{\partial C_m}\left\langle 0, \frac{\partial Q_\ell^*}{\partial C_m}\right\rangle 0\right)$. *A symmetric property holds when the cost of the supermarket increases, i.e.,* $\left(\frac{\partial Q_h^*}{\partial C_s}\left\langle 0, \frac{\partial Q_\ell^*}{\partial C_s}\right\rangle 0\right)$.

(iii) When the number of farmers increases, both middlemen and the supermarket sell more, i.e., $\left(\frac{\partial Q_h^*}{\partial N} > 0, \frac{\partial Q_\ell^*}{\partial N} > 0\right)$.

Proof: See Appendix.

Result 2: *Since we can show that* $Q_\ell + Q_h < K$, *we obtain that the prices in the consumer market are positive; i.e.,* $\left(P_\ell > 0, P_h > 0\right)$.

Proof: See Appendix

5. DISCUSSION

The result of the Nash equilibrium shows that at market equilibrium there is fierce competition between the traditional and modern food distribution systems. This indicates a unique positive equilibrium that requires the technical assumption:

$$0 < \left(\ell K - C_m\right) < \left(hK - C_s\right) < 2\left(\ell K - C_m\right),$$

implying that at market equilibrium one sector may be out of the market. In fact, to coexist in the market, each sector must be in the control quality index and the cost of the food supply, since consumers move freely between the two distribution channels.

The result of our model also indicates that the market power of middlemen and the supermarket in the food distribution system affects both farmers and consumers. The comparative result of Proposition 2 shows that several factors affect the market share of each sector at market equilibrium, including: (i) the competition between middlemen, (ii) the costs of middlemen and the supermarkets, and (iii) the number of farmers. Our model shows that when there is more competition between middlemen, the supermarket will lose market share, i.e.,

$$\left(\frac{\partial Q_h^*}{\partial m} \left\langle 0, \frac{\partial Q_\ell^*}{\partial m} \right\rangle 0 \right).$$

Therefore, its trade quantity will become smaller at equilibrium. To gain market share the supermarket must decrease its cost, and at the same time reduce the market share of the middlemen; i.e.,

$$\left(\frac{\partial Q_h^*}{\partial C_s} \left\langle 0, \frac{\partial Q_\ell^*}{\partial C_s} \right\rangle 0 \right).$$

Our results make sense given the particular context of Vietnam, as seen in the work of Maruyama and Trung (2007, 2010, 2012), which indicates that to develop their position, supermarkets in Vietnam must offer low prices. These activities actually make a higher-index high quality and reduce the cost, as shown in our model. In other studies, Cadilhol et al. (2006) and Mergenthaler et al. (2009) note that supermarkets should lower their prices to get a higher share of the food market. These situations are clearly explained by our comparative analysis results for Proposition 2.

If we analyse the increase in m, we can observe that since $m \to \infty$ the model will give a case of perfect competition. In this case, we can show the result[1] that the supply of the middlemen is given as:

$$S\left(P_\ell, P_{fm}\right) = \begin{cases} 0, if\ P_\ell \le P_{fm} + C_m \\ \left[0, +\infty\right], if P_\ell = P_{fm} + C_m \\ +\infty, P_\ell > P_{fm} + C_m \end{cases}$$

This means that since the price at final market equals what the middlemen must pay, they will sell whatever they want. The case of perfect competition is non-existent in the context of Vietnam since there is imperfect market competition in the Vietnamese food market.

The result also indicates that in some situations there may be support for both middlemen and supermarkets. For example, when there are more farmers in the market, farmers will have less market power. Therefore, both middlemen and supermarkets gain; i.e.,

$$\left(\frac{\partial Q_h^*}{\partial N} > 0, \frac{\partial Q_\ell^*}{\partial N} > 0\right).$$

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[1] Market equilibrium in the case of perfect competition can be general defined as: at equilibrium, $\lambda_j, q_i^*, Q_h^*, P_\ell, P_h, P_{fm}$ are given as followed:

(i) Farmers maximize profit: $\forall_j \lambda^* \in agr\, max_\lambda P_{fm} j\left(\lambda_j\right) - \lambda_j$;

(ii) Middlemen maximize profit: $\forall_i, q_i^* \in \max\left(P_\ell - P_{fm} - C_m\right) q_i$;

(iii) Supermarkets maximize profit: $Q_h^* max_{Q_h} \in \left(P_h - P_{fm} - C_s\right) Q_h$;

(iv) Farmer's supply and aggregate quantity in the downstream: $Q_h^* = D_h\left(P_\ell, P_h\right)$; $\sum_{i=1}^{m} q_{\ell i} = D_\ell\left(P_\ell, P_h\right)$; . $\sum_{j=1}^{N} f\left(\lambda_j^*\right) = Q_h^* + \sum_{i=1}^{m} q_{\ell i}$. We can use the Lagrange multiplier method, subject to constraint, to study the case of perfect competition and the Karush–Kuhn–Tucker conditions for equality constraint for the maximisation problem of middlemen and the supermarket.

The effect of land reform policy

The results provide an opportunity to introduce the policy implications. Since food producers in Vietnam are mostly small-scale farmers (Trung & Thanh, 2012; GSO, 2018) and the market power of middlemen and supermarkets affects both farmers and consumers, we propose a land reform policy that intervenes in market power and improves the wealth of farmers and consumers. As landholdings in Vietnam are small and fragmented, the aim of land reform is to make better use of small landholdings and to use the labour force more frequently and effectively in order to reduce production costs and improve productivity. Therefore, the policy aims to create a productivity shock to the farmers' food-supply market that will affect market behaviour and competitive relationships in the food retail sector.

The objective of land reform is to create a supply shock in the farmers' food-supply market in the upstream of the food system. We consider that in the downstream of the food distribution system: (i) the traditional system is obtained by Cournot competition, and (ii) the modern supply channel is characterised by a monopoly market. Therefore, nothing changes on the demand side of the food distribution system after land reform is established, while what does change is simply the food supply in the upstream of the system. Based on such considerations, if we set land reform α in the production function of farmers in the following way:

$$q = f(\lambda) = \sqrt{\alpha\lambda}$$

the changes will only appear in the supply as follows:

$$Q_{\ell}(\alpha) + Q_{h}(\alpha) = \frac{\alpha N}{2} P_{fm}$$

In the comparative static analysis of the model we show that, at market equilibrium, since a greater number of farmers are in the market they will have less market power and as a consequence both middlemen and supermarkets will gain. Therefore, if we implement a land reform policy we can expect that land reform willit to increase the market share of the low-quality products and reduce the market share of the supermarket. To address the question of how the market

shares of both sectors are adjusted, we study the property of the ratio of the trade quantity of each sector to total foods traded: for example, the ratio of low-quality products to the total traded quantities in the market. Based on Lemma 1 and the result at system of equations (2), keeping the same computation with the appearance of α , we obtain that, at equilibrium, land reform increases the market share of the low-quality products. In other words:

$$\left(\frac{d\left(\frac{Q_\ell}{Q_\ell + Q_h} \right)}{d\alpha} > 0 \right)$$

This can be explained by the fact that since a land reform policy has been established, small farmers and sellers will choose a lower production cost. As a result the price is lower in the consumer market, which implies that poor consumers have more opportunities to buy foods, especially in the traditional market. This is why the low-quality product gains more market share at equilibrium. In general, at market equilibrium, in this case a land reform policy, the trade quantities improve, and the selling price to consumers decreases. Land reform will benefit the consumer through the ability to buy foods at a lower price and benefit farmers by distributing more products in the market.

The land reform policy is introduced to affect the food market's imperfect competition. However, a situation may occur in which the number of farmers, N , is very large, and so the model obtains a very low price, P_{fm} . This closely links to diseconomies of scale in production. In that case, forming cooperatives can be an important solution that allows farmers to decide on an effective scale of production and improve their bargaining power with buyers by adding more value to their products. Optimal land reform is necessary to make land reform effective. Since a land reform policy is proposed in the context that two distribution channels are active at equilibrium, the computation of an optimal α land policy will be very complicated. Let us now present a general model of an optimal land reform policy. To study the optimal land reform policy we construct at market equilibrium the sum of the utilities of consumers net of all the costs. In doing so, let us first recall the consumer's behaviour in the demand market, which

is the decision rule of consumers to buy foods. We consider that consumers can choose to buy low- or high-quality foods or choose to buy nothing, and the utility of consuming high- and low-quality food is increasing in $\theta \in [0, K]$. We therefore identify two agents, $\underline{\theta}$ and $\overline{\theta}$, such that $\underline{\theta}$ is the indifference between buying nothing or buying low-quality food, and $\overline{\theta}$ is the indifference between buying low- or high-quality food. The choice utility equals

$$U_h^{\theta} = \theta h - P_h,$$

while the choice to buy low quality is given as

$$U_{\ell}^{\theta} = \theta \ell - P_{\ell},$$

and in the case that they buy nothing, $U_{\phi} = 0$. We can now obtain the sum of the utilities of consumers, which is given by:

$$\int_{\underline{\theta}}^{\overline{\theta}} (\theta \ell - P_{\ell}) d\theta + \int_{\underline{\theta}}^{\overline{\theta}} (\theta h - P_h) d\theta = \left[\frac{1}{2} \theta^2 \ell - P_{\ell} \theta \right]_{\underline{\theta}}^{\overline{\theta}} + \left[\frac{1}{2} \theta^2 h - P_h \theta \right]_{\overline{\theta}}^{K} \tag{3}$$

If (i) we have that

$$P_{\ell} = \ell (K - Q_{\ell} - Q_h),\ P_h = h(K - Q_h) - \ell Q_{\ell},$$

and (ii) we also know that the demand $D_{\ell}(P_{\ell}, P_h)$ and $D_h(P_{\ell}, P_h)$ for low- and high-quality food are respectively given by:

$$\begin{pmatrix} D_{\ell}(P_{\ell}, P_h) \\ D_h(P_{\ell}, P_h) \end{pmatrix} = \begin{pmatrix} \overline{\theta} - \underline{\theta} \\ K - \overline{\theta} \end{pmatrix} \Leftrightarrow \begin{cases} \overline{\theta} = K - Q_h \\ \underline{\theta} = K - Q_h = Q_{\ell} \end{cases}, \tag{4}$$

given (i) and (ii), we obtain that:

$$P_{\ell} = \ell \theta;\ P_h = h\overline{\theta} - \ell(\overline{\theta} - \underline{\theta}) \tag{5}$$

Let us now replace Equations (4) and (5) with Equation (3) to obtain the sum of utility of consumers, depending on quantities:

$$f\left(Q_\ell, Q_h\right) = \left(h - \ell + 1\right)Q_h^2 + Q_\ell^2 - 4\left(Q_h - Q_\ell\right) + 2Q_hQ_\ell + K^2\left(\ell + 3\right) \tag{6}$$

The sum of consumers' utilities in Equation (6) now depends on Q_ℓ, Q_h, so we can move to the function of optimal land reform, which we can obtain by taking the sum of consumers' utilities net of all the costs. In this case these include three kinds of cost: (i) the production cost; (ii) the cost of middlemen, C_m, and of the supermarket, C_s; and (iii) the cost of conducting land reform. If the production function of a farmer is given by

$$q = f\left(\lambda\right) = \sqrt{\alpha\lambda},$$

we can verify that the production cost equals

$$\lambda^* = \frac{q^2}{\alpha} = \frac{Q_\ell + Q_h}{\alpha N}.$$

We can also set the cost of land reform equal to $\frac{1}{2}V\left(\alpha - 1\right)^2$. Since we have the sum of consumers' utilities depending on Q_ℓ, Q_h, we can construct the function of optimal land reform as:

$$\max_\alpha \left(f\left(Q_\ell^\alpha, Q_h^\alpha\right) - C_mQ_\ell^\alpha - C_sQ_h^\alpha - \lambda^* - \frac{1}{2}V\left(\alpha - 1\right)^2 \right)$$

The first-order condition for the optimisation problem of α is therefore given by:

$$\left(\frac{\partial f\left(Q_\ell^\alpha, Q_h^\alpha\right)}{\partial Q_\ell} - C_m - \frac{\partial \lambda}{\partial Q_\ell} \right) \frac{\partial Q_\ell}{\partial \alpha} - V\left(\alpha - 1\right) = 0$$

$$\left(\frac{\partial f\left(Q_\ell^\alpha, Q_h^\alpha\right)}{\partial Q_h} - C_s - \frac{\partial \lambda}{\partial Q_h} \right) \frac{\partial Q_h}{\partial \alpha} - V\left(\alpha - 1\right) = 0$$

If we replace trade quantities $Q_\ell^\alpha, Q_h^\alpha$, we will find the solution of optimal α. The computation of the first-order condition (FOC) and second-order condition (SOC), however, becomes complicated, especially the derivation, since $f\left(Q_\ell^\alpha, Q_h^\alpha\right)$ is composed of a long equation with both Q_ℓ, Q_h, depending on several parameters. Based on this observation, let us keep this question of computation to find the solution to α as an extension of the paper.

6. CONCLUSION

We present a model of the competitive relationship between the traditional and modern food distribution systems for developing countries, based on the framework of an industrial organisation approach. The model describes the competition between two sectors by linking the low- and high-quality food markets. We study the game played by middlemen and the supermarket. Depending on market power at both the upstream and downstream of the food system, middlemen and the supermarket each maximise their profit and make decisions depending on the other. Under our technical assumption, we show that there is a Nash equilibrium in the game between the conventional and modern food distribution systems. We show that there is fierce competition between the two sectors and market equilibrium. We also determine the solution to various aspects at market equilibrium, including trade quantities, the price given to farmers, and the price paid by consumers.

We studied the effects of the costs, the number of middlemen, and the number of farmers on trade quantities and prices when both sectors have market power on both market sides of the food distribution system. The results of comparative analysis at market equilibrium reveal that when there is more competition between middlemen, due to the substitution effect the supermarket trades less and middlemen sell more (and a symmetric property holds when the costs of the supermarket increase). We obtain the usual result that when the number of farmers in the market increases they will hold less market power, and as a consequence both middlemen and supermarket will gain.

The results of our model explain the case of developing countries, where supermarkets have developed rapidly and where there is fierce competition between supermarkets and the traditional food system. We show that if there is

only one food market in the upstream, farmers receive the same price from middlemen and the supermarket. This situation implies that farmers need to have an organisation to help them access the modern supply channel and obtain a higher price. We also indicate that to gain market share at market equilibrium the supermarket must decrease its costs while at the same time reducing the market share of the middlemen. The result of this paper is relevant to the discussion in Maruyama and Trung (2007, 2012), Cadilhol et al. (2006), and Mergenthaler et al. (2009), who analyse the transformation of the Vietnamese food retail sector, and bears similarities to the results of Key and Runsten (1999), Kirsten and Kurt (2002), Moustier et al. (2010), and Minot (2018) regarding the role of farmer organisations or contract farming in supporting farmers' access to the market and redirecting the food market toward modern distribution channels.

