

# Corruption in Mexico and Central America

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## Abstract

This paper investigates the determinants of corruption and the effects of certain variables on corruption. The variables that have marked incidence of corruption are, among others, increases in imports, in the shadow economy, self-employment, the interest rate, and the trade deficit, while corruption has a negative incidence on economic growth, exports, wage employment, and productivity, and others. Using principal component analysis new indicators of corruption and anti-corruption were developed, which were validated by comparing them with the World Bank's control of corruption index. The paper presents the main elements of a regional strategy to combat corruption and ends with a series of conclusions.

**Keywords:** corruption, probity, principal components, human capital, regional strategy

**JEL classification:** H5, H30, O1, O2.

## 1. Introduction

The economics literature has devoted considerable attention to the study of corruption, which is defined as the use of public sector facilities for personal gain.

This interest lies in the evidence that corruption has a negative impact on economic growth; in addition to its macroeconomic impact, there are other reasons to appreciate its negative impact on economic development. The diversion of tax resources resulting from corruption, for example due to the overvaluation of infrastructure works or government purchases, results in the loss of resources that could have been allocated to projects of importance for social development.

Likewise, upon perceiving and confirming the prevalence of corruption in the government, the civil service may feel demotivated and may reduce its diligence in carrying out its tasks, which has negative implications on the efficiency and productivity of the public sector.

It must be added that the prices paid by the public sector in the acquisition of goods and services are distorted by the effects of corruption, with adverse effects on the efficiency of the national production apparatus.

The literature that analyzes the repercussions of corruption on economic variables, particularly of a macroeconomic nature, is vast, but relatively little attention has been given to the study of the determinants of corruption. In the Latin American countries, there are very few studies that analyze these issues in the literature.

This work analyzes the determination of corruption using a sample of panel data from Mexico, the Dominican Republic, Guatemala, El Salvador and Costa Rica. This is considered to be the first work on this topic in the mentioned countries. The work is based on the estimation of Var models using panel data from the period 2000-2017. The data series end in that last year because for some of them, there was no data after 2017.

The estimated Vars allow us to appreciate the role of certain variables on corruption, particularly economic openness, the underground economy and the quality of education, while other Vars analyze the impacts of corruption on certain social and economic variables.

The next section presents a brief review of the selected literature, which is followed by the discussion of the data and its statistical properties. Next, the results of the estimation of Var models that show the effects on the control of corruption derived from shocks to certain variables are presented. Other models are estimated to appreciate the impact of control of corruption on economic and social variables. In another section, the determination of corruption is analyzed through the application of the principal components methodology. The work ends with a series of conclusions.

## 2. Review of Selected Literature

Bahnasawy and Revier (2012) analyzed the determinants of the perception of corruption in a sample of 197 countries with data from 2000, 2002, 2003 and 2005. The results showed that openness to foreign trade, defined as the sum of the ratios of export and imports to GDP had a negative effect on corruption, while the abundance of natural resources and public spending as a percentage of GDP had no effect. It should be noted that the percentage of seats in the national congress occupied by women, as well as the percentage that women represent in the workforce had negative effects on corruption, while the percentages of religious affiliations and ethnic fragmentation had no negative effects. For their part, increases in accountability and rule of law indices tended to reduce corruption.

Grundler and Potrafke (2019) used data from the period 2012-2018 from 175 countries to estimate the role of the Transparency International corruption index on the economic growth rate. The results indicated that in the long term, increasing this index by one standard deviation led to a fall in GDP per capita by 17 percent. The authors also reported that the transmission channels of corruption to economic growth lay in the role of corruption in reducing investment and increasing the inflation rate.

Goel and Nelson (2011) estimated equations using a cross-section of data from all 50 US states to identify variables that determined corruption. When the measurement of corruption was based on the perception by the state population that corruption existed in the state, the results showed that increases in state GDP, population, and the average level of education led to a reduction in corruption, while degree of urbanization and state employment increased it. When corruption was measured as the average annual number of convictions in federal court for acts of corruption, the variables included in the previous estimate remained significant, in addition to the number of federal officers per 100,000 inhabitants dedicated to the investigation of acts of corruption, as well as the percentage of state employment corresponding to people who work in the judicial sector.

Lederman, Loayza, and Soares (2005) analyzed the determinants of corruption using panel data from 1984-1999 from countries in various regions of the world. In the probit and regression model estimates, the dependent variable was the corruption index published by the International Country Risk Guide, which was expressed in terms of political and economic development variables. The results showed that the indicators of bureaucracy and economic decentralization had negative effects on corruption, while imports as a percentage of GDP and the average level of education of the population had no effect. On the contrary, the increase in GDP per capita showed a negative effect, implying that the development process entails the reduction of corruption.

Badinger and Nindl (2014) used a panel of data from the period 1995-2005 from 102 countries to identify the variables that determined the corruption perception index, taken from Transparency International. The results showed that GDP per capita, the average level of education of the population, openness to foreign trade and capital inflows contributed to the fall in corruption, with more marked effects in developing countries. On the contrary, inequality in income distribution increased corruption.

## 3. Data and Its Statistical Properties

The data used in the estimates of the Var models were taken from the World Bank's World Development Indicators, except for the Shadow variable that measures the size of the underground economy as a percentage of GDP, which was taken from Medina and Scheneider (2018). Table 1 shows the average values and standard deviations of the variables used in this work.

Table 1. Average values and standard deviations of the variables

	AUTOEMPLEOFE ME	AUTOEMPLEOM ASC	EMPLEOSALARIO FEME	EMPLEOSALARIO MASC	EXPORTS	IMPORTS
Mean	38.65456	38.82578	61.34667	61.17522	28.96056	37.36867
Std. Dev.	11.75395	8.669709	11.75419	8.670037	5.996818	7.131829
	GROWTH	CONTROLCORRUPTION	REMESAS	CREDITO PRIVADO	BROADMONEY	
Mean	3.333294	-0.35983	7.97866	32.12647	42.35526	
Std. Dev.	2.311344	0.498746	6.420797	12.71742	11.10963	
	POBLACIONCAPITAL	HOMICIDIOS	POVERTYGAP	EMPLEOPOPJOV ENFEME	EMPLEOPOPJO VVENMASC	
Mean	34.17583	30.60158	1.848148	27.74257	55.99206	
Std. Dev.	5.283241	24.9734	1.70036	3.864957	10.8863	

	PUPILTEACHERP RIMARIA	RATIO FM PARTICIPACION	PRODUCTIVIDAD
Mean	26.68164	54.94094	30752.07
Std. Dev.	7.342672	5.328447	10571.55

### 3.1 The Model

The variables that enter the Var were selected according to four categories; in the first, variables related to social exclusion are grouped, such as remittances and homicides. In the next category are labor market variables, such as self-employment rates and employment in the service sector. Another group covers variables associated with deindustrialization, such as the percentages occupied by the manufacturing and service sectors in the GDP, and the tariff on imports. The last category includes variables associated with the monetary sector, such as credit to the private sector and money broadly defined, both as a percentage of GDP, inflation and interest rates, and reserves per capita. Initially, the Vars were estimated including qualitative variables to control the fixed effects, but their coefficients turned out to be non-significant, so they were excluded from the Var. In this way, the estimates were made with a pooled cross section of data from five countries. As exogenous variables, a qualitative variable was included to represent the years when economic growth rates had been negative, *Cualicrisis*, another to represent the years of high economic growth, greater than six percent annually, in the Dominican Republic, *Cualidrgrowth*, and another to represent the years of economic stagnation of the US economy, *Cualiexterna*.

The first Var to be estimated is the following: (Remittances, homicides, imports, exports, X1, X2, control of corruption) in which the most exogenous variable is the ratio of remittances to GDP, in percentage, followed by the rate of homicides per 100,000 inhabitants, while the most exogenous is the control of corruption. These are variables from the base case that remain in all the Vars to be subsequently estimated, in which the variables X1 and X2 that come from the different categories of variables indicated above, will be added. The estimation results of the Var models are shown below.

## 4. Results

### 4.1 Variables of Social Exclusion and Foreign Trade

It is observed in Figure 1 that the increase of one standard deviation of remittances as a percentage of GDP gives rise to the fall of corruption control, significantly throughout the period. This result can be associated with the fact that remittances originate in persistent situations of unemployment and informal work, which are conducive to corruption.

It is also observed that control of corruption has a negative and significant response to the increase in the homicide rate. The explanation could be that the growth of violence increases opportunities for corruption.

Accumulated Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.

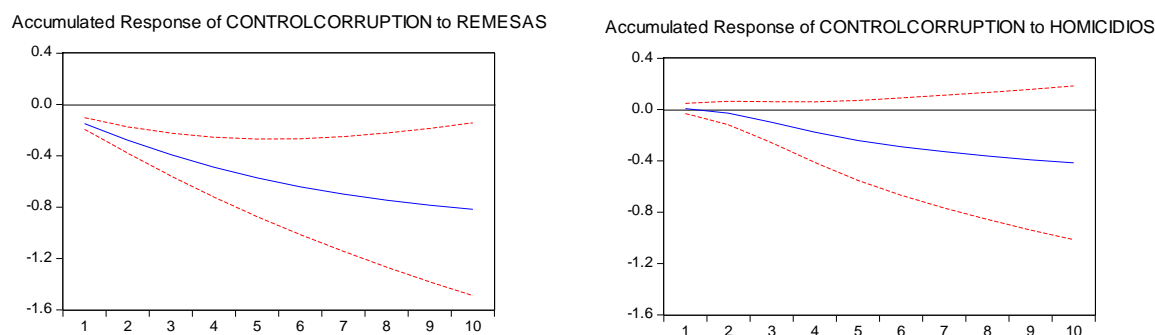


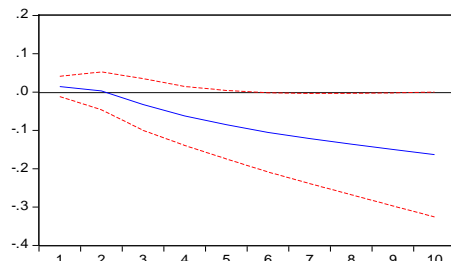
Figure 1. Control of corruption responses to increases in remittances and homicides

In Figure 2, it is striking that the increase in imports gives rise to the deterioration of control of corruption, that is, imports generate opportunities for corruption. An extensive literature has exposed the problem of the overvaluation of imports and the undervaluation of exports, as means to facilitate capital flight (Caceres, 1993).

On the contrary, the response of control of corruption to the increase in exports is positive and marginally significant in the first three years.

Accumulated Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.

Accumulated Response of CONTROLCORRUPTION to IMPORTS



Accumulated Response of CONTROLCORRUPTION to EXPORTS

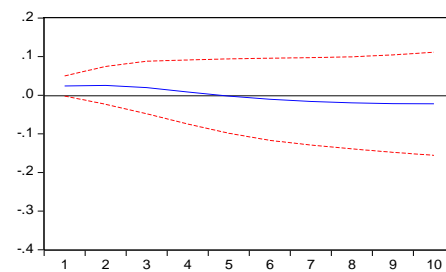


Figure 2. Control of corruption response to increases in imports and exports

It is worth highlighting the result shown in Figure 3 that the control of corruption falls significantly with the increase in the ratio of imports to exports, which is a measure of the deficit in the trade account.

This deficit has increased substantially in Central American countries; Santos-Paulino (2002), Thirlwall and Santos-Paulino (2004) and Stiglitz (2003) have shown that the deterioration of the trade account has been the main result of the liberalization of foreign trade undertaken by these countries in the 1990s. The supposed objective of these reforms was to increase the “efficiency” of export companies, but in view of the role of openness in stimulating corruption, the achievement of this objective is nullified by the perverse impact of corruption on productivity.

Accumulated Response of CONTROLCORRUPTION to Cholesky One S.D. IMPORTS/EXPORTS Innovation

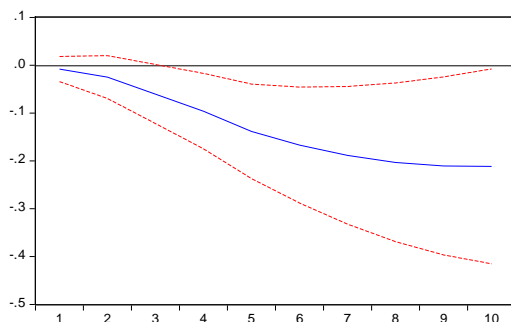


Figure 3. Response of corruption control to an increase in the deficit in the trade account

Accumulated Response of CONTROLCORRUPTION to Cholesky One S.D. GINI Innovation

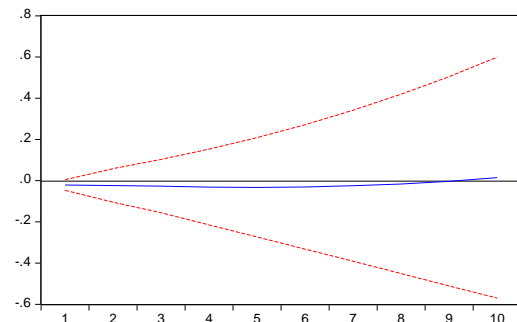


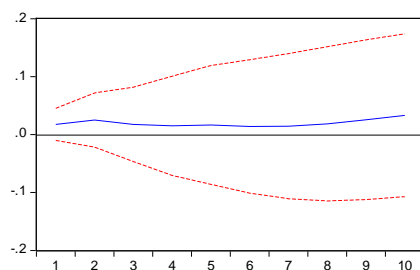
Figure 4. Response of control of corruption to increase in the Gini coefficient, as shown in the Figure

It is of interest to note that the increase of inequality in the distribution of national income does not give rise to a significant response from control of corruption (Figure 4).

It is observed in Figure 5 that control of corruption has a positive and marginally significant response in the first three years to the increase in the economic growth rate, that is, in the face of economic dynamism the propensity for corruption falls. On the contrary, the increase in the underground economy leads to an increase in corruption, which denotes the contributing role of informality on corruption.

Accumulated Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.

Accumulated Response of CONTROLCORRUPTION to GROWTH



Accumulated Response of CONTROLCORRUPTION to SHADOW

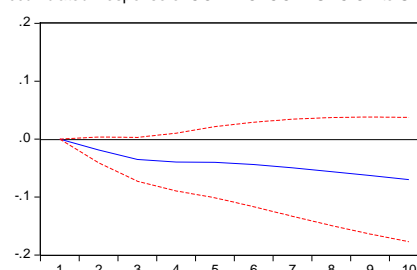


Figure 5. Response of control of corruption to an increase in the rate of economic growth and the underground economy

It is observed in Figure 6 that the control of corruption increases marginally in the first three years of the period in response to the increase in the investment rate; given the relationship between investment and economic growth, this result could be associated with the positive response of control of corruption to the increase in the economic growth rate shown on the previous Figure. The response to the increase in labor productivity is positive and significant throughout the period. The increase in productivity could represent the increase in salaries, in the face of which corruption decreases.

Accumulated Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.

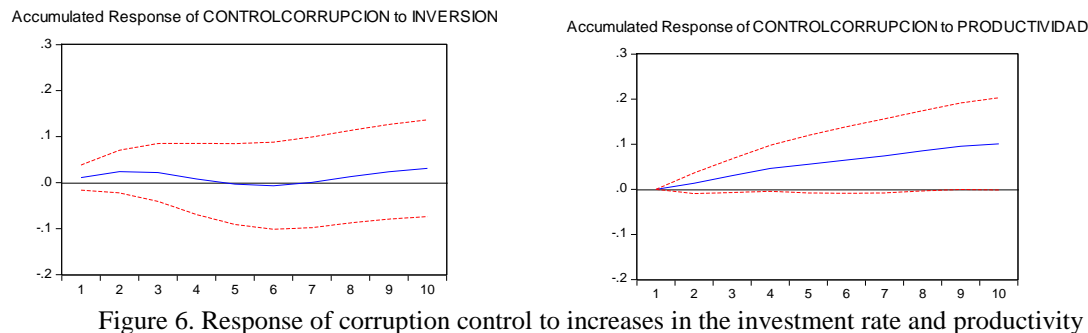


Figure 6. Response of corruption control to increases in the investment rate and productivity

It is of interest to observe in Figure 7 that the control of corruption has a positive and significant response in the first three years to the increase in the percentage of the population residing in the capital city, while the response to the increase in the percentage of the population living in the five largest cities is not significant. This shows that there are economies of agglomeration in the fight against corruption.

