Determinants of Total Factor Productivity in Ecuador

Determinantes da produtividade total do fator no Equador

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RESUMO
Este artigo analisa o crescimento econômico do Equador no período 1950–2014. O estudo enfoca principalmente a produtividade total dos fatores (PTF) e propõe uma função não linear que permite à PTF depender de um conjunto de variáveis explicativas consideradas na literatura relevantes para explicar o crescimento econômico. Variáveis específicas para o caso equatoriano também estão incluídas. São encontradas fortes evidências empíricas que apóiam os efeitos positivos do capital humano e da infraestrutura pública na PTF. Os resultados sugerem que as receitas do petróleo não têm efeito direto sobre a PTF. Além disso, alguns períodos importantes parecem ter causado mudanças estruturais na PTF. Os resultados são robustos a diferentes especificações e métodos de estimativa.

Palavras-chave: Equador, crescimento econômico, produtividade total dos fatores, petróleo.

ABSTRACT
This article analyzes Ecuador's economic growth for the period 1950–2014. The study focuses particularly on total factor productivity (TFP) and proposes a nonlinear function that allows the TFP to depend on a set of explanatory variables considered in the literature to be relevant in explaining economic growth. Specific variables for the Ecuadorian case are also included. Strong empirical evidence supporting positive effects of human capital and public infrastructure on TFP is found. The results suggest that oil revenues have no direct effect on TFP. Moreover, some key periods seem to have caused structural changes in TFP. The results are robust to different specifications and estimation methods.

Keywords: Ecuador, economic growth, total factor productivity, oil.

1 INTRODUCCIÓN

Ecuador's economic performance has been subordinated to its export commodities. Banana and oil booms have reported significant revenues to the country which have shaped its economic structure. However, such revenues do not seem to have been effectively transformed into sustained economic growth or prolonged industrial development. Hence, the industrial sector has been uncompetitive and lacking innovation, making it volatile and extremely vulnerable to internal and external shocks (Senplades, 2009; Calderón, 2016).

Over the period 1950–2014, most of the volatility characterizing Ecuador's economic growth was due to total factor productivity (TFP) since the growth rate due to inputs was fairly stable. The literature on economic growth has widely established that TFP can capture not only technology as usually assumed in the earliest theoretical model, but also many other factors such as institutional, political, cultural and geographical aspects. Moreover, country specific shocks could also affect TFP. In fact, TFP is assumed to include all factors that affect economic production other than inputs.

The aim of this article is to identify determinants of TFP in Ecuador. In order to achieve this objective, TFP is considered to be a nonlinear function of variables, other than production inputs, which are considered in the literature to be relevant in explaining economic growth. Moreover, specific variables that could foster economic growth in Ecuador have been considered for the analysis. The TFP index built by Feenstra *et al*. (2015) and provided by the Penn World Table (PWT)[1] is the dependent variable that is used in this article.

Our specification is able to capture to a large extent the categories of variables proposed by Isaksson (2007) that have been found to affect TFP, i.e., the creation, transmission and absorption of knowledge, education and training, technology transfer and adoption, infrastructure, quality of institutions, the social dimension, structural changes and the integration and trade.

The objective of this article could be also framed within the literature on institutions and economic growth (North, 1990; Hall and Jones, 1999; Rodrik *et al.*, 2004; Dixit, 2009) which claims that the output per worker is mainly driven by the quality of institutions and government policies. This literature attempts to explain why some underdeveloped countries have been able to absorb technological progress from developed countries better than others and eventually converge in terms of per capita income, as well as why some countries rich in natural resources still persist in a chronic industrial lag and therefore remain developing economies.

We are aware of the drawbacks of a single country study like this in comparison to a multiple country study. However, our focus on Ecuador is justified because its economy has performed, on average,

[1] The Penn World Table is a set of national-accounts data developed by the University of California, Davis, and the Groningen Growth Development Centre of the University of Groningen to measure productivity, real GDP, capital, employment and all kind of data for making comparisons across countries and over time on economic development and growth.

much better than its neighboring countries, even those with similar characteristics such as oil dependency. According to De Gregorio (1992), Ecuador performed better than other Latin American countries due precisely to the bonanza experienced from the 1950s to the 1970s. In fact, Ecuador's annual average economic growth rate over the analyzed period has been higher than that of the average of the seven largest Latin American countries.[2] Moreover, Ecuador's economic growth rate is the highest among the main net oil exporter countries in the region. [3] The comparison with Venezuela, which was the major oil-exporting country in the region and whose average annual economic growth rate was the lowest during the period 1950–2014, is striking. In fact, Agnani and Iza (2011) demonstrated that although Venezuela is an oil abundant country its economic growth is due to the evolution of its non-oil GDP and the aforementioned authors suggested that Venezuela is immersed in a great depression. However, this is not the case of Ecuador.

The fact that Ecuador's economic growth is conditioned on the evolution of the prices of its main export commodities (banana until the late 1960s and oil after that) has meant that the country may have suffered the so-called "curse of natural resource" (Sachs and Warner, 1995, 2001) or "Dutch disease" (Corden and Neary, 1982; Gylfason, 2001; Torvik, 2001) as various authors suggest (Naranjo, 1995; Fontaine, 2002). However, we consider that countries like Ecuador are not condemned to suffer a prolonged disease or curse, since there are factors contained in the TFP that can help to overcome such a misfortune.