The competitive market model of the food distribution system gives us an opportunity to analyse the implications of land reform policy for imperfect competition in the food market. Future research could construct a model of a policy, for example, a tax policy, in order to study the effects of this instrument on the market share of both sectors at equilibrium and its effect on the wealth of farmers and consumers.

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APPENDIX

1. Proof of Lemma 1

Let us first observe that the images of the demand function:

$$D\left(\mathbb{R}^2_+\right)=\left\{\left(Q_\ell,Q_h\right)\in\mathbb{R}^2_+ : Q_\ell+Q_h\le K\right\}$$

This gives us the range of correspondence $\dot{P}$.

Case 1: $\left(Q_\ell,Q_h\right)\gg 0, Q_\ell+Q_h\le K$

Since both low- and high-quality goods are purchased, we simply need to invert:

$$\left(\frac{P_h-P_\ell}{h-\ell}-\frac{P_\ell}{\ell},K-\frac{P_h-P_\ell}{h-\ell}\right)=\left(Q_\ell-Q_h\right)$$
$$\Leftrightarrow\left(P_\ell-P_h\right)=\left(\ell\left(K-Q_\ell-Q_h\right),h\left(K-Q_h\right)-\ell Q_\ell\right)$$

Moreover, we must verify (i) that we meet

$$P_h\ge\frac{h}{\ell}P_\ell$$

and

$$P_h\le P_\ell+\left(h-\ell\right)K$$

for all $\left(Q_\ell,Q_h\right)\gg 0$ since $h>\ell$ by assumption, and (ii) that $\left(P_\ell,P_h\right)\ge 0$ since again $h>\ell$ and $Q_\ell+Q_h\le K$.

Case 2: $Q_\ell=0$ and $Q_h\in\left[0,K\right]$

Since only high-quality foods are purchased, we know that

$$Q_h = K - \frac{P_h}{h} \Leftrightarrow P_h = h\left(K - Q_h\right)$$

It follows that $P_h \in \left[0, hK\right[$ since $Q_h \in \left]0, K\right]$. But we also know that the demand for the low-quality goods is $0 \text{ if } P_h < \frac{h}{\ell} P_\ell$. This implies that

$$P_\ell > \ell\left(K - Q_h\right).$$

It shows that the inverse demand correspondence in this case is given by:

$$P\left(0, Q_h\right) = \left\{\left(P_\ell, P_h\right) \in \mathbb{R}_+^2 : P_h = h\left(K - Q_h\right), P_\ell \in \left]\ell\left(K - Q_h\right), +\infty\right[\right\}$$

Case 3: $Q_h = 0$ and $Q_\ell \in \left[0, K\right]$

This case is symmetric to the previous one. We thus obtain that

$$P_\ell = \ell\left(K - Q_\ell\right)$$

and we observe that

$$P_h > P_\ell + \left(h - \ell\right)K$$

implies that

$$P_h > \ell\left(K - Q_\ell\right) + \left(h - \ell\right).$$

So the inverse demand function is given by:

$$P\left(Q_\ell, 0\right) = \left\{\left(P_\ell, P_h\right) \in \mathbb{R}_+^2 : P_\ell = \ell\left(K - Q_\ell\right), P_h \in \left]\ell\left(K - Q_\ell\right) + \left(h - \ell\right), +\infty\right[\right\}$$

Case 4: $Q_h = 0$ and $Q_\ell = 0$

This situation only occurs if

$$\left(P_\ell, P_h\right) \geq \left(\ell, h\right) K$$

2. **Proof of proposition 1** (Proof of unique equilibrium)

If we set:

$$K_m = \ell K - C_m; K_s = hK - C_s,\ \mu = \left(\frac{1}{m} + 1\right)$$

the system of equation condition of middlemen and the supermarket presented in section 4.3, which is:

$$\left(\frac{1}{m}+1\right)\left(\ell + \frac{2}{N}\right).Q_\ell + \left(\ell + \frac{2}{N}\right)Q_h - \left(\ell K - C_m\right) = 0$$
$$\left(\ell + \frac{2}{N}\right)Q_\ell + \left(2h + \frac{4}{N}\right).q_h - \left(hK - C_s\right) = 0$$

will becomes:

$$\begin{aligned} &\mu\left(\ell + \frac{2}{N}\right).Q_\ell + \left(\ell + \frac{2}{N}\right)Q_h = K_m \\ &\left(\ell + \frac{2}{N}\right)Q_\ell + \left(2h + \frac{4}{N}\right).Q_h = K_s \end{aligned} \tag{7}$$

In fact, we have to show that the following system has a positive solution:

$$\underbrace{\begin{bmatrix} \mu\left(\ell + \frac{2}{N}\right) & \left(\ell + \frac{2}{N}\right) \\ \left(\ell + \frac{2}{N}\right) & \left(2h + \frac{4}{N}\right) \end{bmatrix}}_{:=A} \bullet \begin{bmatrix} Q_\ell^* \\ Q_h^* \end{bmatrix} = \begin{bmatrix} K_m \\ K_s \end{bmatrix}$$

This means that the last vector of the previous equation must be in the positive cone generated by the two columns of the matrix, which gives us our linear

equation system. So, if we normalise the second component of these vectors to 1, we are able to verify that:

$$\left(\frac{N}{N\ell+2}\right)\left(\mu\left(\ell+\frac{2}{N}\right)\right)>\frac{K_m}{K_s}>\frac{\left(N\ell+2\right)}{2\left(Nh+2\right)}$$

$$\Leftrightarrow \mu>\frac{K_m}{K_s}>\frac{\left(N\ell+2\right)}{2\left(Nh+2\right)}$$

We can assert that a unique positive solution exists. Since we have assumed that $0<K_m<K_s$, the first inequality is obvious: the first term is bigger than 1 while the second is smaller than 1. Concerning the inequality, let us recall that we have also assumed that $2K_m>K_s$ or in other words that $\frac{K_m}{K_s}>\frac{1}{2}$. Now let us observe that:

$$\frac{\left(N\ell+2\right)}{2\left(Nh+2\right)}=\frac{1}{2}\left(\frac{N\ell+2}{Nh+2}\right)<\frac{1}{2} \text{ since } \ell<h \text{ by assumption.}$$

3. Proof of result 1 (computation of trade quantities):

Following equation (7), if we set:

$$a=\left(\frac{1}{m}+1\right)=\mu;$$

$$b=\left(\frac{N}{N\ell+2}\right)\left(2h+\frac{4}{N}\right);$$

$$c=\left(\frac{N}{N\ell+2}\right)K_m;$$

$$d=\left(\frac{N}{N\ell+2}\right)K_s \qquad (8)$$

equation (7) is equal to:

$$\begin{cases} aQ_\ell + Q_h = c \\ Q_\ell + bQ_h = d \end{cases} gives \begin{pmatrix} Q_\ell \\ Q_h \end{pmatrix} = \left(\frac{1}{ab-1}\right)\begin{pmatrix} bc-d \\ ad-c \end{pmatrix} \tag{9}$$

Inserting a, b, c, d in Equation (8) into Equation (9), we obtain:

$$Q_\ell = \frac{\left(\frac{N}{N\ell+2}\right)\left(\left(\frac{2(Nh+2)}{N\ell+2}\right)K_m - K_s\right)}{\left(\frac{2(Nh+2)}{N\ell+2}\mu - 1\right)} > 0$$

$$Q_h = \frac{\frac{N}{(N\ell+2)}\mu(K_s - K_m)}{\left(\left(\frac{2(Nh+2)}{N\ell+2}\right)\mu - 1\right)} > 0 \tag{10}$$

We observe that the quantities $Q_\ell; Q_h$ are positive since we have considered the assumption that $h > \ell$, $\mu > 1$ and $0 < K_m < K_s < 2K_m$.

4. Proposition 2.2 (the effect)

Let us now prove the property of middlemen's cost $C_m; C_s$, middlemen *m,* and farmers *N*. If we consider a, b, c, d in Equation (8), we observe that:

4.1 Effect of the cost:

$$\partial_{c_m} Q_\ell = \frac{b}{ab-1}\partial_{c_m} c = \frac{b}{ab-1}\left(-\frac{N}{N\ell+2}\right) < 0$$

$$\partial_{c_m} Q_h = \frac{b}{ab-1}\partial_{c_m} c = \left(-\frac{b}{ab-1}\right)\left(-\frac{N}{N\ell+2}\right) > 0$$

$$\partial_{c_x} Q_\ell = \left(-\frac{b}{ab-1}\right)\partial_{c_s} d = \left(-\frac{b}{ab-1}\right)\left(-\frac{N}{N\ell+2}\right) > 0$$

$$\partial_{c_x} Q_h = \left(\frac{a}{ab-1}\right)\partial_{c_s} d = \left(\frac{a}{ab-1}\right)\left(-\frac{N}{N\ell+2}\right) < 0$$

We therefore obtain that $\partial_{c_m} Q_\ell \left\langle 0; \partial_{c_m} Q_h \right\rangle 0; \partial_{c_x} Q_\ell > 0; \partial_{c_x} Q_h < 0$.

4.2 Effect of middlemen:

$$\partial_m Q_\ell = (bc-d)\partial_m \left(\frac{1}{ab-1}\right) = \frac{bc-d}{(ab-1)^2}\left(-\left(-\frac{1}{m^2}\right)\right) > 0$$

$$\partial_m Q_h = \left(\frac{ad-c}{ab-1}\right)' = \left(\frac{(bc-d)}{(ab-1)^2}\right)\left(-\frac{1}{m^2}\right) < 0$$

We therefore conclude that $\partial_m Q_\ell > 0; \partial_m Q_h < 0$.

4.3 Effect of the number of farmers:

$$\partial_N Q_\ell = \frac{(bc-d)'(ab-1)-(ab-1)'(bc-d)}{(ab-1)^2}$$

$$= \left(\frac{1}{(ab-1)^2}\right) b'\left((ab-1)c-(bc-d)a+(ab-1)(bc'-d)\right)$$

$$= G \bullet \left(\underset{\smile}{4}\underset{>0}{(h-\ell)}\underset{>0}{(ad-c)} + \underset{\smile}{(ab-1)}\underset{>0}{\left(\left(\frac{Nh+2}{N\ell+2}\right)4K_m - 2K_s\right)} \right) > 0$$

With

$$G = \frac{1}{(ab-1)^2}\left(\frac{1}{(N\ell+2)^2}\right) > 0$$

Similarly:

$$\partial_N Q_h = \left(\frac{1}{(ab-1)^2}\right)\Big((ab-1)(a'd+d'a-c')-(ad-c)(a'b+b'a)\Big)$$

$$= \left(\frac{1}{(ab-1)^2}\right)\left(\frac{1}{(N\ell+2)^2}\right)\left(\frac{(2K_s\mu-2K_m)(2\mu-1)}{N\ell+2}\right) > 0$$

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LABOUR MARKET RETURNS TO HEALTH CAPITAL DURING CHILDHOOD: EVIDENCE FROM MEDICAID INTRODUCTION

ABSTRACT: *Health capital development during childhood can affect later-life outcomes. This paper examines the long-term effects of the introduction of Medicaid during the 1960s as one of the earliest attempts in US history to provide publicly financed health insurance for the poor. Using a large panel dataset and a difference-in-differences-in-differences identification strategy, I show that exposure to Medicaid during ages 0–5 has sizable and significant effects on economic and non-economic outcomes throughout ages 25–55, including income, employment, education, disability, and wealth. Exposure to Medicaid among fully eligible cohorts is associated with roughly 0.4 percentage higher wage income, equivalent to an increase of $145 above the mean of annual wages. It also implies a minimum of 7.8% externality of the programme in labour market wages.*

KEY WORDS: *Medicaid, human capital, labour market, income, education, health capital, public insurance*

JEL CLASSIFICATION: I13, H51, J24, H75, D62

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1. INTRODUCTION

The accumulation of health endowments during the early-life period could alter the trajectory of individuals' outcomes later in life. Several studies have documented the link between initial health endowments and short-, medium-, and long-term outcomes, including infant mortality, cognitive development, test scores, education, employment, earnings, and even hazards of old-age cause-specific death (for a recent review, see Costa, 2015).

Several programmes in US history have aimed to promote health investments, mainly among children, with the primary purpose of influencing their future health and economic conditions. The introduction of Medicaid during the 1960s was one of the leading and most extensive efforts in US history to provide health insurance for the poor. The programme increased the share of publicly insured people, especially among children and women from low-income households. Despite the massive scale of the programme and its high costs to the taxpayer, little research has quantified its success. Most studies explore the benefits of Medicaid expansions during the 1980s and offer evidence of its effects on health outcomes (Bernard and Feingold, 1970; Boudreaux et al., 2016; Bronchetti, 2014; Cohodes et al., 2016; Currie and Gruber, 1996; Currie and Duque, 2019; Currie and Grogger, 2002; Dave et al., 2019; Frean et al., 2017; Goodman-Bacon, 2016; Gruber and Yelowitz, 1999; Lindsey et al., 2010; Medicaid Snapshots, 2020; Miller and Wherry, 2019; NoghaniBehambari et al., 2020; Noghanibehambari and Salari, 2020; Thompson, 2017; Wherry et al., 2018; Wherry and Meyer, 2016), education (Cohodes et al., 2016; Miller and Wherry, 2019), and earnings (Brown et al., 2015; Miller and Wherry, 2019). One notable exception is Goodman-Bacon (2018), who provides evidence that Medicaid implementation increased insurance coverage, mainly among children, and reduced infant mortality. In a similar study, Goodman-Bacon (2016a) shows that the introduction of Medicaid during 1960s reduced adult mortality rate of cohorts who were eligible for Medicaid during early life and also it improved their labor market outcomes. Buchmueller et al. (2021) use the Medicaid expansions due to implementation of Affordable Care Act to explore the moral hazard of being benefited by the expansions of health insurance coverage. They find no evidence that unemployed workers choose to leave the labor force as a result of public insurance expansions. Another example is Boudreaux et al. (2016), who find that exposure to Medicaid in early childhood is associated with improved health outcomes in adulthood,

while it has no statistically significant effect on the educational outcome and economic index.

