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Corruption and Inflation in Agricultural Production: The Problem of the Chicken and the Egg

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Abstract: Corruption and inflation are two economic problems with serious social consequences. This paper analyzes the link between these two problems, focusing on the case of 19 prices observed for agricultural products in 90 countries since 2000. Using 'panel data cointegration' techniques, we conclude that, in most cases, there is a long-term relationship between inflation and corruption. The direction of causality favors the hypothesis that the inflation of agricultural products promotes incentives that lead to an increase in corruption levels. These results have important implications in terms of fighting corruption, giving special attention to controlling inefficiencies in agricultural markets that lead to higher prices that are then tapped into corruption mechanisms.

Keywords: corruption; inflation; production price levels; panel cointegration

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1. Introduction

Corruption is now seen as a phenomenon that significantly deteriorates economic growth projections. This economic phenomenon, which involves the abuse of public functions through bribes and income extracted by holders of public office, has been studied in greater detail in the last thirty years. It was soon realized that corruption created disastrous consequences for socioeconomic development, from a worsening of socioeconomic inequality to capital flight from the corrupted economy, through pressures on taxation and the effort required by the population to support the tendency of increasing public expenditures (Maeda and Ziegfeld 2015).

If the consequences of corruption were quickly identified and tested in several studies, the causes of corruption also received extensive attention in the literature. Various causes of corruption were also studied, from imbalances in political forces to literacy levels. However, none of these works related corruption to the price level indicator felt by agricultural producers. In reality, the inflation felt in the agricultural sector has its own peculiarities. On the one hand, the reality felt by agricultural producers tends to reflect more clearly the so-called inflation of raw materials. On the other hand, the dependence of particular spaces on the so-called primary sector puts additional pressure on the prices of this sector, seen as important determinants of the level of socioeconomic development of certain countries (Fink 2002).

As a consequence, some countries may show a closer relationship between corruption and pressures on production price levels, especially on agricultural production price levels. However, arguments about this relationship operating in a twofold direction abound. On the one hand, higher producer price inflation can generate greater incentives for corrupt practices. However, corruption itself can cause significant distortions in agricultural markets, leading to price increases in these markets.

Thus, it is important to analyze the structural relationship between corruption and agricultural prices. With this motivation, we developed this original study that concludes that for 19 agricultural products observed in 90 countries, there is a tendency for the inflation realized in the agricultural sector to generate incentives to engage in corrupt practices.

The remainder of this work is developed as follows. In Section 2, we carry out a review of the literature, dividing it between the literature that identifies inflation in the agricultural sector as a cause of corruption and the literature that identifies corruption as a cause of inflation in the agricultural sector. In Section 3, we present our empirical study. Given the nature of the panel data, we will analyze the relationship between inflation in the agricultural sector and corruption through panel data cointegration. Thus, in addition to testing the 'slope homogeneity' and 'cross-section dependence', we will also analyze the stationarity of the data, the existence of panel cointegration and the direction of associated causality. In the empirical section, we estimate the relative coefficients for each country observed in the respective cointegration equation. Finally, Section 4 concludes the paper.

2. Review of the Literature Focused on the Link between Corruption and Inflation in Agricultural Products

The evolution of production prices has over the past two hundred years been a stimulating topic for economic analysis. On the one hand, the first approaches from Adam Smith (and even earlier by physiocrats such as Turgot) to the insights of David Ricardo in 1817 or Marshall in 1890 showed how the evolution of prices realized by producers is reflected in the general equilibrium and also affects the distribution of income across the population. The causes of this rise in producer prices were scrutinized alternatively by economists, such as Pareto (1906) and Baudin (1936), who identified a vast list of causes that would later be identified as 'structural', exogenous or even as speculative.

The consequences of rising prices for specific sectoral production, particularly the agricultural sector, have been studied by authors, including Boehlje and Tweeten (1980) and Johnson (1980). Authors, such as Van Zyl (1986) and Njegovan and Tomaš-Simin (2020), state that the rise in the pProducer Price Index puts a bias in the management of agricultural credits. Thus, those who have debt tend to gain because the currency used to pay off the debt will be worth less in units of agricultural products than when the debt was assumed. In return, creditors of such agricultural debts will see the real value of their credit diminish.

Additionally, as observed by Bakir and Campbell (2006), the inflation of agricultural products artificially raises the profit rates of capital, mainly as a temporary effect. While the investing company can sell the agricultural goods in question at higher prices, raw materials and goods for intermediate consumption (such as seeds or fertilizers) can be bought at old prices.

Another effect of rising agricultural prices is, according to Benjamin's (1991) perspective, the reduction in the purchasing power of certain segments of income generated in the primary sector, namely, the income of specific workers and investors supported by agricultural goods whose price evolves more slowly. This type of differentiation increases socioeconomic inequality in the sector and increases the possibility of exploitation of rents by some economic agents (Anderson 2010).

In international terms, the rise in the prices of agricultural goods leads to the loss of competitiveness of the economies with the most inflated prices. Agricultural goods from a country with higher prices run the risk of losing competitiveness in international markets compared to similar goods produced in other countries at lower costs. As a result, the profit rates of producers of agricultural goods in countries with the highest prices decline. As Foster et al. (2011) warn, there follows not only the outflow of investments from these sectors to other more competitive sectors within the country but also the outflow of investments from these sectors toward investment opportunities abroad. Depending on the weight of the agricultural sector in the national economy, the rise of prices in the agricultural sector will lead to a reduction in the country's global exports, an increase in imports and a tendency toward a weakening of the national currency (Reding 1996).

However, within this dense discussion, corruption has never been considered in detail, as we do in this paper. On the one hand, what we understand today as corruption—the private use of resources or processes of the public sphere—was implicit in the many approaches of the previous generations of economists. For example, Fasiani (1941) addressed the problems of the 'Monopolist State' as a generator of private rents that benefited those in power (which Buchanan listed as the main beneficiaries of the Bureaucratic State, creator of fiscal illusion). These rents would then interact with and influence the national price system. We may additionally highlight the contribution of economists, such as Sraffa or Amin, who studied how the prices of agricultural goods exported by peripheral nations contributed to the creation of local elites with implications for national economic institutions (Beg 2017). However, the problem of corruption has only known empirical and theoretical developments in recent decades that allow us to address this issue with appropriate empirical methods. Actually, as a result of the efforts of data sources such as 'Transparency International', we now have estimates of the levels of corruption associated with each country or each economic sector, with data mainly since 2000.

However, the causal direction of this complex relationship remains challenging. On the one hand, there are several arguments in favor of corruption as a cause of agricultural price inflation (Section 2.2). On the other hand, many studies demonstrate that corruption is a result of pressures on the prices of agricultural products in certain economies (Section 2.3). The following sections will detail these arguments.

2.1. Corruption as a Cause of Agricultural Price Inflation

The literature has already identified several consequences of corruption. Corruption has real impacts on the development of societies with multidimensional implications (Idrovo et al. 2010), including healthy life expectancy (Islam et al. 2018), public health conditions (Ortega et al. 2016), public finances (Shah et al. 2019), foreign direct investment (Tuzunturk et al. 2018), economic growth (Mensah 2014) and even agricultural prices (Ruengdet and Wongsurawat 2015).

Several studies have found negative relationships between corruption variables and economic growth (Armeanu et al. 2018). Others have identified positive impacts of corruption perceptions on competitiveness (Kisel'akova et al. 2019) and on GDP per capita (Podobnik et al. 2008), even with specific geographical focuses (Simovic 2021).

Another dimension where corruption may have an impact is policy implementation (Bogdanovica et al. 2011) and quality management systems (de Oliveira Neves et al. 2021). If the consequences of corruption are diverse, the causes of a lower level of transparency also vary (Lyeonov et al. 2019) and are sometimes associated with low wages (Nelson and Agrawal 2008). Money laundering, power abuse and corruption are often interlinked (Tang et al. 2018a). Corruption has also been found to be a dynamic process with tendencies to be self-reinforcing (Tang et al. 2018b), namely, with socioeconomic inequality (You and Khagram 2005). However, we also claim that corruption influences the production prices of certain economic sectors, namely, the agricultural sector, as we will examine next.

Most current authors tend to distribute the multiple causes of the various inflationary episodes into two main groups of mechanisms: those acting on aggregate demand or mechanisms acting on the cost system (Dunnett 1990). As studies of corruption began to emerge with special frequency, corruption was identified in both sets of causes of inflation.

On the one hand, corruption tends to increase public spending (Monte and Pennacchio 2020) and create inefficiencies in the public sector (Dzhumashev 2006), contributing to pressures on aggregate demand. Additionally, as pointed out by theorists of the monetarist school, governments are impelled to promote increases in the money supply, inducing direct national inflation and indirect inflation pressure on their primary international economic partners (Dunnett 1990).

The works by Sanz et al. (2020) or Dumbili and Sofadekan (2016) showed how corruption under particular socioeconomic conditions tends to favor certain professional groups, pressuring the rise of their own incomes. The works of Traca and Dutt (2007) found that corruption interferes in the processes that generate import costs. If we know from classical authors such as David Ricardo that rising import costs, such as those of oil, cause inflationary pressures, we also know that different countries react with different domestic inflation rates to the same price escalation in international costs. The works by Laajaj et al. (2019) further analyzed this approach, revealing that corruption mechanisms (whether national or international) cause serious distortions in the prices of import baskets, especially in markets dominated by cartels or oligopolies (Kumar and Stauvermann 2020).

Haberler (1974) already presented the possibility of inflation being caused by structural defects in economies. Invoking the position of the 'structuralist' authors, Haberler (1974) found that the distribution of productive resources, the obstacles to factor mobility, low levels of education and the poor quality of economic structures contributed to mechanisms that tended to additionally pressure prices.

Models such as those by Centorrino and Ofria (2003) argue that more spendthrift states tend to welcome more bureaucrats prone to corruption. Thus, in this assumption, the corrupt public official will tend to seek to 'hide' the damage s/he causes to the state by asking for more public expenditure that will simultaneously help mask the inefficient performance and defend her/himself against the direct diversion of public money in favor of private benefits. The various authors who have studied inflation due to aggregate demand mechanisms converge in the view that pressures on public spending feed inflationary tensions.

However, models, such as those by Dankumo et al. (2019), also show that 'institutionalized corruption' tends to pressure governments to, in addition to increases in public spending, favor certain 'protected' sectors through wage increases and displacement of public and private investment for the associated lobbies. The increase in prices practiced in these production sectors will, thus, be a likely consequence of this 'institutionalized corruption'.

2.2. Corruption as a Consequence of Agricultural Price Inflation

One of the first socioeconomic consequences of rising agricultural prices is the redistribution of income relative to intermediate consumption. The economy tends to observe a significant heterogeneity of producer behaviors. A wide range of factors contribute to this differentiation, from the importance of the sector's final consumption to the structures of competitiveness in the supply of each agricultural sector. Thus, the rise in agricultural prices in sectors that are decisive for a country's Gross Value Added and employment tend to be more immediately realized in the inflation perceived by consumers. Additionally, agricultural sectors supported by oligopolies tend to have a greater capacity to sell their goods at higher prices without a significant loss of final revenue/incomes. Either way, the increase in agricultural prices will tend to cause imbalances in the distribution of income allocated to the various agricultural sectors in a country. Thus, in line with Dincer and Gunalp (2008), increases in income disparities provide incentives that induce corruption.

As Haberler (1974) also suggested, rapid inflation and inflation of certain structural products such as agricultural goods have consequences at various economic levels. Traditionally, these consequences were located in (low) economic growth and capital flight abroad; we have added to these effects, as a result of our work, the generation of corruption.

Specifically, as Haberler (1974) points out, inflation tends to discourage savings, motivates the diversion of investments abroad and distorts future investment intentions.

However, as Haberler (1974) already found for the 1960s and 1970s, billions of dollars of residents of countries with high inflation rates tend to be shifted, officially and unofficially, to foreign banks such as those in the United States, the European Union or, above all, to tax havens. Unofficial capital flows are associated with mechanisms that easily generate corruption. As Tyavambiza (2017) or Pupovic (2012) established, facilitating such capital movements in a timely manner results in a tendency to bribe employees in the banking system of origin (Pupovic 2012), to appeal to the forgery of documents (Tyavambiza 2017) or to stimulate the circulation of resources in parallel economies (Lehman and Thorne 2015).

However, Tatum (2010) also showed that, in their eagerness to fight inflation, many governments chose to control the symptoms of inflation through import quotas, control of exchange rate policy and the definition of more complex bilateral trade policies. These choices tend to cause the growth of bureaucracy and formalism, identified by Laajaj et al. (2019) as mechanisms that encourage corruption.

Additionally, to fight inflation, governments tend to promote the control of public utility services, accelerating the regulation of railways, production and distribution of electricity and communications. The traditional consequences of attacking the symptoms of inflation through these regulatory processes are the following: the reduction in the profit of companies operating in these sectors, the underinvestment in the same sectors and the nationalization of companies thus disinvested but considered essential for the country. The long-term consequence is measured by the reduction in the competitiveness of these sectors in the national economy and by the generation of 'public monopolies' that are attractive for the generation of unofficial rents under an institutional framework that does not clearly punish corrupt practices in these sectors.

2.3. Synthesis of the Relationship between Corruption and Producer Price Indices—The Importance of a Study Focused on Agricultural Goods

We have verified that the literature does not clarify the causal relationship between corruption and the evolution of price indices in an economy. However, the relationship between these dimensions is significant, as there is abundant literature linking more corruption with pressures on national price indices.

On the one hand, the literature recognizes that economies characterized by significant dimensions of corruption tend to keep the price system under pressure. Extracting groups in economies that harbor higher levels of corruption tend to put pressure on aggregate demand, which leads to higher prices at the end of the process. Additionally, the same groups that promote corruption put pressure on production costs, which also tends to drive up the prices of the most exposed sectors. These are the conclusions of authors as diverse as Sanz et al. (2020), Dumbili and Sofadekan (2016) and Traca and Dutt (2007).

On the other hand, authors such as Laajaj et al. (2019) also recognize that the rise in price indices—whether Producer Price Indices or consumer price indices—deteriorates the purchasing power of economic agents, promotes the exit of capital of the economy in question and facilitates the emergence of corruption schemes to circumvent the difficulties experienced by the same economic agents in production or consumption decisions.

2.4. Corruption and Prices of Agricultural Products—The Working Hypothesis

Thus, in the remainder of this paper, we will analyze this issue in detail for 90 countries between 2000 and 2020. We will focus on a certain set of Producer Price Indices for agricultural products.

We present three main reasons for this focus. The first reason is related to the importance of these goods for most economies. Studies such as those by Radukic et al. (2015) have shown how the prices of agricultural goods continue to significantly influence the evolution of prices in general in economies, even those supported mainly by the service sector.

The second reason is the sublimated importance of these goods for emerging economies, where the weight of agricultural production is significantly greater than the weight of agricultural production in the gross domestic product of industrialized or tertiary economies. Additionally, these economies have important oligopolistic structures linked to the production and distribution of agricultural goods (Maes et al. 2016). As a result, it is important to look with special attention to the agricultural sector if we intend to study in detail the link between corruption and price developments.

Finally, the prices of agricultural goods tend to more clearly reflect the structures that generate market imperfections (Konefal et al. 2005). Thus, since corruption tends to be seen as an important source of various imperfections in the different markets where it is observed, it is important to choose the focus on agricultural markets that will tend to better reflect these impacts. The next section will present some indicators available to monitor corruption worldwide as well as Producer Price Indices for agricultural goods.