The empirical results show that the main variables that enhance TFP in Ecuador are human capital and public infrastructure, while consumer price index diminishes TFP. Moreover, some key periods have been found to have caused a structural break in TFP. Although the oil industry is considered the driver of the Ecuadorian economy since its revenues have allowed the funding of major national projects, oil prices seem to have no direct effect on TFP. The empirical results provided in this article suggest that the positive effects of oil prices on economic growth in Ecuador might accrue through the accumulation of inputs or any other factor, rather than through TFP. Furthermore, it is thought that oil has an indirect effect on TFP because oil revenues fund public investment in infrastructure and education.

The article is structured as follows. An overview of Ecuador's economic progress over the period 1950–2014 is provided in section 2. In section 3, an empirical strategy is proposed to shed light on the determinants of TFP in Ecuador, while section 4 shows the results of the estimation. Robustness checks are performed in section 5 and the main conclusions of the article are summarized in section 6.

[2] The seven largest Latin American economies are: Argentina, Brazil, Chile, Colombia, Mexico, Peru and Venezuela.
[3] The net oil exporter countries of the region are: Venezuela, Mexico, Colombia, and Ecuador.

2 OVERVIEW OF DATA AND EVOLUTION OF THE ECONOMY

As pointed out above, Ecuador has performed better, on average, than the average of the largest Latin American countries during the period 1950–2014. Table 1 shows the annual average GDP per capita and per worker growth rates and the TFP growth rate for the largest countries of the region. Data on real GDP (in millions of USD 2011), population and employment were provided by the UC Davis and Groningen Growth and Development Centre's Penn World Table (PWT). As can be seen, the annual average GDP per capita and TFP growth rates of Ecuador are higher than the annual growth rate of the average of these countries. Looking across countries, Ecuador's growth rate is just below Chile and Brazil in terms of GDP per capita and per worker, and only below Brazil in terms of TFP. Most interestingly, considering the net oil exporter countries of the region, Ecuador's growth rate is the highest.

Figure 1 shows the evolution of the GDP per capita and per worker of Ecuador over the period 1950–2014 which are measured by the left-hand axis, while the evolution of the TFP index is measured by the right-hand axis. As can be observed, GDP per worker (per capita) and TFP follow a very similar trend, which could be suggesting that economic growth in Ecuador is mostly driven by TFP. Figure 2 confirms our suspicion, since it shows that GPD growth rate volatility is mostly due to TFP volatility since the input growth rate is more stable during the 1950–2014 period. [4]

According to Figure 1, four phases of economic growth can be clearly distinguished in Ecuador. The period from 1950 to 1971 is what can be called the "pre-oil boom" period. The period from 1972 to 1981 is characterized by the bonanza due to the first oil boom which was followed by the debt and financial crisis after the decrease in oil prices from 1982 to 1999. The last period started in 2000 when a major change in economic policy was introduced: the dollarization of the economy, which coincided with a second boom in oil prices.

Pre-oil boom period (1950–1971)

During this phase, banana was the main export product of the Ecuadorian economy. Banana plantations were mainly concentrated in the coastal regional and soon took over land used to cultivate other agricultural products, which remained only to supply domestic demand. The higher demand for labor in the banana plantations fostered migration from the Sierra to the Coast. According to Acosta (2006), since multinational companies were in charge of the production and trade of banana, an oligopoly was formed in the banana sector with negative consequences on the labor sector due to the reduction in the average wage of workers below the poverty line, which allowed these companies to gain competitiveness in the world market. During the 1950s and part of the 1960s, Ecuador became the main banana producer and exporter in worldwide.

[4] In a study of the productivity of the Ecuadorian manufacturing sector, Camino-Mogro et al. (2018) found that productivity growth coincides with the growth of GDP.

According to statistical information on international trade from the Central Bank of Ecuador (BCE, 2012), exports of traditional products, mostly agricultural products, accounted for at least 80% of total exports and banana exports accounted for approximately 40% of total exports during this phase.

In the 1950s, Ecuador joined its fellow regional countries in adopting the import-substituting industrialization model (ISI)[5,6] to boost the industrial sector following the ECLAC recommendations. The revenues brought by banana exports allowed priority economic sectors to be subsidized and social projects to be supported. As a result, the public sector started growing as well as the external debt[7] (Acosta, 2006). However, the ISI model would not be fully implemented until a military dictatorship took control of the country in 1963. The Military Junta started a reform of the Ecuadorian tax system in order to generate the necessary income to maintain the ISI model. According to Paz and Cepeda (2015), a progressive income tax policy was implemented under this tax reform which aimed to favor the lower income classes. Moreover, the Single Taxpayer Registration was created in order to improve the collection of taxes on commercial transactions, a predecessor to the value-added tax,[8] and the unification of taxes on the trade of several import products. When the Military Junta regime came to an end in 1966, some of the reform policies had not yet been fully implemented.