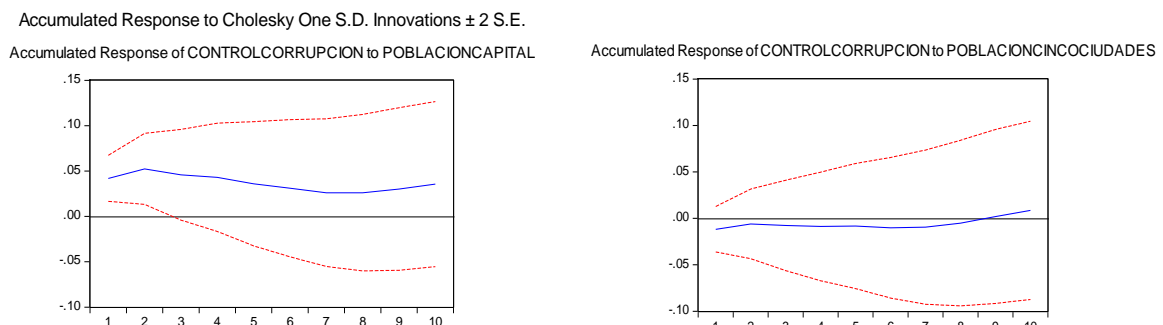


Figure 7. Responses of the control of corruption to increases in the percentages of the population living in the capital city and in the five largest cities

#### 4.2 Money Market Variables

Figure 8 shows that the response to the increase in credit to the private sector as a percentage of GDP is not significant, while the response to the increase in the money supply as a percentage of GDP, (M2), is positive and significant in the first three years. The implication is that corruption would tend to increase when money contractions occur, which can occur when a country goes through a period of macroeconomic adjustment. In this situation the resulting increase in corruption can hinder economic stabilization.

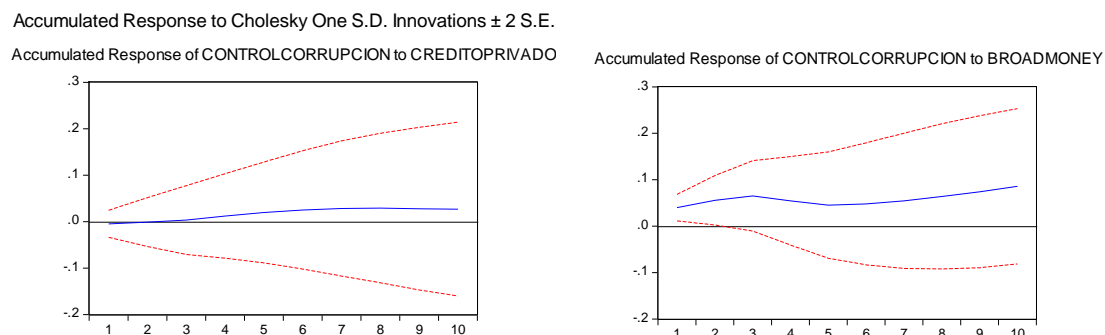


Figure 8. Responses of control of corruption to increases in credit to the private sector and in the money supply, both as a percentage of GDP

It is observed in Figure 9 that the control of corruption shows a negative and significant response to the increase in the loan interest rate. The high interest rate can denote a situation of liquidity limitations for companies and individuals, which could lead them to resort to corruption to solve such a situation.

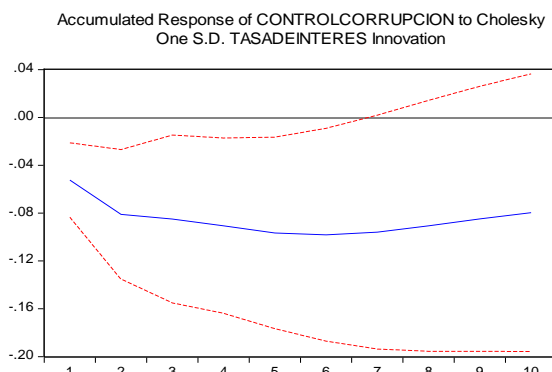
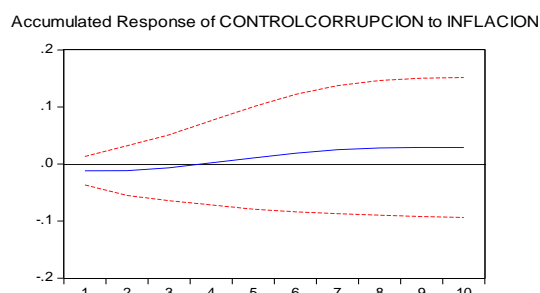


Figure 9. Response of corruption control to increase in the interest rate on loans

Figure 10 shows that the response of control of corruption to the increase in the inflation rate is not significant, but its response to per capita reserves is negative and significant. The increase in per capita reserves may denote a situation of economic prosperity that could relax vigilance over probity; conversely, the fall in per capita reserves could reflect a crisis situation in the external sector that could induce greater probity of the public apparatus.

Accumulated Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.



Accumulated Response of CONTROLCORRUPTION to RESERVESPC

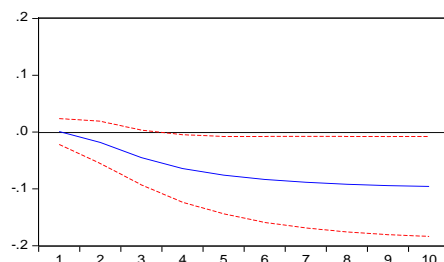


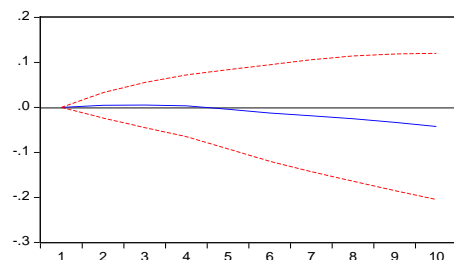
Figure 10. Responses of control of corruption to increases in the inflation rate and per capita reserves

#### 4.3 Labor Market Variables

It is observed in Figure 11 that the response of control of corruption to the increase in the female self-employment rate is not significant, while the response to the increase in the male self-employment rate is negative and significant in the first three years. Self-employment consists of precarious employment, usually in the informal sector, so it follows that informality encourages men to incur in corruption.

Accumulated Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.

Accumulated Response of CONTROLCORRUPTION to AUTOEMPLEOFEME



Accumulated Response of CONTROLCORRUPTION to AUTOEMPLEOMASC

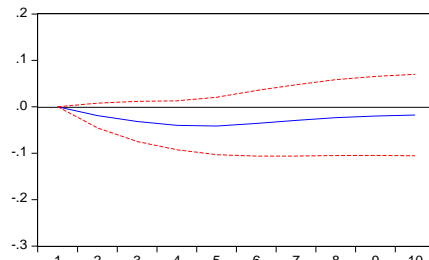


Figure 11. Responses of control of corruption to increases in female and male self-employment rates

The increase in the rate of female wage employment has no impact on the control of corruption, but the increase in the rate of male wage employment increases it. This result shows that the promotion of quality employment is a way to combat corruption.

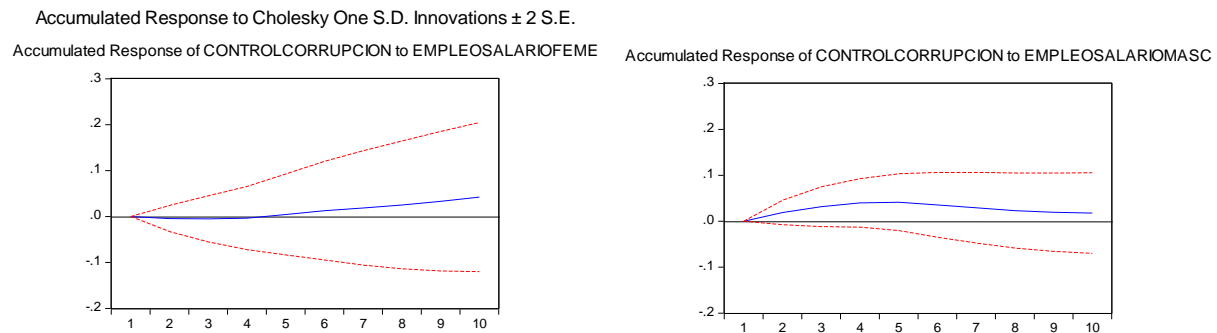


Figure 12. Response of corruption control to increases in female and male wage employment rates

Different responses are observed to the increase in employment rates in the services sector (Figure 13). The increase in female employment in this sector leads to the fall of control of corruption, while the increase in male employment leads to its increase. The explanation could be that male employment in services is better quality employment than female employment in this sector.

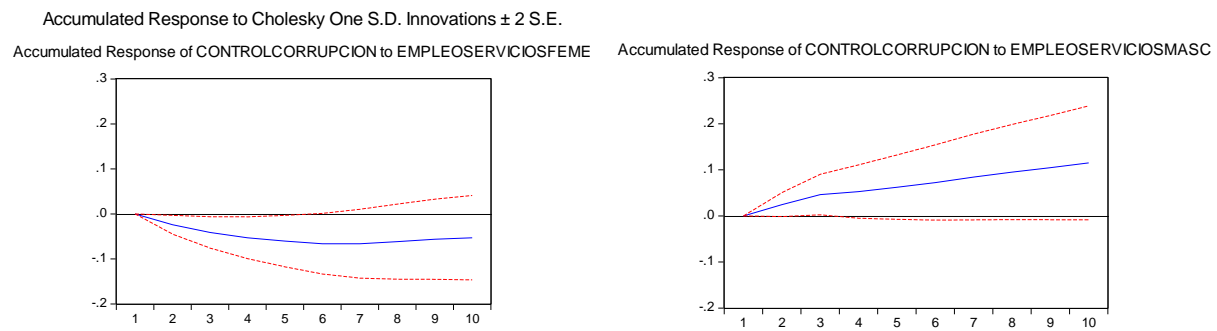


Figure 13. Control of corruption responses to increases in female and male employment rates in the service sector

Of special interest is the result shown in the Figure 14 where it can be seen that the increase in the ratio of female labor participation to male participation gives rise to a positive and significant response from control of corruption. That is, as more women than men enter the labor market, corruption tends to fall.

This points out the importance of facilitating the entry of women into the labor market, for example, by opening daycare centers, promoting single mothers to return to their jobs, or to schools, and preventing girls and young women from withdrawing from school. There is evidence that increasing the quality of education leads to reducing the school dropout rate (Lloyd & Clark, 2000), which would lead to an increase in female labor participation, and therefore a fall in corruption. The quality of education increases as a result of the increase in public spending on education (Caceres, 2018), which shows that increasing spending on education is a means to reduce corruption. As a result of the Covid pandemic, female unemployment increased considerably in Latin American countries, which could affect the deterioration of the control of corruption.

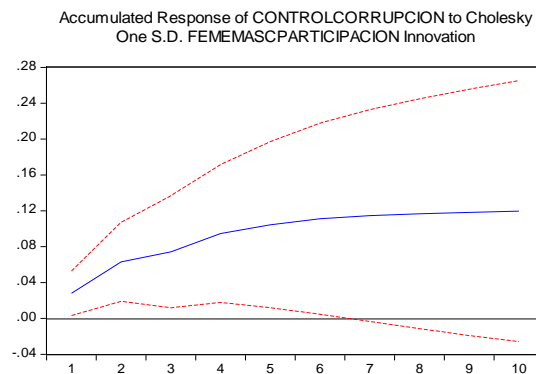


Figure 14. Response of corruption control to the increase in the ratio of female to male participation

#### 4.4 Governance Variables

Of special interest is the response to the increase in trust in the government, represented as the sum of the percentages of people who stated that they had some and a lot of trust in the government, taken from LatinBarometro (Figure 15). This response is categorically positive and significant to a greater degree than all the other responses shown in this work. Caceres (2019) has presented evidence that in Latin American countries, trust in the government is determined by the population's perception that the government is committed to reducing poverty, so that progress in improving the quality of life of the population will lead to increased confidence in the government and a fall in corruption. That is, governments have to “deliver” in terms of poverty reduction to generate trust and probity.

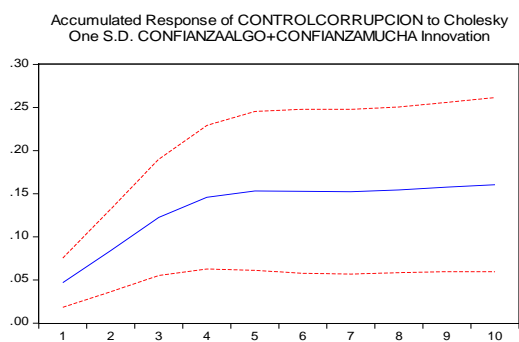


Figure 15. Response of control of corruption to increased trust in the government

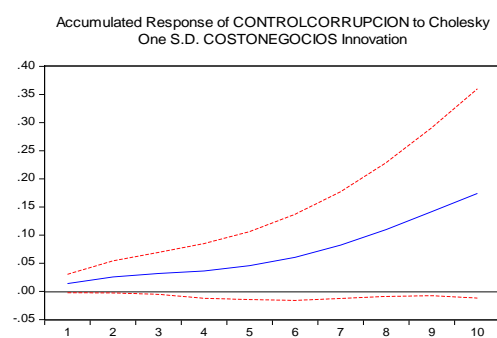


Figure 16. Response of control of corruption to the increase in the cost of registering a company

An extensive literature has postulated that corruption “helps” investors in the sense that upon encountering high transaction costs, complicated paperwork, and slow bureaucracies, investors resort to corruption to ensure that their ventures are subject to expeditious processing. This literature sees corruption as a facilitator of business, that is, as a “bypass” of the heavy bureaucracy.

This position does not find support in the results of this work since the response of control of corruption to the cost of registering a company is positive and significant (Figure 16), which indicates that the rigor of the registration procedures, which are reflected in the registration costs, purge the environment of corruption.

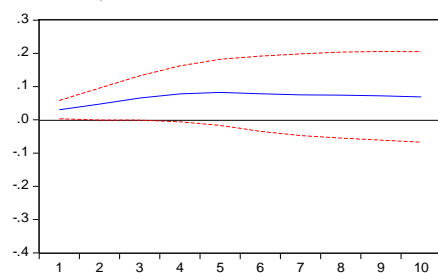
#### 4.5 Variables Associated with Deindustrialization

The Figure 17 shows that control of corruption increases as the percentage participation of the manufacturing sector in the GDP increases. Given the evidence that the manufacturing sector is the main determinant of economic growth (Caceres, 2017), it could be considered that the increase in control of corruption reflects the increase in economic dynamism because of the increase in the manufacturing sector. This result contrasts with the fact that the manufacturing sector has shown contraction in all countries, which is explained by the reduction of tariffs as a result of the liberalization of foreign trade. This response is significant and highlights the importance of promoting reindustrialization and, in general terms, of protecting national production.