2.5. Corruption Measures and Agricultural Price Indices

The work of Klitgaard (2015) synthesizes several sources and several indicators that currently detail the phenomenon of corruption on an international scale. Such diversity is the result of growing attention to corruption, which is also understood as a significant source of economic and social costs. However, this diversity does not prevent the identification of a more limited number of indicators that have been preferred by the academic community. These indicators include the Corruption Perception Index (produced by Transparency International) and the Control of Corruption (as a subitem of the project 'World Governance Indicators' by Kaufmann et al. (2010)).

2.5.1. CPI, Control of Corruption, and Percentile Rank

The Corruption Perception Index (CPI) is a multicriteria indicator (Onuferova et al. 2020) that appears to be relevant for ranking countries worldwide (Clem 2011). Alternatively, the level of corruption may be measured through the Control of Corruption Index (Ruiz Morillas 2016). The CPI is also considered an important indicator to monitor the financial system (Dekhtyar et al. 2019), to assess public welfare (Kozlovskyi et al. 2020) and as a proxy for vulnerability to rent-seeking events (Mukherjee and Chakraborty 2013).

The "Corruption Perception Index" is thus an index that evaluates the perception of communities in each country in relation to corruption practices. Perceptions are not necessarily facts. Perceptions of corruption, however, have been found to be negatively correlated with per capita income or average income; therefore, the lower the CPI, the greater the perception—and likelihood—of corruption. It has been observed in several studies that higher levels of perception actually correspond to higher levels of corruption, not because they are just opinions but because they are associated with lower levels of development, weaker institutions, various precariousness and lower levels of trust between members of the same society (Kozlovskyi et al. 2020; Mukherjee and Chakraborty 2013).

In 2020, the countries with the highest CPI scores were New Zealand and Denmark (with a score of 88 points), Finland, Switzerland, Singapore and Sweden (with a score of 85 points) and Norway (with a score of 84 points). In contrast, Somalia and South Sudan (with a score of 12 points), Syria (with a score of 14 points) and Yemen and Venezuela (with a score of 15 points) were the countries with the lowest CPI scores for 2020. We can also state that during the period 2012–2020, there was relative stability across the top- and bottom-ranked countries.

In 2012, of the 180 countries analyzed, 52 had a score equal to or greater than 50 points (approximately 28% of the population). We can thus conclude that over the years, there has been an increasing number of countries presenting a positive score (50 or more points): for the year 2020, the average score was 43.34 points, while for 2012, the average score was 43.15 points.

2.5.2. Control of Corruption

The "Control of Corruption" indicator was developed within the "World Governance Indicators" project of the research team of Kaufmann et al. (2010).

According to the official source, "Control of Corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. A country's score on the aggregate indicator is estimated in units of a standard normal distribution, i.e., ranging from approximately −2.5 to 2.5".

For 2019, the countries that presented the highest coefficients for controlling corruption were New Zealand, Singapore, Finland, Sweden, Luxembourg, Denmark, Norway and the Netherlands. All these countries had a coefficient greater than two. In contrast, South Sudan, Equatorial Guinea, Somalia, Syria, Yemen, Libya, North Korea, the Democratic Republic of Congo, Turkmenistan and Venezuela were the countries with the worst results, with coefficients equal to or less than −1.5. In 1996, Denmark, Finland, Sweden, Norway, New Zealand, Singapore, the Netherlands and Canada were the countries with coefficients equal to or greater than two. From another perspective, the Democratic Republic of Congo, Iraq, Georgia, Myanmar and Liberia were considered the worst countries at controlling corruption with coefficients equal to or less than −1.5. During this period, we were able to verify that most of the countries that presented the best coefficients in the control of corruption maintained those values over 23 years. The number of countries that have a coefficient equal to or less than −1.5 has tended to increase over the years.

We can also verify that in 2019, of the 214 countries under analysis, 88 had a positive coefficient (approximately 41% of the population sample). However, in 1996, 79 of the 214 had a positive coefficient (approximately 37% of the population), an increase of 4% in the number of countries with a positive coefficient in the control of corruption.

2.5.3. Percentile Rank

The observation of the indicator related to "Control of Corruption" can lead to certain biases (Kaufmann et al. 2010). Hence, there is the recurring suggestion to analyze the respective "Percentile Rank" instead of the isolated value of "Control of Corruption". According to the original source, "Control of Corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. Percentile rank indicates the country's rank among all countries covered by the aggregate indicator, with 0 corresponding to lowest rank and 100 to highest rank. Percentile ranks have been adjusted to correct for changes over time in the composition of the countries covered by the WGI".

In 1996, 19 of the 214 countries (which corresponds to 9% of the sample population) had a percentile rank above 90. The three countries with the highest percentile rank are Bolivia, Brazil and Barbados. On the other hand, the countries with the lowest percentile rank are Zimbabwe, Zambia and the Democratic Republic of Congo. In that same year, 94 countries had a percentile rank above 50 (approximately 44% of the sample population). However, for 27 countries, it was not possible to obtain information.

In 2006, 21 of the 214 countries (approximately 10% of the sample population) had a percentile rank above 90. The countries with the lowest percentile rank were Zimbabwe, Zambia and the Democratic Republic of Congo. We can see that after 10 years, the countries with the worst percentile rank remained the same. In that year, 103 countries had a percentile rank above 50 (approximately 48% of the sample population).

In 2019, the number of countries with a percentile rank above 90 was maintained. In contrast, the countries with the worst scores were Zimbabwe, Zambia and the Democratic Republic of Congo.

2.6. Price Indices in Agriculture and the Evolution of Corruption—An X-ray of the Evolution in Several Countries

The agricultural prices quantify the annual changes in the prices paid to the farmers (prices at the farm level or at the starting selling point in the agricultural chain). The Producer Price Indices according to the Food and Agriculture Organization of the United Nations/FAO (2001) are calculated dividing the current year prices by the base period prices (in our case 2014–2016). We carried out a survey of all agricultural prices available in the FAO databases. However, considering per capita consumption, we preferred to develop an analysis of the prices of the 19 most relevant agricultural products in most countries. Therefore, we will consider in this analysis the price evolution of apples, bananas, barley, cassava, cucumbers and gherkins, grapes, maize, oil palm fruit, onions dry, oranges, potatoes, rice paddy, soybeans, sugar beet, sugarcane, sweet potatoes, tomatoes, melons and wheat. Let us briefly observe the distribution of these prices, taking the example of the African continent.

The evolution of agricultural prices on the African continent has been analyzed in research such as Wanjiku et al. (2016) and Binswanger-Mkhize et al. (2010). Countries that reflect the dynamics of the evolution of agricultural prices on the African continent are Nigeria and Zimbabwe.

In 2000, Nigeria had a price index of 71.05 for onions, 48.85 for potatoes and 29.15 for tomatoes, with a CPI of 1.2 points. After 6 years, the onion price index rose to 112.05, the potato price index rose to 65.51 and the tomato price index rose to 62.03, while the CPI score also increased from 1.2 to 2.2 points. Finally, in 2018, the index of these three agricultural products stood at 76.92, and the value of the CPI stood at 27 points.

Zimbabwe is an interesting country with a highly volatile agricultural price index. In 2000, its price index for onions was 2.74, for potatoes was 48.44 and for tomatoes was 3.25 (it is worth noting that Zimbabwe had a CPI score of 3 points at the time). In 2006, and with a decrease in the CPI to 2.4 points, the indices of those three agricultural products experienced a significant increase. The onion price index was 11,002.22, that of potato was 24,978.22 and of tomato was 96,716.51. In 2017, prices moved in the opposite direction, with a relevant drop in the three indices. The onion price index was 100.53, the potato price was 117.47, and the tomato price was 146.78. The CPI value was 22 points.

3. Hypotheses, Data and Empirical Equation

From the above discussion, we recall that we intend to test the relationship of corruption levels and the evolution of production prices in the agricultural sector of diverse economies in this paper. Therefore, we will analyze panel data specifications starting from Equation (1):

$$y_{it} = \mathrm{x}_{it}'\beta_i + \mathrm{z}_{it}'\gamma_i + e_{it} \tag{1}$$

In Equation (1), countries are indicated by i, and time is indicated by t. In this empirical study and from the above discussion, we will test two different directions.

Considering the direction suggested by Dincer and Gunalp (2008) and Tatum (2010), i.e., corruption is caused by price evolution, y designates each 'proxy' for corruption, and x designates a vector of production prices. In the direction suggested by Sanz et al. (2020), Laajaj et al. (2019), and Kumar and Stauvermann (2020), i.e., corruption influences production prices, y is the vector of certain production prices, and x relates to the Corruption Indicators. Here, β is the corresponding vector of coefficients to be estimated for the x-vector; z describes a vector of control variables, where Υ_i is the respective vector of estimated coefficients.

As described, we will use three indicators for corruption: the Corruption Perception Index, the level of Control of Corruption and the percentile rank of Control of Corruption. To study the evolution of agricultural inflation, let us look at the pProducer Price Index of our sample of agricultural products. We will look at 90 countries since 2000. Our 90 countries are: Angola, Argentina, Armenia, Australia, Austria, Azerbaijan, Belarus, Belgium, Bolivia (Plurinational State of), Botswana, Brazil, Bulgaria, Burkina Faso, Cameroon, Canada, Chile, China, Colombia, Costa Rica, Cote d'Ivoire, Croatia, Czechia, Denmark, Ecuador, Egypt, El Salvador, Estonia, Ethiopia, Finland, France, Germany, Ghana, Greece, Hong Kong, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Japan, Jordan, Kazakhstan, Kenya, Latvia, Lithuania, Luxembourg, Malawi, Malaysia, Mauritius, Mexico, Morocco, Mozambique, Namibia, Netherlands, New Zealand, Nigeria, Norway, Peru, Philippines, Poland, Portugal, Republic of Korea, Republic of Moldova, Romania, Russian Federation, Senegal, Singapore, Slovakia, Slovenia, South Africa, Spain, Sweden, Switzerland, Taiwan, Thailand, Tunisia, Turkey, Uganda, Ukraine, United Kingdom of Great Britain and Northern Ireland, United Republic of Tanzania, United States of America, Uzbekistan, Venezuela (Bolivarian

Republic of), Vietnam, Yugoslavia, Zambia and Zimbabwe. The descriptive statistics of these variables, as well as the respective sources, are shown in Table 1.

Table 1. Descriptive Statistics.

Variable	Observations	Mean	Std. Deviation	Minimum	Maximum
Corruption Perception Index (cpi)	1890	22.99538	25.97975	0.0000872	92
Control of Corruption	1890	0.3023958	1.066263	−1.52	2.47
Control of Corruption (percentile rank)	1890	56.75673	29.58121	0.0003891	100
apples	1890	464.4982	11,154.5	0.00000247	336,501.1
bananas	1890	255.4008	5999.226	0.00000219	180,300.1
barley	1890	55.35064	47.62522	0.0001151	195.81
cassava	1890	22.96647	44.79801	0.000000439	505
cucumbers and gherkins	1890	281.7146	5941.807	0.0000231	178,323.5
grapes	1890	151.6874	2821.976	0.0000222	84,696.94
maize	1890	113.8439	1687.538	0	69,435.37
oil palm fruit	1890	13.2718	50.19763	0.00000226	1233.59
onions dry	1890	529.9577	12,596.02	0.00000345	379,513.9
oranges	1890	133.5039	2520.897	0.00000213	75,506.17
potatoes	1890	299.2566	6254.74	0.00000117	187,020.8
rice paddy	1890	39.25667	46.38307	0.000000228	200.94
soybeans	1890	860.3369	22,180.81	0.0000274	669,268.9
sugar beet	1890	45.11226	53.51277	0.00000342	262.16
sugarcane	1890	191.4717	5601.529	0	231,040.9
sweet potatoes	1890	444.5301	11,111.4	0.00000320	334,522.1
tomatoes	1890	450.173	10,229.83	0.0000167	307,122.4
melons	1890	44.94437	61.15798	0.00000557	1017.68
wheat	1890	564.426	13,593.78	0.00000507	408,938.1

We have already commented on the main values in Table 1 in the previous sections. For instance, we recall the highest values of the inflation indexes are related to African economies such as Nigeria and Zimbabwe. The most worrying corruption values are attributed to economies such as the Democratic Republic of Congo, Iraq, Georgia, Myanmar and Liberia.

The empirical analysis of Equation (1) consists of the following steps:

- Analysis of the results of tests relating to the 'slope homogeneity tests and cross-sectional dependence tests';
- Analysis of Panel Unit Root tests;
- Analysis of Panel Cointegration tests;
- Analysis of Panel Causality tests;
- Analysis of Panel Estimation results.

3.1. Slope Homogeneity Tests and Cross-Sectional Dependency

Taking into account the proper steps of an empirical analysis considering the nature of these data, we need to first test the homogeneity of the slope coefficients. The null hypothesis for this test is that all (individual) equations in Equation (1)'s β are the same (Pesaran and Yamagata 2008). Rejecting the null and following Hoyos and Sarafidis (2006), we then test for cross-sectional dependence. These two steps are crucial for model specification and for estimation method selection. Tables 2 and 3 show us that for the generality of cases, we cannot accept the null hypothesis of slope coefficients being homogeneous.

Table 2. Tests on slope coefficients' homogeneity (Pesaran and Yamagata 2008).

	Corruption Perception Index		**Control of Corruption (Levels)**		**Control of Corruption (Percentiles)**	
Production Price Index	**delta**	**adj.**	**delta**	**adj.**	**delta**	**adj.**
apples	9.692 ***	10.469 ***	2.541 **	2.745 ***	3.541 ***	3.825 ***
bananas	10.348 ***	11.177 ***	0.941	1.016	1.517	1.638
barley	5.244 ***	5.664 ***	4.313 ***	4.659 ***	3.719 ***	4.017 ***
cassava	1.253	1.353	2.589 ***	2.797 ***	2.901 ***	3.134 ***
cucumbers and gherkins	14.171 ***	15.307 ***	3.278 ***	3.540 ***	4.625 ***	4.995 ***
grapes	7.589 ***	8.197 ***	2.423 **	2.617 ***	3.009 ***	3.251 ***
maize	6.234 ***	6.733 ***	5.091 ***	5.498 ***	4.794 ***	5.178 ***
oil palm fruit	0.115	0.124	0.829	0.895	0.674	0.729
onions dry	13.458 ***	14.537 ***	2.812 ***	3.037 ***	3.258 ***	3.519 ***
oranges	9.136 ***	9.868 ***	3.356 ***	3.625 ***	2.757 ***	2.978 ***
potatoes	13.767 ***	14.870 ***	5.245 ***	5.665 ***	5.130 ***	5.541 ***
rice paddy	3.526 ***	3.809 ***	5.146 ***	5.558 ***	4.374 ***	4.725 ***
soybeans	12.933 ***	13.969 ***	5.753 ***	6.214 ***	5.876 ***	6.347 ***
sugar beet	11.138 ***	12.031 ***	5.514 ***	5.956 ***	5.825 ***	6.292 ***
sugarcane	2.492 **	2.692 ***	−0.232	−0.251	−0.278	−0.300
sweet potatoes	8.963 ***	9.681 ***	2.391 **	2.583 ***	2.441 **	2.637 ***
tomatoes	19.114 ***	20.646 ***	6.472 ***	6.990 ***	7.088 ***	7.655 ***
melons	8.014 ***	8.656 ***	3.507 ***	3.788 ***	3.221 ***	3.479 ***
wheat	12.593 ***	13.602 ***	5.415 ***	5.848 ***	4.749 ***	5.130 ***

Note: the reported value relates to each test's specification given by a different dependent variable and a different independent variable. In this table, the dependent variable is the Corruption Indicator, in column; and the independent variable is the Production Prices Index, in row; significance level—1%, ***; 5%, **.