During the first years of the ISI model, the main source of external revenues for Ecuador came from the banana exports that would later be replaced by oil exports. The revenues generated by these commodities allowed the government to invest in infrastructure.[9]

As a development strategy, the ISI model was intended to accelerate the process of structural change in Latin American countries, going from the agro-export model to industrialization by substituting the consumption of basic and non-durable imported goods by those produced internally. Later, the substitution of capital goods would follow a similar path once the domestic industry had been able to absorb the necessary technology from imported capital goods, hence reducing the technological gap (Hirschman, 1968; Baer, 1972; Balassa, 1980). Government intervention was thought to be crucial to achieve successful results. However, as the governments tended to protect the bonanza sector through subsidies and protectionist policies, detrimental effects were produced on other economic sectors as a result of neglecting the comparative advantage theory (Balassa, 1980; Edwards, 1995). According to Baer (1972), the absence of an entrepreneurial class, a qualified workforce and the incapacity of the governments to cope with a prolonged industrial process did not permit the absorption of new

[5] The ISI model was promoted by the Economic Commission for Latin America and the Caribbean (ECLAC/CEPAL), which was created in 1948 to foster and boost economic development in Latin American countries by protecting the industrial sector. The model aimed to follow the path of industrialized countries in order to tighten the technological gap.
[6] Baer (1972) and Chang (2002), among others, argued that most of the current developed countries went through a stage of protectionism to develop their industries, especially in the late nineteenth century and the first decades of the twentieth century.
[7] In 1950, Ecuador's total external debt amounted to 24.5 million USD. By the year 1971, it had reached 260.8 million USD.
[8] It was not until the 1989 tax reform that the tax on commercial transactions started to be called value-added tax (VAT) and was applied to more products.
[9] Infrastructure to connect the Sierra and the Coast was significantly improved.

technologies. Moreover, Gerschenkron (1962) had already stated that the more backward a country that started its industrialization process, the less likely its agricultural sector would play any active role in the economic growth.

Despite the growth of industrial activity in Ecuador, there were few positive impacts on other economic sectors, which could be also related to the lack of coordination between sectors, the absence of a macroeconomic policy and political instability. Hirschman (1968) and Pinto (1970) warned about the protectionist policy by arguing that such a policy would ended up preventing investors and businessmen from creating wealth, and make it difficult to reduce the technological gap. They also noted that for small economies, the success of protectionist policies is very limited. When the banana market started to show signs of exhaustion, the banana companies began to leave the country to settle in Central America in search of higher profits. The decrease in the prices of agricultural goods and especially the lower price of bananas caused the trade balance to go into deficit for most of the 1960s.

As can be seen in Table 2, Ecuador's GDP growth rate during this first stage was, on average, 4.91% annually, while GDP per capita and per worker showed an annual average growth of 1.95% and 2.61%, respectively. Moreover, the TFP index grew at an average annual rate of 1.81%. Acosta (2006) and Rodrigues (2010), among others, argued that this growth was caused by the dynamism of the recovery and growth of the world markets after the Second World War, as well as the action of certain social groups rather than as a result of the ISI model policy. However, this growth was not strong enough to cause a fundamental change in the productive structure of these countries. Moreover, it is often believed that there was not enough political interest to change the structure of the economy as Baer argued (1972). The first panel of Table 2 also shows that the inflation rate was low, the economy was fairly closed to international markets and the rate of illiteracy was high. However, the period shows the least inequality of the four. The evolution of the economic structure is shown in the second panel of Table 2.

First oil boom (1972–1981)

In 1972, large-scale oil exports began[10] in Ecuador, which was under another dictatorship regime that had taken control of the country in the early 1970s. In this period, Ecuador experienced a major change in the accumulation of wealth. The urbanization process in big cities was consolidated, a middle class emerged and the public sector expanded significantly as one out of three employees in urban areas was working in the public sector (Hofman, 1994; Acosta, 2006).

Ecuador joined OPEC in 1973,[11] becoming the second Latin American country to form part of the organization after Venezuela. Oil prices climbed by up to 300% from 1973 to 1974 and the Military Junta

[10] In 1964, the Texaco-Gulf partnership obtained a license to explore for oil in eastern Ecuador. The first oil well was drilled in 1967.
[11] In 1992, Ecuador voluntarily suspended its membership to OPEC. It resumed membership in 2007.

ordered by law the return of approximately 80% of concessions that foreign oil companies had previously obtained to explore for oil in the country. The law permitted the government to control oil production and trade, thus increasing revenues, which allowed it to fund funding important oil projects such as the Esmeraldas Refinery, the Ecuadorian State Petroleum Corporation and the Ecuadorian Petroleum Fleet, as well as basic infrastructure.

Economic growth rate was spectacularly high in 1972 (14%) and 1973 (25%); the highest levels reported in these six decades (see Figure 2). According to Central Bank of Ecuador statistics, oil exports became the main component of total exports with almost 50% on average from this phase on and an important source of revenues for the public budget with a share of about 30% since the 1970s.

Strikingly, during the oil boom, the dictatorship incurred loans from international organizations to finance the increasing public spending. This easy access to credit would later lead to the debt crisis in Ecuador.