The response to the increase in the participation of the services sector in the GDP is negative and significant, which can also be associated with deindustrialization, that is, the liberalization of foreign trade led to the displacement of national production by imports and the expansion of the tertiary sector, thus weakening the control of corruption.

Accumulated Response to Cholesky One S.D. Innovations  $\pm$  2 S.E.

Accumulated Response of CONTROLCORRUPCION to MANUFACTURE



Accumulated Response of CONTROLCORRUPCION to SERVICES

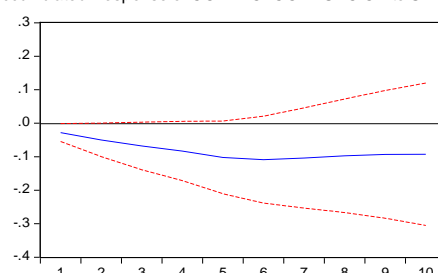


Figure 17. Control of corruption responses to increases in the manufacturing and service sectors



The previous result is associated with the response of control of corruption to the increase in the import tariff, which is positive and significant, which shows that the reduction of the import tariff has led to an increase in corruption.

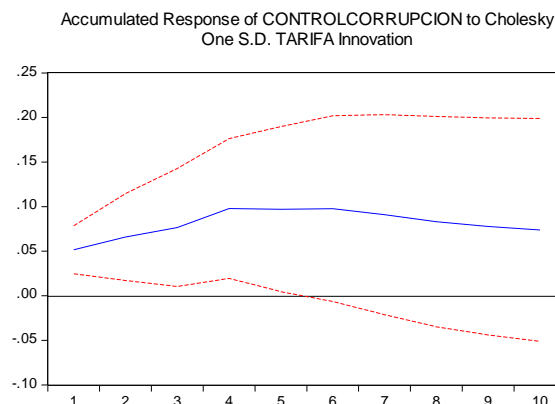


Figure 18. Response of control of corruption to the increase in import tariffs

The origin of deindustrialization is shown in the Figure 19, where the response of the manufacturing sector to the increase in tariffs is positive and significant, which denotes reindustrialization, and corroborates that the fall in tariffs gave rise to deindustrialization. It is also observed that with the increase in the tariff, the participation of the services sector in the GDP decreases, that is, the increase in this sector in the last two decades is explained by the liberalization of foreign trade.

Accumulated Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.

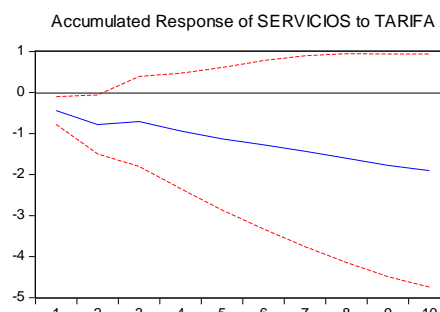
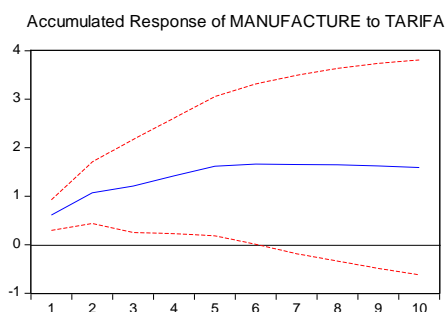


Figure 19. Responses of the shares of the manufacturing and services sectors to increases in import tariffs.

The reduction in tariffs also led to increased violence; the Figure 20 shows that in Costa Rica the reduction of the tariff rates is associated with an increase in homicides.

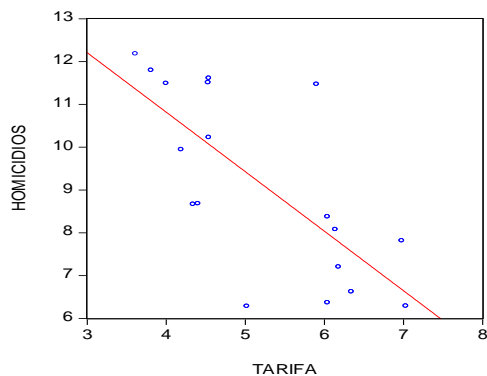


Figure 20. Tariff rate and homicide rate in Costa Rica

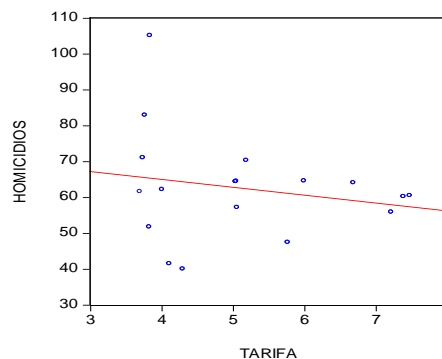


Figure 21. Tariff rate and homicide rate in El Salvador

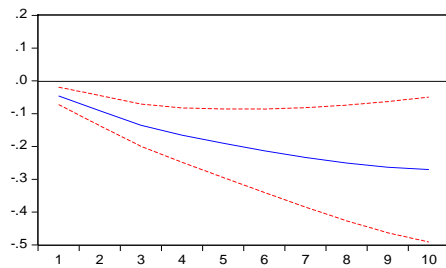
A similar relationship is observed in El Salvador (Figure 21).

The Figure 22 shows that the increase in the percentage of the population that uses the Internet gives rise to a

negative response from control of corruption, indicating that access to the Internet undermines probity. The response of control of corruption to the increase in tourism income as a percentage of exports is positive and significant in the first three years, that is, there is an association between tourism income and probity.

Accumulated Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.

Accumulated Response of CONTROLCORRUPTION to INTERNETUSERS



Accumulated Response of CONTROLCORRUPTION to INGRESOSTURISNO

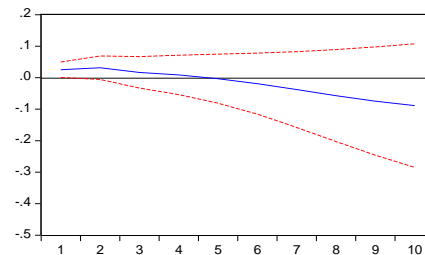


Figure 22. Corruption control response to the increase in internet users and tourism income.

Of special importance is the response of control of corruption to the increase in initial conditions, which are represented by the value prevailing in the year 2000 of this variable. It can be seen in Figure 23 that the response is positive, which denotes that the control of corruption is subject to “path dependence” effects. This result indicates that an improvement in control of corruption has a persistent effect in subsequent periods, as does its deterioration.

Accumulated Response of CONTROLCORRUPTION to Cholesky  
One S.D. CONDICIONINICIALCONTROLC Innovation

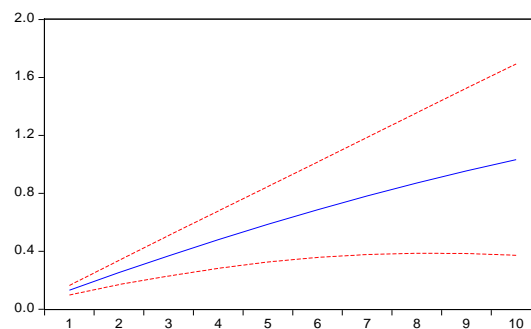


Figure 23. Response to initial corruption control conditions

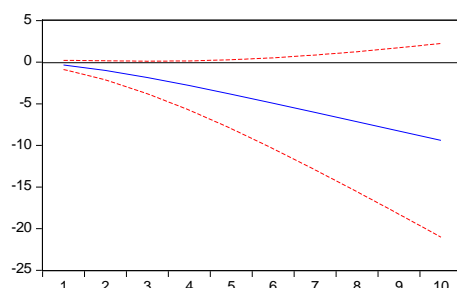
#### 4.6 Repercussions of Control of Corruption on Macroeconomic Variables

Next, results from the estimation of Var models are presented that permit to appreciate the incidence of control of corruption on economic and social variables.

It can be seen in the Figure 24 that the size of the underground, or Shadow economy, falls due to the increase in corruption control. On the contrary, the response of the economic growth rate is positive and marginally significant in the first half of the period. This result shows that corruption promotes informality and undermines economic dynamism.

Accumulated Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.

Accumulated Response of SHADOW to CONTROLCORRUPTION



Accumulated Response of GROWTH to CONTROLCORRUPTION

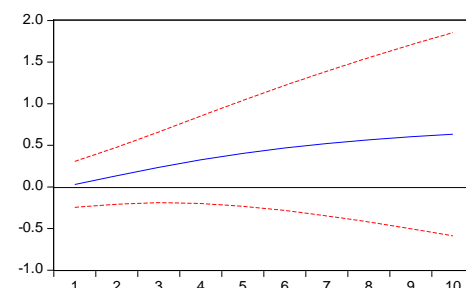
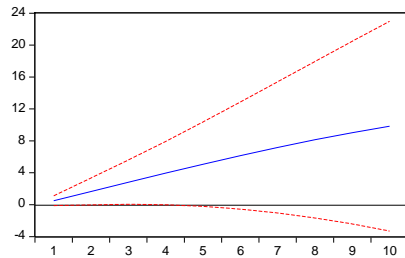


Figure 24. Shadow responses and economic growth rate to increased corruption control

Of special interest is the result that female and male wage employment rates increase with the control of corruption (Figure 25). It is observed that the increase in male salaried employment is twice the increase in female employment, which implies that women encounter additional obstacles to obtaining quality employment that men do not face. Given that both responses are significant, particularly that of male employment, it follows that corruption plays an important role in obtaining quality jobs by women and men.

Accumulated Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.

Accumulated Response of EMPLEOSALARIOFEME to CONTROLCORRUPTION



Accumulated Response of EMPLEOSALARIOMASC to CONTROLCORRUPTION

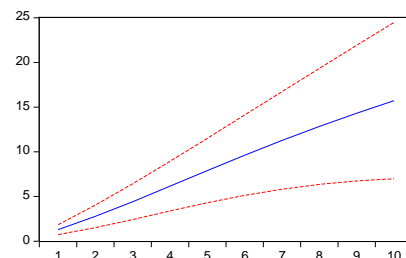
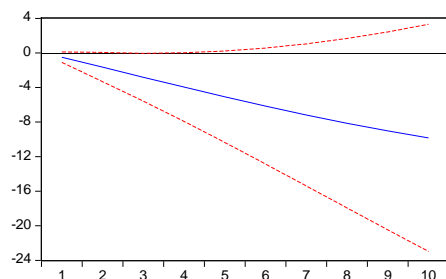


Figure 25. Responses of female and male wage employment rates to increased control corruption

Female and male self-employment fall with the increase of control of corruption and the drop in male self-employment is twice the size of the drop in female self-employment (Figure 26), which implies that corruption punishes women more than men. Another implication is that it is more difficult for women to exit informality than for men. These results expose the discrimination women suffer in the labor market.

Accumulated Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.

Accumulated Response of AUTOEMPLEOFEME to CONTROLCORRUPTION



Accumulated Response of AUTOEMPLEOMASC to CONTROLCORRUPTION

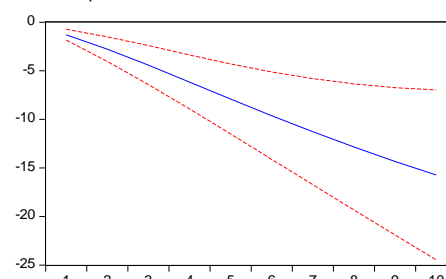
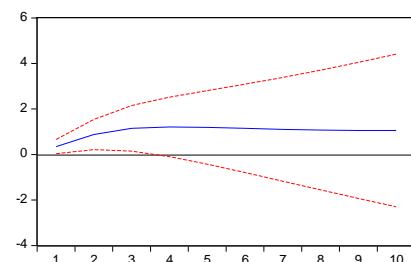


Figure 26. Responses of female and male self-employment rates to increases in control of corruption

The responses of the ratios of female and male youth employment to population are positive and significant, the first in the first five years and the second in the entire period (Figure 27). It is observed that young men benefit more than young women from the increased control of corruption.

Accumulated Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.

Accumulated Response of EMPLEOPOPJOVENFEME to CONTROLCORRUPTION



Accumulated Response of EMPLEOPOPJOVENMASC to CONTROLCORRUPTION

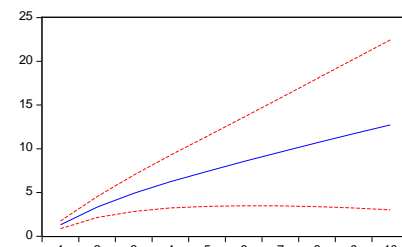


Figure 27. Responses of ratios of female and male youth employment to population

It should be noted that the increase in control of corruption gives rise to a positive and significant response in the ratio of female to male participation (Figure 28).

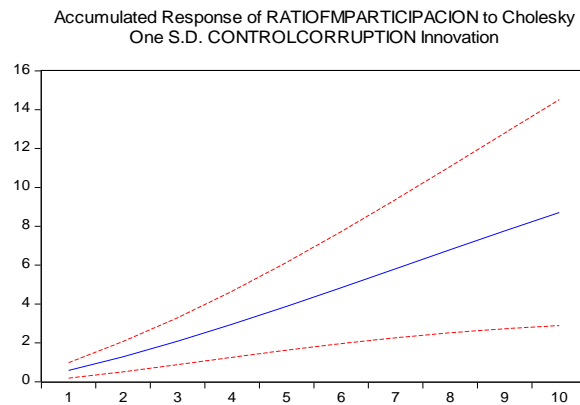
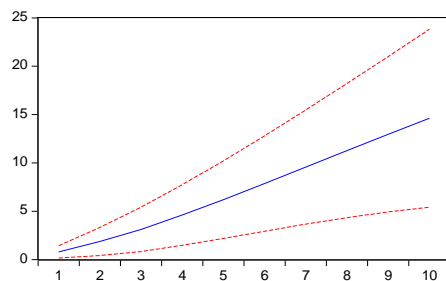


Figure 28. Response of the ratio of female to male participation to increased control of corruption

The Figure 29 shows that the response of credit to the private sector as a percentage of GDP is positive, so that greater control of corruption induces greater expansion of credit to the private sector. The response of money as a percentage of GDP is also positive and significant. These results show that probity plays an important role in countries' financial markets.

Accumulated Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.

Accumulated Response of CREDITOPRIVADO to CONTROLCORRUPTION



Accumulated Response of BROADMONEY to CONTROLCORRUPTION

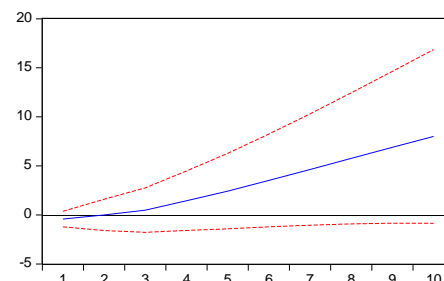


Figure 29. Responses of credit to the private sector and money, both as a percentage of GDP to increased control of corruption

#### 4.7 Control of Corruption and Transmission of Social and Monetary Policies

The Figure 30 shows three circuits through which the control of corruption affects economic growth. In the literature review, reference was made to studies that reported that the average educational level of the population had a positive effect on the control of corruption (Badinger & Nindl, 2014). Given that the complete series of schooling levels for some countries are not available for the period of analysis, it was decided to use public spending on primary education per student as a percentage of GDP per capita as an indicator of the quality of education of the respective country. It is assumed that control of corruption increases with the increase in public spending on education.