Table 3. Tests on slope coefficients' homogeneity (Pesaran and Yamagata 2008).

	Corruption Perception Index		**Control of Corruption (Levels)**		**Control of Corruption (Percentiles)**	
Production Price Index	**delta**	**adj.**	**delta**	**adj.**	**delta**	**adj.**
apples	−5.210 ***	−5.627 ***	−6.266 ***	−6.768 ***	−5.954 ***	−6.431 ***
bananas	−3.445 ***	−3.721 ***	−6.209 ***	−6.706 ***	−6.040 ***	−6.524 ***
barley	11.260 ***	12.162 ***	2.091 **	2.258 **	1.547	1.671 *
cassava	4.794 ***	5.178 ***	−1.042	−1.125	−0.689	−0.745
cucumbers and gherkins	−3.346 ***	−3.614 ***	−5.960 ***	−6.438 ***	−5.348 ***	−5.776 ***
grapes	−1.832 *	−1.979 **	−5.218 ***	−5.636 ***	−4.264 ***	−4.606 ***
maize	3.271 ***	3.533 ***	1.997 **	2.157 **	1.056	1.140
oil palm fruit	−4.568 ***	−4.934 ***	−4.786 ***	−5.170 ***	−4.850 ***	−5.239 ***
onions dry	−5.315 ***	−5.741 ***	−6.385 ***	−6.897 ***	−6.066 ***	−6.552 ***
oranges	0.072	0.078	−4.857 ***	−5.246 ***	−4.415 ***	−4.768 ***
potatoes	−3.086 ***	−3.334 ***	−5.726 ***	−6.185 ***	−5.319 ***	−5.745 ***
rice paddy	9.382 ***	10.134 ***	2.170 **	2.343 **	1.627	1.757 *

Table 3. *Cont.*

	Corruption Perception Index		Control of Corruption (Levels)		Control of Corruption (Percentiles)	
soybeans	−6.003 ***	−6.484 ***	−6.526 ***	−7.049 ***	−6.500 ***	−7.021 ***
sugar beet	8.504 ***	9.185 ***	3.195 ***	3.451 ***	2.893 ***	3.125 ***
sugarcane	−4.466 ***	−4.824 ***	−6.026 ***	−6.508 ***	−5.754 ***	−6.215 ***
sweet potatoes	−5.216 ***	−5.634 ***	−6.409 ***	−6.922 ***	−6.334 ***	−6.841 ***
tomatoes	−4.590 ***	−4.958 ***	−6.216 ***	−6.714 ***	−5.707 ***	−6.165 ***
melons	11.022 ***	11.905 ***	0.653	0.705	0.573	0.619
wheat	−3.606 ***	−3.895 ***	−5.784 ***	−6.248 ***	−3.474 ***	−3.752 ***

Note: the reported value relates to each test's specification given by a different dependent variable and a different independent variable. In this table, the dependent variable is the Production Prices Index, in row; and the independent variable is the corruption indicator, in column; significance level—1%, ***; 5%, **; 10%, *.

Consequently, and as stated, we have to also analyze cross-sectional dependence. For this purpose (Mehmet et al. 2014), we will run the test proposed by Pesaran (2007). Its null hypothesis is $Cov(\varepsilon_{it}, \varepsilon_{ij}) \neq 0$. As referred to by Mehmet et al. (2014), in the first generation of panel unit root tests (such as Levin et al. (2002), Breitung (2000), Im et al. (2003), Hadri (2000)), cross-sectional dependence can introduce significant bias. If there is cross-sectional dependence in panel data, the more appropriate unit root tests are IPS (IPS 2003) and Pesaran (2003). Tables 4 and 5 show us that for most of our series, we have to recognize the presence of cross-sectional dependence.

Table 4. Test for cross-sectional dependence (Pesaran 2007).

	Corruption Perception Index		Control of Corruption (Levels)		Control of Corruption (Percentiles)	
Production Price Index	**test val**	***p*-val**	**test val**	***p*-val**	**test val**	***p*-val**
apples	236.421	0.0000	2.668	0.0076	−0.045	1.0357
bananas	236.402	0.0000	2.669	0.0076	−0.043	1.0345
barley	239.905	0.0000	1.916	0.0554	−0.022	1.0175
cassava	233.157	0.0000	2.291	0.0220	−0.260	1.2054
cucumbers and gherkins	236.445	0.0000	2.668	0.0076	−0.044	1.0352
grapes	236.463	0.0000	2.668	0.0076	−0.045	1.0360
maize	236.595	0.0000	2.654	0.0079	−0.065	1.0516
oil palm fruit	236.468	0.0000	2.526	0.0115	−0.114	1.0911
onions dry	236.407	0.0000	2.668	0.0076	−0.044	1.0353
oranges	236.427	0.0000	2.670	0.0076	−0.044	1.0349
potatoes	236.453	0.0000	2.670	0.0076	−0.043	1.0342
rice paddy	237.065	0.0000	1.649	0.0991	−0.420	1.3255
soybeans	236.393	0.0000	2.668	0.0076	−0.044	1.0352
sugar beet	236.216	0.0000	4.413	0.0000	1.943	0.0520
sugarcane	236.595	0.0000	2.658	0.0079	−0.056	1.0448
sweet potatoes	236.407	0.0000	2.668	0.0076	−0.044	1.0348
tomatoes	236.415	0.0000	2.669	0.0076	−0.044	1.0349
melons	234.054	0.0000	3.082	0.0021	0.693	0.4881
wheat	236.402	0.0000	2.670	0.0076	−0.044	1.0350

Note: the reported value relates to each test's specification given by a different dependent variable and a different independent variable. In this table, the dependent variable is the Corruption Indicator, in column; and the independent variable is the Production Prices Index, in row.

Table 5. Test for cross-sectional dependence (Pesaran 2007).

	Corruption Perception Index		**Control of Corruption (Levels)**		**Control of Corruption (Percentiles)**	
Production Price Index	**test val**	***p*-val**	**test val**	***p*-val**	**test val**	***p*-val**
apples	235.490	0.0000	7.739	0.0000	9.943	0.0000
bananas	226.483	0.0000	5.582	0.0000	3.443	0.0006
barley	102.659	0.0000	101.153	0.0000	99.166	0.0000
cassava	79.245	0.0000	11.417	0.0000	14.635	0.0000
cucumbers and gherkins	235.435	0.0000	27.515	0.0000	28.696	0.0000
grapes	229.499	0.0000	36.014	0.0000	32.024	0.0000
maize	193.648	0.0000	107.159	0.0000	102.579	0.0000
oil palm fruit	146.977	0.0000	0.467	0.6403	1.015	0.3101
onions dry	231.305	0.0000	8.448	0.0000	9.111	0.0000
oranges	203.245	0.0000	19.607	0.0000	16.027	0.0000
potatoes	233.712	0.0000	33.014	0.0000	31.971	0.0000
rice paddy	66.012	0.0000	47.069	0.0000	53.921	0.0000
soybeans	232.530	0.0000	1.225	0.2206	0.028	0.9780
sugar beet	90.293	0.0000	35.230	0.0000	34.817	0.0000
sugarcane	219.527	0.0000	6.927	0.0000	3.716	0.0002
sweet potatoes	228.577	0.0000	2.600	0.0093	1.248	0.2119
tomatoes	233.134	0.0000	14.518	0.0000	16.432	0.0000
melons	73.425	0.0000	56.671	0.0000	55.931	0.0000
wheat	233.177	0.0000	7.047	0.0000	7.926	0.0000

Note: the reported value relates to each test's specification given by a different dependent variable and a different independent variable. In this table, the dependent variable is the Production Prices Index, in row; and the independent variable is the corruption indicator, in column.

3.2. Unit Root Tests

To explore the presence of unit roots with panel data, several tests suggested by the literature are currently used. Various authors suggested a combined reading of several of the tests under discussion. We used the following tests: Levin et al. (2002), Breitung (2000); Breitung and Das (2005), Phillips–Perron–PP–Fisher (Choi 2001) and Hadri (2000) tests, all first-generation tests, and Pesaran (2003) and Im–Pesaran–Chin/IPS (2003), second-generation tests. Based on a panel model with a first-order autoregressive component, we generalize the objective of these tests by introducing Equation (2):

$$y_{it} = \delta_i \times y_{i,\,t-1} + \gamma_i \times z_{it} + \epsilon_{it} \tag{2}$$

In Equation (2), δ_i represents the autocorrelation coefficients for each Panel i; γ_i is the coefficient vector of the deterministic term that controls the specific panel effects and the time trend. The null hypothesis of the Levin–Liu–Chu test is that the series contains a unit root, and the alternative is that the series is stationary. The Breitung and PP Fisher unit root tests are used to test the null hypothesis of the existence of a unit root for all panels ($\delta_i = 1$). The Breitung test establishes a simplifying hypothesis that all panels share the same autocorrelation coefficient ($\delta_i = \delta$) and assumes that the error ϵ_{it} is not correlated between i and t. In this test, stationarity for all panels is assumed to be an alternative hypothesis ($\delta < 1$).

In a different way, the PP Fisher test considers that each panel has a specific autocorrelation coefficient and assumes as an alternative hypothesis the stationarity of at least one panel ($\delta_i < 1$ of at least one i). Unlike the two previous tests, Hadri (2000) proposes a Lagrange multiplier test based on residuals (Hadri LM) that assumes as a null hypothesis that all panels are stationary and as an alternative hypothesis that at least one panel includes a unit root.

Following Pesaran (2007), Pesaran (2003) can be introduced in the following way. The null hypothesis tests the presence of (homogeneous nonstationary) slopes H0: $b_i = 0$ for all i against the possibly heterogeneous alternatives:

$$H1\text{: } b_i < 0,\ i = 1, 2, \ldots, N_1$$

$$b_i = 0,\ i = N_1 + 1, N_1 + 2, \ldots, N$$

However, b_i is now tested in a cross-sectionally augmented DF (CADF) regression:

$$\Delta y_{it} = a_i + b_i \times y_{i,t-1} + c_i \times MEAN\_y_{t-1} + d_i \times MEAN\_\ \Delta y_{it} + e_{it}$$

Converging to the Im, Pesaran and Shin (IPS 2003) test, the test of Pesaran (2003) is based on the mean of individual DF (or ADF) t statistics of each unit in the panel. Its null hypothesis assumes that all series are nonstationary.

Tables 6 and 7 reveal in common the p values for each of the tests on different specifications of our series: series in levels, first differences in the series, with trend, without constant in the original test regression or 'demeaned'. Additional details (on the number of lags used, the criteria for selecting the number of lags, the definition of the 'kernel', etc.) will be made available upon request.

For the various variables in levels, without constants in the test regressions or with the 'demeaned' series, the results of the unit root tests show convergent readings. Thus, they tend to reject the respective null hypotheses for the series in levels, for the series with no constant in the test regressions or for the 'demeaned' series. Including a trend in the test specification, the generality of the p-values in Table 6 tends to accept the null hypothesis of a unit root. In the PP Fisher and Hadri LM tests, the respective null hypotheses are rejected, which suggests the existence of stationarity or unit root, respectively, in at least one panel. For the first differences in the variables, the nonrejection of the null hypothesis of the Breitung test suggests that the generality of panels has a unit root. Under the PP Fisher test, the null hypothesis of unit root for all panels is rejected, so the results suggest that at least one panel is stationary. In the Hadri LM test, the null hypothesis tends not to be rejected, which leads to the conclusion that the generality of panels are likely stationary. Even the second-generation tests (IPS 2003; Pesaran 2003) converge with the conclusions from the first-generation tests (Table 7).

Thus, despite the diversity of the specifications of the respective tests, as well as the diversity of the variables under analysis, it seems appropriate to conclude that the variables in levels are not stationary.

Table 6. Panel unit-root tests (1st-generation tests).

	Fisher						Hadri LM			Levin–Liu–Chu				Breitung			
	Dfuller			Pperron													
Variable	**Levels**	**Trend**	**Demean**	**Levels**	**Trend**	**Demean**	**Levels**	**Trend**	**Demean**	**Levels**	**Trend**	**No_Constant**	**Demean**	**Levels**	**Trend**	**No_Constant**	**Demean**
cpi	1.0000	0.9054	1.0000	1.0000	0.9990	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0979	0.7149	0.0000	0.8829	0.0992
d.cpi	0.0000	0.0084	0.0000	0.0000	0.0000	0.0000	1.0000	0.0360	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
apples	0.0000	0.0000	0.1161	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.6336	1.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000
d.apples	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000
bananas	0.0000	0.0004	0.0922	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.9739	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000
d.bananas	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000
barley	0.0136	0.9958	0.9621	0.0000	0.0000	0.0005	0.0000	0.0000	0.0000	0.9278	1.0000	0.0000	0.1725	0.0000	1.0000	0.0000	0.0000
d.barley	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.5760	1.0000	1.0000	0.0000	0.8553	0.0000	1.0000	0.0000	0.0000
cassava	0.0000	0.0000	0.0000	0.0000	0.0000	0.8107	0.0000	0.0000	0.0000	0.0000	0.6228	0.0000	0.6732	0.0000	1.0000	0.0000	0.0000
d.cassava	0.0000	0.0000	0.5982	0.0000	0.0000	0.0000	0.5772	0.0000	0.9381	0.0000	0.0000	0.0000	1.0000	0.0000	0.9420	0.0000	0.0000
cucumbers and gherkins	0.0000	0.0957	0.0841	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.9688	1.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000
d.cucumbers and gherkins	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000
grapes	0.0000	0.0317	0.0822	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1028	1.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000
d.grapes	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0015	0.9207	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000
maize	0.9902	1.0000	0.0000	0.0099	1.0000	0.0000	0.3872	0.0000	0.3849	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000
d.maize	0.0002	0.0336	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0151	0.5742	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
oil palm fruit	0.0000	0.0000	1.0000	0.0000	0.0000	0.0070	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0052	0.0000	0.0000
d.oil palm fruit	0.0000	0.0000	0.0000	0.0000	0.0000	0.5198	1.0000	0.9998	1.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000
onions dry	0.0314	0.6389	0.1067	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.9017	1.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000
d.onions dry	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.3235	0.9790	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000
oranges	0.0000	0.0718	0.0784	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	1.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000
d.oranges	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0021	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000
potatoes	0.0005	0.9984	0.0527	0.0000	0.0006	0.0000	0.0000	0.0000	0.0000	0.9915	1.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000
d.potatoes	0.0000	0.0542	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000
rice paddy	0.0000	0.0000	0.8495	0.0000	0.0000	0.8032	0.0000	0.0000	0.0000	0.0012	1.0000	0.0000	0.9999	0.0000	1.0000	0.0000	0.0000
d.rice paddy	0.0000	0.0000	0.0118	0.0000	0.0000	0.0000	0.0000	0.0000	0.2246	0.0099	0.9909	0.0000	1.0000	0.0000	1.0000	0.0000	0.0000
soybeans	0.0022	0.9944	0.1167	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.4474	1.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000
d.soybeans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0186	0.7946	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000

Table 6. *Cont.*

	Fisher						Hadri LM			Levin–Liu–Chu				Breitung			
	Dfuller			Pperron													
Variable	**Levels**	**Trend**	**Demean**	**Levels**	**Trend**	**Demean**	**Levels**	**Trend**	**Demean**	**Levels**	**Trend**	**No_Constant**	**Demean**	**Levels**	**Trend**	**No_Constant**	**Demean**
sugar beet	0.0017	0.6428	1.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.5952	1.0000	0.0000	1.0000	0.0000	1.0000	0.0000	0.0031
d.sugar beet	0.0000	0.0000	0.2428	0.0000	0.0000	0.0000	0.0000	0.0000	0.1511	0.0000	0.0161	0.0000	1.0000	0.0000	1.0000	0.0000	0.0000
sugarcane	0.0016	0.6825	0.0000	0.0000	0.0000	0.0000	0.5272	0.0000	0.5264	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000
d.sugarcane	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
sweet potatoes	0.0000	0.0000	0.0930	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000
d.sweet potatoes	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0001	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000
tomatoes	0.0957	1.0000	0.0870	0.0000	0.5933	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000
d.tomatoes	0.0085	0.8579	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000
melons	0.0000	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	1.0000	0.0000	0.0208	0.0000	1.0000	0.0000	0.0000
d.melons	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.9951	0.0106	1.0000	0.0000	0.6863	0.0000	1.0000	0.0000	1.0000	0.0000	0.0000
wheat	0.1802	1.0000	0.0887	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.9945	1.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000
d.wheat	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000
Control of corruption	0.0408	0.0055	0.0526	0.0003	0.0478	0.0080	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0078	0.0000	0.0002	0.0176
d.control of corruption	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.9993	0.9783	0.9989	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
percentile rank	0.0149	0.1535	0.0690	0.0000	0.0518	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3025	0.0000	0.0001	0.0000	0.3189	0.0001
d.percentile rank	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.9989	0.9861	0.9980	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Legend: d.[var], first differences of [var]; otherwise, levels of [var].