When Ecuador regained democracy in 1979, the ISI model was already in decline with disappointing results. While it is true that industrial activity increased, the dependency on imported inputs led to a high import ratio, making this policy inefficient to promote structural change in Ecuador. Moreover, according to Fontaine (2002), the oil sector caused a reduction in industrial and agricultural productivity in Ecuador which, along with the ISI model and its substitution effect, led to a progressive loss of competitiveness of non-export sectors and a "de-industrialization" process of the economy.

The ISI model was progressively abandoned in the late 1970s and early 1980s by Latin American countries due to its disappointing results, which led to the adoption of trade liberalization policies. Felix (1989) and Kay (2002) compared the implementation of the ISI model in both Latin America and Asian NICs[12] as these regions applied the model after the mid-twentieth century and found that the paths taken by these regions were remarkably different for various reasons; one of them being the consumption behavior that allowed the Asian NICs to more quickly absorb the technology from capital-goods imports, while Latin American countries were unable to do so. Another was the agrarian reform. While agrarian reform in the Asian NICs came before any attempt at industrialization in Latin America, this reform started after the implementation of the ISI model. Prescott (1998) suggested that for some sectors of some countries there is a kind of resistance to adopt new technologies and use currently operating technologies efficiently.

De Gregorio (1992), Hofman (1994) and Astorga *et al*. (2005, 2011), among others, found that from 1950 until the mid-1970s Latin American countries in general showed a rapid TFP growth with little volatility. Indeed, it was thought that these countries were on the path to convergence with industrialized countries. Moreover, De Gregorio (1992) pointed out that Ecuador performed better than other Latin

[12] "Newly industrialized countries" is a term applied to several countries whose economies have not yet reached the status of a developed country, but have outpaced their developing counterparts.

American countries due precisely to the bonanza experienced from the 1950s to the 1970s. After this period, however, the TFP growth rate began to decrease as can be seen in Figure 1 for Ecuador.

According to Naranjo (1995) and Ocampo (2005), the mismanagement of oil resources and increasing government intervention caused the Dutch disease or "the curse of natural resources" of the Ecuadorian economy. Gylfason (2001), Torvik (2001) among others who have studied the Dutch disease, argued that well-endowed countries with non-renewable natural resources, such as oil, find it difficult to grow and catch-up with developed countries due to the volatility of such foreign revenues. They also noted that these countries experience low economic growth because the sector in which the boom occurs is unable to produce a "learning by doing" effect due to the low education level and low investment in human capital. Moreover, Gelb (1988) suggested that Ecuador, Iran, Nigeria and Trinidad and Tobago suffered Dutch disease mainly due to a decline in the agriculture sector during the oil booms from 1972 to 1981.

According to Bulte *et al*. (2003), another characteristic of Dutch disease is that it drives public investment to non-productive and less technological sectors, thus preventing the pursuit of economic efficiency and causing a null "learning by doing" effect because the business class becomes dependent on the incentives and subsidies that the government provides.

As can be seen in Table 2, the oil boom boosted the country's economy. Ecuador's annual average GDP growth rate during this first phase was 8.83%, while GDP per capita and per worker grew, on average, 5.93% and 5.01% annually. Moreover, the annual average growth of TFP was 3.46%. However, the inflation rate reached two digits and inequality increased despite some social programs, such as alphabetization which did reduce the illiteracy rate.

Debt and financial crisis (1982–1999)

In the early 1980s a new democratic system was established and the reduction of government spending was one of the two main policies implemented to fulfill payment obligations of the external debt[13] incurred during the boom period. This was a critical period due to the tightening of monetary policies of the US and UK, which raised the interest rate and caused a crisis in global bond markets. The decline of export revenues due to the fall in commodities prices and the rising prices of import goods led to the deterioration of the external balance. Moreover, the deficit of the non-oil trade balance became more evident due to the high dependency of the manufacture sector on imports for production. Arcos (1990) pointed out that since industrial production in Ecuador was mostly targeted at the domestic market, the country's exports other than oil continued to be primary and hardly generated foreign inflows. Hence, external indebtedness acquired more relevance.

Under these circumstances, Ecuador adopted a trade liberalization policy. The promotion of

[13] In the 1970s, the share of external debt did not exceed 20% of GDP. By the end of the 1990s, however, this share increased to 90% of GDP.

exports was the main economic policy undertaken by the government to boost economic growth. Liberalization brought a large influx of foreign capital which, along with the austerity policy to reduce public spending, aimed to correct Ecuador's external and internal balances. According to Arteta (2000), such foreign inflows were mostly driven to fund consumption and for the accumulation of reserves. Moreover, the inflation rate started to grow disproportionately which affected wages and domestic demand, the sucre (the domestic currency) began a process of continuous devaluation[14] and the weakness of the fiscal policy contributed to reducing government revenues, thus jeopardizing its capacity to pay the foreign debt.

The credit boom due to foreign capital flows led to a financial crisis in the late 1990s. Despite government intervention through a bank bailout, most of the country's largest banks went bankrupt and the Ecuadorian economy decreased 5% in 1999, per capita income decreased 3%, inflation rose to 52% and the sucre was devaluated about 210%. One of the consequences of this crisis was the loss of the sucre and the adoption of the US dollar as the national currency. Another consequence was the massive migration of Ecuadorians to other countries.