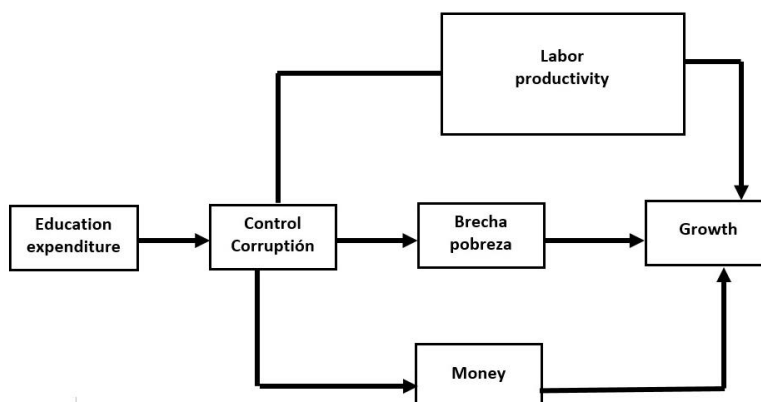


Figure 30. Circuits of transmission of public spending in primary education through the control of corruption

This is corroborated by the Figure 31 that shows that the positive response of control of corruption to the increase in spending on primary education (gastoeduprimaria).

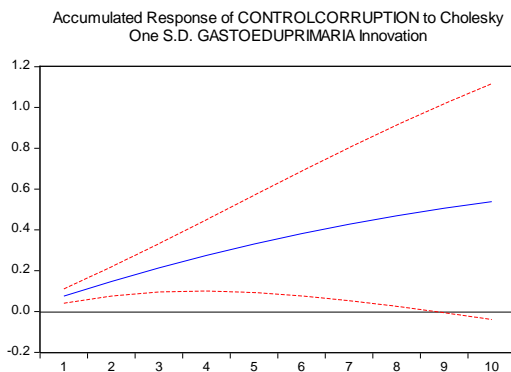


Figure 31. Corruption control response to increased public spending on primary education

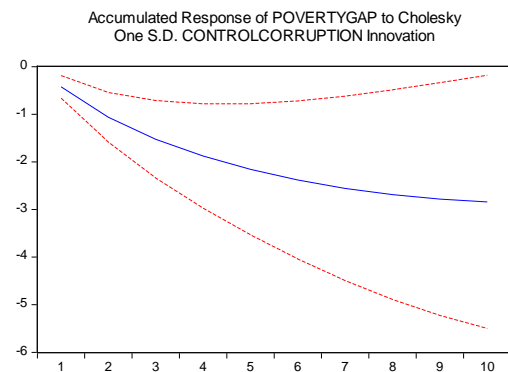


Figure 32. Poverty gap response to increased control of corruption

It must be taken into account the Figure 32 that shows that increasing control of corruption leads to a reduction in the poverty gap, that is, probity is an important element in the fight against poverty (Note 1).

The result that must be emphasized is that the increase in the poverty gap leads to the fall in the economic growth rate (Figure 33). In other words, to the extent that as the control of corruption increases the poverty gap falls, which gives rise to an increase in the rate of economic growth.

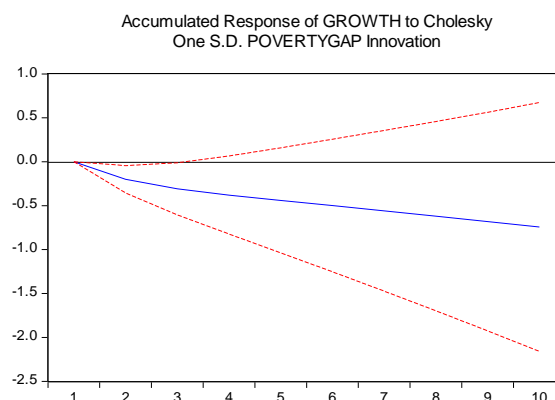


Figure 33. Response of economic growth rate to increase in the poverty gap

Of special relevance are the results shown in the Figure 34 that show that, with the increase in public spending on education, the poverty gap falls, while the economic growth rate increases.

In this way, it is deduced that control of corruption can be seen as a mechanism for the transmission of social policy towards economic growth, a result that has gone unnoticed in the literature.

Accumulated Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.

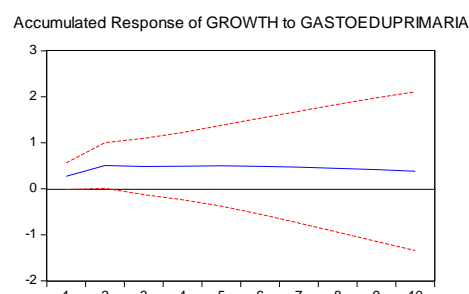
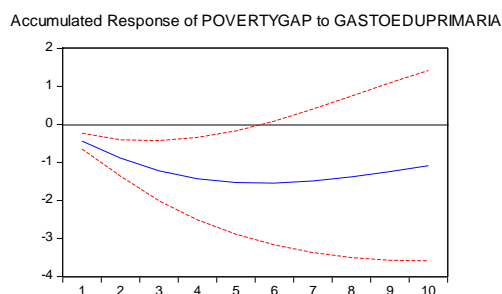


Figure 34. Responses of the poverty gap and the economic growth rate to increases in public spending on primary education

Another transmission circuit of social policy lies in the role of increased control of corruption in increasing the ratio of money to GDP, expressed in percentages, as was seen in the Figure 29. For its part, the increase in money gives rise to a positive and significant response in the economic growth rate, as shown in the Figure 35. In other words, there is a circuit that begins with increased spending on education, which leads to increased control of corruption, which in turn generates a positive response from money, which leads to an increase in the rate of economic growth.

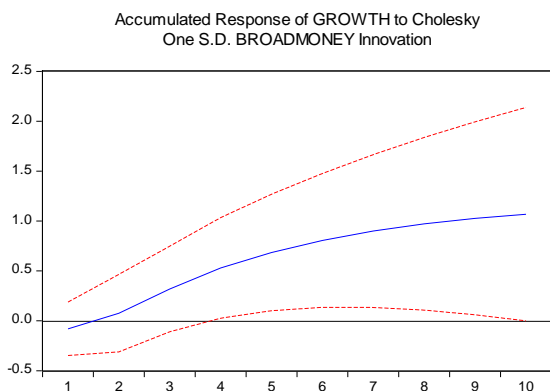


Figure 35. Response of the economic growth rate to an increase in the ratio of money to GDP

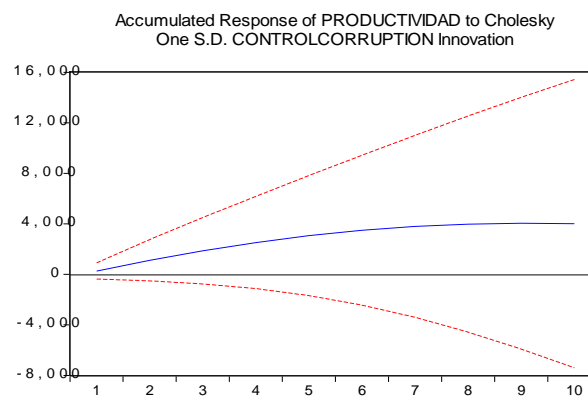


Figure 36. Response of labor productivity to increased control of corruption

There is a third channel, which was shown in the Figure 30, through which fiscal policy, that is, the policy of increasing education spending, has an impact on the rate of economic growth. It can be seen in the Figure 36 that the increase in control of corruption gives rise to a positive and significant response in the first five years of labor productivity, that is, the increase in probity leads to the public and private sectors producing more for each employed woman or man. An explanation resides in the fact that the increase in control of corruption leads to an increase in credit to the private sector, which would allow this sector to acquire machinery and new equipment, thus leading to an increase in labor productivity.

It should be noted in the Figure 37 that the increase in labor productivity leads to an increase in the economic growth rate. This highlights another channel of transmission of fiscal policy through control of corruption.

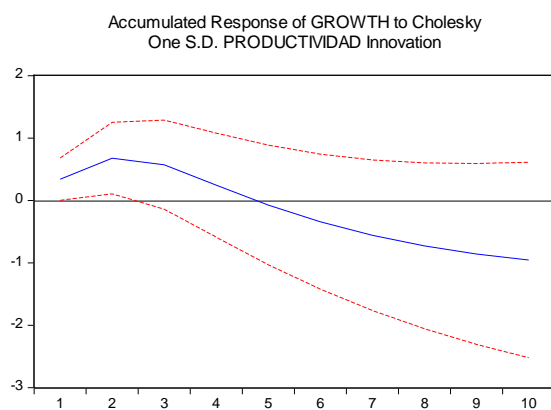


Figure 37. Increase in economic growth rate with increase in labor productivity

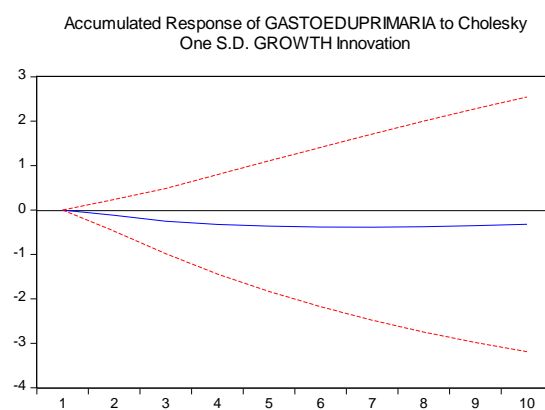


Figure 38. Response of public spending on primary education to increase in economic growth rate

There is no significant response of spending on education to the increase in the economic growth rate, as seen in the Figure 38. The non-significant response implies that there is no positive feedback that would impart continuity to the operation of the system, that is, spending on education does not behave like in a solo mode, but rather each year “it starts from zero”. This could be explained by the low elasticity of tax revenues with respect to economic growth, as well as the discretion in the preparation of the national budget.

#### 4.8 Economic Interdependence Through the Control of Corruption

Several studies have highlighted the strong economic interdependence between Central American countries as a

result of their trade flows between countries (Caceres, 2021a, 2021b). Figure 39 shows that interdependence is also reinforced through the channel of control of corruption in the countries.

In quadrant 1 of the Figure 39 the economic growth rate of country 1, Growth 1, increases to the extent that its control of corruption index, ControlC1, increases. Given the increase in its economic activity, country 1 increases its imports from country 2, X21, (quadrant 2), and, therefore, the economic growth rate of country 2, Growth2, increases, as seen in quadrant 3. Using quadrants 1 and 3, a positive relationship is constructed in quadrant 4 between the control of corruption in country 1 and the growth rate of country 2, indicating that the economic dynamism imparted by ControlC1 in country 1, spreads to country 2.

That is, the countries “share” the increase in economic dynamism that results from increased control of corruption in a country. In other words, the control of corruption is a valid instrument of economic integration, a topic that had not been analyzed in the literature. Hence the importance of countries undertaking joint efforts to make progress in controlling corruption.

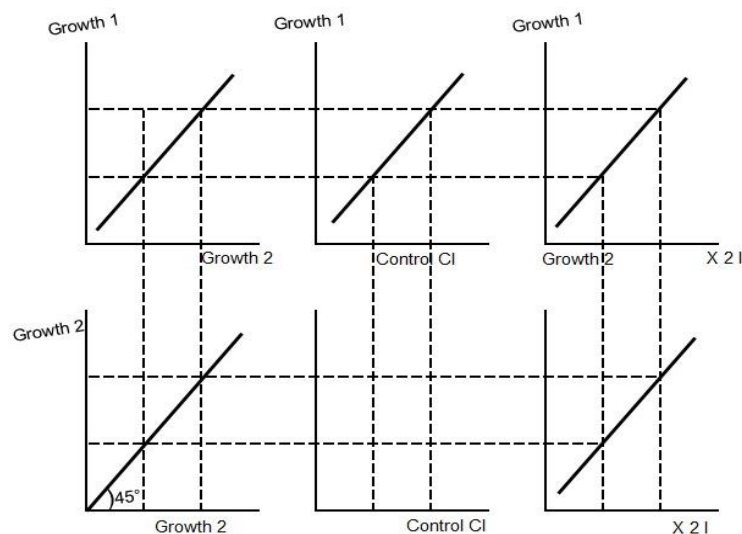


Figure 39. Economic interdependence through control of corruption

The Figures 40 and 41 show the positive relationship between corruption control in Guatemala and the economic growth rates of El Salvador and Honduras, while the Figure 42 shows the control of corruption index of El Salvador and the growth rate of Costa Rica, which validates the model presented in Figure 39.

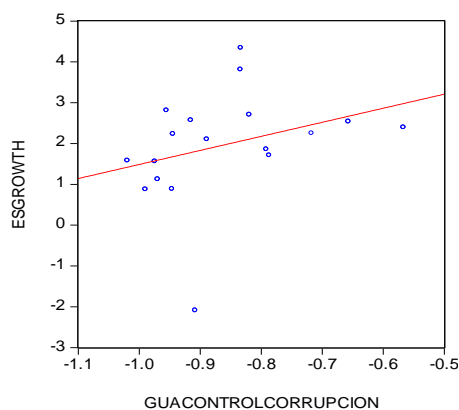


Figure 40. Control of corruption in Guatemala and economic growth rate in El Salvador

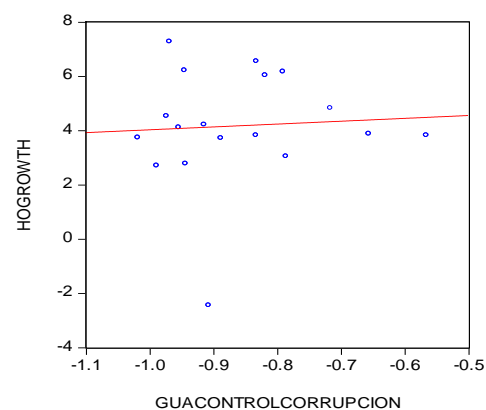


Figure 41. Control of corruption in Guatemala and economic growth rate in Honduras

Using the 45-degree line in quadrant 5, the positive relationship between the growth rates of countries 1 and 2 is shown in quadrant 6, indicating that the increase in control of corruption in a country has given rise to a synchronic relationship in the growth rates of both countries. In this way, economic integration acquires dynamism and resilience from within, due to its efforts to combat corruption, while trade flows become more robust and thus the countries are better positioned to face the ups and downs of the international economy.

The Figure 43 shows the close association between the economic growth rates of Costa Rica and El Salvador, which validates the model presented in the Figure 39.

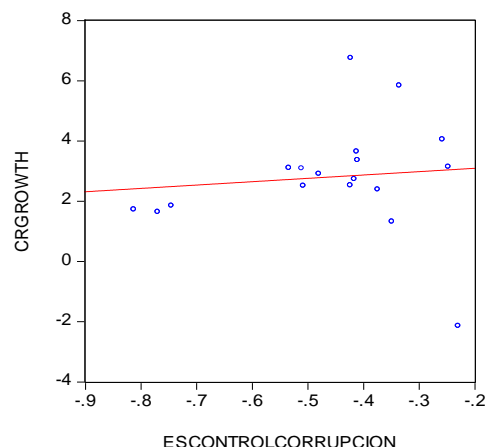


Figure 42. Control of corruption in El Salvador and economic growth rate of Costa Rica

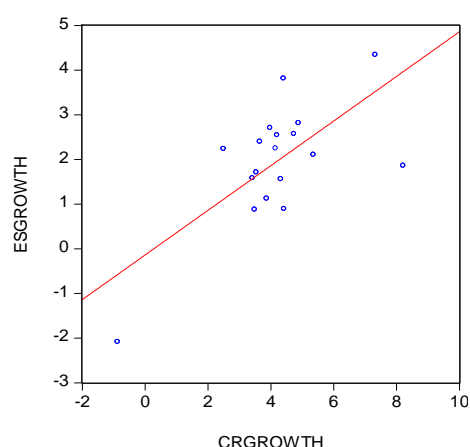


Figure 43. Economic growth rates of Costa Rica and El Salvador

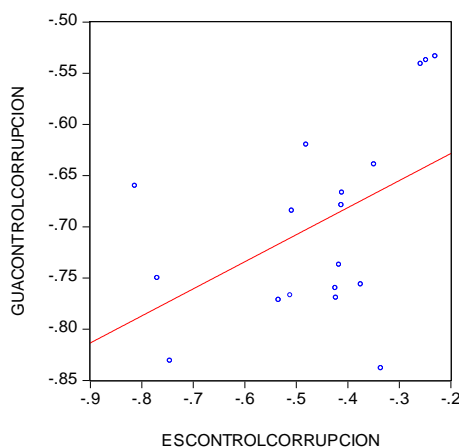


Figure 43a. Contagion effects from corruption

It can be shown that the increase in economic growth in country 2 leads to an increase in its control of corruption, and thus a positive relationship between the two countries' control of corruption indicators is obtained, see Figure 43a. In this model, the two countries experience reciprocal contagion effects between their control of corruption indicators; this model is a contribution to current research being done on the contagious effects from corruption, see, among others, Borsky and Lalkschmied (2019), Becker et al. (2009).