Table 7. Panel unit-root tests (2nd-generation tests).

	Pesaran 2003						IPS 2003							
	Levels		Trend		Demean		Levels				Trend			
Variable	***z* Value**	***p* Value**	***z* Value**	***p* Value**	***z* Value**	***p* Value**	**Cips**	**10%**	**5%**	**1%**	**Cips**	**10%**	**5%**	**1%**
cpi	−4.797	0.000	0.834	0.798	−4.797	0.000	−2.955	−2.01	−2.07	−2.17	−3.040	−2.51	−2.56	−2.66
d.cpi	−5.903	0.000	−6.763	0.000	−5.903	0.000	−4.104	−2	−2.07	−2.18	−4.518	−2.51	−2.57	−2.7
apples	−0.250	0.401	6.474	1.000	−0.250	0.401	−2.840	−2.01	−2.07	−2.17	−2.603	−2.51	−2.56	−2.66
d.apples	−1.174	0.120	3.292	1.000	−1.174	0.120	−3.364	−2	−2.07	−2.18	−3.528	−2.51	−2.57	−2.7
bananas	−2.168	0.015	4.897	1.000	−2.168	0.015	−3.330	−2.01	−2.07	−2.17	−3.117	−2.51	−2.56	−2.66
d.bananas	−3.394	0.000	2.617	0.996	−3.394	0.000	−4.149	−2	−2.07	−2.18	−4.122	−2.51	−2.57	−2.7
barley	−0.475	0.317	8.670	1.000	−0.475	0.317	−2.883	−2.01	−2.07	−2.17	−2.513	−2.51	−2.56	−2.66
d.barley	0.529	0.702	4.821	1.000	0.529	0.702	−3.976	−2	−2.07	−2.18	−4.142	−2.51	−2.57	−2.7
cassava	−4.459	0.000	1.415	0.921	−4.459	0.000	−3.831	−2.01	−2.07	−2.17	−3.756	−2.51	−2.56	−2.66
d.cassava	−10.124	0.000	−6.506	0.000	−10.124	0.000	−5.354	−2	−2.07	−2.18	−5.435	−2.51	−2.57	−2.7
cucumbers and gherkins	0.435	0.668	11.018	1.000	0.435	0.668	−2.386	−2.01	−2.07	−2.17	−1.965	−2.51	−2.56	−2.66
d.cucumbers and gherkins	3.188	0.999	9.026	1.000	3.188	0.999	−2.761	−2	−2.07	−2.18	−2.821	−2.51	−2.57	−2.7
grapes	0.017	0.507	9.511	1.000	0.017	0.507	−2.848	−2.01	−2.07	−2.17	−2.498	−2.51	−2.56	−2.66
d.grapes	0.526	0.701	5.873	1.000	0.526	0.701	−3.645	−2	−2.07	−2.18	−3.701	−2.51	−2.57	−2.7
maize	9.046	1.000	19.975	1.000	9.046	1.000	−1.199	−2.01	−2.07	−2.17	−1.053	−2.51	−2.56	−2.66
d.maize	7.499	1.000	10.180	1.000	7.499	1.000	−3.479	−2	−2.07	−2.18	−3.801	−2.51	−2.57	−2.7
oil palm fruit	−4.631	0.000	−1.858	0.032	−4.631	0.000	−3.939	−2.01	−2.07	−2.17	−3.881	−2.51	−2.56	−2.66
d.oil palm fruit	−9.793	0.000	−5.161	0.000	−9.793	0.000	−5.423	−2	−2.07	−2.18	−5.547	−2.51	−2.57	−2.7
onions dry	3.324	1.000	12.258	1.000	3.324	1.000	−2.618	−2.01	−2.07	−2.17	−2.463	−2.51	−2.56	−2.66
d.onions dry	1.387	0.917	5.322	1.000	1.387	0.917	−3.736	−2	−2.07	−2.18	−3.882	−2.51	−2.57	−2.7
oranges	−2.566	0.005	4.928	1.000	−2.566	0.005	−3.190	−2.01	−2.07	−2.17	−3.052	−2.51	−2.56	−2.66
d.oranges	−4.568	0.000	0.732	0.768	−4.568	0.000	−4.230	−2	−2.07	−2.18	−4.325	−2.51	−2.57	−2.7

Table 7. *Cont.*

	Pesaran 2003						IPS 2003							
	Levels		Trend		Demean		Levels				Trend			
Variable	***z* Value**	***p* Value**	***z* Value**	***p* Value**	***z* Value**	***p* Value**	**Cips**	**10%**	**5%**	**1%**	**Cips**	**10%**	**5%**	**1%**
potatoes	2.605	0.995	15.870	1.000	2.605	0.995	−2.263	−2.01	−2.07	−2.17	−1.861	−2.51	−2.56	−2.66
d.potatoes	5.780	1.000	10.151	1.000	5.780	1.000	−3.172	−2	−2.07	−2.18	−3.281	−2.51	−2.57	−2.7
rice paddy	−6.070	0.000	0.060	0.524	−6.070	0.000	−3.499	−2.01	−2.07	−2.17	−3.473	−2.51	−2.56	−2.66
d.rice paddy	−10.111	0.000	−4.689	0.000	−10.111	0.000	−4.738	−2	−2.07	−2.18	−4.779	−2.51	−2.57	−2.7
soybeans	3.022	0.999	14.541	1.000	3.022	0.999	−2.526	−2.01	−2.07	−2.17	−1.962	−2.51	−2.56	−2.66
d.soybeans	2.581	0.995	5.413	1.000	2.581	0.995	−3.304	−2	−2.07	−2.18	−3.536	−2.51	−2.57	−2.7
sugar beet	−0.975	0.165	1.880	0.970	−0.975	0.165	−3.029	−2.01	−2.07	−2.17	−3.416	−2.51	−2.56	−2.66
d.sugar beet	−8.829	0.000	−4.752	0.000	−8.829	0.000	−4.864	−2	−2.07	−2.18	−4.951	−2.51	−2.57	−2.7
sugarcane	14.335	1.000	20.467	1.000	14.335	1.000	−0.827	−2.01	−2.07	−2.17	−1.001	−2.51	−2.56	−2.66
d.sugarcane	11.210	1.000	12.658	1.000	11.210	1.000	−2.151	−2	−2.07	−2.18	−2.579	−2.51	−2.57	−2.7
sweet potatoes	0.246	0.597	7.681	1.000	0.246	0.597	−3.191	−2.01	−2.07	−2.17	−3.070	−2.51	−2.56	−2.66
d.sweet potatoes	−2.429	0.008	3.051	0.999	−2.429	0.008	−4.343	−2	−2.07	−2.18	−4.388	−2.51	−2.57	−2.7
tomatoes	3.944	1.000	15.410	1.000	3.944	1.000	−1.965	−2.01	−2.07	−2.17	−1.557	−2.51	−2.56	−2.66
d.tomatoes	7.380	1.000	12.897	1.000	7.380	1.000	−2.742	−2	−2.07	−2.18	−2.821	−2.51	−2.57	−2.7
melons	−1.803	0.036	3.913	1.000	−1.803	0.036	−3.442	−2.01	−2.07	−2.17	−3.465	−2.51	−2.56	−2.66
d.melons	−5.999	0.000	−1.170	0.121	−5.999	0.000	−5.106	−2	−2.07	−2.18	−5.156	−2.51	−2.57	−2.7
wheat	5.189	1.000	17.112	1.000	5.189	1.000	−1.983	−2.01	−2.07	−2.17	−1.588	−2.51	−2.56	−2.66
d.wheat	3.340	1.000	7.387	1.000	3.340	1.000	−2.718	−2	−2.07	−2.18	−2.771	−2.51	−2.57	−2.7
Control of corruption	−2.110	0.017	0.030	0.512	−2.110	0.017	−1.900	−2.01	−2.07	−2.17	−2.270	−2.51	−2.56	−2.66
d.control of corruption	−5.605	0.000	−1.535	0.062	−5.605	0.000	−4.060	−2	−2.07	−2.18	−4.115	−2.51	−2.57	−2.7
Percentile rank	−1.248	0.106	1.191	0.883	−1.248	0.106	−1.816	−2.01	−2.07	−2.17	−2.274	−2.51	−2.56	−2.66
d.percentile rank	−5.583	0.000	−2.293	0.011	−5.583	0.000	−4.209	−2	−2.07	−2.18	−4.239	−2.51	−2.57	−2.7

Legend: d.[var], first differences of [var]; otherwise, levels of [var].

3.3. Cointegration Tests

When the series are nonstationary, it is appropriate to perform cointegration tests to determine whether the variables have a stable long-term relationship, that is, whether they are cointegrated. The cointegration tests of Kao (1999), Pedroni (1999, 2004) and Westerlund (2005) are used in this study, which are based on the following model (Equation (3)):

$$y_{it} = \sigma_i x_{it} + \gamma_i z_{it} + \omega_{it} \tag{3}$$

In Equation (3), we have the following elements: σ_i is the cointegration vector; γ_i identifies the vector with the coefficients including the deterministic term related to each panel specificity and the time trend. These tests have as null hypothesis the statement that y_{it} and x_{it} are not cointegrated series ($\sigma_i = 0$).

The Kao (1999) test assumes a cointegration vector equal for all panels ($\sigma_i = \sigma$), estimates means for each panel (as fixed effects) and does not allow the inclusion of a time trend. In this test, the alternative hypothesis assumes that the series are cointegrated in all panels with the same cointegration vector. Four versions of the Dickey–Fuller test are considered: Dickey–Fuller; Dickey–Fuller not adjusted; modified Dickey–Fuller and modified Dickey–Fuller not adjusted. In these tests, the residual autocorrelation term ρ is the same for all panels, but the statistical tests differ in the way they formulate the hypotheses and how they control the correlation of the residuals in the equation that estimates the cointegration relationship. The Dickey–Fuller test considers the hypothesis that $\rho = 1$. In a different way, the modified Dickey–Fuller and unadjusted modified Dickey–Fuller tests test if $\rho - 1 = 0$.

The Pedroni test (Pedroni 1999, 2004) presents two differences in relation to the Kao test: for each panel, it assumes specific cointegration vectors, σ_i, and specific autocorrelation terms, ρ_i. Therefore, the alternative hypothesis assumes that the series are cointegrated on all panels with specific cointegration vectors for each panel. In this test, two versions of the Phillips–Perron test are presented that consider different hypotheses regarding the terms of autocorrelation of the residuals: the Phillips–Perron test tests hypothesis $\rho_i = 1$, and the modified Phillips–Perron test tests hypothesis $\rho_{i-1} = 0$.

The Westerlund test (Westerlund 2005) includes a statistical test of the variance ratio that is obtained by testing the existence of a unit root of the estimated residuals of the Dickey–Fuller regression, which considers that the term of autocorrelation of the residuals is the same for all panels. In this case, the alternative hypothesis establishes that the series are cointegrated in all panels.

The estimated statistics of the Kao, Pedroni and Westerlund cointegration tests are used to measure the cointegration of each pair of variables under analysis (each of the three Corruption Indicators and each Producer Price Index for each agricultural product). These statistics are shown in Tables 8–10. We also run ECM panel cointegration tests, following Westerlund (2007). We recall that Westerlund (2007) examines the null hypothesis of no cointegration. The test is based on whether the error-correction term is equal to zero in a conditional panel error-correction model. It tests the existence of an error correction for the group mean ($G\tau$ and $G\alpha$) and for the panel ($P\tau$ and $P\alpha$).

The Pedroni test for cointegration rejected that the residuals of the series are integrated in order I(1), suggesting the existence of panel cointegration (Table 8). The Kao test, assuming homogeneous coefficients, provided evidence of panel cointegration of the series. Still observing Table 9, we favor the conclusion that, considering Westerlund's (2007) specification, panel cointegration tends to exist for the observed series. Thus, this conclusion indicates that the respective pair of variables explicit in Table 10 (each Corruption Indicator and the related Producer Price Index) tends to be cointegrated in at least one panel, identifying existing long-term relationships between the prices of agricultural products and the levels of corruption.

Table 8. Panel cointegration tests between Corruption Perception Index and each Production Prices Index.