Although the GDP grew over this period, it exhibits the lowest annual average growth rate of the four periods. Moreover, GDP per capita and per worker growth rates were negative. TFP from this period onwards showed a decreasing trend and a negative annual average growth rate (see Figure 2 and Table 2) and the inflation rate worsened.

The 1990s may have been the most difficult decade for the Ecuadorian economy, not only as a result of the economic factors pointed out above, but also for other reasons such as a war with Peru in 1995, which involved a major expense for the government, and El Niño in 1997–1998, which caused millions of dollars in losses, especially in the country's infrastructure and agricultural sector.

Dollarization and the second oil boom (2000–2014)

In January 2000, the government decided to adopt the US dollar as the national currency to avoid the total collapse of the economy. However, this measure did not prevent at least one million people from leaving the country in the following years due to the lack of employment.[15] According to an International Labor Organization report (ILO, 2013), more than half of all Ecuadorians that left the country following the financial crisis were young people between the ages of 15 and 29 who were either working or studying.

Uncertainty and the political instability in the late twentieth century and early twenty-first century[16] sunk Ecuador into a severe economic crisis. Mauro (1995), Astorga *et al*. (2005) and Dixit (2009) argued that less developed countries usually suffer from political instability, weak governments,

[14] Under the macroeconomic adjustment and stability policies, the government and the Central Bank of Ecuador established a scheme of controlled devaluations within exchange rate bands, which were adjusted consecutively until 1999.
[15] In 2000, Ecuador had a population of about 12 million inhabitants.
[16] Seven presidents (elected and interim) held office in the country from 1996 to 2006.

bureaucratic corruption and macroeconomic uncertainty, which lead to poor economic performance. According to Baumol *et al*. (2007), governments of Latin America, the Arab Middle East, Africa and most of the countries that belonged to the former Soviet Union tend to maintain and enhance the economic position of a small portion of the population, while economic growth is not a central objective of the government.

Although dollarization prevented Ecuador from entering into a deep economic depression, it unveiled deficiencies in the production structure that the previous oil bonanza had disguised.

According to an Inter-American Development Bank report (IADB, 2008), migrant remittances[17] and the rising oil prices since 2005, among other factors, allowed the recovery of the economy at that time. However, the country's production structure remained weak, uncompetitive, undiversified and dependent on the oil sector, thus making it vulnerable to external and internal shocks.

Spurred on by the higher oil revenues, the government started implementing several social programs to reduce poverty and inequality in 2007. One of the main objectives of the government has been to achieve the desired structural change and in order to achieve such an objective, investment in public infrastructure has become essential, especially in roads, power plants, education and health. In order to maintain such investments, the government has assumed greater control over strategic sectors which has raised concern among private investors. Hall and Jones (1999) suggested that government interference in production will be unable to achieve levels of output per worker near the levels of rich countries. Dixit (2009) stated that government's failure to protect private property rights are major causes of poor economic performance in many countries, especially less developed countries.

During the global financial crisis of 2008–2009, migrant remittances decreased. However, the higher oil prices, as well as government policies such as the strengthening of the fiscal policy,[18] the renegotiation of external debt and substantial external financing, allowed Ecuador to achieve significant economic growth during this international crisis while most of its fellow regional partners did not.

Despite the fact that the Ecuadorian trade balance has been mostly positive in the first decade of the twenty-first century, the non-oil trade balance has been negative and the diversification of exportable supply has remained practically static over the years according to statistical reports of the Central Bank of Ecuador (BCE, 2012). Moreover, the application of certain restrictions on imports to protect domestic industry has caused concern in the private sector.

As can be seen in Table 2, this period is marked by a recovery of the Ecuadorian economy. The country has again found the growth path in terms of GDP. TFP is showing signs of reversing the negative

[17] Remittances from migrants accounted for 1.88% of GDP from 1991 to 1997 and increased to 6.40% of GDP from 1999 to 2005. From 2010 to 2014 remittances accounted for 3.03% of GDP.
[18] Data from the tax collection agency (*Servicio de Rentas Internas-SRI*) website: Average tax collection in the period 2001–2006 was 20.3 millions of dollars. Average tax collection in the period 2007–2012 was 47.9 million dollars. The tax burden in 2001 was 11.2%, while it was 19.7% in 2014.

trend, inflation and illiteracy rates have diminished notably, the economy is more open and inequality has begun to decrease.

3 EMPIRICAL STRATEGY

Let the economy produces according to a production function with neutral technical progress in Hicks' sense as follows

$$Y_t = A_t F(K_t, L_t)$$

Where *Y* is the output, *K* is the stock of physical capital, *L* is the numbers of workers and *A* is what Solow (1957) defined as "technological change" that we call TFP and collect the effects of variables other than inputs (*K* and *L*) on the output. Sub index *t* is the time period.

TFP is considered to be the main driver of GDP volatility, especially in middle- income countries, as found by Moro (2015). Therefore, in this section an econometric model to shed light on the determinants of TFP in Ecuador is proposed.

Let TFP evolve over time according to the following equation:

$$TFP_t = Z_t HC_t^{\beta_1} KMS_t^{\beta_2} FDI_t^{\beta_3} FER_t^{\beta_4} CI_t^{\beta_5} PI_t^{\beta_6} OIL_t^{\beta_7} \quad (1)$$

Equation (1) is a kind of Cobb-Douglas production function of TFP. Therefore, it establishes a nonlinear relationship between the dependent variable and the independent variables which turn out to be a more plausible assumption than a linear specification that assumes constant marginal returns. Moreover, it allows interpreting the coefficients as elasticities.