This paper investigates the effect of early-life exposure to Medicaid implementation between 1966 and 1970 on later-life labour market outcomes. Federal law requires all states that implement Medicaid to cover all cash recipient families ('categorical eligibility'). The identification strategy takes advantage of the variations in eligibility across cohorts and space-time variations in their exposure to the introduction of Medicaid as the plausibly exogenous shock to the childhood health environment. Using a difference-in-differences-in-differences strategy among cohorts who were born well before and after the introduction of Medicaid (1950–1982) and observed during their adulthood years (1980–2018), I find that exposure to Medicaid during childhood (ages 0–5) is associated with sizeable improvements in labour market outcomes. Contrary to Boudreaux et al. (2016), the results show significant and strong effects on high school graduation, income, and employment. An event study analysis rules out potential pre-trend variation between exposed and unexposed cohorts. The results suggest that likely eligible groups that were fully exposed to Medicaid up to age 5 have approximately 0.4 percentage higher wages and 0.1 percentage higher school graduation rates. These groups are more likely to enter the labour force and be employed, and have higher total income. I show that changes in the composition of births in response to the Medicaid implementation do not drive the results. There is no evidence that the programme induced selective fertility. I also find suggestive evidence that increased insurance use and public health expenditure, and a better health environment in general, could be channels through which Medicaid affects later-life outcomes.

The contribution of the current study to the literature is twofold. First, it adds to the literature on the benefits of Medicaid by providing causal evidence of its long-term labour market returns. Second, it adds to the literature that investigates the early-life origins of adult outcomes. The seminal work of Almond and Currie (2011) highlights the importance of early childhood in the development of human capital that can explain the variation in adult outcomes. This study offers new evidence that health capital during childhood, as one of the main determinants of human capital, has significant impacts on later-life labour market outcomes.

The rest of the paper is organized as follows. Section 0 describes the data sources and sample selection strategy, section 0 presents the empirical approach, and section 4 explores the endogeneity issues. Section 5 presents the concluding remarks and a short discussion.

2. DATA AND SAMPLE SELECTION

The primary source of data is the decennial census (1980–2000) and the American Community Survey (2000–2018), extracted from Ruggles et al. (2020). The main advantage of this data is that it asks about state and year of birth. Thus, I can link all individuals to their childhood state- and year-specific Medicaid status. I restrict the sample to all individuals born between 1950 and 1982. Since most states adopted Medicaid in the 1960s,[1] the selected window covers well before and after Medicaid implementation. Importantly, the Medicaid expansions for children during the 1980s began with extended eligibility for children born after September 1983. To avoid the new eligible cohorts, I drop cohorts born after 1982.[2] I restrict the sample to individuals at least 25 years old, a standard threshold for completed education, and at most 55 years old, a common age threshold before retirement. I also exclude individuals with missing values on the state and year of birth. The final sample consists of over 25 million individuals. I collapse this sample by race (white/non-white), year, year of birth, and state of birth.

3. EMPIRICAL STRATEGY

The amendment to the Social Security Act that established Medicaid required states that adopted Medicaid to cover all families that were cash recipients of federally funded welfare programmes, including participants of Aid to Families with Dependent Children (AFDC), which was the main child-specific welfare programme. AFDC-based eligibility varied across states and demographic groups. It ranged between 0.11% and 4.4% among white families and between 0.4% and 25% among non-white families. The top panel of Figure 1 shows the

[1] Medicaid was established in 1965. Twenty-six states adopted Medicaid in 1966. The remaining states adopted Medicaid by the year 1970, except for Arizona and Alaska. Arizona adopted Medicaid in 1982 and Alaska in 1972.

[2] The results are robust and very similar to the main estimates if I include earlier cohorts, i.e., cohorts born 1940–1982.

cross-state variation in AFDC rates at the year each state implemented Medicaid. The bottom panel depicts the changes in children's insurance use in the first five years after the Medicaid. Both panels are divided into five groups (besides those states with missing information). Groups are based on quintiles of each variable, e.g. for the top panel the higher AFDC rate states are shown with darker colors and states with lower AFDC rates are shown in lighter colors. Visually, states with higher initial AFDC rates also experienced higher increases in children's insurance increase.[3]

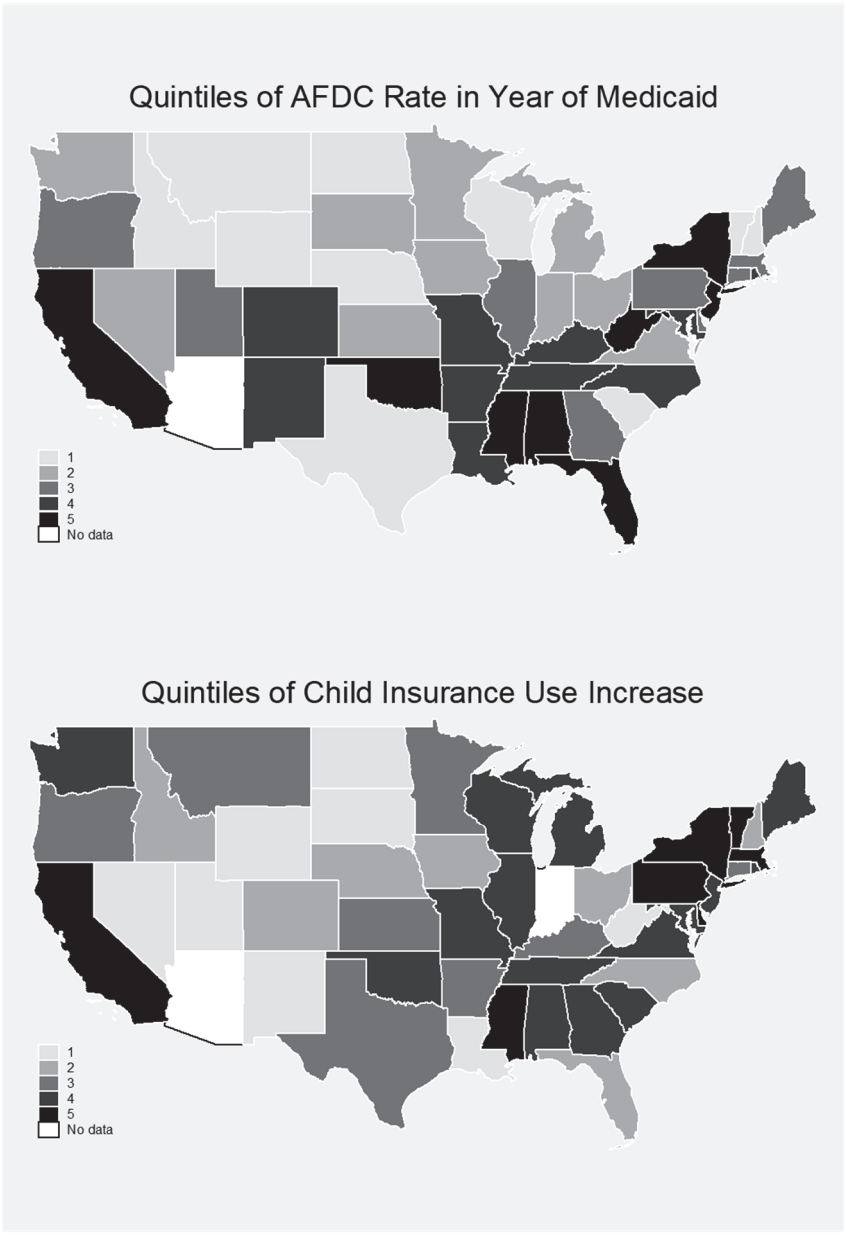
The bottom panel depicts the changes in children's insurance use in the first five years after Medicaid was adopted. Visually, states with higher initial AFDC rates experienced higher increases in children's insurance.[4]

The primary assumption in the identification strategy is that the outcomes of cohorts who were exposed to Medicaid and had higher AFDC-based eligibility would have followed the same path and been influenced by the same factors as the outcomes of unexposed cohorts, except for their eligibility and exposure to Medicaid. Since AFDC rates were long-run features of states and mostly determined by institutional factors, they are arguably uncorrelated with state policies over the years of Medicaid implementation. Thus, across-states variation in AFDC-based eligibility generates a plausibly exogenous shock to the admissibility of public health insurance use.

[3] Appendix A Explores the quantitative relationship between AFDC participation and immediate insurance use and publicly assistance health expenditure.

[4] 0 explores the quantitative relationship between AFDC participation and immediate insurance use and public assistance health expenditure.

Figure 1 - State Rank based on Five-Years Child Insurance Use Increases and Initial AFDC Rate



Outcomes. To show the health benefits of Medicaid for later-life economic and noneconomic outcomes, I focus on a series of outcomes as follows: total personal income which is the summation of all farm, business, wages, and salary income; total family income which is the summation of total personal income of all working individuals within a given family; wage income which is a short expression for wage, salary, and all paid-job-based commissions; and high school graduation rate. As a further analysis, I also use a series of indicators for having worked zero weeks during last year, whether individual is currently in labor force or not, whether individual is currently employed or not, and whether individual has a work disability or not. Additionally, I use inflation-adjusted housing value as another outcome which could potentially measure the wealth of individual. Then, I collapse all the data at the birth-cohort-race-state-year level.

Event Study Analysis. To show the heterogeneous effects of Medicaid across exposed and unexposed cohorts, I use an event study specification that compares the effect of Medicaid for individuals who turned age 5 before and after Medicaid, based on their AFDC-based eligibility. Specifically, I estimate Ordinary-Least-Square regressions of the following form:

$$\log(y)_{brst} = \sum_{E=-15}^{15} \left(AFDC_{rs}^{0} \times I_{E_{bs}=E} \right).\chi_E + \varsigma X_{brst} + \varepsilon_{brst} \tag{1}$$

where y is the average outcome of cohorts born at state[5] s and year b with race r and observed in year t. The $I(.)$ is an indicator function that equals 1 if the constructed measure of exposure is E, and zero otherwise. The exposure E_{bs} is the year that a cohort (born in year b and state s) turns age 5 minus the year of Medicaid implementation. For instance, Alabama operationalised Medicaid in 1970. Cohorts born in 1960 turned age 5 in 1965, five years before the introduction of Medicaid. Therefore, they are assigned an E equal to –5. Cohorts who were born in 1980 turned age 5 in 1985, fifteen years after Medicaid implementation. These cohorts are assigned an E equal to +15. Each indicator is interacted with AFDC-based eligibility, $AFDC_{rs}^{0}$, which is the race- and state-specific AFDC rate at the time of Medicaid implementation. The matrix X includes a set of dummies for the current year, race, state of birth, and year of

[5] Throughout the paper, I use state and state of birth synonymously.

birth, and also a set of interactions to control for unobservable factors that vary by year of birth: Medicaid implementation year interacted with birth year, the region of birth interacted with birth year, and state of birth interacted with a linear birth year trend. It also includes a set of state-level covariates at the time of Medicaid implementation interacted with a linear year trend. These controls are per capita income, number of hospitals per capita and per capita expenditure on a series of welfare programmes including food stamps, social security, medical spending, and spending on general assistance.[6] Finally, ε is a disturbance term. I cluster the standard errors at the state-of-birth level. All regressions are weighted using the average state-level population aged 0–5.

The coefficients of interest are represented by the vector χ_E. They reflect the relationship between Medicaid eligibility and outcome variables among cohorts with different sets of exposure to Medicaid. I normalise the coefficient for cohorts that had zero exposure to Medicaid for their first five years of life to zero, i.e., $\chi_E(E=-1)=0$.

The main results (the coefficients χ_E) are depicted in Figure with the log of total personal income as the outcome. There is no discernible trend among cohorts who turned age 5 after the introduction of Medicaid ($E<-1$). This fact rules out the concern about the pre-trends between exposed and unexposed cohorts. The effects rise for cohorts who turned age 4 ($E=1$) at the year of Medicaid implementation. This is in line with other studies that find that the first five years of life have reliable predictive power for adult outcomes (Almond and Currie, 2011).

The sharp rise in marginal effects starts at $E=6$; i.e., for cohorts that experienced Medicaid implementation during prenatal development. Among these cohorts, full eligibility for Medicaid is associated with 0.25 percentage higher income during adulthood (p-value=0.13). Being fully exposed to Medicaid during ages 0–5 ($E>6$) is associated with economically and statistically significant higher income during adulthood. For example, among cohorts for whom $E=8$, a higher

[6] These data are extracted from Almond, Hoynes, and Schanzenbach (2011).

rate of eligibility for Medicaid leads to 0.4 percentage higher annual income, equivalent to an increase of roughly $180 in 2017 dollars.

Figure reports the estimates for the log of high school graduation rate as the outcome. The interaction effects rise significantly for cohorts who were at most 4 years old at the time of Medicaid implementation. For cohorts that were born at the year of Medicaid implementation ($E=5$) the coefficient is 0.16 (p-value=0.06). Note that the coefficients fall to zero for cohorts who turn age 10 and above at the time of Medicaid implementation. All the coefficients are statistically insignificant for $E<-1$, which confirms that there is no pre-trend in the educational outcomes of exposed and unexposed cohorts.

Figure and Figure explore two additional measures of economic success: income from wages and total family income. The patterns are similar to the previous figures. For instance, cohorts with higher eligibility whose antenatal development coincided with Medicaid (fully exposed during ages 0–5) have 1.14 percentage higher annual wages (p-value=0.06), or an increase of roughly $450 in annual wage income.