	Pedroni							Kao					Westerlund			
	Panel				Group											
Production Price Index	**v**	**rho**	**t**	**adf**	**rho**	**t**	**adf**	**ModDF**	**DF**	**ADF**	**UnModDF**	**UnDF**	**Gt**	**Ga**	**Pt**	**Pa**
apples	6.277 ***	−5.69 ***	−7.742 ***	−7.695 ***	−0.5177	−5.713 ***	−163.9 ***	−17.0008 ***	−11.8586 ***	−22.1999 ***	−16.0093 ***	−11.6247 ***	−0.261	−0.840	−13.595 ***	−4.873 ***
bananas	6.354 ***	−5.539 ***	−7.52 ***	−4.942 ***	−0.3779	−5.449 ***	−90.67 ***	−16.7452 ***	−11.6060 ***	−22.0404 ***	−15.5170 ***	−11.3128 ***	−0.531	−2.184	−13.638 ***	−4.862 ***
barley	13.67 ***	−8.091 ***	−5.551 ***	−2.666 **	−3.07 ***	−2.138 **	−7.782 ***	−7.1889 ***	−4.7638 ***	−5.5351 ***	−14.1770 ***	−7.5791 ***	−0.030	−0.686	2.554	0.509
cassava	29.79 ***	−7.85 ***	−2.453 **	0.2933	−3.012 ***	1.482	−7.78 ***	−10.1924 ***	−7.1119 ***	−9.1570 ***	−12.0030 ***	−7.7432 ***	−0.513	−1.735	−10.344 ***	−3.397 ***
Cucumbers and gherkins	6.365 ***	−5.475 ***	−7.437 ***	−6.331 ***	−0.3183	−5.353 ***	−140.9 ***	−16.6513 ***	−11.5107 ***	−21.9733 ***	−15.3293 ***	−11.1939 ***	−0.308	−1.240	−13.657 ***	−4.858 ***
grapes	6.397 ***	−5.491 ***	−7.452 ***	−4.955 ***	−0.334	−5.37 ***	−64.77 ***	−16.6495 ***	−11.5102 ***	−21.9711 ***	−15.3285 ***	−11.1936 ***	−0.348	−1.085	−13.650 ***	−4.854 ***
maize	4.971 ***	−14.73 ***	−18.4 ***	−6.657 ***	−8.95 ***	−18.39 ***	−7.838 ***	−32.9442 ***	−22.9144 ***	−19.8833 ***	−33.6712 ***	−22.9989 ***	0.129	−0.255	−15.780 ***	−6.493 ***
oil palm fruit	21.65 ***	−8.179 ***	−5.053 ***	−1.998*	−4.022 ***	−3.436 ***	−17.64 ***	2.5962 ***	−0.1243	−11.2950 ***	−22.3564 ***	−15.2237 ***	−0.462	−1.240	2.938	2.176
onions dry	6.303 ***	−5.635 ***	−7.661 ***	−8.726 ***	−0.4666	−5.616 ***	−146.1 ***	−16.9126 ***	−11.7680 ***	−22.1478 ***	−15.8308 ***	−11.5118 ***	0.036	−0.468	−13.617 ***	−4.874 ***
oranges	6.421 ***	−5.412 ***	−7.324 ***	−4.112 ***	−0.2622	−5.219 ***	−31.61 ***	−16.5380 ***	−11.4042 ***	−21.8879 ***	−15.1235 ***	−11.0633 ***	−0.401	−1.565	−13.667 ***	−4.845 ***
potatoes	6.397 ***	−5.34 ***	−7.261 ***	−6.445 ***	−0.1923	−5.142 ***	−129.5 ***	−16.5630 ***	−11.3563 ***	−22.0859 ***	−14.9921 ***	−10.9786 ***	−0.049	−0.800	−13.784 ***	−4.914 ***
rice paddy	22.95 ***	−7.623 ***	−3.344 ***	0.6149	−2.753 ***	0.6401	−5.35 ***	−8.3281 ***	−4.9361 ***	−5.0999 ***	−11.1975 ***	−6.0579 ***	−0.416	−1.461	−1.716	−0.379
soybeans	6.27 ***	−5.701 ***	−7.754 ***	−8.499 ***	−0.5283	−5.727 ***	−159.6 ***	−17.0230 ***	−11.8793 ***	−22.2127 ***	−16.0486 ***	−11.6497 ***	−0.098	−0.579	−13.598 ***	−4.877 ***
sugar beet	22.86 ***	−4.651 ***	0.8496	3.146 ***	−1.943 *	5.677 ***	−1.989 *	−3.0189 ***	−0.6320	−0.8616	−6.6851	−2.6102 ***	−0.457	−1.223	−2.091	−0.298
sugarcane	4.929 ***	−14.92 ***	−18.81 ***	−5.907 ***	−9.121 ***	−18.85 ***	−31.4 ***	−33.4893 ***	−23.2446 ***	−20.2902 ***	−34.1434 ***	−23.3187 ***	−0.349	−0.776	−13.691 ***	−6.653 ***
sweet potatoes	6.286 ***	−5.583 ***	−7.604 ***	−6.425 ***	−0.417	−5.548 ***	−128.6 ***	−16.9563 ***	−11.7600 ***	−22.3700 ***	−15.7871 ***	−11.4838 ***	−0.418	−1.878	−13.668 ***	−4.915 ***
tomatoes	6.364 ***	−5.491 ***	−7.458 ***	−8.332 ***	−0.3327	−5.377 ***	−170.7 ***	−16.6766 ***	−11.5351 ***	−21.9910 ***	−15.3768 ***	−11.2239 ***	−0.114	−0.906	−13.655 ***	−4.862 ***
melons	19.64 ***	−10.7 ***	−7.766 ***	1.708 *	−5.967 ***	−4.529 ***	−0.06335	−12.7084 ***	−9.7214 ***	−12.3801 ***	−15.1832 ***	−10.4664 ***	−0.321	−1.277	−18.693 ***	−5.889 ***
wheat	6.296 ***	−5.547 ***	−7.559 ***	−7.406 ***	−0.3843	−5.496 ***	−143.6 ***	−16.9030 ***	−11.7077 ***	−22.3320 ***	−15.6852 ***	−11.4194 ***	−0.054	−0.678	−13.676 ***	−4.912 ***

Legend—Significance level: 1% ***; 5%, **; 10%, *.

Table 9. Panel cointegration tests between control of corruption and each Production Prices Index.

	Pedroni							**Kao**					**Westerlund**			
	Panel				**Group**											
Production Price Index	**v**	**rho**	**t**	**adf**	**rho**	**t**	**adf**	**ModDF**	**DF**	**ADF**	**UnModDF**	**UnDF**	**Gt**	**Ga**	**Pt**	**Pa**
apples	5.542 ***	−5.5991 ***	−7.549 ***	−6.468 ***	−0.884	−5.588 ***	−18.65 ***	−16.9516 ***	−11.8196 ***	−22.1182 ***	−15.9595 ***	−11.5849 ***	−1.473 ***	−7.010 ***	−17.345 ***	−7.476 ***
bananas	5.553 ***	−5.789 ***	−7.299 ***	−3.856 ***	−0.6951	−5.287 ***	−18.7 ***	−16.6961 ***	−11.5670 ***	−21.9598 ***	−15.4680 ***	−11.2731 ***	−1.618 ***	−7.452 ***	−17.474 ***	−7.483 ***
barley	10.48 ***	−6.426 ***	−5.35 ***	−0.3188	−2.675 **	−3.4 ***	−1.427	−6.7931 ***	−4.5291 ***	−5.3143 ***	−14.1519 ***	−7.5477 ***	−1.270 ***	−5.195 ***	−8.506 ***	−2.540 ***
cassava	18.39 ***	−4.534 ***	−1.227	1.861 *	−0.1841	2.083 **	1.676 *	−9.9457 ***	−7.0694 ***	−9.0382 ***	−11.7382 ***	−7.7017 ***	−1.824 ***	−8.868 ***	−19.005 ***	−6.136 ***
Cucumbers and gherkins	5.575 ***	−5.721 ***	−7.21 ***	−5.991 ***	−0.6356	−5.185 ***	−19.09 ***	−16.6008 ***	−11.4711 ***	−21.8913 ***	−15.2791 ***	−11.1535 ***	−1.536 ***	−6.644 ***	−17.528 ***	−7.485 ***
grapes	5.575 ***	−5.735 ***	−7.22 ***	−3.157 ***	−0.6531	−5.206 ***	−16.16 ***	−16.6002 ***	−11.4713 ***	−21.8907 ***	−15.2796 ***	−11.1539 ***	−1.651 ***	−7.928 ***	−17.524 ***	−7.483 ***
maize	5.237 ***	−15.51 ***	−18.27 ***	−11.02 ***	−9.726 ***	−18.41 ***	−7.827 ***	−32.9108 ***	−22.8842 ***	−19.8296 ***	−33.6355 ***	−22.9687 ***	−1.221 **	−4.373	−19.266 ***	−8.704 ***
oil palm fruit	16.88 ***	−6.026 ***	−3.977 ***	0.8101	−1.809 *	−2.053 **	−0.1525	2.7273 ***	0.0403	−11.0577 ***	−22.3265 ***	−15.2179 ***	−1.701 ***	−8.178 ***	1.642	1.630
onions dry	5.545 ***	−5.917 ***	−7.462 ***	−6.881 ***	−0.8144	−5.483 ***	−21.27 ***	−16.8632 ***	−11.7289 ***	−22.0663 ***	−15.7812 ***	−11.4720 ***	−1.299 ***	−6.057 ***	−17.393 ***	−7.481 ***
oranges	5.565 ***	−5.62 ***	−7.103 ***	−3.446 ***	−0.5384	−5.058 ***	−15.72 ***	−16.4873 ***	−11.3639 ***	−21.8057 ***	−15.0734 ***	−11.0223 ***	−1.697 ***	−7.652 ***	−17.587 ***	−7.484 ***
potatoes	5.585 ***	−5.569 ***	−7.029 ***	−6.305 ***	−0.4917	−4.966 ***	−20.79 ***	−16.5121 ***	−11.3167 ***	−22.0042 ***	−14.9419 ***	−10.9381 ***	−1.393 ***	−6.091 ***	−17.769 ***	−7.577 ***
rice paddy	14.96 ***	−4.815 ***	−2.328 **	4.376 ***	−0.9768	0.404	6.097 ***	−7.6812 ***	−4.8907 ***	−5.2249 ***	−10.4990 ***	−6.0283 ***	−1.695 ***	−7.183 ***	−12.295 ***	−3.395 ***
soybeans	5.534 ***	−6.005 ***	−7.573 ***	−7.005 ***	−0.8958	−5.613 ***	−22.46 ***	−16.9743 ***	−11.8405 ***	−22.1314 ***	−15.9994 ***	−11.6101 ***	−1.426 ***	−5.938 ***	−17.340 ***	−7.479 ***
sugar beet	19.57 ***	−2.851 ***	1.739 *	3.634 ***	−1.434	5.918 ***	−1.528	−2.8777 ***	−0.4092	−0.4296	−6.5545 ***	−2.4136 ***	−1.414 ***	−6.312 ***	−8.221 ***	−2.026 ***
sugarcane	5.275 ***	−15.88 ***	−18.87 ***	−9.685 ***	−10.04 ***	−19.05 ***	−4.555 ***	−33.4470 ***	−23.2091 ***	−20.2294 ***	−34.1002 ***	−23.2833 ***	−1.520 ***	−6.233 ***	−16.595 ***	−8.837 ***
sweet potatoes	5.525 ***	−5.854 ***	−7.406 ***	−5.737 ***	−0.7528	−5.413 ***	−20 ***	−16.9077 ***	−11.7214 ***	22.2889 ***	−15.7382 ***	−11.4444 ***	−1.557 ***	−6.667 ***	−17.494 ***	−7.546 ***
tomatoes	5.577 ***	−5.746 ***	−7.243 ***	−6.534 ***	−0.6604	−5.225 ***	−20.78 ***	−16.6261 ***	−11.4955 ***	−21.9089 ***	−15.3266 ***	−11.1836 ***	−1.200 *	−5.436 ***	−17.513 ***	−7.484 ***
melons	13.57 ***	−8.727 ***	−7.205 ***	−0.3555	−5.166 ***	−5.138 ***	0.6627	−12.8274 ***	−9.8385 ***	−12.3289 ***	−15.3214 ***	−10.5843 ***	−1.571 ***	−6.881 ***	−21.662 ***	−6.438 ***
wheat	5.535 ***	−5.824 ***	−7.363 ***	−7.114 ***	−0.7258	−5.359 ***	−21.48 ***	−16.8545 ***	−11.6693 ***	−22.2513 ***	−15.6365 ***	−11.3802 ***	−1.210 **	−5.171 ***	−17.523 ***	−7.547 ***

Legend—Significance level: 1% ***; 5%, **; 10%, *.

Table 10. Panel Cointegration tests between the percentile rank of control of corruption and each Production Prices Index.

	Pedroni							Kao					Westerlund			
	Panel				Group											
Production Price Index	**v**	**rho**	**t**	**adf**	**rho**	**t**	**adf**	**ModDF**	**DF**	**ADF**	**UnModDF**	**UnDF**	**Gt**	**Ga**	**Pt**	**Pa**
apples	5.613 ***	−5.948 ***	−7.513 ***	−4.994 ***	−0.839	−5.544 ***	−16.93 ***	−16.9551 ***	−11.8234 ***	−22.1251 ***	−15.9657 ***	−11.5894 ***	−1.812 ***	−9.778 ***	−16.266 ***	−6.156 ***
bananas	5.637 ***	−5.756 ***	−7.271 ***	−3.95 ***	−0.6586	−5.252 ***	−21.35 ***	−16.6995 ***	−11.5707 ***	−21.9664 ***	−15.4740 ***	−11.2775 ***	−2.003 ***	−10.696 ***	−16.404 ***	−6.171 ***
barley	10.29 ***	−6.213 ***	−4.901 ***	−0.0405	−2.288 **	−2.821 ***	−0.227	−6.8888 ***	−4.5744 ***	−5.3880 ***	−14.1649 ***	−7.5460 ***	−1.509 ***	−6.923 ***	−11.181 ***	−4.743 ***
cassava	17.43 ***	−4.764 ***	−1.771 *	1.181	−0.3627	1.449	−1.447	−9.9954 ***	−7.0867 ***	−9.0800 ***	−11.7174 ***	−7.6927 ***	−2.010 ***	−10.797 ***	−20.697 ***	−7.528 ***
Cucumbers and gherkins	5.654 ***	−5.677 ***	−7.175 ***	−5.118	−0.5866	−5.143 ***	−18.68 ***	−16.6041 ***	−11.4748 ***	−21.8979 ***	−15.2850 ***	−11.1578 ***	−1.737 ***	−9.034 ***	−16.462 ***	−6.177 ***
grapes	5.666 ***	−5.699 ***	−7.185 ***	−2.532 **	−0.6118	−5.162 ***	−13.71 ***	−16.6035 ***	−11.4750 ***	−21.8974 ***	−15.2856 ***	−11.1583 ***	−1.805 ***	−10.098 ***	−16.460 ***	−6.176 ***
maize	5.2 ***	−15.56 ***	−18.29 ***	−10.17 ***	−9.765 ***	−18.41 ***	−7.929 ***	−32.9089 ***	−22.8857 ***	−19.8331 ***	−33.6376 ***	−22.9706 ***	−1.388 ***	−5.619 ***	−20.660 ***	−8.229 ***
oil palm fruit	16.25 ***	−6.232 ***	−4.355 ***	2.822 ***	−1.924*	−2.429 **	0.6559	2.6662 ***	−0.0388	−11.1719 ***	−22.3311 ***	−15.2193 ***	−2.045 ***	−10.230 ***	0.403	0.500
onions dry	5.619 ***	−5.872 ***	−7.419 ***	−5.869 ***	−0.7653	−5.429 ***	−20.57 ***	−16.8664 ***	−11.7326 ***	−22.0730 ***	−15.7871 ***	−11.4763 ***	−1.588 ***	−9.208 ***	−16.315 ***	−6.164 ***
oranges	5.658 ***	−5.587 ***	−7.077 ***	−2.608 **	−0.502	−5.029 ***	−11.84 ***	−16.4905 ***	−11.3674 ***	−21.8119 ***	−15.0790 ***	−11.0264 ***	−1.867 ***	−9.329 ***	−16.529 ***	−6.182 ***
potatoes	5.678 ***	−5.541 ***	−7.011 ***	−5.681 ***	−0.4596	−4.945 ***	−21.57 ***	−16.5153 ***	−11.3204 ***	−22.0104 ***	−14.9478 ***	−10.9424 ***	−1.588 ***	−7.366 ***	−16.672 ***	−6.257 ***
rice paddy	14.41 ***	−4.809 ***	−2.552 **	3.029 ***	−1.173	−0.04406	4.089 ***	−7.7290 ***	−4.8976 ***	−5.2221 ***	−10.5190 ***	−6.0215 ***	−1.829 ***	−9.196 ***	−14.587 ***	−5.348 ***
soybeans	5.604 ***	−5.962 ***	−7.536 ***	−5.881 ***	−0.8503	−5.568 ***	−23.93 ***	−16.9777 ***	−11.8442 ***	−22.1382 ***	−16.0055 ***	−11.6146 ***	−1.583 ***	−6.999 ***	−16.258 ***	−6.156 ***
sugar beet	18.91 ***	−3.105 ***	1.38	4.242 ***	−1.8 *	5.572 ***	0.3693	−2.6622 ***	−0.2671	−0.3601	−6.2808 ***	−2.2710 **	−1.362 ***	−6.814 ***	−7.365 **	−2.869 ***
sugarcane	5.157 ***	−15.9 ***	−18.86 ***	−9.73 ***	−10.04 ***	−19 ***	−5.218 ***	−33.4464 ***	−23.2111 ***	−20.2330 ***	−34.1030 ***	−23.2857 ***	1.801 ***	−9.007 ***	−17.728 ***	−8.348 ***
sweet potatoes	5.607 ***	−5.82 ***	−7.376 ***	−4.816 ***	−0.7155	−5.377 ***	−22.35 ***	−16.9111 ***	−11.7251 ***	−22.2955 ***	−15.7443 ***	−11.4489 ***	−1.799 ***	−8.690 ***	−16.384 ***	−6.213 ***
tomatoes	5.647 ***	−5.702 ***	−7.203 ***	−6.012 ***	−0.6103	−5.175 ***	−23.73 ***	−16.6295 ***	−11.4992 ***	−21.9155 ***	−15.3326 ***	−11.1879 ***	−1.373 ***	−7.209 ***	−16.446 ***	−6.176 ***
melons	12.74 ***	−7.774 ***	−6.479 ***	−0.04868 ***	−4.844 ***	−4.906 ***	2.514 **	−12.9433 ***	−9.9177 ***	−12.2694 ***	−15.4455 ***	−10.6616 ***	−1.846 ***	−9.151 ***	−27.786 ***	−10.852 ***
wheat	5.616 ***	−5.788 ***	−7.334 ***	−5.726	−0.6872	−5.327 ***	−23.05 ***	−16.8578 ***	−11.6730 ***	−22.2578 ***	−15.6425 ***	−11.3846 ***	−1.424 ***	−6.371 ***	−16.413 ***	−6.215 ***

Legend—Significance level: 1%, ***; 5%, **; 10%, *.