#### 4.9 Corruption as a Latent Variable 1

As noted above, the corruption index, as well as the other governance indices developed by the World Bank, are based on periodic surveys of groups of people in the countries in question. Next, it is argued that a better corruption index can be calculated through the theory of latent variables through which the resulting index would capture the influences of the variables that cause corruption, as well as the influences of corruption on other variables.

The starting point is the identification of the variables that cause corruption. Figure 44 indicates that the variables such as the bank interest rate, imports, salaried employment, and others, have effects on the control of corruption as has been shown in this study. Figure 44 also shows the outcome variables, that is, those that are determined by corruption, among which are labor productivity, the poverty gap, the economic growth rate, and others. Through the computations inherent to the theory of latent variables, an index based on the causes and consequences of corruption would be obtained.



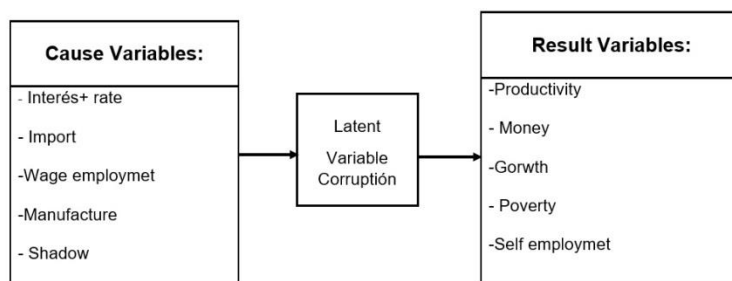


Figure 44. Corruption as a latent variable

#### 4.10 Access Money Corruption as a Latent Variable

In relation to the measurement of corruption, reference should be made to the important paper by Yuen Yuen Ang (2020), which presented a new corruption index, that of unbundling corruption. She developed this index based on surveys of people knowledgeable about the situation in the respective country. This index distinguishes four types of corruption: “petty theft”, “grand theft”, “speed money” and “access money”. Petty and grand theft refer to the theft of public property and extortion; “speed money” is the payment of bribes to public employees to avoid time-consuming bureaucratic processes; and “access money” refers to the market for favors and influence between political and business sectors. These categories were also broken down into their subcomponents.

The author conducted surveys in 15 countries and computed the scores corresponding to each category and subcategories and, as well, the scores were consolidated into a single indicator for each country.

The results showed that developing countries have the highest scores in the “petty theft” and “grand theft” categories, while developed countries showed the highest indicators in the “access money” category.

These indicators have the advantage of disaggregating corruption into distinct categories and subcategories.

It is of interest to use an indicator of the corruption associated with access money through the application of the latent variables methodology, as shown in Figure 44a.

Among the cause variables are amounts of lending to relatives, amounts of lobbying expenses, overvaluation of imports, amounts of capital flight. Among the results variables are interest and inflation rates, interest rate spreads, and labor productivity.

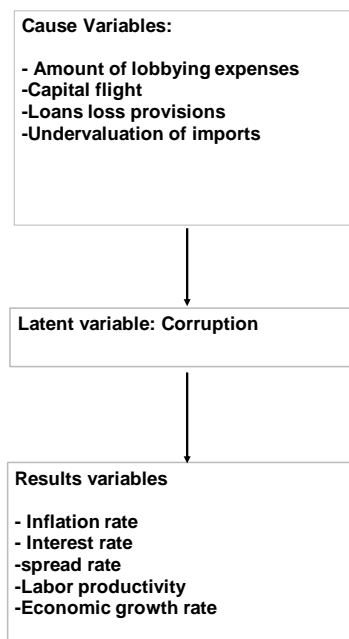


Figure 44a. Access money corruption as a latent variable

#### 4.11 Another Indicator of Corruption

It is of interest to know the corruption trends of a given country in terms of its determining variables. One way to

calculate this trend would consist of computing the deviations of the variables associated with corruption in a given country in relation to the values of variables in another country that are considered to serve as benchmarking for computing corruption. An example of this exercise is shown the Table 1a.

Table 1a. Corruption Benchmarking

Country variable values	Benchmark values	Differences
Self employment		
Youth unemployment		
female		
Youth unemployment		
male		
Import % of GDP		
Remittances % GDP		
Homicides		
Sum of differences		

The sum of the differences can be interpreted as the severity of corruption and its trajectory would indicate its deterioration or improvement and would allow identifying the variables that affect its deterioration.

#### 4.12 Principal Components as Indicators of Control of Corruption

The estimation of Var models allowed us to identify the variables that lead to an increase in the perception of corruption. Next, it is proposed that a linear combination of a group of these variables can be interpreted as an indicator of corruption. The variables selected for this analysis are remittances, imports, the dimension of the underground economy, all as a percentage of GDP, homicide rates and male self-employment, whose increases, as observed in the Var, give rise to the decline in the perception of control of corruption, that is, they contribute to the increase in corruption. These variables can be consolidated into one, or more, vectors, through the application of principal components, which is a data compression methodology. The results are shown in table 2.

Table 2. Principal components

Computed using: Ordinary correlations				
Extracting 5 of 5 possible components				
Eigenvalues: (Sum = 5, Average = 1)				
number	value	Difference	Proportion	Cumulative value
1	2.927996	1.771534	0.5856	2.927996
2	1.156462	0.624948	0.2313	4.084458
3	0.531515	0.230747	0.1063	4.615973
4	0.300767	0.217507	0.0602	4.916740
5	0.083260	---	0.0167	5.000000
Eigenvectors (loadings):				
Variable	PC 1	PC 2	PC 3	PC 4
SHADOW	0.467728	0.281000	-0.500436	0.669174
IMPORTS	0.392645	-0.479533	0.654787	0.424504
REMITTANCES	0.554958	-0.009274	0.029413	-0.429603
SELF-EMPLOYMENTOMASC	0.156144	0.822221	0.520207	-0.049923
HOMICIDES	0.542864	-0.122284	-0.222120	-0.430060

It is observed that the first principal component explains 58.56 percent of the variance of the five selected variables, while the second principal component explains 23.13 percent.

The first principal component is given by the expression:

$$\text{Corruption} = 0.4677 * \text{Shadow} + 0.3928 * \text{Imports} + 0.5550 * \text{Remittances} + 0.1561 * \text{Self-employmentmale} + 0.5428 * \text{Homicides}$$

In the first principal component, the highest coefficients (“loadings”) correspond to the homicide rate, remittances and the informal economy, so it can be deduced that the first principal component represents poverty

and that poverty is a manifestation of high rates of informality, male unemployment, imports, and remittances.

It is observed in the first principal component that the coefficient (“loading”) of the male self-employment rate has the lowest “loading”, which can indicate that the labor market does not exert marked effects on corruption in the dimension of the first principal component. On the contrary, in the second principal component, the male self-employment rate has the highest loading, (0.8222), so that this component represents the incidence of the labor market in corruption. It should be noted that this component only explains 23 percent of the variance. In the third principal component, the highest coefficients correspond to Shadow (0.6548), and to male self-employment (0.5202), so it can be deduced that the third principal component represents informality.

The poverty gap variable was not included in this analysis because no data was found for Mexico and Guatemala, but it should be noted that there are associations between the computed Corruption variable and the poverty gap in the other countries, as seen in the Figures 45, 46 and 47.

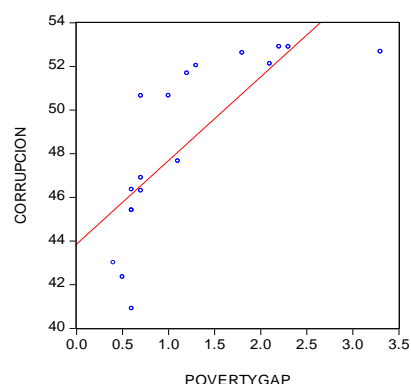


Figure 45. Poverty Gap and Indicator of Corruption in Costa Rica

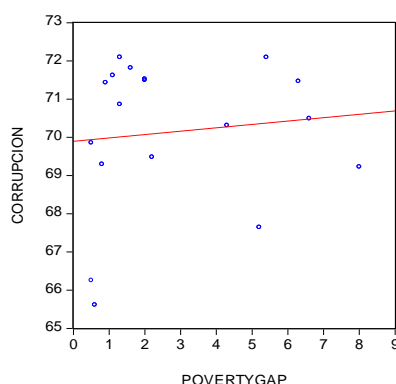


Figure 46. Poverty Gap and indicator of Corruption in El Salvador

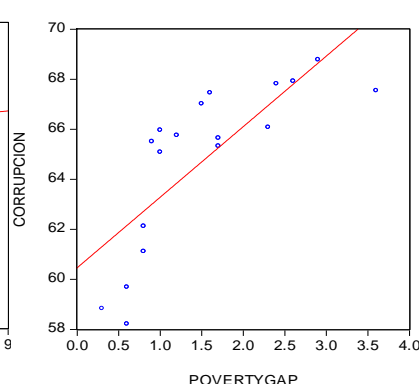


Figure 47. Poverty Gap and indicator of Corruption in the Dominican Republic

The previous Figures imply that the poverty gap, as well as homicide and self-employment rates, remittances, which represents emigration, informality, and imports, constitute an environment conducive to corruption.

The first principal component, which has been called Corruption, is shown in the Figure 48. It is observed that the period 1-18 the corruption index, which represents Mexico, remains relatively constant; in the following period 19-36, which corresponds to Guatemala, the index increases to the maximum value of 85, from which it begins to fall. The falls continue in the period 37-54 of Costa Rica to its lowest value of 50, and rises in the period 55-72 of El Salvador, to fall in the period 73-90 corresponding to the Dominican Republic.

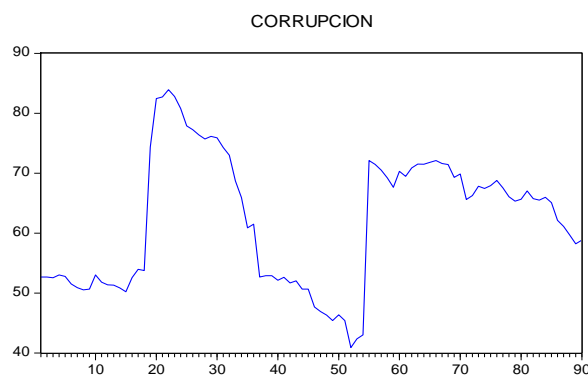


Figure 48. Computed values of the first principal component

Figure 49 shows that there is a negative association between the corruption indicator with a two-year lag and the World Bank’s control of corruption index. This Figure indicates that the increase in the corruption indicator due, for example, to the increase in homicides, or informality, gives rise, two years later, to the drop in the population’s perception that corruption is being controlled. An implication is that the increases in the homicide rate, the shadow economy, and remittances are early indicators of the World Bank’s control of corruption indicator.

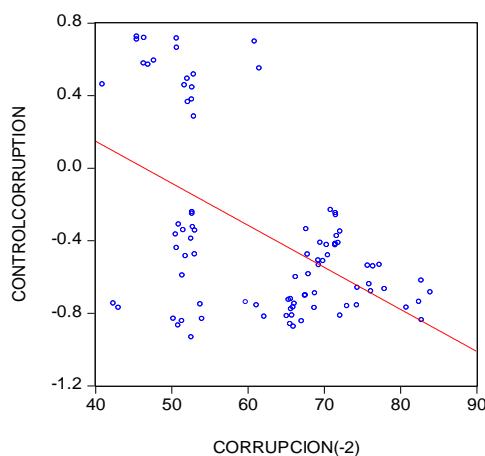


Figure 49. World Bank control of corruption and Indicator of Corruption

Equations were estimated expressing the World Bank's control of corruption indicator in terms of the corruption index with a two-year lag and the annual change in control of corruption, with the following results:

Mexico, Guatemala and Costa Rica:

$$\text{Control of corruption} = 1.3772 - 0.0268\text{Corruption}(-2) + 0.6713\text{D}(\text{Control of corruption})$$

(4.39)      (5.18)                      (2.34)

R squared = 0.38

Costa Rica, El Salvador and Dominican Republic:

$$\text{Control of Corruption} = 2.4250 - 0.0431\text{Corruption} + 0.7554\text{D}(\text{Control of Corruption control})$$

(7.28)      (8.02)                      (4.08)

R square = 0.58

It is observed that in both equations the coefficients of Corruption (-2) are negative and significant, which validates this indicator. The coefficients of the annual change in control of corruption are positive and significant, which denotes that there is a “learning” process in the perception of control of corruption.

In the previous paragraphs, it has been shown that the linear combination of the size of the informal economy, imports, homicide and male self-employment rates, and remittances, represent an environment conducive to corruption. But in reality, this linear combination, which is the first principal component, and which has been called Corruption, can be a manifestation of an educational system that does not have the resources required to offer quality education. This can be seen in Figure 50 which shows that there is a negative association between the Corruption indicator and spending on primary education.

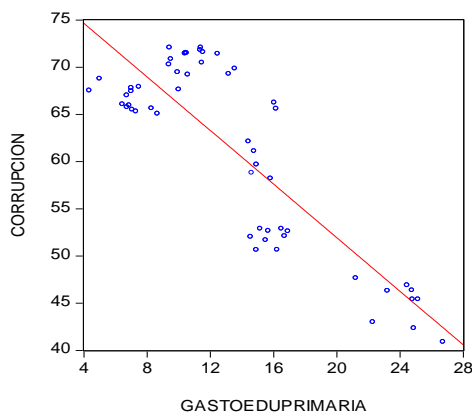


Figure 50. Primary education expenditure and corruption indicator

It is of interest to establish the relationship between the Corruption variable and the economic growth rate, which is shown in the following equation:

$$\text{Growth} = 3.3560 - 0.0686D(\text{Corruption}(-1)) + 4.4038\text{CualiDRgrowth} - 4.9401\text{Cualicrisis} - 1.0566\text{Cualiexterna}$$

(19.76)      (1.87)                      (7.75)                      (6.08)                      (1.98)

R square = 0.63

This equation indicates that in the Dominican Republic, the actual drop in this corruption indicator by 8 percentage points in the period 2010-2017 (from -0.8476 in 2010 to -0.7389 in 2017), would have contributed to increasing the economic growth rate by 0.54 percentage points.

#### 4.13 Anti-Corruption

In a similar way, the variables that, according to the estimated Var, exert positive impacts on the control of corruption were selected to consolidate them in a vector of principal components and thus obtain an indicator of the environment conducive to probity, or anti-corruption. For this purpose, the variables were chosen: public spending on education at the primary level, the female wage employment rate, the female to male labor participation ratio, and the female wage employment rate. The results are shown in the table 3.