Figure 2: The Event-Study Analysis of the Effect of Introduction of Medicaid during Childhood on Log of Total Personal Income in Adulthood

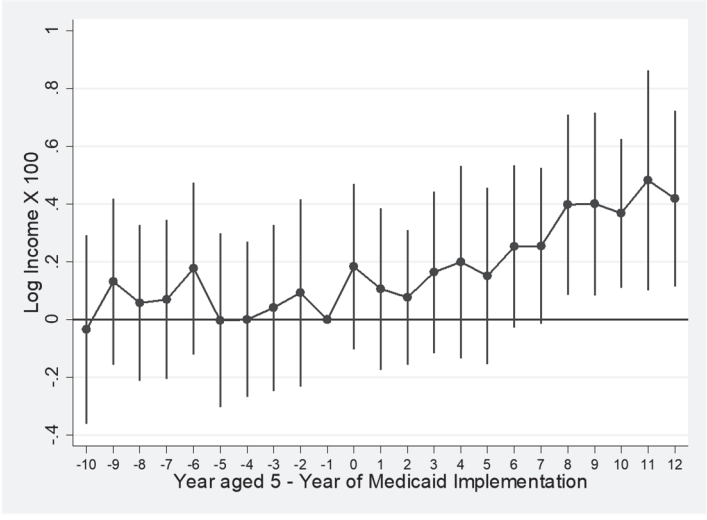


Figure 3: The Event-Study Analysis of the Effect of Introduction of Medicaid during Childhood on Log of High School Graduation Rates in Adulthood

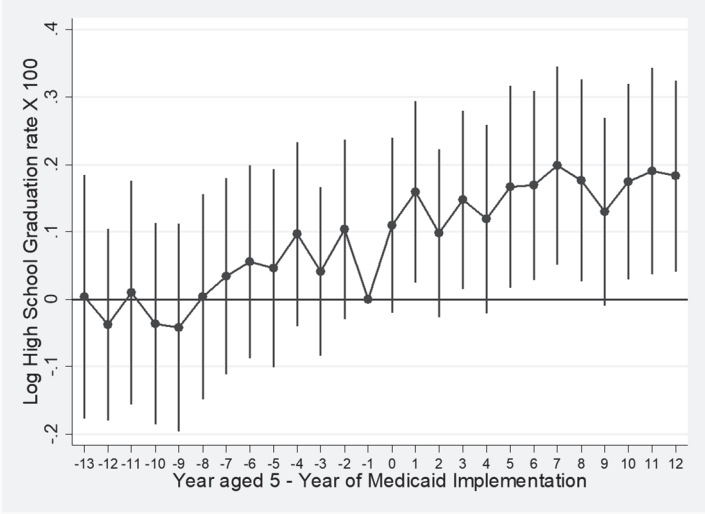


Figure 4: - The Event-Study Analysis of the Effect of Introduction of Medicaid during Childhood on Log of Wages in Adulthood

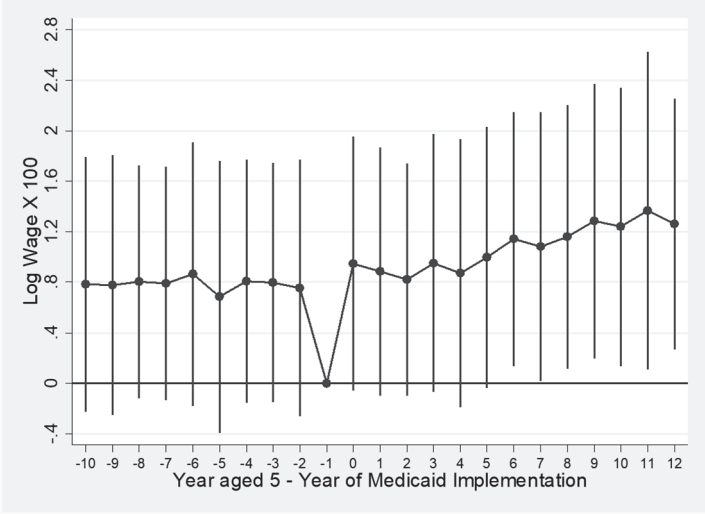
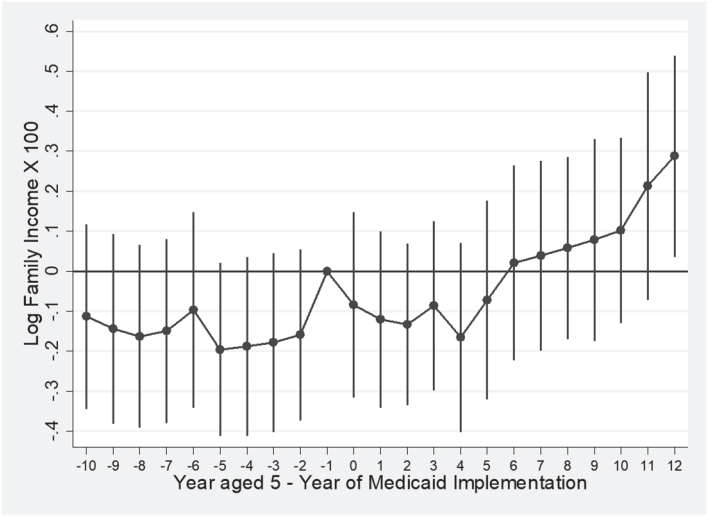


Figure 5: The Event-Study Analysis of the Effect of Introduction of Medicaid during Childhood on Log of Total Family Income Adulthood



Triple Difference Strategy. Besides the variations in AFDC-based eligibility, I also use the changes in location and timing of Medicaid to construct a continuous measure of exposure to Medicaid during childhood, specifically ages 0–5. In so doing, I assign $exposure = 0$ for all cohorts who turned age 6 (and above) at the year their state of birth introduced Medicaid. For cohorts born before Medicaid, *exposure* equals five. For other cohorts, *exposure* is the year of birth minus the state-specific year of Medicaid. This variable varies between 0 and 5. To ease the interpretation, I divide the *exposure* by five to obtain a ratio measure, Exp_Ratio. This constructed measure of exposure varies from zero, for unexposed cohorts, to one, for fully exposed cohorts.

To quantify exposure to and eligibility for Medicaid during childhood and adult labour market outcomes, I use the following Ordinary-Least-Square regression:

$$\log(y)_{brst} = \alpha + \beta Exp\_Ratio_{bs} \times AFDC^{0}_{rs} + \gamma AFDC^{0}_{rs} + \delta Exp\_Ratio_{st} + \varsigma X_{brst} + \varepsilon_{brst} \qquad (2)$$

In matrix X, I include all common covariates, fixed effects, and trends, as in Equation 1. The parameter β is the coefficient of interest. It captures the impact of exposure to Medicaid for cohorts that are eligible to participate in Medicaid

compared to cohorts that are not. The main results are reported in Table 1.[7] The coefficient of interaction is strongly significant at the 1% level for all primary outcomes. Exposure of fully eligible cohorts is associated with 0.38 percentage higher annual wages, 0.32 percentage higher annual income, 0.31 percentage higher yearly family income, and 0.1 percentage higher high school graduation rates. As expected, there is no statistical evidence of the main effects.

Table 1: Triple-difference analysis: The effects of Medicaid during ages 0–5 on labour market outcomes during adulthood

	Dependent Variable in Logarithms × 100			
	Wage Income	Total Personal Income	Total Family Income	High School Graduation Rate
	(1)	(2)	(3)	(4)
$Expoure_{0-5} \times AFDC_s^0$	0.379***	0.320***	0.314***	0.104***
	(0.078)	(0.046)	(0.038)	(0.016)
$Expoure_{0-5}$	1.601	3.298	–0.366	–1.784
	(12.700)	(5.882)	(4.978)	(3.752)
$AFDC_s^0$	1.189	–0.015	–0.421	0.074
	(1.014)	(0.310)	(0.244)	(0.145)
Fixed Effects	Yes	Yes	Yes	Yes
Covariate Trends	Yes	Yes	Yes	Yes
Observations	51,341	51,341	51,333	51,341
Mean of DV	10.456	10.607	11.252	–0.121
R^2	0.188	0.370	0.541	0.175

Notes. The data covers the years 1980–2018 for cohorts born over the years 1950–1982 and aged 25–55. All regressions are weighted by the average state population aged 0–5 over the sample period. Standard errors, reported in parentheses, are clustered at the state-of-birth level. Fixed effects and covariates are explained in the text. The dollar values are converted into 2017 dollars.

[7] The estimated coefficients are quite robust in different specification checks: exclusion of covariate trends, exclusion of state-by-birth-cohort trend, and also exclusion of region by birth-year fixed effects. The results are not reported here.

These estimations contradict the findings of Boudreaux et al. (2016), who investigate the effect of the introduction of Medicaid on later-life health, education, and economic outcomes. They do not find conclusive evidence that Medicaid had any impact on economic index or years of schooling. Miller and Wherry (2019) explore the effects of Medicaid expansions during the 1980s on adults' outcomes. They show that exposure to Medicaid during ages 1–18 is associated with 0.1–0.3 percentage points higher probability of high school graduation, equivalent to a 4% rise above the mean. The effect of expansion on the log of personal income is positive but statistically insignificant in some specifications. My findings complement these studies by providing evidence that the introduction of Medicaid during the 1960s had statistically significant effects on education and income.

Using the same empirical method, Table 2 reports the results of other economic outcomes. Medicaid reduces the share of people who did not work last year (column 1), increases the labour force participation rates (column 2), increases the percentage of employed individuals (column 3), reduces the share of people with work disability (column 4), and raises the house value, a proxy for individuals' wealth (column 5). For example, exposure to Medicaid for fully eligible cohorts is associated with 0.23 percentage higher labour force participation rates.

Table 2: Triple-difference analysis: The effects of Medicaid during ages 0–5 on economic outcomes during adulthood

	Dependent Variable in Logarithms × 100				
	Zero Weeks Worked Last Year	In Labour Force	Is Employed	Work Disability	House Value
	(1)	(2)	(3)	(4)	(5)
$Expoure_{0-5} \times AFDC_s^0$	−0.287*	0.236***	0.197***	−0.724***	0.482***
	(0.153)	(0.033)	(0.040)	(0.160)	(0.054)
$Expoure_{0-5}$	19.857	−8.717	−3.741	26.233	2.260
	(22.342)	(8.393)	(11.079)	(23.908)	(6.492)
$AFDC_s^0$	3.393	0.536	0.547	1.397*	−0.473
	(1.528)	(0.497)	(0.532)	(0.780)	(0.305)
Fixed Effects	Yes	Yes	Yes	Yes	Yes
Covariate Trends	Yes	Yes	Yes	Yes	Yes
Observations	51,343	51,341	51,341	51,341	51,030
Mean of DV	−2.026	−0.242	−0.329	−5.129	12.326
R^2	0.218	0.084	0.102	0.831	0.620

Notes. The data covers the years 1980–2018 for cohorts born over the years 1950–1982 and aged 25–55. All regressions are weighted by the average state population aged 0–5 over the sample period. Standard errors, reported in parentheses, are clustered at the state-of-birth level. Fixed effects and covariates are explained in the text. The dollar values are converted into 2017 dollars.

4. ENDOGENEITY CONCERNS

The introduction of publicly financed insurance reduces the cost of childrearing among poor families. Thus, it has the potential to induce fertility. If such fertility effects are correlated with other determinants of health capital development during childhood, and their outcomes during adulthood, the estimated coefficients of Equations 1 and 2 will be biased. For instance, if Medicaid encourages more disadvantaged women to have children, then the coefficients

will understate the actual effects. I investigate this source of endogeneity by using an event study of the following form:

$$y_{rst} = \sum_{E=-15}^{15} \left(AFDC_{rs}^{0} \times I\left(t - t_{medicaid,s}\right)\right).\chi_E + \varsigma X_{st} + \varepsilon_{st} \tag{3}$$

The event time in this formulation is the number of years before/after the implementation of Medicaid, $t_{medicaid,s}$, at state s. The outcome variable is the share of births to race r (white/non-white) in state s and year t.[8] The matrix X includes state fixed effects, the interaction of year and Medicaid timing fixed effects, and state interacted with a linear year trend. I also include the common covariates as in Equations 1 and 2. The results are reported in Figure 6 and Figure 7 for the share of births to white and non-white mothers, respectively. There is no economically and statistically discernible difference between the share of births to advantaged and disadvantaged groups before and after Medicaid. The marginal effects are insignificant and also inconclusive in sign. Overall, these results rule out the possibility of endogenous fertility as a response to the introduction of Medicaid.

[8] The data on birth by race and state for the years 1950–1980 are extracted from Manson, Schroeder, Van Riper, Ruggles, and others (2017).

Figure 6: Potential Fertility Inducing Effect of Medicaid among White Mothers

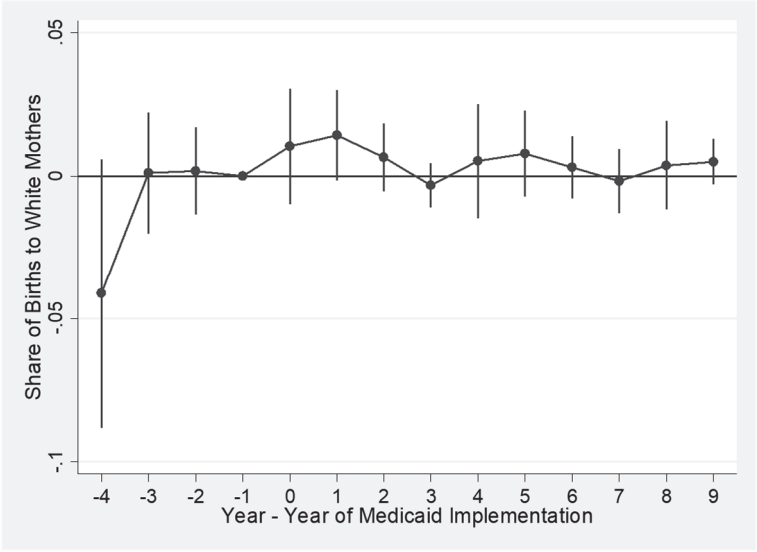
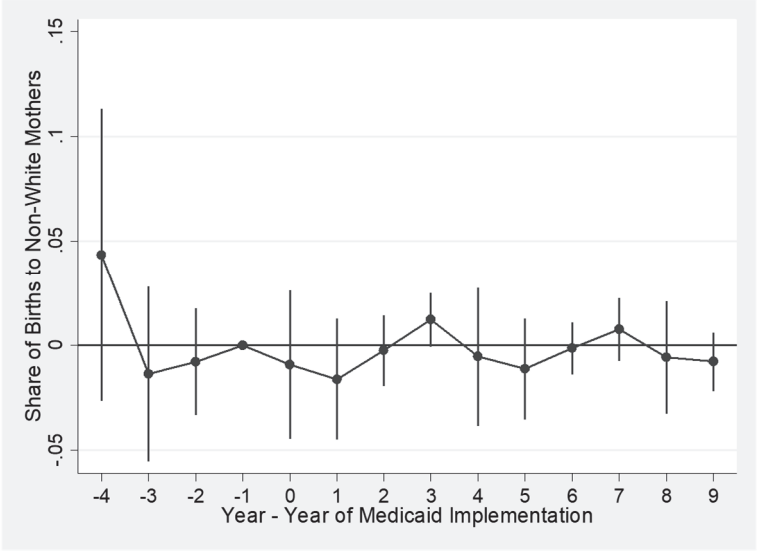


Figure 7: Potential Fertility Inducing Effect of Medicaid among Non-White Mothers



5. DISCUSSION AND CONCLUSION

This paper examines the long-term effects of Medicaid implementation on individuals' long-run outcomes. Cohorts that were exposed to Medicaid during their childhood and were more likely to be eligible for the programme revealed an improvement in their labour market outcomes compared to unexposed cohorts. The results of an event study analysis show that there is no pre-trend in the outcomes of exposed and unexposed cohorts. The marginal effects of Medicaid rise and become statistically significant for cohorts that were exposed to the introduction of Medicaid over their early life, specifically ages 0–5. I complement the event study results using a difference-in-differences-in-differences estimation strategy that compares the outcomes of cohorts by their rate of exposure to Medicaid at ages 0–5 who had higher/lower initial AFDC-based eligibility. There are economically sizable and statistically significant effects of Medicaid on income, education, employment, labour force participation, and a proxy for wealth. Moreover, there is no evidence that Medicaid induced a fertility effect among mothers of different demographic groups. An event study analysis did not provide conclusive evidence that endogenous fertility and changes in the composition of births biased the main results.