Traditional variables that have been shown in the literature to affect TFP or GDP per capita growth have been introduced in equation (1).

Thus, *HC* is the human capital index based on years of schooling and returns to education as developed by Barro and Lee (2013) and provided by PWT. The seminal theoretical work of Romer (1990) showed that human capital has an important effect on *TFP* because of its role as a determinant of an economy's capacity to carry out technological innovation. Benhabib and Spiegel (1994) showed empirical evidence supporting Romer's theoretical results and suggested that the level of human capital influences a country's capacity to develop its own technological innovations, which in turn is a determinant of TFP growth. Moreover, the empirical works of Becker*et al*. (1990), Barro (1991) and Hall and Jones (1999), among others, have demonstrated that high levels of investment in human capital have a positive impact on productivity.

KMS (kilometers per road built) is a proxy for the stock of public infrastructure provided by the Secretary of Public Works. The seminal work of Aschauer (1989) showed that public capital has a

significant impact on productivity.[19]

FDI is the foreign direct investment (in millions of USD at 2011 constant prices) provided by the Central Bank of Ecuador. De Gregorio (1992) found a positive correlation between growth and FDI and suggested that it seems to be more efficient than domestic investment in Latin American countries. As pointed out by Isaksson (2007), FDI is viewed as a key channel for the transfer of advanced technology and superior organizational forms from industrialized to developing countries. Furthermore, FDI is believed to generate positive externalities in the form of knowledge spillovers to the domestic economy through, for instance, linkages with local suppliers and clients learning from nearby foreign firms and employee training programs.

FER is the fertility rate (children per woman) provided by the Statistics Institute of Ecuador (INEC). According to Becker et al. (1990) and Barro (1991), lower fertility rates mean more investment in human capital and economic growth. Moreover, they found that poorer countries tend to have higher fertility rates.

CI is a corruption index built by Dahlberg *et al*. (2017). The higher the CI index, the greater the corruption and vice versa. Political instability, weak institutional development and excessive bureaucratic rules lead to corruption, which is thought to affect long-run economic growth negatively (Barro, 1991; De Gregorio, 1992; Astorga *et al*., 2011).

PI is the consumer price index at 2011 base provided by the Central Bank of Ecuador. De Gregorio (1992) found a negative effect of inflation on growth in his sample for Latin American countries.

Because Ecuador is an oil exporting country and its economy largely depends on this resource, the variable *OIL*, which is the oil price in the international markets, is included and provided by the BP Statistical Review of World Energy.

The variable Z captures deterministic and random shocks in the Ecuadorian economy and is specified as follows

$$Z_t = e^{(a_0 + a_1 D_t^{boom} + a_2 D_t^{crisis} + \alpha_3 D_t^{dol} + a_4 D_t^{ISI} + D_t^{soc} + \varepsilon_t)} \qquad (2)$$

Where a_0 is the constant term, three dummies are included to control for the phases of economic growth described in section 2. Thus, D^{boom}, D^{crisis} and D^{dol} are the dummies for the first oil boom, the crisis period and the dollarization period.[20] Moreover, events which are suspected to have caused structural breaks are considered. Hence, D^{ISI} is a dummy capturing the import-substituting industrialization period (1952–1982) and D^{soc} is a dummy for the period of Rafael Correa's government (2007–2014). Finally, ε_t is a random disturbance.

Substituting equation (2) in (1) and taking the logarithm, the following linear specification is

[19] For a survey of the effects of public capital on the economy, see Bom and Ligthart (2014).
[20] The dummy for the first phase is not included to avoid perfect multicollinearity.

obtained:

$$\ln(TFP_t) = \alpha_0 + a_1 D_t^{boom} + a_2 D_t^{crisis} + \alpha_3 D_t^{dol} + a_4 D_t^{ISI} + a_5 D_t^{soc} + \beta_1 \ln(HC_t) + \beta_2 \ln(KMS_t) + \beta_3 \ln(FDI_t) + \beta_4 \ln(FER_t) + \beta_5 \ln(CI_t) + \beta_6 \ln(PI_t) + \beta_7 \ln(OIL_t) + \varepsilon_t \quad (3)$$

According to the literature, human capital, public infrastructure and foreign direct investment should have a positive impact on TFP. Therefore, $\beta_1, \beta_2, \beta_3 > 0$, while fertility rate, the corruption index and the price index are expected to be negatively related to TFP, that is, $\beta_4, \beta_5, \beta_6, < 0$. In addition, oil prices should be expected to have a positive effect on TFP, $\beta_7 > 0$.