Therefore, most statistical tests tend to reject the respective null hypothesis. Thus, we can suggest that, according to these panel data cointegration tests, there tends to exist a stable relationship between the generality of corruption indices and the generality of Producer Price Indices considering the set of agricultural goods under analysis. However, thus far, we have not yet discussed the causality direction. The next subsection will elucidate this issue.

3.4. Causality Tests

Tables 11 and 12 present the study of the direction of causality according to Dumitrescu and Hurlin (2012). Specific details of the particularity of the Dumitrescu and Hurlin (2012) and how it fits in the sequence of the analysis of the Im et al. (2003) can be found in Wang et al. (2019).

In Table 11, the Null Hypothesis is that the Corruption Indicator (in Column) does not Granger-cause the Production Price Index (in Row) for any panel. In Table 12, the Null Hypothesis is that the Production Price Index (in Row) does not Granger-cause the Corruption Indicator (in Column) for any panel. For the proper choice of 'lags' to be introduced in the model, we inserted the option 'l (bic)' in the Stata command 'xtgcause' so that the Bayesian information criteria were minimized; full details are available upon request.

Table 11. Dumitrescu–Hurlin 2017 Granger non-causality test results [Null Hypothesis: Corruption Indicator (in column) does not Granger-cause the Production Price Index (in row)].

Corruption Indicator	**CPI**		**Control of Corruption**		**Percentile Rank**	
Production Price Index	**Zbar(Pval)**	**ZbarTilde(Pvar)**	**Zbar(Pval)**	**ZbarTilde(Pvar)**	**Zbar(Pval)**	**ZbarTilde(Pvar)**
apples	0.377(0.709)	−0.415(0.678)	1.821(0.068)	0.737(0.461)	2.110(0.034)	0.967(0.333)
bananas	0.873(0.383)	−0.017(0.986)	1.587(0.113)	0.551(0.582)	1.597(0.110)	0.559(0.576)
barley	0.449(0.654)	−0.354(0.723)	3.634(0.000)	2.179(0.029)	4.136(0.000)	2.579(0.000)
cassava	−0.853(0.393)	−1.389(0.165)	1.587(0.112)	0.551(0.581)	2.469(0.000)	1.253(0.210)
cucumbers and gherkins	−0.455(0.649)	−1.073(0.283)	−0.009(0.992)	−0.718(0.472)	1.147(0.251)	0.201(0.840)
grapes	0.671(0.502)	−0.178(0.859)	2.662(0.008)	1.406(0.159)	2.151(0.031)	0.999(0.317)
maize	0.144(0.798)	−0.923(0.231)	0.262(0.898)	0.422(0.331)	1.202(0.199)	1.541(0.177)
oil palm	2.116(0.034)	0.972(0.331)	1.672(0.091)	0.624(0.533)	1.419(0.155)	0.417(0.676)
onions dry	2.489(0.012)	1.268(0.204)	3.512(0.004)	2.083(0.037)	4.317(0.000)	2.772(0.006)
oranges	2.841(0.004)	1.547(0.121)	1.538(0.124)	0.513(0.608)	0.976(0.329)	0.064(0.448)
potatoes	0.241(0.809)	−0.519(0.603)	1.704(0.088)	0.644(0.514)	2.661(0.008)	1.404(0.160)
rice paddy	1.489(0.136)	0.473(0.636)	2.689(0.007)	1.428(0.153)	3.708(0.000)	2.238(0.025)
soybeans	1.386(0.165)	0.391(0.697)	3.105(0.001)	1.757(0.078)	3.632(0.003)	2.177(0.029)
sugar beet	2.713(0.007)	1.446(0.148)	1.722(0.081)	0.658(0.511)	1.206(0.227)	0.247(0.804)
sugarcane	0.812(0.401)	−0.016(0.985)	1.577(0.209)	0.541(0.600)	1.798(0.092)	0.591(0.467)
sweet potatoes	0.533(0.593)	−0.287(0.774)	1.796(0.072)	0.718(0.473)	1.424(0.154)	0.421(0.674)
tomatoes	2.982(0.003)	1.660(0.097)	1.904(0.057)	0.803(0.422)	0.990(0.322)	0.076(0.939)
melons	1.489(0.136)	0.404(0.636)	1.339(0.181)	0.350(0.726)	1.146(0.251)	0.200(0.841)
wheat	0.307(0.719)	−0.467(0.640)	3.720(0.102)	2.247(0.025)	3.491(0.001)	2.067(0.039)

Table 12. Dumitrescu–Hurlin 2017 Granger non-causality test results [Null Hypothesis: Production Price Index (in row) does not Granger-cause the Corruption Indicator (in column)].

Corruption Indicator	**CPI**		**Control of Corruption**		**Percentile**	
Production Price Index	**Zbar(Pval)**	**ZbarTilde(Pvar)**	**Zbar(Pval)**	**ZbarTilde(Pvar)**	**Zbar(Pval)**	**ZbarTilde(Pvar)**
apples	7.65(0.00)	5.37(0.00)	2.841(0.004)	1.548(0.121)	3.508(0.000)	2.079(0.037)
bananas	5.13(0.00)	3.37(0.00)	2.720(0.006)	1.452(0.146)	1.891(0.058)	0.793(0.428)
barley	13.53(0.00)	11.64(0.00)	5.55(0.00)	3.705(0.002)	7.020(0.000)	4.872(0.000)
cassava	5.367(0.00)	3.557(0.00)	2.867(0.004)	1.569(0.117)	2.298(0.0215)	1.117(0.264)
cucumbers and gherkins	9.413(0.00)	6.775(0.000)	4.398(0.000)	2.787(0.000)	2.623(0.009)	1.375(0.169)
grapes	6.199(0.000)	4.219(0.000)	2.702(0.007)	1.437(0.150)	2.460(0.014)	1.245(0.213)
maize	13.533(0.000)	11.642(0.000)	5.552(0.000)	3.799(0.000)	7.882(0.000)	4.967(0.000)
oil palm	6.034(0.000)	4.088(0.000)	2.130(0.031)	0.983(0.353)	2.365(0.018)	1.169(0.242)
onions dry	18.272(0.000)	13.272(0.000)	2.991(0.002)	1.674(0.094)	3.916(0.001)	2.403(0.016)
oranges	6.098(0.000)	4.137(0.000)	0.971(0.331)	0.061(0.951)	0.642(0.521)	−0.200(0.841)
potatoes	11.04(0.00)	8.067(0.000)	5.919(0.000)	3.996(0.000)	6.393(0.000)	4.373(0.000)
rice paddy	14.36(0.00)	10.71(0.136)	1.01(0.31)	0.09(0.92)	1.827(0.067)	0.742(0.458)
soybeans	14.02(0.00)	10.44(0.00)	6.093(0.000)	4.134(0.00)	6.586(0.000)	4.527(0.000)
sugar beet	6.74(0.00)	4.65(0.00)	3.639(0.000)	2.183(0.002)	2.987(0.003)	1.664(0.096)
sugarcane	6.201(0.000)	4.288(0.000)	2.703(0.006)	1.492(0.110)	2.498(0.010)	1.249(0.212)
sweet potatoes	7.58(0.00)	5.32(0.00)	5.27(0.000)	3.48(0.000)	4.954(0.000)	3.208(0.001)
tomatoes	8.67(0.00)	6.185(0.000)	5.646(0.000)	3.699(0.006)	4.236(0.000)	2.698(0.008)
melons	16.797(0.00)	12.648(0.000)	4.076(0.001)	2.492(0.012)	1.974(0.04)	0.858(0.391)
wheat	144.5(0.000)	114.2(0.000)	4.939(0.000)	3.217(0.000)	5.165(0.000)	3.398(0.000)

Checking Tables 11 and 12, we confirm that in most cases, increases in the Production Price Index for each of the identified agricultural goods lead to increases in the levels of corruption observed in the economy, regardless of the Corruption Indicator used. There are few cases of bidirectional causality (in which in at least one country, corruption causes the price of a certain agricultural good to rise, but also in at least one another country, the reverse is observed). For example, these are the cases of the production price indices for onions and each indicator of corruption we are observing (P-VALUEs converging to values close to zero both in Tables 11 and 12). However, the generality of the interpretation we make favors the aforementioned sense of unidirectional causality: increases in the price indices for the producer of agricultural goods anticipate changes in the Corruption Indicators.

Thus, in view of these results, we are compelled to validate the hypothesis stating that rises in producer prices of agricultural products tend to deteriorate the functioning institutions of economies and, ultimately, to cause opportunities for corruption. In line with Dincer and Gunalp (2008), increases in the prices of agricultural goods tend to cause opportunities for corruption through three aforementioned mechanisms:

(1) The increase in the prices of goods considered nontradable makes most consumer prices in these countries more expensive, which triggers an increase in the likelihood of public agents being corrupted in order to increase their private revenues and in response to growing tendencies of corruption proposals.

(2) The increase in prices of tradable agricultural goods tends to benefit companies exporting these products with inflated prices (and their respective shareholders), creating an additional resource for these oligopolies to exert various pressures through corruption mechanisms to ensure quotas in the export market (Tyavambiza 2017; or Pupovic 2012), especially in economies with weaker regulatory institutions (Lehman and Thorne 2015).

(3) The increase in the prices of agricultural goods decreases the disposable income of the consumer to access the public goods that are purchased, creating additional incentives for the use of corruption channels as a way to enhance the opportunity to acquire these goods (Diacon 2013).

3.5. Results of the Estimation

In the previous subsection, we concluded that in the panel data we are observing, there is a general trend that the rise in agricultural price indices entails significant changes in the corruption values observed in the countries in the following periods. We will now detail this effect using three standard methods in the panel data discussion (FMOLS, DOLS and CCR). Table 13 reveals the estimates of Equation (3) using these three methods: FMOLS by Pedroni (1999, 2004), DOLS and CCR. Let us focus on Table 13 with the estimates for "Panel Mean". Additional details, namely, on the number of lags used, will be made available upon request.

We carried out these estimates for 90 countries for the period 2000–2020. For space efficiencies, we show the estimations associated with the 'panel mean' case. The 90 separate country cases will be highlighted upon request.

As mentioned previously, we are working with 3 corruption indicator and 19 agricultural Producer Price Indices. Table 13 shows the estimation of Equation (3) (where the dependent variable is, in turn, each Corruption Indicator, and the independent variable is the pProducer Price Index identified in the row). In each estimation line, the beta, the estimated deviation and the respective p value are exhibited for the observations of each agricultural price. The data in Table 13 represent the panel mean estimate. Thus, once again, in line with the direction suggested by the causality tests, an increase in the Producer Price Index of the various agricultural goods analyzed significantly affects the evolution of the values of Corruption Indicators; we note that a negative coefficient means higher corruption due to higher prices of agricultural products.

In view of the results of these tables, we recognize that increases in the prices of agricultural goods are a significant cause of increases in the levels of corruption in the observed countries. Thus, if it is currently recognized that corruption is a significant cause of the deterioration of economic growth capacities, our study finds the influence of the increase in agricultural prices on the evolution of corruption, especially in economies that are more dependent on employment in the agricultural sector, but also in economies more dependent on the public sector and public employment.

3.6. An Example—The Price of Apples as an Inducer of Corruption

We also decided to obtain the coefficient estimates for the mean group estimator (MG), considering the method proposed by Pesaran and Smith (1995). The Pesaran and Smith (1995) MG estimator additionally provided heterogeneous coefficients for each country in the panel under cross-sectional independence.

Thus, we have the estimated values for the coefficients estimated for each country in each equation representing the influence of each of the 19 Producer Price Indices analyzed on each of the 3 Corruption Indicators under analysis. For illustrative purposes, Table 14 shows the estimated coefficients for only one of the Producer Price Indices under analysis—in this case, the 'Production Prices Index for Apples', because apples are a commonly diffused fruit grown around the world (Schmit et al. 2018).

Table 13. Panel mean estimates (dependent variable in columns).