Eligible cohorts who were fully exposed to Medicaid have, on average, 0.37 percentage higher wages, roughly $150 annually in 2017 dollars. These effects accrue over time. For instance, if I assume each individual works between ages 25–55 (the age selection in my sample), the accumulated wage benefits equal $4,500. In 1975 the per-recipient cost of Medicaid among children aged 0–19 was $3,037 in 2017 dollars (Goodman-Bacon, 2018). If all eligible and exposed cohorts received benefits over these ages, the per-child cost of Medicaid would add up to $57,703. Therefore, the later-life income return of public health insurance during childhood is roughly 7.8 percentage. Although this number is only a back-of-the-envelope calculation, it points to a minimum externality of public health insurance. Medicaid has the potential to affect a wide range of non-economic outcomes such as health, mortality, and education. A more comprehensive cost-benefit analysis must include all the accrued benefits from economic and non-economic outcomes.

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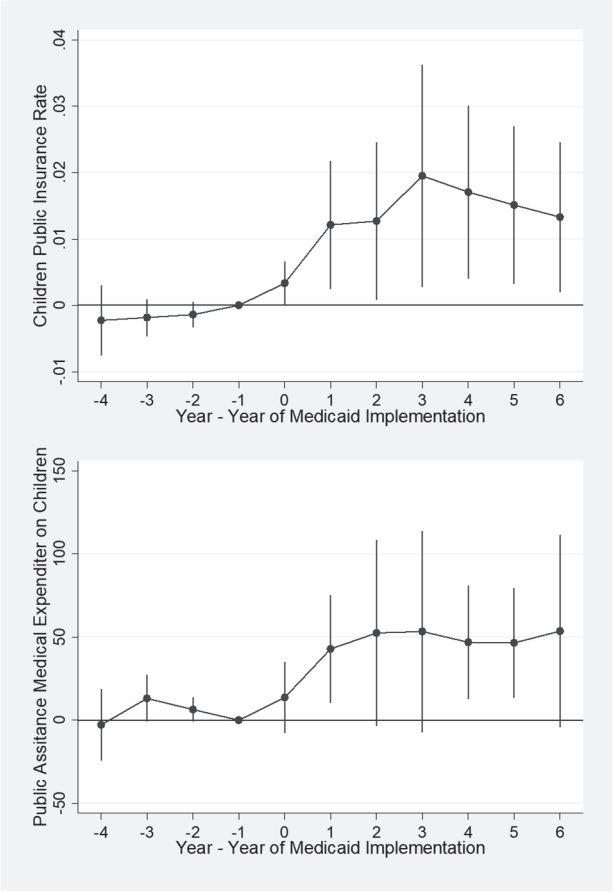
APPENDIX A

This appendix explores the first-stage effects of Medicaid implementation. In so doing, I run an event study similar to Equation 3 and replace the outcome variable by the rate of child insurance use and publicly financed medical expenditure on children. The results are reported in Figure A-1. While there is no economically and statistically discernible effect among unexposed cohorts ($E < -1$), the marginal effects rise and become significant for cohorts born after Medicaid.

Figure A-1: Event Study Analysis: Effect of Medicaid on Children's Insurance Use and Medical Expenditure



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REMITTANCES AND HEALTH OUTCOMES IN SUB-SAHARAN AFRICAN COUNTRIES: UNDERSTANDING THE ROLE OF FINANCIAL DEVELOPMENT AND INSTITUTIONAL QUALITY

ABSTRACT: *Sub-Saharan Africa (SSA) is one of the highest recipients of remittances; however, this is inconsistent with the region's growth and the state of its weak healthcare systems. This paper therefore analyses the effect of remittances on health outcomes for 39 selected SSA countries over the period 1996 to 2016. It considers the channels through which remittances affect health outcomes, including financial development and institutional quality. Using dynamic panel estimation, we find that remittances sustain health outcomes, while both financial development and institutional quality complement remittances in this respect. SSA countries should therefore continue to improve their financial sectors and develop the quality of institutions to an adequate level. Achieving sound financial systems and institutions would both allow and attract a substantial amount of remittances, benefitting human capital and health outcomes and alleviating poverty.*

KEY WORDS: *remittances, health sustainability, financial development, institutions, SSA*

JEL CLASSIFICATION: F22, I15, O5

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1. INTRODUCTION

In recent years the financial sector of the global economy has witnessed a massive surge in its dependence on remittances as a considerable source of funding. The rise of remittance inflows in developing countries has had a developmental effect on the recipient nations' economic growth and financial development. This economic growth may be in the form of improved healthcare services, education investment, or improved livelihoods. At the micro level, this money primarily covers household essentials such as food and shelter. It also contributes to basic education and healthcare expenses and business investments, and smooths fluctuations in overall household expenditure.

It is widely accepted that remittances play a key role in alleviating poverty and spurring economic growth in the developing world (Adams and Page, 2005; Lee, 2011; Ratha, 2005). The substantial inflow of remittances is driven by migration, as many people leave their home countries due to a lack of economic opportunity and earn a better income in other, mostly developed countries. Remittances become a source of financing for health outcomes in many developing countries as they continue to seek long-term solutions to critical health needs (Drabo and Ebeke, 2010). This external financing can improve health outcomes by enabling recipient households to purchase healthcare services and assist healthcare-related costs. However, low-income countries are facing challenges in reducing the mortality rate, preventing infectious diseases, and increasing the availability of efficient healthcare services. The changing needs of populations mean that these countries have to expand health coverage schemes, exerting pressure on public health expenditure (World Bank, 2016).

The inflow of remittances has been growing in recent years, constituting the largest foreign inflow in developing countries. The money sent home by migrant workers is estimated to have reached US$529 billion, surpassing foreign direct investment (FDI) and foreign aid (World Bank and KNOMAD, 2019). Moreover, it has become an integral part of the financial sector due to its stability and endurance when compared to FDI and foreign aid. These remittance inflows can support millions of families by lifting financial constraints on essential consumption needs and act as leverage to finance education and healthcare.

Remittance inflows in the developing world are determined by several factors, such as a substantial increase in migration and sustained good policies. Recent literature provides evidence that better functioning and performing institutions foster the inflow of remittances, thereby attracting remittances to investment opportunities in the recipient country (Ratha, 2005; Lartey and Mengova, 2016). Improved development of financial markets is also an essential element to drive remittance inflows in developing countries (Bang et al., 2013).

Health outcomes refer to the state of a population's health, measured by changes in various facets of health status that result from healthcare interventions over a period of time (WHO, 2016). A range of indicators is used in the literature as a proxy for health outcomes, including mortality rates (infant, under-5, and maternal), life expectancy at birth, and health expenditure. Improving the well-being of children and mothers is a key public health goal across the globe, with emphasis on reducing child and maternal mortality. The consensus among scholars is that the most effective strategy to reduce maternal and child mortality is offering good quality healthcare (Aakvik and Holmås, 2006; Zhang et al., 2017; Alkire et al., 2018).

Investing in health is also essential for promoting economic growth, as healthier citizens are more productive, earn more, and work longer (Becker, 1962; Romer, 1990; Benhabib and Spiegel, 2005). Various factors contribute to the low health outcomes in this region, including the lack of effective health programmes, inadequate financial resources, lack of supportive policies, and political upheaval. According to the World Health Organization (2010), the cost of healthcare services can be a major challenge to reducing maternal and child mortality. This situation hinders efforts to implement health-related policies. SSA has been unable to sustain its health outcomes due to relatively low healthcare expenditure compared to other regions in the world (UNECA, 2019).

Although remittances may not always have a direct relationship with health outcomes, their effect on health may be actuated through other channels; for example, through financial development, institutions, and trade liberalisation (Giuliano and Ruiz-Arranz, 2009; Ahmed, 2012; Yol, 2017). Financial development is an important driver of the effect of remittances on health outcomes as it mobilises resources for receiving households to finance better

healthcare services. Several studies argue that a well-developed financial sector attracts remittance inflows by lowering the transaction cost of remittance transfers. This encourages remittances to flow through formal channels and mobilises this financial resource in the form of savings and investment to fund education and healthcare services (Giuliano and Ruiz-Arranz, 2009; Ahamada and Coulibaly, 2011; Bettin and Zazzaro, 2012). An increase in remittance income is a domestic financial sector motive for the recipient households to invest in more productive activities such as healthcare. With a more developed financial sector, remittances may be channelled into investment uses rather than consumption, and the greater the depth of financial sector development, the more it may facilitate a positive impact of remittances on health outcomes. If the financial sector is in place to attract remittances from migrants, it may lead to higher investment in health.

It is widely believed that low rates of economic growth in developing countries are due to a poor institutional setup and inadequate governance (North, 1990; Rodrik, 2004; and Acemoglu and Robinson, 2008; Radulović, 2020). Low institutional quality is associated with a less favourable policy environment and weak institutions are expected to outweigh the positive impact of remittances. In line with this view, Lartey and Mengova (2016) suggest that improvements in institutions can increase the inflow of remittances, and a more favourable macroeconomic environment is likely to attract migrants to send more remittances. Furthermore, from an investment perspective, an improved institutional quality is necessary to stimulate a different pattern of remittances. Catrinescu et al. (2009) suggest that remittances are more likely to generate growth where political and economic institutions are of high quality. In other words, an unstable political environment and weak institutions might not be conducive to investment and might deter remittance inflows. The key point here is that the patterns of investment of remittances and the subsequent health outcomes may depend on the competence of institutions in recipient economies.

The objective of this paper is to empirically analyse the effect of remittances on health outcomes in selected SSA countries. Because of the ambiguous and indirect relationship between remittances and health outcomes, the paper will investigate two possible channels - financial development and institutional quality - that influence the remittances–health outcomes relationship. The study is organised

as follows: the next section outlines the current state of remittances and health outcome in SSA, followed by a literature review in section 3. Section 4 explains the model, methodology, and data. Section 5 presents the results and discussion, while section 6 concludes.

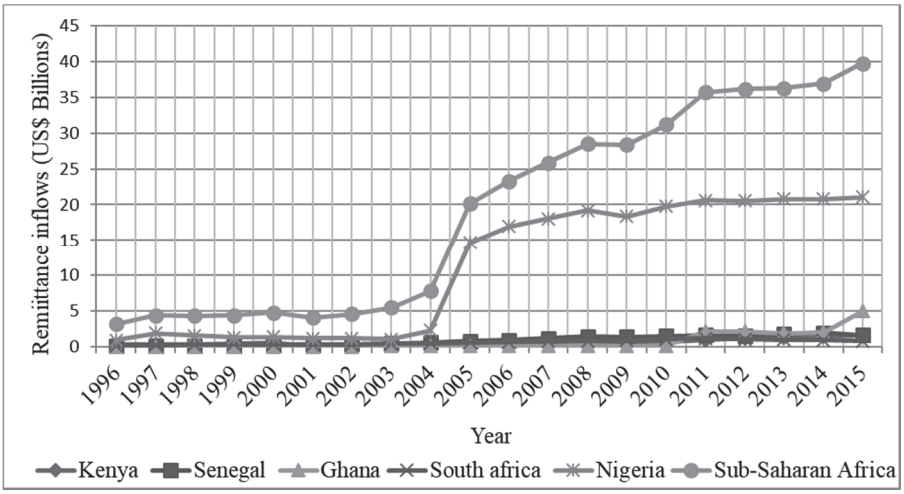
2. REMITTANCES AND HEALTH OUTCOMES IN SUB-SAHARAN AFRICA (SSA)

The inflow of remittances to developing countries has dramatically increased in the past few decades. Remittances to Sub-Saharan Africa (SSA) increased by 38 billion between 1996 and 2015 (World Bank, 2016). The region's major recipient of remittances, Nigeria, is among the top 10 receiving countries in the world, with 21 billion USD of remittances in 2016. The region also hosts a number of countries where remittances account for a significant share of GDP, notably Liberia with 26%, Comoros with 21%, and Lesotho with 15.6%. SSA countries face financial constraints and are searching for alternative funding for education, health, and poverty reduction in accordance with the changing needs of the population (Chireshe and Ocran, 2020).

Figure 1 shows the amount of remittance inflows of the top five recipients in the Sub-Saharan African region. Nigeria received more than half of the total remittance inflow in the region between 1996 and 2015. The increased flow of remittances in some countries in the region more recently may be due to stabilised political circumstances . For some time, SSA countries have been struggling with poor institutional infrastructure, mainly related to political and economic institutions, which can distort the inflow of remittances (Ajide and Raheem, 2016).

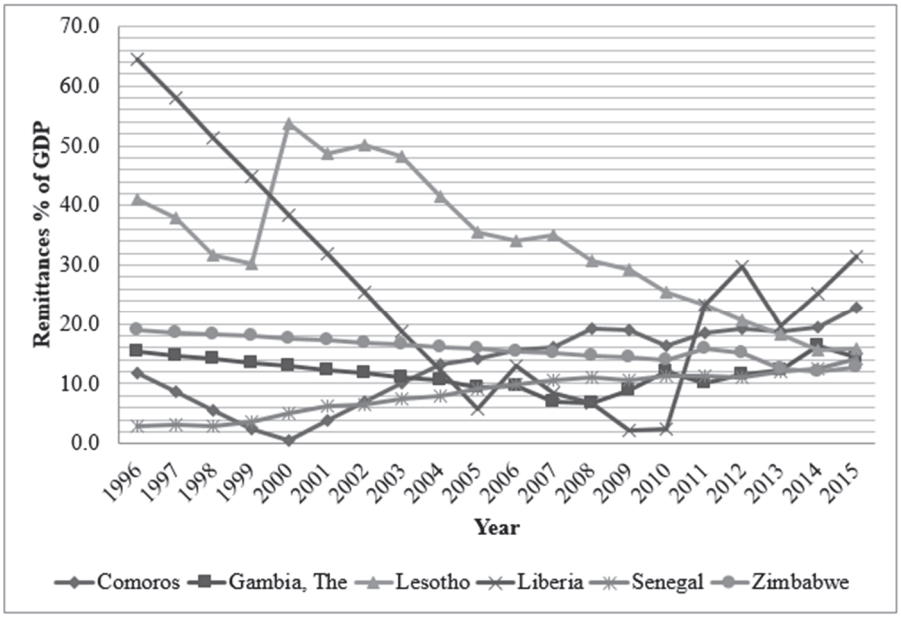
Figure 2 presents the top remittance inflows as a share of GDP in SSA countries between 1996 and 2015, showing that the region's poorer and smaller economies have the highest remittance inflows as a share of GDP. Liberia has the highest inflow with 26%, followed by Gambia and Comoros, which both received 21%, while Lesotho received 15.6% of GDP from remittances.