Table 3. Principal components analysis

Computed using: Ordinary correlations						
Extracting 4 of 4 possible components						
Eigenvalues: (Sum = 4, Average = 1)						
number	value	Difference	Proportion	Cumulative value	Cumulative Proportion	
1	2.269502	1.063006	0.5674	2.269502	0.5674	
2	1.206496	0.829632	0.3016	3.475998	0.8690	
3	0.376864	0.229725	0.0942	3.852861	0.9632	
4	0.147139	---	0.0368	4,000000	1.0000	
Eigenvectors (loadings):						
Variable	PC 1	PC 2	PC 3	PC 4		
PRIMARY EDUCATIONAL EXPENSE	0.566106	0.162311	-0.793888	-0.151398		
RATIOPARTICIPACIOFM	0.384526	0.697702	0.318925	0.513458		
EMPLOYMENTSALARYFEME	0.603527	-0.132302	0.516393	-0.592950		
EMPLOYMENTOPOPYOVENFEME	0.409168	-0.685101	0.036984	0.601539		

The first principal component is called Anticorruption and represents the environment conducive to probity, and is given by the expression:

$$\text{Anti-corruption} = 0.5661 * \text{Public primary education spending} + 0.3845 * \text{Female/male participation ratio} + 0.6035 * \text{Female salaried employment} + 0.4092 * \text{Ratio of female youth employment to population}$$

The first principal component explains 56.74 percent of the variance of the variables that enter the first principal component, while the second component explains 30.16 percent.

It is observed that the highest coefficient of the first principal component corresponds to female salaried employment, (0.6035), followed by spending on primary education, (0.5661), and the ratio of female youth employment to population, (0.4091). In the second principal component, the highest coefficient is that of the ratio of female to male participation, whose increase would indicate greater economic autonomy for women and therefore greater savings capacity (Caceres, 2020).

The Anticorruption variable is shown in the Figure 51. The highest values correspond to Costa Rica, which is explained by its high public spending on primary education and the high rate of female salaried employment.

It should be noted that there is a positive relationship between the probity index (Anti-corruption) and the World Bank's corruption control index (Figure 52), which validates the capacity of the first principal component to measure the environment conducive to probity.

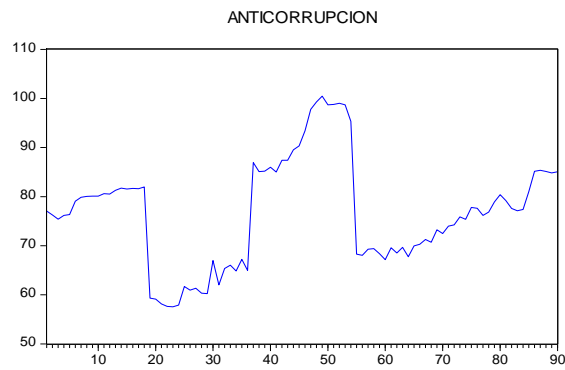


Figure 51. Anti-corruption Indicator

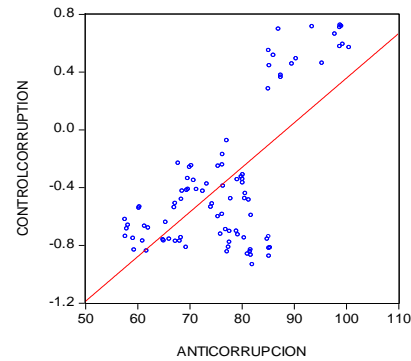


Figure 52. Anti-corruption and control of corruption

The equation expressing the control of corruption in terms of the anti-corruption indicator with the following result:

$$\text{Control of corruption} = 2.6882 + 0.0303\text{Anti corruption} + 0.4092D(\text{Control of Corruption})$$

(10.04)      (8.78)      (2.40)

R square = 0.50

It should be noted that the poverty gap has a negative relationship with the anti-corruption indicator (Figure 53). This association shows that poverty undermines the environment conducive to probity.

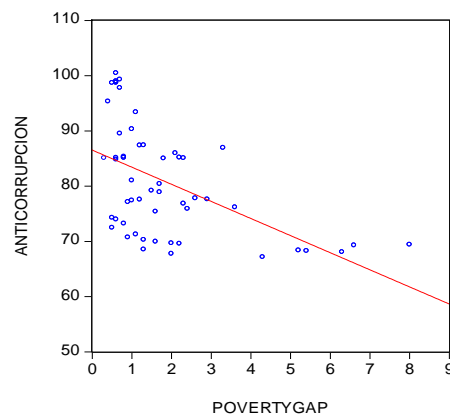


Figure 53. Poverty gap and anti-corruption indicator

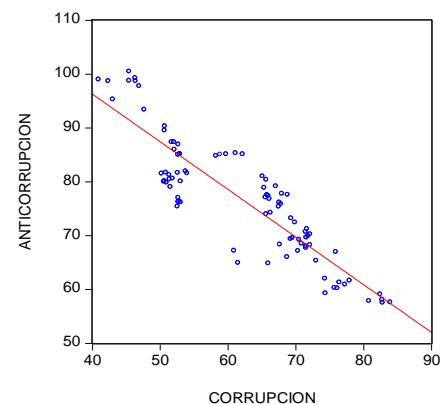


Figure 54. Corruption and anti-corruption indicators

It is of interest to note that the Corruption and Anti-corruption indices have a close negative relationship, which is shown in the Figure 54. This indicates that informality, imports, remittances, homicide and male self-employment rates have a negative or counter counterpart with the public spending on education, the female employment rate, the ratio of female youth employment to population and the ratio of female to male youth employment participation.

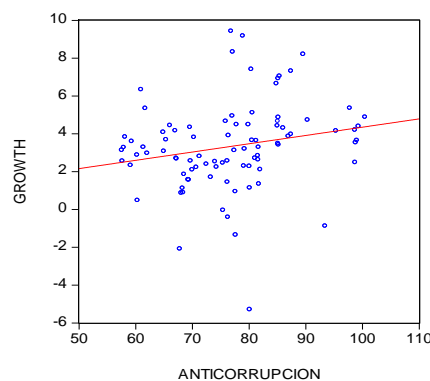


Figure 55. Anti-corruption and economic growth rate

It should be noted that the Anti-corruption variable has a positive association with the economic growth rate, as seen in the Figure 55.

The corresponding equation is:

$$\text{Growth} = 0.6577 + 0.0356\text{Anticorruption} + 4.3086\text{CualiDRgrowth} - 4.8049\text{Cualicrisis} - 1.1062\text{Cualiexterna}$$

(0.63)      (2.62)                      (7.72)                      (6.19)                      (2.17)

R squared = 0.65

When the Anti-corruption indicator is added to the previous equation, it is found that the Corruption coefficient is significant at the 15 percent level:

$$\text{Growth} = 0.8923 - 0.0514\text{D(Corruption(-1))} + 0.0322\text{Anti-corruption}$$

(0.84)      (1.45)                      (2.34)

$$- 5.0963\text{Cualicrisis} - 0.9958\text{Cualiexterna} + 4.2717\text{CualiDRgrowth}$$

(6.42)                      (1.91)                      (7.67)

R squared = 0.65

It is observed in this equation that corruption and probity act simultaneously, that is, both are important in determining economic growth. Therefore, concerning the Corruption indicator, it is important to reduce the informal economy, remittances, and male self-employment to boost growth. On the Anti-corruption indicator side, it is important to increase public spending on education and the variables associated with female employment with view towards reaching dynamic growth.

The Corruption and Anti-corruption indicators are conducive to the increase and reduction of irregular emigration flows, which can be measured by remittances. The Figure 56 shows that as the corruption indicator increases, remittances increase, while Figure 57 shows that the increase in Anti-corruption leads to a fall in remittances. Thus, there is a negative relationship between the Anti-corruption indicator and remittances, which shows the importance of increasing spending on education as well as increasing female employment as measures that discourage irregular emigration.

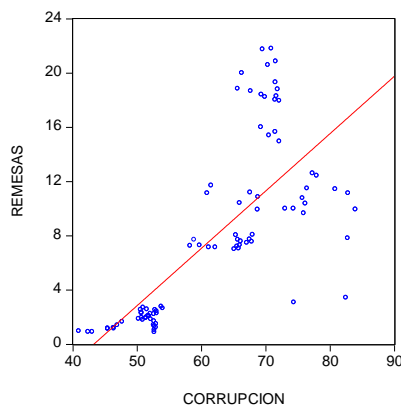


Figure 56. Corruption and remittances

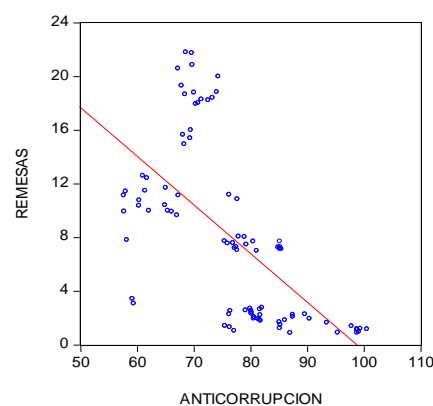


Figure 57. Anti-corruption and remittances

An implication of this equation is that the increases in the determining variables of Anti-Corruption, that is, the increase in public spending on education, or the increase in the rate of female salaried employment, or in the increase of the ratio of female youth employment to population, or the increase in the ratio of female to male labor participation, would lead to increased economic growth.

The increase in the Anti-corruption indicator depends on female labor participation, which depends in part on the level of salaries (Caceres, 2018). Given that salaries increase with increasing productivity (Caceres, 2021), Figure 58 shows that the ratio of female to male participation increases with labor productivity. This is another way productivity drives economic growth. It should be noted that labor productivity depends on the average level of education in the respective country (Caceres, 2018).

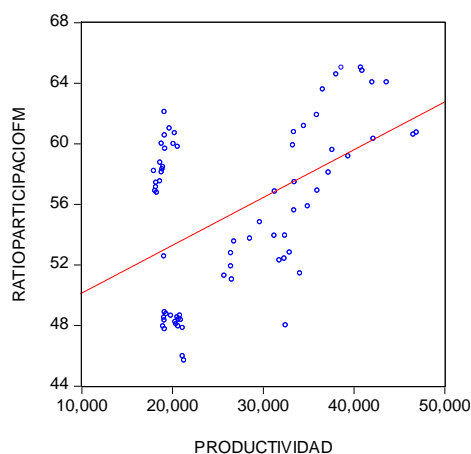


Figure 58. Labor productivity and the ratio of female to male employment.

It is especially important to design a “Rule” on the value that Anti-Corruption must achieve so that the economic growth rate reaches a certain minimum value. This would be a more appropriate mechanism than setting inflation targets, since inflation targeting can lead to increases in unemployment and inhibits the economy from reaching its potential, with adverse consequences for employment and family well-being.

But it must be recognized that, under current conditions, boosting economic growth would require the “Rule” in question to establish Anti-Corruption values that would be difficult to achieve in the medium term. For example, the economic growth rate of 6 percent demands an Anti-corruption indicator of  $6/0.0356 = 168.54$ , a value 68 points higher than that of Costa Rica (Figure 55). The target economic growth rate of 5 percent would require an Anti-Corruption indicator to be 140.45.

The average value of Anticorruption in the period is 76.75, which indicates that the expected value of annual economic growth is 2.73 (Note 2). This value is of the order of magnitude of the current economic growth rates in recent decades, and is extremely low, equal to half of the economic growth values prevailing in the 1960’s and 1970’s, and does not decisively contribute to the generation of employment or to avoid irregular emigration. The answer to solve this situation is simple: Increase public spending on education, promote the rate of female salaried employment, the ratio of female to male participation, and the ratio of female youth employment to population.

In a recent study, Steinberg and Masato (2012) ask: Can Women Save Japan? Supported by the results of this work, the affirmative response of these authors also applies to Central America, in the sense that it is valid to conclude:

The future of Central America will be determined by women.

#### 4.14 Validation of Corruption and Anti-Corruption Indicators

Another way to validate the corruption and probity indicators calculated in this work is through the estimation of a var model that permit to appreciate the responses of macroeconomic variables to increases in the Corruption and Anti-corruption indicators.

The Figure 59 shows that the Anti-corruption variable decreases in response to the increase in Corruption, which validates both variables. Credit to the private sector, money broadly defined, and exports also fall as Corruption rises.

Of particular importance are the responses of Growth to Corruption and Anti-corruption, which are shown in the Figure 60. It is observed that economic growth has a negative and marginally significant response to the increase in Corruption and a positive and significant response to the increase in Anti-corruption. which were expected results that validate these indicators.



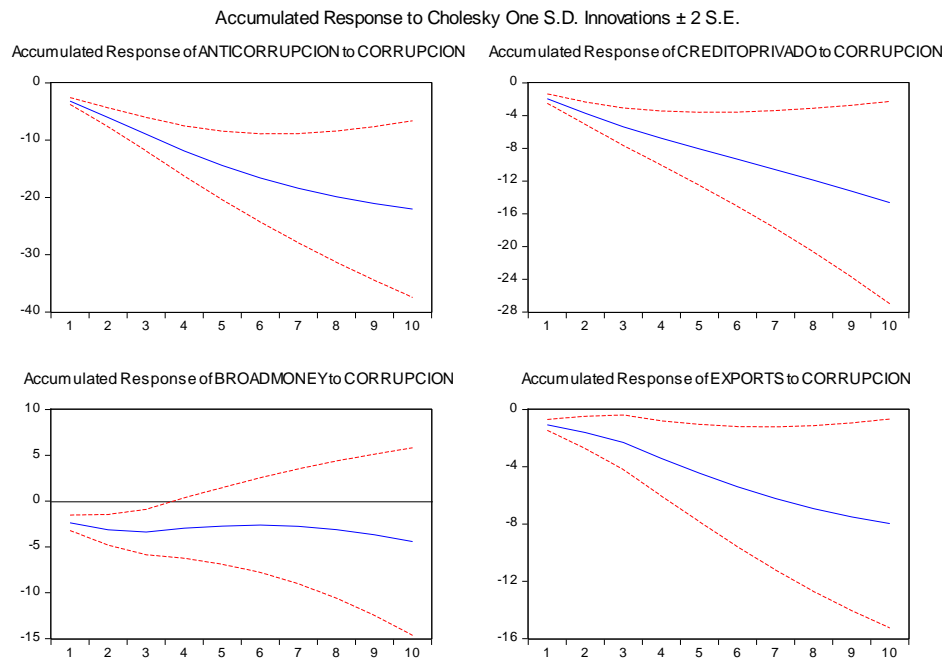


Figure 59. Responses of variables to increases in Corruption

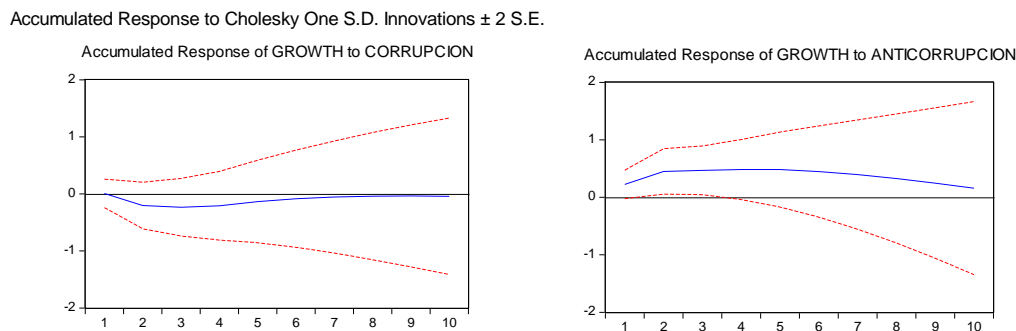


Figure 60. Economic growth rate responses to increases in corruption and anti-corruption

However, the responses of the Corruption and Anti-corruption indicators to the increase in the economic growth rate are not significant, indicating that these circuits do not reproduce themselves in the face of the increase in the economic growth rate (Figure 61). This shows that the increase in the economic growth rate does not lead to improvements in the determining variables of the Corruption and Anti-corruption indices. In other words, the results suggest that informality, male self-employment, irregular emigration and homicides do not decrease in the face of the increase of the economic growth rate, while the ratio of female to male participation and spending on education does not increase. That is, the inertia of these variables in response to increases in economic growth does not favor the increase in probity and economic growth. It seems the system is truncated so that there are no trickle down effects.