	CPI						Control of Corruption						Percentile Rank					
	FMOLS		DOLS		CCR		FMOLS		DOLS		CCR		FMOLS		DOLS		CCR	
	Beta	Tstat	Beta	Tstat	Beta	Tstat	Beta	Tsat	Beta	Tstat	Beta	Tstat	Beta	Tstat	Beta	Tstat	Beta	Tstat
apples	14.59	11.74	−237.57	53.73	151.06	5.83	1.17	−4.96	1.79	−12.50	1.74	−3.62	34.48	−5.08	−6.08	−1.46	59.85	−3.95
bananas	368.82	11.61	1087.95	52.69	434.34	8.14	−0.21	−2.62	−3.38	−7.68	−0.84	−1.77	20.83	−3.41	32.72	−3.27	6.76	−3.68
barley	227.96	20.37	495.29	87.80	341.90	12.63	−1.17	−1.61	−2.11	−2.56	−1.42	−0.79	−36.27	1.14	−60.70	−5.73	−36.29	1.21
cassava	−426.71	10.67	−452.36	33.90	−287.92	7.77	−0.00	−3.36	−0.83	−4.65	0.26	−2.73	−19.98	−0.35	−27.25	−2.95	−22.12	0.06
cucumbers and gherkins	91.48	16.13	193.68	94.23	87.19	8.19	−0.14	0.09	−2.09	−6.62	−0.13	1.03	−1.67	1.16	−102.10	0.44	4.36	1.01
grapes	−72.45	7.01	243.38	45.41	−97.56	3.45	−0.49	−4.90	3.17	−13.67	−1.11	−4.36	−20.74	−7.43	104.13	−13.73	−50.11	−7.44
maize	−0.40	0.13	0.37	0.15	−0.61	0.22	0.00	0.01	−0.00	0.02	0.00	0.01	−0.01	0.02	−0.02	0.02	−0.01	0.03
oil palm fruit	259.41	5.41	695.23	19.14	328.83	4.36	0.48	2.02	0.21	0.70	−0.22	1.52	24.21	2.93	−7.38	3.07	3.89	2.25
onions dry	−92.10	17.37	226.35	79.93	−221.35	10.20	0.46	−1.48	3.29	3.20	0.42	−1.15	−2.07	0.85	75.85	1.45	−8.80	0.19
oranges	115.19	15.50	−487.32	44.41	138.59	10.19	−0.47	−4.34	−0.97	−10.25	−0.69	−3.22	17.72	−4.09	−27.53	−10.48	35.28	−3.91
potatoes	31.64	20.26	−161.44	99.16	99.90	12.18	−0.05	−2.66	−1.25	−17.55	−0.09	−2.89	0.62	−1.52	−33.33	−14.74	2.78	−2.55
rice paddy	−143.01	17.47	−123.68	61.22	−160.71	11.98	−0.22	0.69	0.27	−7.84	−0.30	0.66	−15.65	−1.62	0.33	−7.99	−22.85	−1.46
soybeans	−25.31	19.35	1286.36	74.59	−127.50	12.57	0.68	−11.82	−0.82	−15.55	0.99	−8.89	8.59	−8.54	−21.76	−16.44	11.85	−6.95
sugar beet	−328.38	−0.71	206.26	24.44	−241.55	−3.34	−1.09	6.50	−2.00	15.13	−1.92	6.06	−55.01	7.22	−96.87	8.32	−93.12	7.42
sugarcane	−0.69	0.21	0.45	0.24	−0.95	0.25	0.00	0.26	−0.00	0.22	0.00	0.21	0.01	0.21	−0.06	0.01	0.02	0.03
sweet potatoes	80.27	13.42	137.03	51.36	94.49	8.93	−1.56	−2.51	−2.87	−9.58	−1.56	−1.80	−52.72	−9.51	−7.49	−9.82	−68.08	−8.39
tomatoes	−45.05	22.90	−320.36	112.83	−52.93	13.58	−0.10	0.73	−0.20	1.21	−0.01	0.96	1.46	5.15	−6.21	0.30	4.03	3.95
melons	101.99	15.78	867.22	68.32	−19.64	9.91	−0.02	1.30	0.66	−4.42	0.31	1.04	10.79	−0.71	17.73	−4.13	22.68	−0.97
wheat	106.90	11.10	59.98	107.94	116.31	3.29	−0.60	−3.43	−3.08	−8.88	−0.43	−2.18	−13.01	−13.82	−79.51	−7.90	−2.36	−12.46

Table 14. Influence of apples' Producer Price Index on each of the 3 Corruption Indicators on the different economies.

	Estimation Methods								
	CPI			Control of Corruption			Percentile Rank		
	FMOLS	DOLS	CCR	FMOLS	DOLS	CCR	FMOLS	DOLS	CCR
Country_ID	**Beta**	**Beta**	**Beta**	**Beta**	**Beta**	**Beta**	**Beta**	**Beta**	**Beta**
Angola	1430.59 (1596.44)	5292.97 (4185.87)	2323.09 (2340.39)	5.20 (4.81)	41.88 ** (18.98)	8.80 (7.70)	347.01 * (213.71)	777.43 (630.30)	504.47 * (311.76)
Argentina	0.10 (0.09)	0.31 (0.27)	0.10 (0.10)	−0.00 * (0.00)	0.00 (0.00)	−0.00 * (0.00)	−0.05 * (0.03)	0.05 (0.05)	−0.05 * (0.04)
Armenia	−0.01 (0.03)	0.42 *** (0.10)	−0.02 (0.04)	−0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	−0.03 (0.05)	0.00 (0.03)	−0.03 (0.05)
Australia	−0.01 (0.15)	0.76 *** (0.27)	−0.08 (0.23)	0.00 (0.00)	0.00 ** (0.00)	0.00 (0.00)	0.01 * (0.01)	0.04 ** (0.02)	0.01 (0.01)
Austria	0.11 (0.10)	2.17 *** (0.18)	−0.02 (0.16)	−0.00 (0.00)	−0.01 *** (0.00)	0.00 (0.00)	−0.01 (0.01)	−0.14 *** (0.01)	0.01 (0.02)
Azerbaijan	−0.01 (0.06)	0.15 ** (0.09)	−0.02 (0.07)	−0.00 (0.00)	−0.00 (0.00)	−0.00 (0.00)	−0.01 (0.03)	−0.01 (0.06)	−0.01 (0.03)
Belarus	0.28 *** (0.02)	0.37 *** (0.02)	0.28 *** (0.03)	0.00 *** (0.00)	0.00 *** (0.00)	0.00 *** (0.00)	0.12 *** (0.01)	0.20 *** (0.01)	0.12 *** (0.01)
Belgium	0.12 ** (0.07)	1.91 *** (0.33)	0.03 (0.10)	0.00 (0.00)	0.00 *** (0.00)	0.00 (0.00)	0.01 (0.01)	0.04 *** (0.01)	0.01 (0.01)
Bolivia (Plurinational State of)	0.27 *** (0.04)	0.52 *** (0.05)	0.25 *** (0.06)	−0.00 (0.00)	0.00 (0.00)	−0.00 (0.00)	−0.00 (0.01)	−0.02 (0.02)	−0.01 (0.01)
Botswana	−1432.66 (3509.61)	−0.00015 *** (2279.56)	−373.40 (4269.56)	13.62 *** (5.08)	45.97 *** (9.08)	9.47 * (6.79)	302.49 ** (173.93)	731.28 *** (191.75)	263.71 (231.95)
Brazil	0.11 *** (0.04)	0.30 *** (0.02)	0.10 ** (0.05)	0.00 (0.00)	−0.00 (0.00)	0.00 (0.00)	0.03 (0.04)	0.01 (0.06)	0.03 (0.04)
Bulgaria	0.00 (0.05)	0.07 (0.12)	0.00 (0.05)	−0.00 *** (0.00)	−0.00 *** (0.00)	−0.00 *** (0.00)	−0.03 *** (0.00)	−0.04 *** (0.01)	−0.03 *** (0.00)
Burkina Faso	−1153.99 (2730.79)	−5462.84 (8503.54)	−2668.68 (4279.11)	6.10 (9.76)	0.15 (34.59)	11.65 (17.35)	237.95 (410.72)	−121.91 (1435.46)	529.82 (727.72)
Cameroon	2312.75 ** (1277.85)	799.81 (3201.79)	3333.54 ** (1701.93)	−7.44 *** (2.72)	−0.99 (11.44)	−11.04 *** (3.87)	20.86 (94.20)	415.14 * (267.37)	49.69 (139.93)
Canada	0.48 *** (0.19)	2.12 *** (0.20)	0.02 (0.36)	0.00 (0.00)	−0.00 *** (0.00)	0.00 (0.00)	0.01 ** (0.00)	0.00 (0.01)	0.00 (0.01)
Chile	0.55 *** (0.07)	0.65 *** (0.05)	0.54 *** (0.08)	−0.00 *** (0.00)	−0.00 *** (0.00)	−0.00 *** (0.00)	−0.06 *** (0.00)	−0.08 *** (0.01)	−0.05 *** (0.00)
China	−0.17 *** (0.04)	−0.14 ** (0.07)	−0.17 *** (0.05)	−0.00 *** (0.00)	−0.00 *** (0.00)	−0.00 *** (0.00)	−0.05 *** (0.01)	−0.05 *** (0.01)	−0.05 *** (0.01)
Colombia	0.31 *** (0.04)	0.43 *** (0.03)	0.30 *** (0.04)	−0.00 ** (0.00)	−0.00 *** (0.00)	−0.00 ** (0.00)	−0.05 ** (0.02)	−0.07 *** (0.01)	−0.05 ** (0.02)
Costa Rica	−1743.69 (2538.86)	1854.67 (6896.63)	−2705.73 (3871.10)	3.68 (7.77)	8.41 (15.09)	0.92 (11.84)	84.82 (188.54)	180.34 (258.03)	−14.57 (285.64)
Cote d'Ivoire	−171.06 (2166.86)	−226.96 (4011.27)	138.48 (2474.20)	−0.01 (0.07)	−0.43 *** (0.12)	−0.02 (0.09)	0.30 *** (0.12)	0.73 *** (0.27)	0.26 ** (0.15)
Croatia	−0.33 *** (0.09)	−1.50 ** (0.76)	−0.35 *** (0.10)	−0.00 (0.00)	−0.01 *** (0.00)	−0.00 (0.00)	−0.02 (0.02)	−0.17 *** (0.02)	−0.03 (0.03)
Czechia	0.02 (0.03)	−0.02 (0.03)	0.04 (0.04)	−0.00 (0.00)	0.00 *** (0.00)	−0.00 (0.00)	0.00 (0.01)	0.06 *** (0.01)	0.00 (0.01)
Denmark	−0.65 *** (0.12)	−1.32 *** (0.49)	−0.68 *** (0.13)	0.00 ** (0.00)	0.00 *** (0.00)	0.00 ** (0.00)	0.02 ** (0.01)	0.01 * (0.01)	0.02 * (0.01)
Ecuador	0.19 *** (0.07)	0.41 *** (0.04)	0.18 ** (0.09)	0.00 *** (0.00)	0.00 *** (0.00)	0.00 ** (0.00)	0.03 *** (0.01)	0.07 *** (0.01)	0.03 *** (0.01)

Table 14. *Cont.*

	Estimation Methods								
	CPI			Control of Corruption			Percentile Rank		
	FMOLS	DOLS	CCR	FMOLS	DOLS	CCR	FMOLS	DOLS	CCR
Country_ID	**Beta**	**Beta**	**Beta**	**Beta**	**Beta**	**Beta**	**Beta**	**Beta**	**Beta**
Egypt	0.18 ** (0.09)	0.89 *** (0.05)	−0.03 (0.22)	0.00 * (0.00)	0.00 (0.00)	0.00 * (0.00)	0.02 (0.02)	0.01 (0.04)	0.03 (0.03)
El Salvador	−980.42 (1771.66)	−4661.50 (4705.99)	−941.56 (2311.20)	−5.88 (6.42)	−21.29 * (15.60)	−5.90 (9.28)	−326.45 (328.47)	−1448.66 ** (778.05)	−328.60 (473.70)
Estonia	0.04 (0.14)	0.42 * (0.26)	0.01 (0.21)	0.00 (0.00)	0.01 *** (0.00)	0.00 * (0.00)	0.03 (0.04)	0.10 *** (0.02)	0.03 (0.05)
Ethiopia	−378.07 (2131.88)	670.65 (5882.67)	−957.75 (3562.91)	4.15 (9.74)	4.19 (34.12)	0.59 (16.87)	316.07 (434.54)	350.71 (1462.57)	156.29 (753.07)
Finland	0.15 (0.23)	2.93 *** (0.25)	−0.13 (0.44)	−0.00 (0.00)	−0.01 *** (0.00)	−0.00 (0.00)	−0.01 (0.01)	−0.03 *** (0.01)	−0.01 (0.01)
France	0.43 *** (0.11)	1.67 *** (0.11)	0.31 * (0.20)	0.00 (0.00)	−0.00 (0.00)	0.00 (0.00)	0.01 (0.02)	0.02 (0.02)	0.01 (0.02)
Germany	0.06 (0.11)	3.04 *** (0.24)	−0.10 (0.15)	0.00 (0.00)	0.00 * (0.00)	0.00 (0.00)	0.00 (0.00)	0.05 *** (0.00)	−0.01 (0.01)
Ghana	3212.17 ** (1706.82)	9146.90 *** (1019.60)	3286.29 * (2094.11)	8.59* (5.54)	7.63 (6.42)	8.88 (7.28)	459.69 *** (167.89)	337.19 (384.00)	469.17 ** (222.91)
Greece	−0.18 (0.13)	0.73 *** (0.24)	−0.28 (0.25)	−0.00 (0.00)	−0.02 *** (0.00)	−0.01 * (0.01)	−0.14* (0.11)	−0.64 *** (0.06)	−0.31 ** (0.17)
Hong Kong	2089.02 (4726.85)	−0.00012 * (8053.86)	5390.38 (7095.35)	−13.76 ** (7.60)	32.88 ** (16.36)	−20.66* (12.50)	−200.87 *** (57.32)	−12.39 (161.30)	−189.52 ** (94.27)
Hungary	0.04 (0.07)	0.58 *** (0.08)	−0.01 (0.10)	−0.00 (0.00)	−0.01 *** (0.00)	0.00 (0.00)	−0.01 (0.04)	−0.18 *** (0.02)	0.01 (0.06)
Iceland	−8224.11 ** (4891.65)	6532.34 (10250.40)	−0.00011 ** (5548.67)	55.93 * (34.76)	24.04 (72.64)	74.53 ** (41.22)	600.87 ** (348.97)	411.28 (694.44)	822.60 ** (425.68)
India	0.33 *** (0.05)	0.65 *** (0.06)	0.31 *** (0.08)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.02 (0.02)	0.07 (0.06)	0.02 (0.02)
Indonesia	−154.99 (1726.91)	−2484.51 (5016.34)	−120.42 (2369.85)	−14.47 (31.88)	−108.00 * (74.94)	−18.92 (43.77)	−673.85 (1359.47)	−4367.71 * (3266.52)	−815.02 (1830.88)
Ireland	0.30 ** (0.14)	1.34 *** (0.24)	0.22 (0.23)	0.00 ** (0.00)	0.00 *** (0.00)	0.00 * (0.00)	0.02 *** (0.01)	0.04 *** (0.01)	0.03 ** (0.01)
Israel	0.18 ** (0.09)	0.89 *** (0.11)	0.12 (0.13)	−0.00 ** (0.00)	−0.00 *** (0.00)	−0.00 * (0.00)	−0.06 *** (0.03)	−0.10 *** (0.03)	−0.08 *** (0.03)
Italy	0.16 * (0.10)	1.22 *** (0.06)	−0.03 (0.17)	−0.00 (0.00)	−0.01 *** (0.00)	0.00 (0.00)	−0.06 (0.07)	−0.24 *** (0.05)	−0.06 (0.12)
Japan	−0.45 * (0.28)	3.36 *** (0.35)	−0.61 ** (0.32)	−0.00 (0.00)	0.01 ** (0.00)	−0.01 ** (0.00)	−0.05 ** (0.02)	0.16 *** (0.07)	−0.06 *** (0.02)
Jordan	0.35 *** (0.06)	0.76 *** (0.03)	0.31 *** (0.08)	−0.00 (0.00)	−0.00 * (0.00)	−0.00 (0.00)	−0.00 (0.00)	−0.01 (0.01)	−0.00 (0.00)
Kazakhstan	0.25 *** (0.02)	0.34 *** (0.01)	0.24 *** (0.02)	0.00 *** (0.00)	0.00 *** (0.00)	0.00 *** (0.00)	0.10 *** (0.01)	0.12 *** (0.01)	0.10 *** (0.02)
Kenya	0.16 *** (0.04)	0.41 *** (0.03)	0.14 *** (0.05)	0.00 (0.00)	0.00 ** (0.00)	0.00 (0.00)	−0.01 (0.01)	−0.02 ** (0.01)	−0.01 (0.01)
Latvia	0.28 *** (0.05)	0.60 *** (0.05)	0.28 *** (0.07)	0.00 *** (0.00)	0.00 *** (0.00)	0.00 *** (0.00)	0.03 ** (0.01)	0.05 *** (0.01)	0.03 ** (0.01)
Lithuania	0.27 *** (0.08)	0.63 *** (0.13)	0.26 *** (0.10)	0.00 *** (0.00)	0.00 *** (0.00)	0.00 *** (0.00)	0.02 *** (0.01)	0.05 *** (0.02)	0.02 *** (0.01)
Luxembourg	0.40 *** (0.12)	2.25 *** (0.25)	0.38 ** (0.19)	0.00 (0.00)	0.01 *** (0.00)	0.00 (0.00)	0.03 * (0.02)	0.10 *** (0.01)	0.03 * (0.02)