Figure 1: Top five Sub-Saharan remittance recipients, 1996–2015



Source: World Bank (2016)

Figure 2: Top five Sub-Saharan African recipients of remittances as a share of GDP, 1996–2015

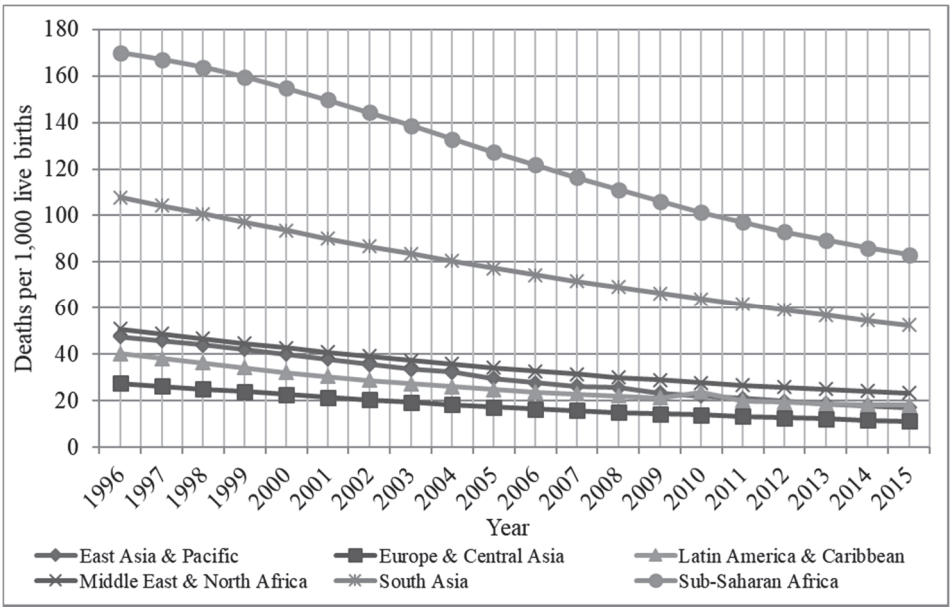


Source: World Development Indicators

When comparing SSA to other developing regions, it is evident that the growth rate of remittance inflows is relatively slow. Of all developing regions, SSA continues to have the lowest level of remittances when measured by the actual volume of inflows. However, it is noticeable that the trend in remittance inflows in SSA countries increased steadily during 1996–2015, as shown in Figure 1. Concerning remittances as a share of GDP, Liberia (26%), Comoros (21%) and Lesotho (15.6%) took the top three positions in SSA in 2016. Nigeria, which ranks as the top remittance recipient in actual inflows, is not ranked among the top 5 remittances–GDP recipients in SSA (World Bank, 2016) SSA countries present a pattern of less remittance inflows compared to other developing countries could be attributed to poor institutional quality and weak financial development. Meanwhile, international migration has increased dramatically over the past years due to conflict, war, and economic vulnerability (Maimbo and Ratha, 2005).

Many developing countries have made significant progress in providing health services and reducing child and maternal mortality rates. However, comparing global progress across various health-related indicators, it is evident that SSA lags behind the other global regions. Under-5 child mortality and maternal mortality rates are all close to double the world's average rate. However, it should be noted that all regions have shown substantial progress, with the under-5 child mortality rate declining and the child survival rate accelerating during 1996–2015. For instance, the under-5 mortality rate in Europe and Central Asia decreased to only 11 deaths in 2015 from 27 deaths per 1,000 live births in 1996. Over the same period the under-5 mortality rate in SSA also decreased, from 170 to 83 deaths per 1,000 live births (Figure 3).

Figure 3: Under-5 child mortality rate by developing region (deaths per 1,000 live births), 1996–2015



Source: World Bank Health, Nutrition and Population (2016)

Child mortality rates have improved dramatically globally, and the SSA region has also shown a substantial reduction, which reflects improved healthcare in the region. In 2015 the under-5 mortality rate in SSA was 83 deaths per 1,000 live births, followed by South Asia with 53 deaths per 1,000 live births. Europe and Central Asia had the lowest child mortality rate with 11 deaths per 1,000 live births, while East Asia and the Pacific had 17 deaths per 1,000 live births. Despite the substantial improvement, the mortality rate in SSA remains high compared to the other regions, and several challenges must still be overcome to successfully reduce child mortality on par with the rest of the world.

Most developing regions have successfully halved their maternal mortality rates since 1996, including SSA. Notably, the region has achieved the largest maternal mortality reduction of all the regions, with a 56% decline, from 916 deaths per 100,000 live births in 1991 to 547 deaths per 100,000 live births in 2015. However, the rate of 540 maternal deaths per 100,000 live births reported in SSA remains high compared to South Asia (182), the Middle East and North Africa (81), Latin

America and the Caribbean (67), East Asia and the Pacific (59), and Europe and Central Asia (16). SSA recorded about 57% of the world's maternal mortalities. Moreover, the numbers represent two-thirds of all maternal deaths per 100,000 live births worldwide. By contrast, Europe & Central Asia account for the lowest maternal mortality ratio compared to other regions, with only 16 deaths per 100,000 live births.

The factors suggested as contributing to the prevalent maternal and child mortality rates in SSA countries include the lack of good health programme management, lack of commitment to maternal and child health, lack or inadequacy of financial resources, lack of supportive policies, and, finally, political upheaval. According to the World Health Organisation (WHO) report (2010), the cost of healthcare services can be a significant challenge to reducing maternal and child mortality rates. In some countries, up to 11% of the population incurs high healthcare costs associated with maternal and child mortality, hindering efforts to implement health-related policies. In SSA the relatively low healthcare expenditure compared to other global regions means that it has been unable to improve health outcomes for women and children.

Due to the low healthcare expenditure in many developing countries, remittances are presumed to improve the health outcomes of the recipient households by procuring better healthcare services. Health investments are essential for economic growth, as healthy citizens are more productive, are able to work harder and longer, and earn more, which significantly impacts a country's development and growth. Although increased remittance inflows have been widely advocated as a means to improve health outcomes in many developing countries, empirical evidence to support this is scarce and inconclusive.

3. LITERATURE REVIEW

The effectiveness of remittances in improving health outcomes has been debated extensively in the literature. Existing studies find contradictory effects. Frank and Hummer (2002), McKenzie (2006), and Amuedo-Dorantes and Pozo (2012), have shown that a persistent remittance income can increase a country's rate of human capital, especially when these inflows are invested in healthcare services that consequently improve the health outcomes of the recipients. Drabo and Ebeke (2011) study the impact of remittances, public health spending, and foreign

aid on healthcare investment in developing countries and find that both remittances and foreign aid increase healthcare access. Amuedo-Dorantes and Pozo (2011) estimate the link between remittance income and healthcare expenditure. Their findings suggested that remittance income increases healthcare expenditure compared to other expenditure. Similarly, Kalaj (2015) examines the effect of remittances on health expenditure in Albania using the propensity score matching method. The results indicate a positive and significant relationship between remittances and health expenditure, suggesting that households increase their expenditure on medicines and other health services in the presence of remittance income. In line with the investment motives of remittances under the new economics of labour migration, Acosta et al. (2007) suggest that health conditions may be improved due to remittance income. They argue that remittances help to improve the health outcome of recipient households through purchasing better healthcare and nutrition. Thus, remittances have been associated with lower mortality rates, higher birth weights, and improved sanitation.

In contrast, Parinduri and Thangavelu (2011) study the effect of remittances on the Indonesian economy using household-level data and find that remittances have little impact on investment in health. They suggest that remittances are merely substitutes for household income and have no significant effect on households' well-being. Similarly, Anton (2010) studies the impact of remittances on the nutritional status of children in Ecuador using household surveys in 2006. The findings show that when remittance flows are substantially reduced, children's health is negatively affected and there is no compensatory behaviour of households.

Several studies have focused on the effect of remittances on mortality and life expectancy. The standard argument is that recipient families make relative investments in healthcare, which consequently reduce infant and child mortality rates (Hildebrandt and McKenzie, 2005; Antón, 2010; Kroeger & Anderson, 2014). Terrelonge (2014) analyses the role of remittances and health expenditure in improving child mortality in developing countries and concludes that remittances improve living standards, which leads to a reduction in child mortality. Zhunio et al. (2012) study the influence of remittances on education and health outcomes in 69 developing countries and find that remittances

increase life expectancy and reduce infant mortality. Similarly, Chauvet et al. (2013) investigate the effectiveness of remittances in reducing the child mortality rate in 84 developing countries. They find that remittances reduce the mortality rate while medical brain drain increases it. However, other studies suggest that migration and remittances may have a negative impact on child health outcomes, increasing the child mortality rate due to the disruptive impact of the absence of parents or family separation (Kanaiaupuni and Donato, 1999). Davis and Brazil (2016) show that remittances have a significant impact on nutritional outcomes in Guatemala. The authors argue that the absence of remitting fathers as a result of migration has a detrimental effect on the well-being of left-behind children.

3.1 Remittances and financial development

Until recently, only a few studies evaluating the empirical linkage between remittances and health outcomes had been conducted in Sub-Saharan Africa countries. Despite the significant impact of remittances on health outcomes, these studies do not investigate the role of financial development and institutional quality in the remittance and health outcome nexus. To address these gaps, we examine the role financial development and institutional quality play in the relationship between remittances and health outcomes.

Regarding the role of financial development in remittances, economists postulate that the development of the financial sector lowers the transaction cost of remittance transfers and encourages remittances to flow more through formal channels (Giuliano and Ruiz-Arranz, 2009; Ahamada and Coulibaly, 2011; Bettin and Zazzaro, 2012). In turn, remittances promote financial development in less developed countries (Aggarwal et al., 2011). These studies argue that financial development enlarges the flow of remittances, which may accelerate economic growth since more remittances may be used for productive activities such as health expenditure, rather than on basic consumption needs. Furthermore, a poor credit rating may be remedied by remittance inflows. Thus, by improving the allocation of capital, remittance transfers will contribute to alleviating credit constraints and accelerate healthcare spending and growth. Thus, the presence of a well-functioning financial system may help remittance recipients to access good healthcare services such as ante-natal care, screening and prevention of non-communicable diseases, and skilled child delivery services; all of which would improve health outcomes.

3.2. Remittances and institutional quality

One strand of empirical literature reveals the connection between remittances and institutional quality. Recent debate has mainly centred on the channels through which remittances can help the recipient country to foster productive investment and growth. Some studies support the hypothesis that remittances influence economic growth of recipient countries conditional on a certain threshold level of institutional quality (Catrinescu et al., 2009). Better institutions may help convert remittances into better investment projects that result in a higher rate of return. Ajide et al. (2015) further investigate how institutions impact the link between remittances and growth volatility in 71 remittance-recipient countries. They show that the impact of remittances on the reduction of growth volatility through well-functioning institutions is quite pronounced. Their empirical analysis also reveals that growth volatility is reduced when there is an interaction between remittances and six institutional-quality indicators.

Others have argued that remittances may themselves lead to a deterioration in institutions if they make it easier or less costly for governments to divert resources for its own use or that of their supporters. Abdih et al. (2012) find a negative and significant effect of remittances on institutional quality. Their study uses control of corruption, government effectiveness, and the rule of law as measures of institutional quality and suggests that an increase in remittance transfers might incur a risk of undermining the quality of institutions. They argue that institutions are complex in nature and that remittance-recipient countries should pay close attention to the potential adverse effects of a substantial increase in remittances.

A more recent study by Williams (2018) examines the role of political institutions in the link between remittances and growth. Using dynamic GMM on 109 developing countries from 1975 to 2014, he finds strong evidence to suggest that remittances are more effective in enhancing growth with strong democratic institutions. This sheds further light on the importance of the political environment in explaining the effect of remittances on growth in developing countries. This recent study indicates that the relationship between remittances and growth is far from straightforward, and the importance of institutional quality to remittance inflows is well recognized.

However, there has been no direct empirical study that tests the role of institutional quality in explaining the effect of remittances on health outcomes. This study intends to bridge this gap by focusing on the contingency role of institutional quality, which might be an important factor by conditioning the effects of remittances on health outcomes. Based on the above connotation, it is reasonable to expect that in countries with better institutional quality, recipients of remittances are more likely to spend on healthcare services or use their remittance income to increase health consumption activities, thereby lowering child and adult mortality rates.