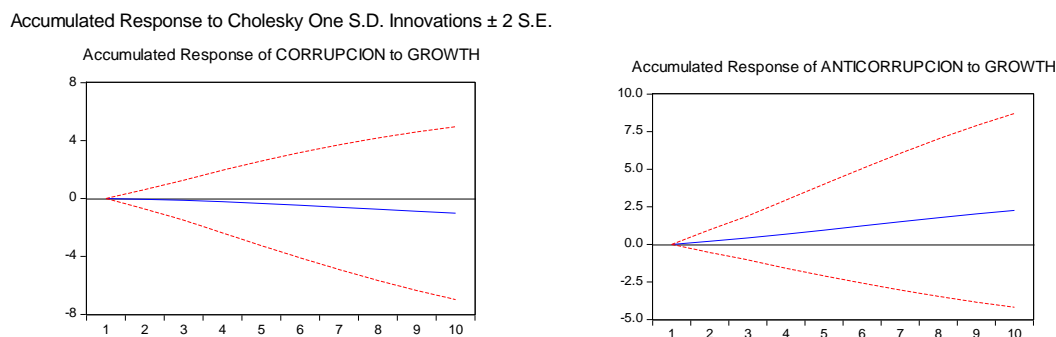


Figure 61. Corruption and anti-corruption responses to increased economic growth rate

It should be noted that the increase of Growth does not provoke significant responses from the determining variables of corruption, as can be seen in the Figure 62.

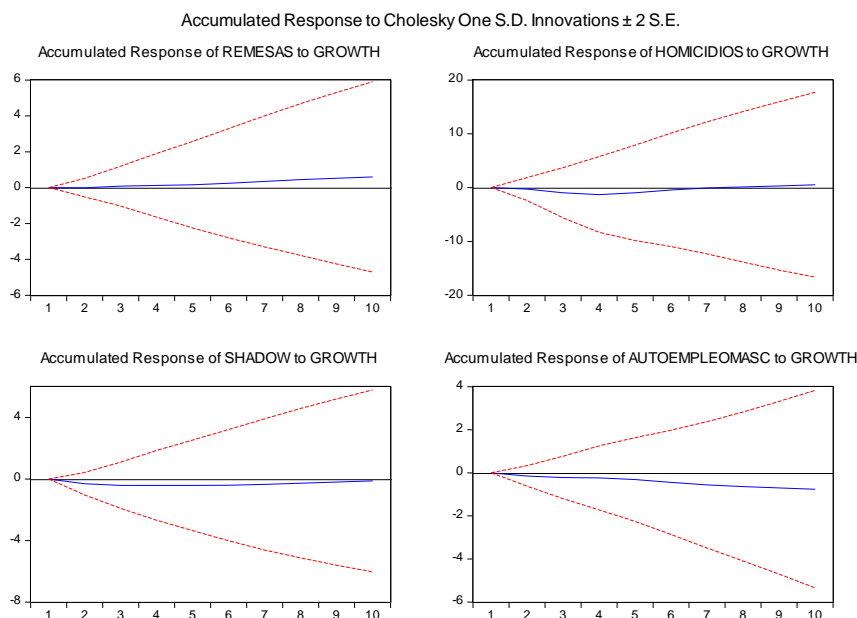


Figure 62. Responses of the variables determining corruption to increase in Growth

It should be noted that the response of the poverty gap to the increase in the economic growth rate is negative but not significant (Figure 63). This result shows again that there is no “trickle down” mechanism from economic growth to poverty reduction, and is another reason that explains the persistence of corruption.

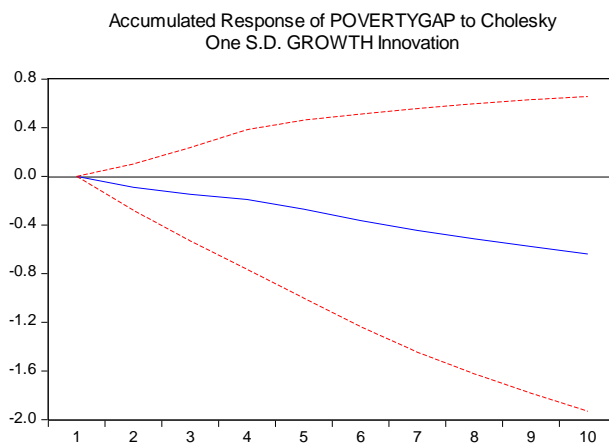


Figure 63. Response of poverty gap to increase in the rate of economic growth

It is also observed that the responses of the variables that determine the Anti-corruption indicator to the increase in the economic growth rate are not significant, except for the ratio of female youth employment to population, which shows a positive response that is marginally significant in the first four years (Figure 64).

The explanation could lie in the fiscal weakness of the countries. The Figures 65 and 66 show that tax revenues as a percentage of the countries' GDP fall and increase respectively in the face of increases in Corruption and Anti-corruption. That is, corruption undermines the ability of governments to increase social spending in such a magnitude that corruption would decline. This may be called a corruption trap.

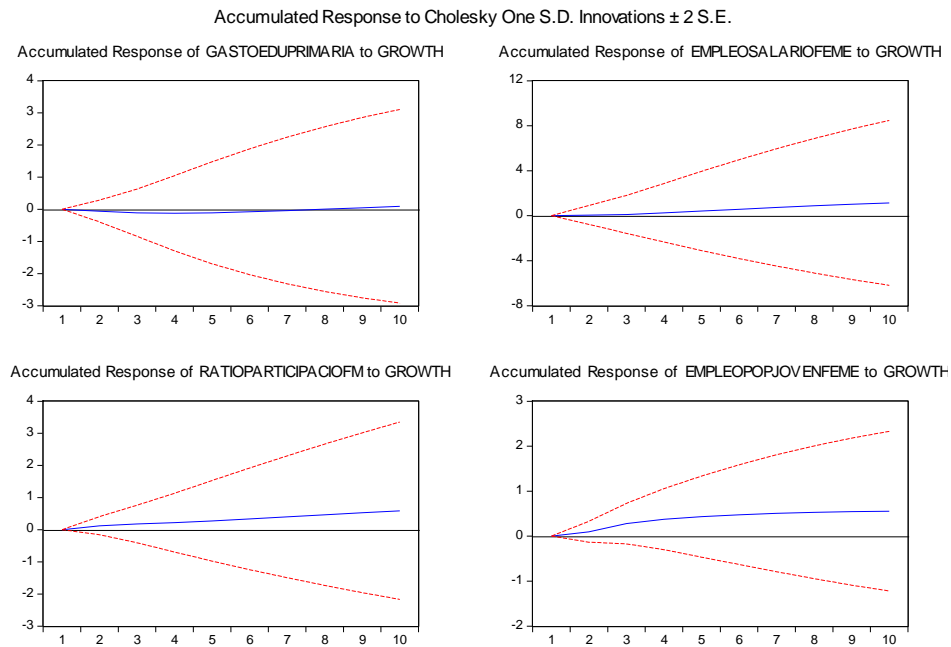


Figure 64. Responses of the variables that determine the probity indicator to the increase in the economic growth rate

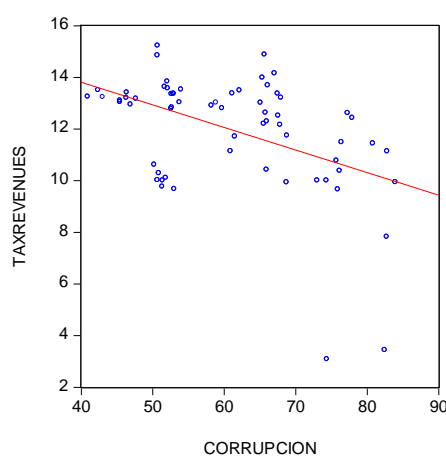


Figure 65. Corruption indicator and tax revenue

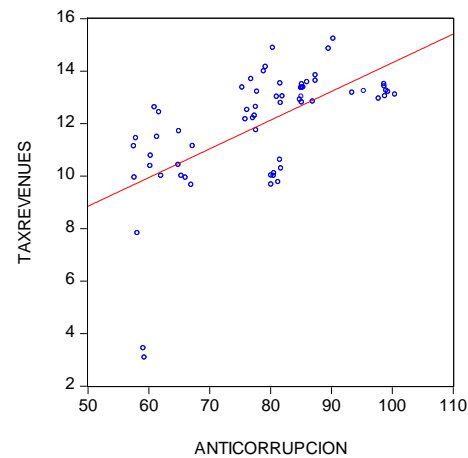


Figure 66. Anti-corruption and tax revenue indicator

However, tax revenues increase with the increase in the economic growth rate, as seen in the Figure 67.

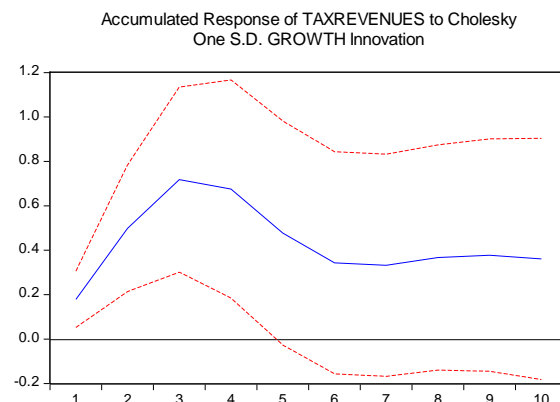


Figure 67. Response of tax revenue as a percentage of GDP to growth increase

This indicates that the absence of a role for economic growth in reducing corruption would be explained not by the scarcity of tax revenues but by the allocation made of tax revenues. The Figure 68 shows that the increase in tax revenue does not have a significant effect on the variables that determine corruption, which suggests that in the allocation of tax resources the items that can reduce corruption do not receive significant allocations. In other words, in the context of the national budget, the variables that can reduce corruption do not receive the priority they deserve.

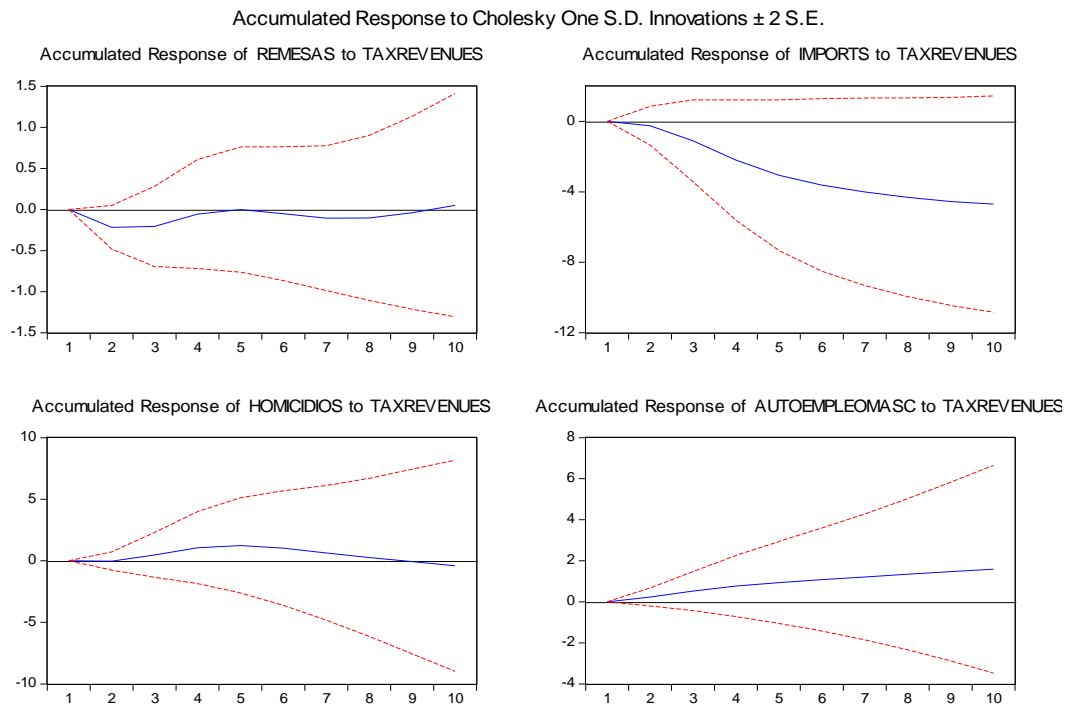


Figure 68. Responses of variables that determine corruption indicator to the increase in tax revenue

#### 4.15 Corruption and Inflation

It is observed in the Figure 69 that the inflation rate increases with the increase in the Corruption indicator and has no significant response to the increase in the probity indicator. This indicates that macroeconomic adjustment programs should include the expansion of public spending in areas that reduce corruption; that is, spending should be directed to reducing informality, self-employment, homicides, imports and remittances. Furthermore, if the adjustment program implies a reduction in public social spending, the result could be more intense inflationary pressures that would weaken the effectiveness of the adjustment measures.

Accumulated Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.

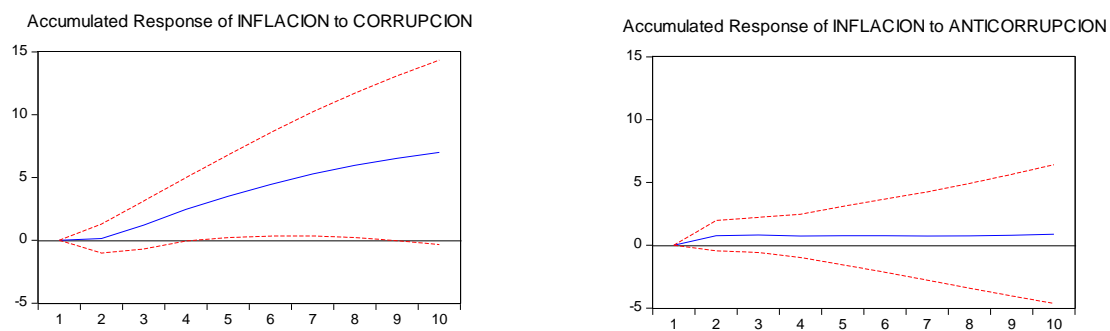


Figure 69. Response of the inflation rate to increases in corruption and anti-corruption

#### 4.16 Role of Initial Conditions

On the other hand, it must be observed that corruption falls with the increase in the initial conditions of control of corruption, measured as the values prevailing in the year 2000, (Figure 70), while Anti-corruption increases. This indicates that, if in 2000 the values of control of corruption had been higher than the values of that year,

Corruption and Anti-corruption in the present would have lower and higher values than the current values. This could indicate that progress in combating corruption does not dissipate over time.

Accumulated Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.