Due to a lack of data, we try to reduce to the greatest possible extent the number of explanatory variables so that the parameters can be estimated with acceptable degrees of freedom. Therefore, variables considered in the literature as fostering economic growth, such as the openness index (exports+imports/GDP), have not been included. This is due to the fact that, in the case of Ecuador, such an indicator is highly correlated with commodity prices for the study period (0.8). Moreover, illiteracy rate (a variable that is frequently used in the literature) is not included since it is captured to a certain degree by the human capital index. In fact, these variables are negatively correlated (0.9). It has recently been argued that inequality has harmful effects on economic growth. However, data on the Gini coefficient are also only available from 1960. In addition, banana price has not been included since data are only available from 1960 in the Global Economic Monitoring of the World Bank. Moreover, the correlation coefficient with oil prices during the period 1960–2014 is 0.9.

Our specification is able to capture to a large extent the categories of variables proposed by Isaksson (2007) that have been found to affect TFP. Thus, HC captures the creation, transmission and absorption of knowledge, as well as education and training. FDI captures technology transfer and adoption. KMS accounts for infrastructure, CI for quality of institutions and FER for the social dimension. Structural changes are captured by the dummies. Moreover, as pointed out above, integration and trade are captured to some extent by oil prices.

4 ESTIMATION ISSUES

The results of estimating equation (3) are shown in Table 3. OLS standard errors and standard errors corrected for heteroskedasticity *à la* White (1980) and for heteroskedasticity and autocorrelation *à la* Newey and West (1987) are also provided.

As expected, the human capital-TFP elasticity turned out to be positive and highly significant (1% level). As the economic literature has demonstrated, the accumulation of human capital is a prime factor for economic growth. Stock of human capital is mainly the result of investment in education. Investment in human capital can be thought as a strategy to enhance the absorptive capacity which in turn facilitates

technology transfer. Figure 3 shows investment in education as a percentage of the GDP of Ecuador during the period analyzed. As can be seen, the trend of this ratio follows a somewhat similar trend to that of the TFP shown in Figure 1.

The positive effect of infrastructure on TFP is once again confirmed. In particular, public infrastructure stock is supposed to enhance the productivity of private capital. The proxy used could be suggesting that public infrastructure stock, such as roads and highways, could reduce time and costs in transporting inputs and goods, and is thus beneficial for productivity gains and economic growth in Ecuador. Furthermore, it generally captures, to a certain degree, the total effect of transport infrastructure in the country (i.e., airports, ports, etc.) and on TFP. Public infrastructure stock is the result of public investment. Figure 4 shows public investment as a percentage of the GDP of Ecuador during the period analyzed. As can be seen, public investment as a ratio of GDP shows a similar trend to that of TFP in Figure 1, with the exception of the first boom period.

Contrary to some previous evidence, non-significant effect of foreign direct investment (FDI) on TFP is found which might have to do with the fact that FDI entering a country like Ecuador has aimed simply at making profits, while technology transfer has not been implied as Acosta (2006) suggested.

Unexpected signs are obtained for the coefficient of the political corruption index and the fertility rate, which turned out to be positive. However, they are not significant at any conventional level.

As expected, the elasticity between the price index and TFP is negative and significant at the 1% level. While it is true that sustainable economic growth entails an increase in the level of prices, this should be predictable for the economic agents who need information to make decisions. However, given that such increases occur in an unexpected manner, economic agents alter their consumption, savings and investment habits because they require a greater margin of error. As a result, the feeling of insecurity in the markets becomes latent and the performance of the economy is affected.

There is no doubt that oil prices have played an important role in Ecuador's economy since 1972. However, the estimation unveils that even though the effect of oil prices on TFP is positive, it is not robust enough. It is only significant at the 5% percent level with OLS standard errors, while it is not significant at any conventional level when standard errors are corrected for heteroskedasticity and autocorrelation. Since the oil industry has become the flagship product for the Ecuadorian economy and its revenues have allowed supporting major national projects, this result could be suggesting that the positive effects of oil prices on economic growth in Ecuador might accrue through the inputs of the production function rather than through TFP. Furthermore, oil prices could have an indirect effect on TFP through human capital and infrastructure since oil revenues fund investment in education and infrastructure. However, the results in Table 3 suggest that the first oil boom caused a positive and significant structural break on TFP, which could be explained by the fact that this event introduced a major change in the economic structure of Ecuador.

Strikingly, the crisis period caused a positive structural break. Although this result may seem odd, this period coincides with the liberalization of the economy. Liberalization typically stimulates competition, which becomes vital to increase TFP. Moreover, the liberalization policies, in general, come with a privatization program which facilitates market entry for new firms which are supposed to be more productive.

The period capturing dollarization of the economy and the second oil boom has not caused a structural break, which could indicate that losing control over monetary policy did not affect TFP or economic growth.

An interesting result is the effect caused by the ISI model during its implementation stage, which is positive and significant at the 1% level. This result may seem odd given the fact that the more closed a country's economy is, the lower the economic growth. However, it cannot be neglected that Ecuador was one of the few Latin American countries that experienced economic growth above the average of the region during the ISI model period. Moreover, this positive effect could have to do with the recovery and growth of the world markets after the Second World War as pointed out above (Acosta, 2006; Rodrigues, 2010). In contrast, the period of Rafael Correa's government seems to have had a significant and negative effect. This could be suggesting that some economic policies or institutional arrangements carried out during this period offset the positive effects of, for example, human capital and infrastructure.