4. MODEL AND METHODOLOGY

To achieve the objective of the study, we follow Terrelonge (2014) as the baseline model:

$$HE_{it} = \beta_0 + \beta_1 HE_{it-1} + \beta_2 PREM_{it} + \beta_3 GHE_{it} + \beta_4 POP_{it} + \beta_5 GDPC_{it} + \eta_t + \mu_i + \varepsilon_{it} \quad (1)$$

where HE_{it} represents health outcomes, $PREM_{it}$ denotes personal remittances, GHE_{it} denotes public health expenditure, POP_{it} denotes population, and $GDPC_{it}$ denotes GDP per capita. η_t represents time-specific effect, μ_I represents country-specific effects, and ε_{it} represents the error term, while i represents the observations of all members of the panel data at time t. We include FD_{it} (financial development) and INS_{it} (institutional quality) in our model to test the hypothesis that the effect of remittances on health outcomes depends on the level of financial development and institutional quality. The novelty of our study is that we extend the baseline model by including the interaction terms between remittances and financial development and remittances and institutional quality in order to investigate the indirect effects of financial development and institutional quality health outcomes. The empirical model is as follows:

$$HE_{it} = \beta_0 + \beta_1 HE_{it-1} + \beta_2 PREM_{it} + \beta_3 FD_{it} + \beta_4 (PREM_{it} * FD_{it}) + \beta_5 GHE_{it} + \beta_6 POP_{it} + \beta_7 GDPC_{it} + \eta_t + \mu_i + \varepsilon_{it} \quad (2)$$

$$HE_{it} = \beta_0 + \beta_1 HE_{it-1} + \beta_2 PREM_{it} + \beta_3 INS_{it} + \beta_4 (PREM_{it} * INS_{it}) + \beta_5 GHE_{it} + \beta_6 POP_{it} + \beta_7 GDPC_{it} + \eta_t + \mu_i + \varepsilon_{it} \quad (3)$$

In Equations (2) and (3) we test whether financial development and institutional quality act as substitute or complement in the remittance–health relationship. Following Inoue (2018), we are interested in the marginal impact of remittances on health outcomes conditional on the financial development or the institutional quality in SSA countries. In Equation (2), if the interaction term (β_4) is negative, remittances and financial development complement each other in enhancing health outcomes in the sample countries. On the other hand, if β_4 is positive, financial level is a substitute, which means that remittances are better at sustaining health outcomes at a lower financial level. Similarly, in Equation (3), if β_4 is negative, institutional quality augments the effect of remittances on health, and if the interaction is positive the negative impact of remittances on health diminishes with low levels of institutional quality.

This study uses three alternative measures of health outcomes: infant mortality rate, under-5 mortality rate, and life expectancy at birth. Infant mortality refers to the number of infants dying before reaching 1 year per 1000 live births in a specific year. Under-5 mortality rate measures the number of new-borns dying before reaching the age of 5 per 1000 live births in a given year. Life expectancy at birth refers to the number of years a new-born would live if prevailing patterns of mortality stay the same throughout its life.

Personal remittances to GDP is used as proxy for remittance inflow and can be defined as a migrant fund transfer that is sent to country of origin. Following Terrelonge (2014), it is expected that remittances have a positive effect on health outcomes by means of the recipient countries purchasing better healthcare services. The coefficient of remittances is expected to be positive, since remittance funds improve health outcomes. Government health expenditure refers to total expenditure on health as a percentage of GDP. An increase in government expenditure on health implies a broader access to healthcare services that may help improve health conditions. Studies have shown that public health expenditure improves health outcomes in various developing countries (Gani, 2008; Amakom and Iheoma, 2014; Ahmad and Hassan, 2016). Following previous empirical studies on the effect of public health expenditure on health outcomes, we hypothesize that the coefficient of public health expenditure is positive.

Population refers to the total population and captures the view that health outcomes increase when the population size is bigger. Higher population in a given country leads to more demand for healthcare services because more people will require healthcare services such as access to good nutrition, ante-natal care, and skilled child delivery services. This health demand will create adverse health outcomes such as increased infant and under-5 mortality rates. Previous empirical studies confirm that population plays a detrimental role in health outcome indicators (Azizi, 2019). We expect that population has a negative effect on health outcomes. GDP per capita represents the measure of per capita income of the population. A country with higher per capita income is expected to improve health outcomes, as it reflects good economic performance. The inclusion of GDP per capita in the model of remittances and health outcomes is based on the grounds that the larger the economy, the better the health outcomes.

Financial development refers to the set of institutions, financial markets, instruments, and financial regulatory permit transactions providing the key functions of the financial sector in the economy. We use the ratio of domestic credit to the private sector to GDP as a proxy for financial development. This indicator of financial development captures the efficiency of the banking sector to evaluate and identify viable and profitable investment ventures. It implies that a high ratio of this financial development indicator lowers transaction costs and increases financial services and the development of financial intermediation. This indictor is also used by Saci et al. (2009) and Giuliano and Ruiz-Arranz (2009). We expect a positive relationship between financial development and health outcomes.

Existing empirical studies have used different measures of institutional quality. However, this study uses two Worldwide Governance Indicators to capture institutional quality: political stability and regulatory quality. Political stability refers to people's perceptions of the likelihood that their government will be destabilised or overthrown by unconstitutional or violent means, including motivated violence and terrorism (Worldwide Governance Indicators, 2016). Regulatory quality measures the perception of the government's ability to formulate and implement sound policies and regulations that permit and promote private sector development (Worldwide Governance Indicators, 2016). In worldwide governance indicators the estimates of political stability and

regulatory quality range from –2.5, representing weak governance performance, to 2.5, indicating strong governance performance. The quality of institutions is an important factor that promotes investment and better allocation of resources.

Concerning remittances, better-quality institutions will result in better allocation and productive use of remittances. Institutions matter to the economic environment, especially regarding investment efficiency. They may also play an important role in determining the impact of remittances on health investment. For instance, preserving political stability as a sign of institutional quality makes remittances effective in the provision of better healthcare services, leading to improved health outcomes. Moreover, from the perspective of the recipient government, sound regulatory quality, which is an integral feature of good institutional quality, is one of the feasible criterions that remittance inflows may depend on. That is, the stronger the commitment of a recipient country towards a quality regulatory environment, the greater the amount of remittances and the contribution to healthcare services to overcome adverse health outcomes. All data are extracted from the World Bank World Development Indicators and World Governance Indicators. The sample comprises an unbalanced panel of 39 selected SSA countries covering the period 1996–2016. The sample years are chosen according to data availability.

Azizi (2019) postulates that remittances are endogenous to many factors, such as human capital, health outcomes, labour supply, and poverty. The endogeneity might be due to measurement errors, reverse causality, or omitted variable bias. Endogeneity is one of the violations of the standard ordinary least squares (OLS) regression that leads to bias and inconsistency in OLS estimation. To overcome the endogeneity problem we need to find instruments for remittances. The instruments selected need to be correlated with remittances but uncorrelated with the error term. Although existing studies suggest some possible instruments for remittances (see Adams and Page 2005 and Azizi 2019 for examples), finding suitable and valid instruments is not easy. Therefore, we resort to empirical methods that account for the endogeneity without using additional exogenous variables.

In this study we employ the dynamic model method, which is the generalised method of moments (GMM). GMM was first introduced by Holtz-Eakin et al.

(1988) and later modified by Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998). The GMM estimator is appropriate for and applicable to panel data with large cross section and small time series (N>T). Because of the dynamic nature of the relationship between the variables, the GMM estimator is preferred due to its ability to address the correlation between lagged dependent variables and the unobserved residuals of the model. The static OLS approach leads to biased estimates due to the correlation that exists between the lagged dependent variables and country-specific effects. The GMM estimator is also consistent in the presence of persistent time series, endogenous variables, or measurement errors (Bond et al. 2001).

To overcome the biased estimates and the weak instrumentation caused by differenced GMM, Arellano and Bover (1995) and Blundell and Bond (1998) proposed a system that combines both the differences and level equations, known as system GMM. This estimator is more efficient as it uses lagged first difference of the variables as the instrument in addition to the normal differenced procedure. The consistency and efficiency of system GMM depends on the over-identification and serial correlation tests. Since we are using the two-step system GMM, we use the Hansen J-test to test for the validity of the instruments. We should not reject the null hypothesis to ensure that the instruments are exogenous. To test for autocorrelation, we apply the Arellano- Bond test. We should reject the null hypothesis for AR (1) but not AR (2).

5. RESULTS AND DISCUSSIONS

We present the estimation results in this section. Our main focus is on the variables of interest, which are remittances, financial development, and institutional quality, although we also discuss the control variables. Table 1 presents the baseline model estimated using difference GMM and two-step system GMM.[1] The baseline regression does not suffer from econometric problems since we do not reject the null for the over-identifying restrictions test (Hansen J-test). It also passes the serial correlation test.

[1] We also conduct estimations using the static models (Pooled OLS, Random Effects, and Fixed Effects). Results are available upon request.

From columns 1–4 it can be concluded that remittances have a negative impact on infant and under-5 child mortality rates, which implies that remittances improve health outcomes measured by these two proxies. On the other hand, remittances are positively correlated with life expectancy, which means that higher remittance inflows contribute to higher life expectancy. These results are consistent with Azizi (2019), Drabo and Ebeke (2010), Amuedo-Dorantes and Pozo (2011), and Zhunio et al. (2012), among others. As regards the control variables, we have the expected result. Higher government expenditure and GDP per capita yield better health outcomes, while higher population increases infant and under-5 mortality as well as life expectancy. The lagged dependent variables are also significant, which proves the reliability and consistency of the dynamic method.

The results for the extended model with interaction terms are presented in Table 2 below. Since the system GMM is more efficient and powerful in handling estimation problems than difference GMM, the following table of results is based only on system GMM. Columns 1–3 present the results for the financial development model. The results indicate that a 1% increase in the interaction between financial development and remittances will lead to a 0.034% decrease in infant mortality rates and a 0.044% decrease in under-5 mortality rates at a 1% level of significance. The estimated coefficients of the interaction terms are negative and significant for two measures of health outcomes (infant and under-5 mortality rates), which suggests that financial development has a complementary impact in improving and sustaining health in SSA, such as lowering infant and under-5 mortality rates. On the other hand, the effect of the estimated coefficients of the interaction term (financial development and remittances) on life expectancy at birth are negative and statistically significant, suggesting that remittances substitute for financial development in the health-improving process shown in column 3 of Table 2.

Table 1: Remittances and health outcomes: baseline model

	(1)	(2)	(3)	(4)	(5)	(6)
	Infant Mortality		**Under-5 Mortality**		**Life Expectancy**	
	DGMM	SGMM	DGMM	SGMM	DGMM	SGMM
Infant mortality	0.681***	0.967***				
	[0.039]	[0.006]				
Under-5 mortality			0.873***	0.975***		
			[0.027]	[0.010]		
Life Expectancy					0.665***	0.685***
					[0.028]	[0.019]
Remittances	–0.009*	–0.021***	–0.012**	–0.027***	0.006***	0.014***
	[0.005]	[0.002]	[0.005]	[0.003]	[0.002]	[0.002]
Expenditure	–0.129***	–0.010**	–0.028**	–0.018***	0.006	–0.012***
	[0.019]	[0.004]	[0.013]	[0.005]	[0.005]	[0.003]
Population	0.397***	0.030***	0.157*	0.080***	0.026	0.097***
	[0.065]	[0.011]	[0.092]	[0.013]	[0.027]	[0.018]
GDP	–0.521***	–0.011***	–0.217***	–0.019***	0.110***	0.099***
	[0.062]	[0.003]	[0.052]	[0.004]	[0.016]	[0.009]
Constant		0.093**		0.046		0.500***
		[0.042]		[0.081]		[0.046]
Observations	186	228	186	228	186	228
Instruments	31	36	23	36	23	36
AR(1)	0.016	0.015	0.004	0.005	0.001	0.002
AR(2)	0.089	0.167	0.096	0.336	0.560	0.815
Hansen J-test	0.606	0.257	0.069	0.174	0.096	0.357

Note: Standard errors in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01

Columns 4–9 present the results for the model incorporating the interactions between remittances and institutional quality. We use two measures of institutions: political stability and regulatory quality. The interaction terms between remittances and political stability (columns 4–6) are negative and

significant at 1%, suggesting that the effect of remittances on infant and under-5 mortality rates will be greater in SSA countries with stable politics. On the other hand, when the interaction effect between political stability as a feature of institutional quality and remittances on life expectancy at birth is considered (column 6), we find a significant substitute effect. The coefficient shows that a 1% increase in the interaction between political stability and remittances would decrease life expectancy at birth by 0.005%.

We also observe similar results for the role of regulatory quality. The interaction terms are negative and significant at the 1% level. As shown in columns 7 and 8 of Table 2, the coefficients of the interaction term between regulatory quality and remittances were found to be negative and statistically significant on reducing infant and under-5 mortality rates, suggesting a complementary effect of remittances and regulatory quality on improving health outcomes in SSA. In other words, with a negative marginal impact, the results show that remittances have a more beneficial effect on health outcomes in countries with better regulatory quality. The result is consistent with the assertion that better domestic institutions enhance growth and investment (Acemoglu and Robinson, 2008; Fajznylber et al., 2008; Abdih et al., 2012; Fajnzylber and Lopez, 2008; Catrinescu et al., 2009).

In this study, however, the impact of remittances on health outcomes seems to work through better political stability, as the coefficient of the interaction terms is significant. This finding supports the view that societal conflict is harmful because it diverts resources from productive economic activities and investment in healthcare services that significantly improves health outcomes. This is in line with Rodrik (2000), who argues that regulatory institutions matter because in a country where corruption exists, investors are aware that some of the proceeds from future investments might be claimed by corrupt officials. Regulatory quality therefore is central to improving the effects of remittances on health outcomes in SSA countries.