Table 14. *Cont.*

	Estimation Methods								
	CPI			Control of Corruption			Percentile Rank		
	FMOLS	DOLS	CCR	FMOLS	DOLS	CCR	FMOLS	DOLS	CCR
Country_ID	Beta	Beta	Beta	Beta	Beta	Beta	Beta	Beta	Beta
Malawi	1593.53 (1558.21)	8083.53 *** (1472.39)	3673.39 (3163.77)	2.23 (4.56)	87.48 *** (22.26)	−5.37 (9.48)	70.67 (243.01)	3556.31 *** (1102.23)	−371.83 (497.85)
Malaysia	−252.47 (2886.00)	11365.63 *** (4423.05)	−2092.92 (4473.42)	1.46 (3.55)	−11.82 (15.30)	3.23 (6.34)	30.66 (197.05)	−775.33 ** (364.82)	72.89 (355.44)
Mauritius	1144.22 (2781.87)	−5009.12 (4757.75)	3331.42 (4311.74)	−1.27 (3.35)	5.77 (5.53)	−5.76 (5.35)	39.34 (92.25)	496.59 (391.66)	−126.57 (147.02)
Mexico	0.11 *** (0.03)	0.44 *** (0.04)	0.09 ** (0.04)	−0.00 ** (0.00)	−0.01 *** (0.00)	−0.00 ** (0.00)	−0.16 ** (0.08)	−0.44 *** (0.01)	−0.17 * (0.10)
Morocco	−0.09 (0.09)	0.79 *** (0.12)	−0.16 * (0.12)	−0.00 (0.00)	−0.00 (0.00)	0.00 (0.00)	0.01 (0.04)	0.00 * (0.04)	0.02 (0.08)
Mozambique	−1160.74 (1173.71)	−4288.43 * (2883.68)	−2142.65 (2035.81)	11.07 (14.51)	32.74 (30.02)	21.01 (25.13)	485.46 (655.35)	1516.94 (1431.56)	943.15 (1127.12)
Namibia	−719.99 (3246.21)	477.84 (9865.82)	−889.47 (4184.38)	−15.33 *** (5.47)	24.16* (14.69)	−15.31 ** (7.03)	−514.10 *** (77.78)	−5.04 (409.92)	−518.93 *** (100.43)
Netherlands	0.40 *** (0.07)	1.25 *** (0.08)	0.33 *** (0.11)	−0.00 (0.00)	−0.00 *** (0.00)	−0.00 (0.00)	−0.00 (0.00)	−0.01 *** (0.00)	−0.00 (0.00)
New Zealand	0.22 (0.20)	1.86 *** (0.43)	0.12 (0.29)	0.00 (0.00)	−0.00 *** (0.00)	0.00 (0.00)	0.01 (0.01)	0.02 *** (0.01)	0.01 (0.01)
Nigeria	−369.60 (1788.59)	−5233.16 (6213.23)	337.84 (2843.63)	19.38* (14.49)	87.32 ** (47.29)	29.94 (23.13)	516.85 (540.48)	2884.43 *** (1192.88)	769.70 (890.44)
Norway	0.10 (0.23)	1.73 *** (0.26)	−0.18 (0.42)	0.00 (0.00)	0.00 *** (0.00)	0.00 (0.00)	0.02 (0.01)	0.06 *** (0.01)	0.01 (0.02)
Peru	−0.27 *** (0.09)	0.96 *** (0.36)	−0.26 *** (0.09)	0.00 (0.00)	−0.01 *** (0.00)	0.01 ** (0.00)	0.08 (0.08)	−0.31 *** (0.12)	0.34 ** (0.18)
Philippines	4695.61 *** (1855.52)	7122.28 *** (491.97)	5835.36 *** (2218.88)	15.14 *** (5.50)	28.15 *** (11.45)	23.05 *** (7.74)	531.83 ** (253.33)	1023.98 ** (475.36)	868.51 *** (360.58)
Poland	0.18 *** (0.06)	0.83 *** (0.14)	0.16 ** (0.09)	0.00 (0.00)	0.01 *** (0.00)	0.00 (0.00)	0.01* (0.01)	0.10 *** (0.02)	0.01 (0.01)
Portugal	−0.23 * (0.14)	2.91 *** (0.39)	−0.33 ** (0.17)	0.00 * (0.00)	−0.01 *** (0.00)	0.01 *** (0.00)	0.03 (0.03)	−0.19 *** (0.05)	0.21 ** (0.10)
Republic of Korea	−0.06 *** (0.02)	−0.12 *** (0.01)	−0.08 *** (0.03)	−0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	−0.02* (0.02)	−0.03 *** (0.01)	−0.02 (0.02)
Republic of Moldova	0.13 *** (0.05)	0.44 *** (0.04)	0.12 ** (0.07)	−0.00 (0.00)	0.00 (0.00)	−0.00 (0.00)	−0.02* (0.01)	−0.02 (0.03)	−0.02 (0.02)
Romania	0.28 *** (0.05)	0.68 *** (0.12)	0.27 *** (0.07)	0.00 *** (0.00)	0.00 *** (0.00)	0.00 *** (0.00)	0.13 *** (0.03)	0.19 *** (0.02)	0.14 *** (0.03)
Russian Federation	0.22 *** (0.04)	0.35 *** (0.03)	0.21 *** (0.05)	−0.00 (0.00)	0.00 (0.00)	−0.00 (0.00)	−0.03 (0.03)	−0.03 (0.02)	−0.03 (0.04)
Senegal	723.19 (2982.32)	−0.00014 *** (3659.65)	3568.95 (4764.80)	3.12 (14.67)	−122.23 *** (25.97)	23.61 (29.48)	81.17 (583.66)	−5034.26 *** (871.95)	902.10 (1173.70)
Singapore	9025.42 ** (4484.05)	11,093.92 ** (5186.71)	12,805.86 ** (5945.78)	−13.41 *** (4.56)	−5.67 (9.03)	−19.12 *** (6.00)	−3.95 (40.32)	94.43 ** (49.18)	2.48 (61.33)
Slovakia	0.03 ** (0.01)	0.14 ** (0.07)	0.08 *** (0.03)	−0.00 (0.00)	−0.01 ** (0.00)	0.00 (0.00)	−0.01 (0.02)	−0.22 ** (0.12)	−0.00 (0.07)
Slovenia	0.10 * (0.07)	1.08 *** (0.17)	0.07 (0.09)	−0.00 ** (0.00)	−0.00 *** (0.00)	−0.00 * (0.00)	−0.03 *** (0.01)	−0.10 *** (0.02)	−0.03 * (0.02)
South Africa	0.38 *** (0.05)	0.61 *** (0.03)	0.37 *** (0.06)	−0.00 *** (0.00)	−0.01 *** (0.00)	−0.00 *** (0.00)	−0.16 *** (0.04)	−0.16 *** (0.01)	−0.17 *** (0.04)

Table 14. *Cont.*

	Estimation Methods								
	CPI			Control of Corruption			Percentile Rank		
	FMOLS	DOLS	CCR	FMOLS	DOLS	CCR	FMOLS	DOLS	CCR
Country_ID	**Beta**	**Beta**	**Beta**	**Beta**	**Beta**	**Beta**	**Beta**	**Beta**	**Beta**
Spain	0.10 (0.12)	2.10 *** (0.18)	−0.07 (0.19)	−0.00 (0.00)	−0.03 *** (0.00)	0.00 (0.01)	−0.07 (0.10)	−0.58 *** (0.06)	−0.12 (0.17)
Sweden	0.34 *** (0.13)	1.99 *** (0.15)	0.18 (0.20)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.01 *** (0.00)	0.00 (0.00)
Switzerland	−0.04 (0.20)	1.81 *** (0.54)	−0.15 (0.33)	0.00 (0.00)	−0.00 (0.00)	−0.00 (0.00)	0.01 *** (0.01)	0.02 *** (0.00)	0.02 ** (0.01)
Taiwan	503.92 (3218.16)	−9542.33 ** (4385.26)	2946.65 (4410.63)	1.10 (8.63)	−31.26 * (19.55)	14.29 (12.59)	31.40 (114.86)	−846.07 ** (452.03)	312.82 ** (169.82)
Thailand	154.35 (2267.22)	9164.14 * (5722.67)	451.60 (2097.71)	9.24 (12.04)	−12.20 (25.00)	9.89 (12.53)	491.46 (604.66)	−690.79 (1477.07)	613.56 (731.39)
Tunisia	0.02 (0.03)	0.99 *** (0.05)	0.00 (0.04)	−0.00 (0.00)	−0.00 *** (0.00)	0.00 (0.00)	0.01 (0.04)	−0.04 ** (0.03)	0.01 (0.05)
Turkey	0.20 *** (0.07)	0.49 *** (0.13)	0.20 ** (0.09)	0.00 * (0.00)	0.00 * (0.00)	0.00 * (0.00)	0.09 ** (0.05)	0.11 * (0.07)	0.09 ** (0.06)
Uganda	−2557.22 ** (1217.90)	−6165.29 *** (351.11)	−3252.83 ** (1557.02)	23.98 ** (14.34)	55.40 *** (5.81)	30.14 ** (17.66)	1014.21 ** (501.61)	2120.34 *** (159.47)	1213.87 ** (614.77)
Ukraine	0.18 *** (0.02)	0.33 *** (0.02)	0.18 *** (0.02)	0.00 * (0.00)	0.00 (0.00)	0.00 * (0.00)	0.02 * (0.01)	0.01 (0.02)	0.02 * (0.01)
United Kingdom of Great Britain and Northern Ireland	0.34 *** (0.08)	1.76 *** (0.13)	0.21* (0.13)	−0.00 (0.00)	−0.00 (0.00)	−0.00 (0.00)	−0.01 (0.01)	−0.02 * (0.01)	−0.00 (0.01)
United Republic of Tanzania	−2772.60 *** (1020.73)	−6343.91 *** (1207.91)	−2943.30 ** (1303.86)	−4.16 (8.43)	−7.11 (21.68)	−6.35 (10.71)	−178.14 (372.07)	−354.41 (1476.10)	−272.15 (469.63)
United States of America	−0.03 (0.03)	−0.16 *** (0.01)	−0.02 (0.03)	−0.00 (0.00)	−0.01 *** (0.00)	−0.00 (0.00)	0.01 (0.02)	−0.06 ** (0.04)	0.02 (0.02)
Uzbekistan	−2197.27 * (1350.77)	343.73 (2635.36)	−2598.15 ** (1516.11)	−4.53 (5.69)	−12.78 (12.87)	−1.29 (7.11)	−378.14 ** (172.57)	−838.89 ** (399.73)	−298.68 * (218.00)
Venezuela (Bolivarian Republic of)	−313.63 (999.45)	−3940.23 *** (1223.42)	−311.81 (1000.51)	−1.12 (31.55)	66.44 ** (31.99)	−2.97 (35.73)	−488.13 (786.01)	1713.22 *** (622.73)	−518.45 (816.48)
Vietnam	1312.86 (1865.61)	−4968.46 *** (1920.40)	2293.69 (2261.16)	8.55 * (5.73)	−31.35 *** (2.31)	17.58 ** (8.12)	222.81 (203.76)	−1542.48 *** (218.57)	647.24 ** (301.62)
Yugoslavia	−35.05 ** (15.99)	0.07 ** (0.04)	−48.14 ** (23.19)	−0.32 *** (0.09)	−0.58 *** (0.22)	−0.34 *** (0.13)	0.03 (0.23)	0.22 (0.27)	0.17 (0.33)
Zambia	−2274.29 (2072.72)	7222.26 (5680.93)	−3485.33 * (2439.89)	−5.35 (6.36)	−26.11 (22.97)	−18.21 ** (10.85)	−18.86 (286.52)	−1117.25 (1073.92)	−301.83 (520.45)
Zimbabwe	−0.00 *** (0.00)	−0.00 * (0.00)	−0.00 *** (0.00)	−0.00 *** (0.00)	−0.00 *** (0.00)	−0.00 *** (0.00)	−0.00 *** (0.00)	−0.00 *** (0.00)	−0.00 *** (0.00)
Panel Mean	14.59	−237.57	151.06	1.17	1.79	1.74	34.48	−6.08	59.85

Significance level, *, 10%; **, 5%; ***, 1%.

The results in Table 14 make it possible to demonstrate the heterogeneity of the effects and magnitudes that the rise in the prices of this agricultural good introduces into the levels of corruption in each economy. In this regard, economies, such as Mozambique, Botswana, Costa Rica or Uganda, tend to see increased levels of corruption due to significant increases in producer prices in apple production. We recall that our three Corruption Indicators (CPI, Control of Corruption, and Percentile Rank) associate the most positive and significant values with economies with lower frequencies of observation of corruption activities. Thus, the negative sign associated with the estimated long-term coefficient for these economies in Table 14 suggests that an increase of one unit in the Producer Price Index for apples in these economies anticipates significant decreases in the future values of these countries in the three indicators (CPI, Control of Corruption, and Percentile Rank), leading to more frequent corrupt practices. Convergent results were reached by Arezki and Bruckner (2011) and Krivonos and Dawe (2014), who found significant stimuli from agricultural prices on the tensions that generate corruption.

Similar Tables to Table 14 will be displayed if requested by the authors of this paper, showing the estimated coefficients for the estimated cointegration relationships for each of the 90 economies between each observed Corruption Indicator and each of the 19 Producer Price Indices under observation.

4. Conclusions, Implications and Future Work

The relationship between inflation and corruption was explored in this work at three levels of originality. The first level relates to the observed inflation pattern: we test Producer Price Indices and their relationship with corruption levels. The second dimension of originality relates to the diversity of Corruption Indicators discussed here. In addition to the "Corruption Perception Index", we also observed the indicator related to "Control of Corruption" and the percentage attributed to each country in the "Control of Corruption". The third dimension is the extent of the analysis. We observed the evolution of producer prices in 19 agricultural products for 90 economies since 2000.

In a summary of the results obtained through panel data cointegration techniques, we recognize that there tends to exist a statistically significant relationship between producer price inflation and levels of corruption. The favored direction of causality is that producer price inflation leads to higher levels of corruption.

Additionally, we explored this relationship for each of the 19 agricultural products against each of the 3 Corruption Indicators for each country. From this observation, there is a certain heterogeneity in the magnitude between the respective Producer Price Indices and the national levels of corruption, with particular gravity for countries with the worst human development indicators.

Thus, our work reinforces the need to fight inflation in all economies but with a special emphasis on emerging economies, with a view to controlling one of the most critical factors in terms of economic growth—corruption. For the studied sample, our work showed that one of the consequences of producer price inflation is corruption, a relationship that we consider that we have analyzed with originality.

We propose four topics for further research: the extension of this relationship to levels of inflation measured by the consumer price index, the detail of the causality observed here in a sample of countries by level of development, the implications of corruption/inflation on the employment of certain economic sector and, finally, the use of structural equations to assess the realities most impacted by the increase in producer prices that tend to generate higher levels of corruption.

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