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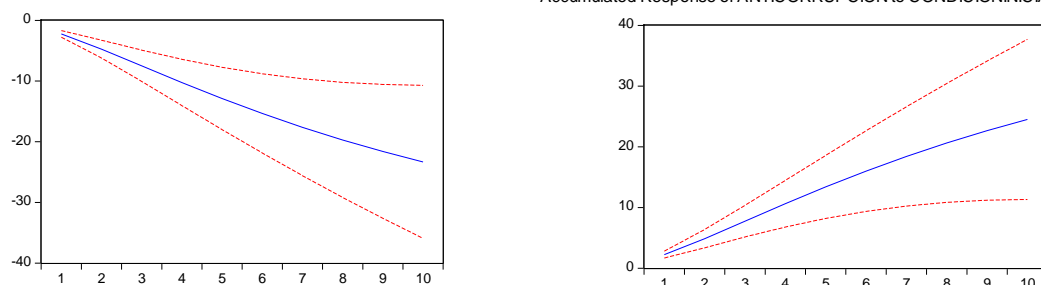


Figure 70. Corruption and anti-corruption responses to increases in initial conditions

#### 4.17 Corruption and Life Expectancy

It should be noted that female and male life expectancy falls with the increase in Corruption. This effect is such that increasing corruption by one standard deviation results in a drop in female and male life expectancy by 2 and 3 years respectively. In other words, corruption causes premature death.

Accumulated Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.

Accumulated Response of LIFEEXPECTANCYFEME to CORRUPCION

Accumulated Response of LIFEEXPECTANCYMASC to CORRUPCION

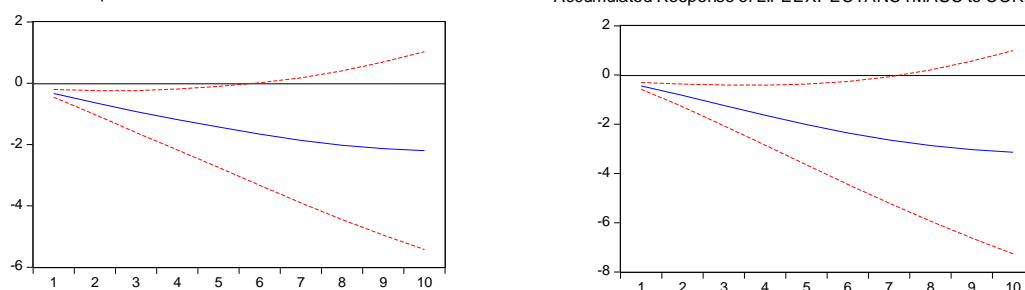


Figure 71. Response of female and male life expectancy to increased corruption

#### 4.18 The Cost of Corruption

With a view to estimating the cost of corruption related to its role in reducing the rate of economic growth, the following equation was estimated that expresses the rate of economic growth in terms of the control of corruption indicator, the investment rate and the qualitative variables cualicrisis and cualiDRgrowth (Note 3). The result is as follows:

$$\text{Growth} = 1.5370 + 0.9289\text{Control of Corruption} + 0.1079\text{Inversion} - 0.5275\text{Cualicrisis} + 4.5448\text{CualiDRgrowth}$$

(1.56)      (2.97)                      (2.10)                      (3.26)                      (6.76)

R square = 0.63 DW = 1.61

It is observed that the coefficients are significant and have the expected signs. The coefficient of control of corruption implies that, in the case of Guatemala, whose index in 2018 was -0.82, corruption would lead to a loss of economic growth that year of  $0.9289 \times -0.82 = 0.76$  percentage points.

The annual losses in economic growth for the countries are shown in the table 4. It is noted that, except for Costa Rica, the annual losses are around half a percentage point. In Costa Rica, the average annual gain for having low values of corruption is 0.51 percentage points.

Table 4. Annual losses of economic growth due to corruption

	MEXICO	GUATEMALA	COsta Rica	EL SALVADOR	REPUBLIC DOMINICAN
2000	0.068553	0.771814	-0.64894	0.692402	0.670116
2001	0.157913	0.696675	-0.5109	0.715253	0.55734
2002	0.232757	0.613094	-0.41296	0.755331	0.442227
2003	0.22441	0.684718	-0.47982	0.38716	0.653059
2004	0.361653	0.575686	-0.26466	0.446496	0.543592
2005	0.319708	0.635557	-0.33923	0.472507	0.641104
2006	0.302009	0.778328	-0.35173	0.312035	0.651117
2007	0.31718	0.714634	-0.42461	0.392982	0.694514
2008	0.28782	0.619239	-0.45814	0.381791	0.674349
2009	0.33994	0.495552	-0.6646	0.213859	0.722746
2010	0.408482	0.502335	-0.61715	0.240222	0.783648
2011	0.440984	0.49905	-0.551	0.230187	0.754357
4-Jul	0.450078	0.630503	-0.53017	0.383183	0.798817
2013	0.549463	0.593577	-0.53649	0.324222	0.812403
2014	0.782738	0.70237	-0.67407	0.348134	0.758078
2015	0.806006	0.705697	-0.66775	0.393934	0.760255
2016	0.771469	0.716428	-0.65964	0.496406	0.702598
2017	0.866615	0.712427	-0.42922	0.475179	0.686386
Average	0.4271	0.647	-0.5123	0.4256	0.6717

It must be kept in mind that the control of corruption increases with the increase in spending on primary education, as was shown in the Figure 31. Thus, it is valid to propose that to the extent that spending on education increases, the control of corruption will increase and the losses in economic growth as a result of corruption will decrease.

To investigate this issue, an equation that expresses control of corruption in terms of spending on education was estimated, with the following results:

$$\text{Control of Corruption} = -1.3150 + 0.0757 \text{Primary education expenditure} \\ (13.90) \quad (10.86)$$

$$R \text{ square} = 0.57$$

With this equation, the increase in control of corruption because of the increase in spending on education is computed. Spending is assumed to increase by \$5, which is equivalent to an increase of 30 percent of the 2017 per-student primary education expenditures for Mexico, El Salvador, and the Dominican Republic, and is also equivalent to increases of 50 percent for Guatemala and 20 percent for Costa Rica. With the new control of corruption values, the new economic growth losses are calculated.

The Figure 72 shows the losses in economic growth with the current values of the corruption control index and with the indexes obtained under the assumption that spending on education has increased by \$5 in all countries, while the Figure 73 shows the differences between these values, that is, the net gain in terms of economic growth resulting from increasing annual public spending on education by \$5 in all countries. Net gains range between 0.34 and 0.36 percentage points.

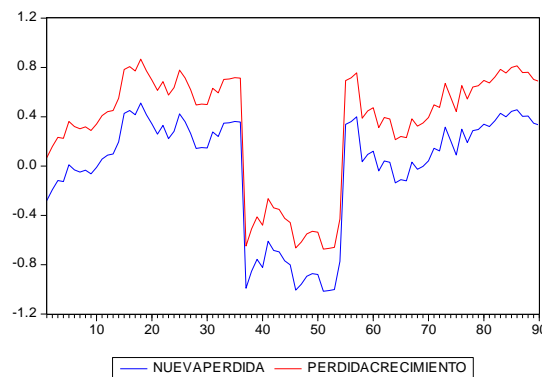


Figure 72. Percentage points of losses in current economic growth under the assumption of increase in public spending on education

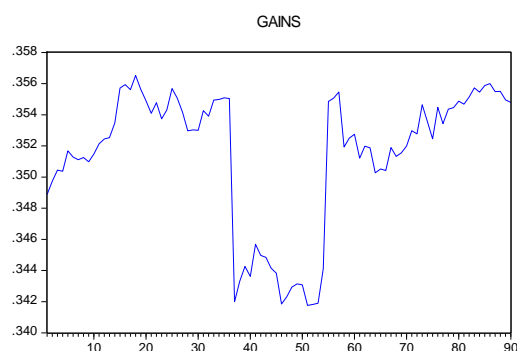


Figure 73. Net gains in annual economic growth (in percentage points), as a result of increased public spending on education. (Gains)

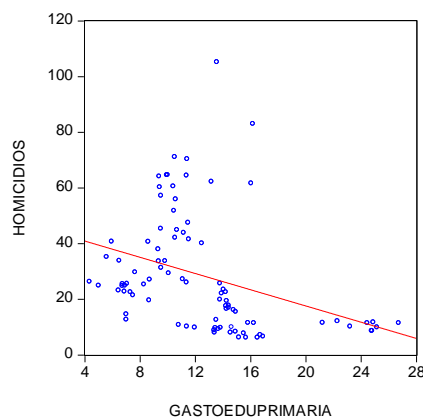


Figure 74. Expenditure on education and homicide rate

Increased spending on education has other benefits as it leads to a reduction in the homicide rate (Figure 74). There is evidence for Central American countries presented by the World Bank (2011) that reducing the homicide rate by 10 percent leads to increasing the economic growth rate by 1 percent. A study by the International Monetary Fund (2023) reports that increasing homicides by 1 percent leads to a reduction in the economic growth rate by 0.3 percentage points.

#### 4.19 Towards a Regional Strategy to Combat Corruption

The previous analysis based on principal components shows that the environment conducive to corruption results from the “clash” or opposition of two forces; one, that which is generated by the determining variables of Corruption, that is, informality, imports, remittances, homicide rates and male self-employment, which are variables associated with poverty and economic stagnation. The other force originates from the conjunction of variables associated with probity, which has been represented by public spending on primary education, the ratio of female to male labor participation, the rate of female salaried employment, and the ratio of female employment to population. In addition to promoting probity, the first principal component of these variables also drives economic growth.

At a given time, in each country the net result of the aforementioned “clash” determines the levels of corruption and the rates of economic growth. Hence, public policy must reduce the momentum of the first force, by increasing social spending, reducing informality, homicides, and remittances, and promote the growth of the second, increasing female employment and increasing the spending on education.

These actions would have a greater chance of success if they were developed in a regional context. This approach implies that the Central American countries reach consensus and commitments related to working together to improve the control of corruption and, in general terms the social development. Regional coordination would provide gains in terms the economies of regional concertation (Caceres, 2017), and particularly in obtaining external resources and in the preparation of projects.

Below is a series of actions to would be carried out by the Central American countries based on binding commitments about actions to promote probity and combat corruption.

Table 6. Regional strategy (Actions and commitments)

Belize Guatemala El Salvador Honduras Nicaragua Costa Rica Panama
<b>Commitments/Actions:</b>
Increase taxation
Increase spending on education
Increase coverage of special education.
Increase coverage of early childhood education.
Increase daycare coverage.
Increase health spending.
Increase psychology services in public schools and for the population in general.

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Increase public spending in the elderly.  
 Increase coverage of food supplements.  
 Increases in wages.  
 Increase water services, electricity, housing in rural areas.  
 Promote national productive sectors.  
 Increases infrastructure, roads and education in rural areas.  
 Increase agricultural and manufacturing production.  
 Increase tax incentives and credit to productive sectors.  
 Increase capital and territorial coverage of State banks.  
 Execute emergency employment programs.

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#### 4.20 Strategy Monitoring

The strategy would be subject to periodic evaluations, to detect problems in its execution and introduce corrective measures. The Central American presidents would receive periodic reports on the execution of the strategy. The monitoring and evaluation indicators are the following:

Table 7. Strategy monitoring

Belize Guatemala El Salvador Honduras Nicaragua Costa Rica Panama
Indicators:
Tax revenue/GDP.
Public spending on education/GDP.
Public spending on health/GDP.
Exports/GDP ratio.
Imports/GDP ratio.
Number of children attending daycare centers as a percentage of the child population.
Number of people treated by psychologists.
School dropout rates.
Homicide rate, female and male.
Feminicide rate.
Economic growth rate.
Participation of manufacturing and agricultural sectors in the GDP.
Percentage of population enrolled in social security.
Homicide rate.
Number of deportees.
Remittances as % of GDP
Salaried employment and self-employment rates, female and male.
Dimension of shadow economy.
Participation ratio, female and male.
Life expectancy.
Female and child mortality.
Ratios of female and male youth employment to population

This strategy may seem too ambitious, but the historical evidence that social development precedes economic development must be emphasized, as Easterlin (1981) has shown for the now-developed countries.

## 5. Conclusions

This work has shown that there are many variables that determine corruption, both variables that represent social decomposition and those associated with the monetary sector. Of all of these, those that have the greatest determining value in the control of corruption are trust in the government, the cost of starting a business, the increase in import tariffs, initial conditions and salaried employment, which increase it, and male self-employment, remittances, interest rates and imports, whose increases bring down the control of corruption.

Likewise, the increase in the control of corruption has impacts on economic and social variables such as the decline in informality, in the poverty gap, and female and male self-employment, while credit to the private sector, the ratio of female to male participation and the ratio of female to male employment increase with



increasing control of corruption.

It should be noted that there are differences by gender in relation to the responses of certain variables to corruption, for example, the increase in male self-employment leads to a drop in control of corruption, but the female response is not significant.

The construction of a corruption indicator through the application of principal components showed that informality, imports, remittances, and the male self-employment rate had a close negative relationship with the control of the corruption index of the World Bank and thus it is valid to deduce that corruption arises from social decomposition.

A principal component was also computed that represented a probity index, calculated on the variables public spending on education, the rate of female salaried employment, the ratios of female to male participation, and the ratio of female youth employment to population, finding that this indicator, unlike corruption, has a positive association with the economic growth rate.

When estimating an equation expressing the economic growth rate in terms of the corruption and probity indicators, results were obtained indicating that the first variable had a negative coefficient, but not significant, while the coefficient of the probity indicator was positive and significant.

It must be emphasized that the responses of the indicators of corruption, probity and public spending on education to increases in the rate of economic growth turned out to be non-significant so that these circuits are not self-sustaining.

A particularly important measure is to increase manufacturing production and benefit from its positive role in controlling corruption. Furthermore, Caceres (2017) has shown that, in El Salvador, female salaried employment, which is a determinant of the probity indicator, increases with the percentage that manufacturing production occupies in the GDP, and with the increase in exports to the other Central American countries. This is another reason to implement a regional approach to combating corruption.

In Central American countries there are very wide female-male wage gaps. Given that female labor participation depends on salaries, closing these wage gaps would contribute to increasing female participation and thus, increasing probity and the rate of economic growth. So, clearly, closing the wage gap is a valuable measure to boost economic growth.

There is also evidence that female participation increases with transportation investments that allow women easy access to their jobs. Hence the importance of carrying out physical infrastructure to reduce transportation costs. Reference should be made to a study by the International Monetary Fund (Ivanova, Puig-Forne, Valente, & Wong, 2019) which indicates that in the Central American countries, the Dominican Republic and Panama, the low levels of education of women and the low investment in infrastructure are determinants of the low rates of female labor participation. Hence the importance of carrying out physical infrastructure programs to reduce transportation costs (Note 4).

A measure of special importance is that the Central American countries added an article to their constitution, establishing that spending on education as a percentage of GDP cannot be below 7 percent. This measure would contribute significantly to reducing corruption and increasing economic growth.

Another proposal of special value is to reach a consensus at the regional level so that the Central American countries jointly undertake efforts to combat corruption through substantial increases in social spending, according to binding commitments and within established deadlines, and with a pre-established monitoring framework, so that this scourge that undermines the well-being of the Central American people is overcome and economic growth is recovered.

The current dilemma lies in choosing to substantially increase social spending, or accept the continuation of the caravans, violence, precarious employment, and corruption.

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**Notes**

Note 1. This var is estimated only with data from El Salvador, Costa Rica and the Dominican Republic.

Note 2. The average economic growth rates for the period 2000-2017, in percentages, are as follows: Mexico, 2.19; Guatemala, 3.46; Costa Rica, 4.20; El Salvador, 1.96; Dominican Republic, 4.85.

Note 3. Other approaches to calculate the cost of corruption in terms of lost economic growth have been presented by Cieslik and Goszek (2018), D'Agostino et al. (2016), Mo (2001), Aidt(2008) and Huang (2016).

Note 4. This Publication concludes: "Increasing investments in infrastructure and information technology would help reduce the costs of working outside the home and help the job seekers. Boosting the quality of infrastructure in rural areas in particular – for example, by making clean water more accessible and improving transportation systems – can reduce the time women spend on domestic tasks and facilitate their access to labor markets."

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