Table 2: Remittances and health outcomes: financial development and institutional quality

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Financial Development			**Political Stability**			**Regulatory Quality**		
	Infant Mortality	**Under-5 Mortality**	**Life Expectancy**	**Infant Mortality**	**Under-5 Mortality**	**Life Expectancy**	**Infant Mortality**	**Under-5 Mortality**	**Life Expectancy**
Infant mortality	0.958***			0.569**			0.600***		
	[0.011]			[0.030]			[0.027]		
Under-5 mortality		0.986***			0.427***			0.561***	
		[0.011]			[0.029]			[0.026]	
Life expectancy			0.763***			0.755**			0.773***
			[0.006]			[0.006]			[0.004]
Remittances	0.106***	0.138***	−0.033***	0.006***	0.006***	0.022***	0.013***	0.017***	−0.008
	[0.008]	[0.011]	[0.002]	[0.001]	[0.002]	[0.003]	[0.004]	[0.005]	[0.005]
Finance	−0.016***	−0.020***	0.009***						
	[0.004]	[0.005]	[0.001]						
Remit*Finance	−0.034***	−0.044***	−0.011***						
	[0.003]	[0.004]	[0.001]						
Institution				0.006**	0.002	0.006***	0.007***	0.009***	−0.001
				[0.003]	[0.002]	[0.001]	[0.002]	[0.003]	[0.002]
Remit*Institution				−0.0002***	−0.0003***	−0.005***	−0.004***	−0.005***	0.003**
				[0.0001]	[0.0001]	[0.001]	[0.001]	[0.002]	[0.001]
Expenditure	−0.017***	−0.017***	0.003	−0.009***	−0.016***	0.000	−0.012***	−0.016***	0.003***
	[0.005]	[0.006]	[0.002]	[0.002]	[0.004]	[0.002]	[0.003]	[0.003]	[0.001]
Population	0.013	0.060***	0.035***	0.046***	0.077***	0.040***	0.047***	0.056***	0.035***
	[0.016]	[0.020]	[0.006]	[0.005]	[0.008]	[0.007]	[0.006]	[0.008]	[0.004]
GDP	−0.001	−0.008**	0.005***	0.002	0.009***	0.004**	−0.002	−0.003	0.009***
	[0.003]	[0.004]	[0.001]	[0.002]	[0.003]	[0.002]	[0.001]	[0.002]	[0.001]
Constant	0.114	−0.022	0.882***	−0.128***	−0.226***	0.916***	−0.106***	−0.128***	0.843***
	[0.074]	[0.079]	[0.021]	[0.015]	[0.022]	[0.023]	[0.012]	[0.016]	[0.016]
Observations	223	223	223	186	194	228	194	194	228
Instruments	38	38	38	30	35	36	30	30	36
AR(1)	0.122	0.019	0.002	0.046	0.240	0.002	41.000	41.000	42.000
AR(2)	0.079	0.173	0.540	0.382	0.105	0.116	0.054	0.181	0.003
Hansen J-test	0.187	0.134	0.260	0.106	0.381	0.133	0.419	0.130	0.091

Note: Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

6. CONCLUSION

This paper analyses the interaction between remittances, financial development, institutional quality, and health outcomes in 39 selected SSA countries in the period 1996–2016. First, the findings of our study reveal that remittances have an improving effect on all categories of health outcome. Remittances ease the budget constraints of recipients and provide an opportunity for them to access healthcare services and improve health conditions in their country. Second, as a result of the interactive impact of financial development and remittances in sustaining health outcomes, we find that financial development plays a positive role in health outcomes in SSA countries. In particular, our study finds that sound financial development attracts higher remittance inflows and improves health outcomes such as infant and under-5 mortality rates. The significant negative interaction between remittances and financial development suggests that financial development in SSA complements the reducing impact of remittances on health outcomes, particularly in lowering infant and under-5 mortality rates. It is also worth noting that the interaction term between remittances and institutional quality is significant and negative, suggesting that well-functioning institutions in the recipient country further enhance or complement the impact of remittances on health outcomes. Thus, this study partially overcomes one of the shortcomings of previous studies that ignore the importance of financial development and institutional quality in the remittance and health outcome nexus. SSA countries should continue to develop their financial sector and the quality of their institutions to an effective level. Achieving sound financial systems and institutions would allow and attract a substantial amount of remittances and would benefit human capital and health outcomes. More precisely, it is imperative to ensure that policymakers in SSA countries devise the means to strengthen institutional quality through safeguarding political stability and improving regulatory quality.

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All submitted papers will undergo a double-blind refereeing process. An anonymous version of the paper should be submitted along with a separate cover page, containing the article's title, author's name and affiliation, e-mail address, and a suggested running head (an abbreviated form of the title of no more than 50 characters with spaces). The cover page should also should contain a short abstract of between 100 to 200 words, summarising the major points and conclusions of the paper, a list of up to five keywords and up to five two-digit codes in accordance with the Journal of Economic Literature (JEL) classification (https://www.aeaweb.org/econlit/jelCodes.php).

Papers should be prepared as a single file (including text, notes, references, figures, and tables) in MS-Word. Papers should be submitted in A4 page format (21×29.7 cm), left and right margins cm, top and bottom 4.5 cm, in font Times New Roman 12, single line spacing. There should be no tabs in paragraphs and a single line spacing should separate paragraphs and titles. Tables, figures and footnotes should be included as they are intended to appear in the final version. Footnotes (in font 10) should be kept to a minimum and numbered as superscripts. Papers which do not conform with the above instructions will not be taken into consideration.

As a rule, submitted articles should not exceed 8,000 words. All pages apart from the first one should be numbered. Subtitles should be concise, clearly marked in bold, and numbered (up to two levels of numbering). No other entries should be bolded. Formulae should be numbered on the right-hand side of the page. In case of long proofs, these should be inserted in a separate Appendix, following the References. Tables and Figures must not use colour, and should be in a format easy to edit, for instance they should take half a page (or a full page) within the indicated margins. They should be clearly labelled at the top, with a legend at the bottom, and should be logically ordered, using Arabic numerals. Sources of the data should be given below tables and figures.

Papers should follow APA style guidelines: https://apastyle.apa.org/style-grammar-guidelines/references/examples#textual-works. Some key points watch out for are as follows. Parenthetic references in the text and in footnotes should be listed by the author surname, with the year of publication in parentheses; in case of more than one author use an ampersand, for instance: (Atkinson, Picketty & Emmanuel, 2011). Narrative citations within the text should use "and" rather than ampersand, for instance: Djankov, Glaeser and La Porta (2003). Use an ampersand in the list of references. When citing works with one or two authors, include the author name(s) in every citation. For works with three or more authors, include the name of only the first author plus "et al." in every citation (even the first citation). Include all author names in the list of references. If the author is unknown, the first few words of the reference should be used; this is usually the title of the source. For example: (*A guide for economy*, 2019). Multiple works by the same author are sorted by date in ascending order; if the works are in the same year they should be ordered alphabetically by title and allocated a letter (a, b, c, ...) after the date. Cite only the works you have read and incorporated into your writing; readers may find long strings of citations difficult to understand. Before submitting your paper, check that all references cited in the paper are included in the reference list at the end of the paper, and that all papers included in the reference list have been cited in the text.

References should be left aligned in alphabetical order in the reference list, according to the following formats:

Article in journals

Author surname(s), initial(s). (Year). Article title. Journal, Volume number (issue or part number, optional), page numbers. DOI.

Rodrik, R., Subramanian, D., & Trebbi, F. (2004). Institutions rule: the primacy of institutions over geography and integration in economic development. *Journal of Economic Growth*, 9(2), 131-165.

https://DOI: 10.1023/B:JOEG.0000031425.72248.85.

Book

Author surname, initial(s). (Year). *Title*. Publisher location: Publisher

De Grauwe, P. (2020) *Economics of Monetary Union* (13th ed.). Oxford: Oxford University Press.

Edited book

Author surname, initial(s). (Ed(s).). (Year). *Title*. Publisher location: Publisher

Baltagi, B.H. (Ed.). (2003). *A Companion to Theoretical Econometrics*. Oxford: Blackwell

Book with several authors

When there are multiple authors, list them all, with the addition of ampersand (&) before the last surname. If there are more than seven authors, list the first six, then write three full stops (…), and at the end write the last author.

Acemoglu, D., & Robinson, J.A. (2006). *Economic Origins of Dictatorship and Democracy*. Cambridge: Cambridge University Press.

Baumol, W. J., Panzar, J. C., & Willig, R.W. (1982). *Contestable Markets and the Theory of Industry Structure*. New York: Harcourt, Brace, Jovanovich, Inc.

Chapter in book

Last name of the chapter author, initial(s). (Year). Chapter title. In editor initial(s), surname (Ed.). *Title* (ed., pp.). Publisher location: Publisher

McMillan J., & Woodruff C. (2003) The central role of entrepreneurs in transition economies. In G. S. Fields, & G. Pfefferman (Eds.). *Pathways Out of Poverty* (pp. 105-121). Dordrecht: Springer. https://doi.org/10.1007/978-94-010-0009-3_6.

E-Book

Author surname, initial(s). (Year). *Title*. URL

Perry, R.B. (1909). *The Moral Economy.*

https://manybooks.net/book/137844/read#epubcfi(/6/2[id00000]!/4/2[id00000]/1:0)

Technical Reports or Working Papers

Individual authors

Author surname, initial(s) or corporate name. (Year). Title. (Report or Working Paper No.). URL.

Cătuți, M., Kustova, I. and Egenhofer, C. (2020) *Delivering the European Green Deal for Southeast Europe: Do we need a regional approach?* (CEPS Research Report No. 2020/1). https://www.ceps.eu/wp-content/uploads/2020/06/RR_2020-01_European-Green-Deal-for-South-Eastern-Europe.pdf.

Corporate authors

American Psychological Association, Task Force on the Interface Between Psychology and Global Climate Change. (2009). *Report of the APA Task Force on the Interface Between Psychology and Global Climate Change*.

http://www.apa.org/science/about/publications/climate-change.aspx

Newspaper Articles

Author surname, initial(s). (Year, Month Day). Title. *Title of Newspaper*, p. or pp. URL*

*only include if the article is online.

Note: the date includes the year, month and date.

Smialek, J. (2020, May 2). Hotel Group Will Return Tens of Millions in Small Business Loans. *The New York Times*, pp. 10.

https://www.nytimes.com/2020/05/02/business/economy/ashford-hotels-virus-monty- bennett.html

Website

Author surname, initial(s). (Year, month day). *Title*. URL

Mitchell, J.A. (2017, May 21). *How and when to reference*.

https://www.howandwhentoreference.com

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LSE RESEARCH ON SOUTH EASTERN EUROPE (LSEE) & CEFTA

BEST PAPER COMPETITION

international trade in South eastern Europe: Obstacles and opportunities for CEFTA and the Common regional Market

Since the signing of the CEFTA agreement in 2006, the Free Trade Agreement has played an important role in promoting international trade in South Eastern Europe. It has contributed to economic integration, trade facilitation, the growth of regional trade flows and created a unified economic space attractive to foreign direct investors and mobility of professional service providers. Intra-regional trade has increased substantially in the fifteen years since the signing of the agreement while the share of trade within the region has also been on the rise. Trade liberalisation within CEFTA has promoted market competition and fostered integration across sectors and industries in the region. It has also encouraged FDI flows both from outside the region and from within. Moreover, CEFTA has facilitated information sharing and collaboration with regard to customs and trade policies more generally, thus encouraging political dialogue, institutional approximation and capacity building among the Parties of the region.

As elsewhere, the Covid-19 pandemic has adversely affected economic activity and trade in the region. This experience has highlighted the important role of intra-regional trade and the need for further regional cooperation and trade liberalisation. Within the proposed Common Regional Market new mechanisms to facilitate trade are being developed including mutual recognition of certificates and testing for industrial and agricultural products, Authorised Economic Operators, and mutual recognition of professional qualifications and financial services. New initiatives related to free trade in services, free movement

of persons, regional e-commerce, and Green Lanes to ensure unimpeded flow of goods during the COVID-19 crisis are being launched. Further measures are being taken to remove non-tariff barriers and support competition regulators.

To celebrate 15 years of the CEFTA agreement, LSEE, the Research Unit on South Eastern Europe at the London School of Economics, and CEFTA are launching a paper competition on the theme "*International Trade in Southeastern Europe: Obstacles and Opportunities for CEFTA and the Common Regional Market*". We invite original scientific papers that address any issues relevant to the theme of the competition. Suggested topics include, but are not limited, to the following:

- Trade liberalisation and economic growth
- Institutional quality and regional trade flows
- Role of CEFTA in creating the Common Regional Market
- Trade in agricultural goods in the CEFTA region
- Trade in services (tourism, postal and financial services)
- Mutual recognition of professional qualifications
- Regional trade, the digital economy and e-commerce
- Trade facilitation and risk management
- Competition, state aid and non-tariff barriers
- The impact of CEFTA on bilateral and regional trade and investment flows
- Regional trade policies and the COVID-19 pandemic
- Bilateral investment flows and regional value chains
- Legal, social and environmental issues of trade in the CEFTA region
- The political economy of CEFTA and the EU integration progress
- Comparisons with FTAs in other regions

The competition is open to papers from all fields of the social sciences, including but not restricted to economics, geography, development, political science, public administration, law, management, business studies, environmental studies, industrial relations, and international studies. The competition is open to researchers holding, or studying towards, a PhD (doctorate) degree who are currently affiliated to an accredited higher education institution, or an equivalent public or private research institution or organisation. Co-authored papers are eligible but, to be considered for the award, the lead author should meet all eligibility criteria. Papers should be of a standard academic format, in line with disciplinary practices, and should not exceed 10,000 words (including tables, footnotes and references).

Papers will be reviewed by a Selection Committee of academics affiliated to LSEE and coordinated by the CEFTA Secretariat. One 'best paper' award (worth €3,000) will be awarded to the paper that is deemed to be of the highest quality on the basis of scientific rigour, clarity of analysis and presentation, and policy relevance. The scientific committee will also grant up to two commendation awards (worth €2,000 and €1,000) for runner-up papers. The decisions of the committee are final. Winning authors (one per paper) will be invited to present their papers and receive their awards during the CEFTA Week in Skopje in November/December 2021. Submitted papers will be considered for publication, with the agreement of the authors, in the discussion paper series *LSEE-CEFTA Research Papers on International Trade* and in a special issue of the refereed academic journal *Economic Annals* published by the Faculty of Economics at the University of Belgrade, subject to standard refereeing practices.

Guidelines for submission:

Full papers should be submitted electronically in anonymised form **by 30 September 2021 (16:00 GMT)** to lsee.ceftanetwork@lse.ac.uk. The subject line of the email should read "CEFTA@15 competition" only, and all application material should be in MS Word format.

Terms & Conditions

The award will be made by a Selection Committee comprising academics from LSE Research on South Eastern Europe solely on the basis of the submitted paper and against the following criteria: relevance and impact (for/on policy developments in the context of CEFTA – weight: 20%), technical quality of the paper (setting up hypothesis, clarity of the work, methods and techniques appropriately applied, etc – weight 50%), novelty (contribution to better understanding the topics – weight: 10%), results and conclusions (quality of discussion and presentation, validation of the conclusions – weight: 15%) and presentation (is the paper well organised and clear – weight: 5%). Applicants must provide a separate title page containing the title of the paper, a 250-word abstract together with up to five keywords, the names of the author(s) and their institutional affiliation, contact details indicating corresponding author, and short bio of each of the author(s).

The Selection Committee is solely responsible for approving the eligibility of applications and reserves the right to request additional information from the applicants. In all cases, the decisions of the Selection Committee will be final. The Committee reserves the right not to make any awards or to adjust the number of awards it makes.

The successful authors will be invited to present their paper in the proceedings of the CEFTA Week, which will take place in Skopje in November/December 2021. The costs of one author of each winning paper will be covered by the CEFTA Secretariat if the event is held *in situ*. Successful authors are required to submit their paper for publication to the *LSEE-CEFTA Research Papers on International Trade* series and to undertake the necessary revisions, to the extent possible, following a review process. Copyright of the original work will remain with the author(s). LSEE and the CEFTA Secretariat retain the right to publicise a summary of the results, with full acknowledgement to the author(s) of the research, on their websites and other publicity outlets.

The author(s) should provide full acknowledgement to the LSEE/CEFTA award in all future publicity and outputs stemming from the paper receiving the award.