Since human capital, infrastructure, CI and PI could be suspected to be simultaneously determined with TFP; Table 3 also shows the Wu-Hausman exogeneity test. A two-stage least squares (2SLS) regression was run using two lags of the variables suspected to be endogenous as instruments. As can be seen, the hypothesis of exogeneity of these variables cannot be rejected. The Sargan and Basmann tests show that the instruments are valid.

Table 3 also shows that the proposed model is able to explain 97% of the variability of the TFP and no concern of spurious regression arises since the Durbin-Watson (DW) is close to 2. Moreover, the Portmanteau test suggests that the residuals are white noise. Therefore, there could be a cointegration relationship between the dependent and independent variables. Due to the nature of economic series, it is possible that there are imbalances in the short term with respect to the long term. Thus, we estimate the error correction mechanism (ECM) to link the analysis of long-term equilibrium with the dynamics of short-term adjustment. Therefore, the following equation was estimated:

$$\begin{aligned}\Delta\ln(TFP_t) = {} & \tau_0+\tau_1 D_t^{boom} + \tau_2 D_t^{crisis} + \tau_3 D_t^{dol} + \tau_4 D_t^{ISI} + \tau_5 D_t^{soc} + \theta_1 \Delta\ln(HC_t) \\ & +\theta_2 \Delta\ln(KMS_t) + \theta_3 \Delta\ln(FDI_t) + \theta_4 \Delta\ln(FER_t) + \theta_5 \Delta\ln(CI_t) + \theta_6 \Delta\ln(PI_t) \\ & +\theta_7 \Delta\ln(OIL_t) + \rho\hat{\varepsilon}_{t-1} + \mu_t \qquad (4)\end{aligned}$$

Where $\hat{\varepsilon}_{t-1}$ are the lagged residuals of the estimation of equation (3).

Table 4 shows the results of estimating equation (4). The estimated coefficient of the lagged residuals has the expected sign and is significant at any conventional level. The Engle-Granger test suggests a stable relationship between the log of TFP and the explanatory variables, that is, there is a common trend. Hence, the Engle-Granger ECM adjusts the short-term behavior of the log of TFP with its long-term behavior.

5 ROBUSTNESS CHECK: ESTIMATING PRODUCTION FUNCTIONS

Suppose that the economy produces according to a Cobb-Douglas production function with constant returns to scale as follows

$$Y_t = A_t K_t^{\gamma} L_t^{1-\gamma} \quad (5)$$

Where *Y* is the output determined by labor, *L*, stock of physical capital, *K*, and the level of technology or TFP, *A*. Data on labor and physical capital are from PWT. The coefficients γ and 1- γ measure the respective contribution of the inputs. Let us rewrite equation (4) in output per worker, y_t, so that we get

$$y_t = A_t {k_t}^{\gamma} \quad (6)$$

Where k_t is the stock of physical capital per worker.

Rewriting equation (6) in log, we obtain:

$$\ln(y_t) = \ln(A_t) + \gamma \ln(k_t) \quad (7)$$

Notice that $\ln(A_t) = \ln(TFP_t)$, therefore, substituting equation (3) in equation (7), the following expression is obtained:

$$\begin{aligned} \ln(y) = {} & \alpha_0 + a_1 D_t^{boom} + a_2 D_t^{crisis} + \alpha_3 D_t^{dol} + a_4 D_t^{ISI} + a_5 D_t^{soc} \\ & + \beta_1 \ln(HC_t) + \beta_2 \ln(KMS_t) + \beta_3 \ln(FDI_t) + \beta_4 \ln(FER_t) \\ & + \beta_5 \ln(CI_t) + \beta_6 \ln(PI_t) + \beta_7 \ln(OIL_t) + \gamma\, ln(K_t) + \varepsilon_t \end{aligned} \quad (8)$$

Table 5 shows the results of estimating equation (8) which are very similar to Table 3. It can be noticed that the variables that explain TFP can also explain output per worker. A similar estimation of the parameters and levels of significances for most of them were found. Strikingly, political corruption has a positive and significant effect, although weak, and oil price exhibits a stronger effect in this model. This might be suggesting that such variables could have direct positive effects on GDP per worker but no direct effects on TFP as found in the baseline model. In fact, the evidence that found positive effects of corruption on economic growth uses GDP per worker or per capita as explanatory variables. In general, the literature suggests that corruption is harmful for economic growth since it generates mistrust in the economic agents

regarding the political system, thus discouraging investment. However, the early work of Leff (1964) had already suggested that there are circumstances when corruption can be positive for economic growth. Recently, several works have analyzed corruption as a burden to economic growth and found evidence suggesting that corruption seems to be not only less harmful but have positive effects on the economy for some countries (Blackburn & Forgues-Puccio, 2009; Méon & Weill, 2010; Dzhumashev, 2014). According to this literature, institutional inefficiency, weak quality governance and excessive bureaucratic regulations can be overcome through corruption so that investors can obtain the necessary permits to operate in these markets, thus stimulating economic growth in these countries. A similar argument could be given to explain the non-significant effect of the dummy for the socialist period. In this case, no structural break on GDP was introduced during this period.

The main drawback to this kind of specification is the odd result regarding the stock of physical capital per worker whose estimated parameter turns out to be non-significant at any conventional level.

Alternatively, the following production function is proposed:

$$Y_t = A_t K_t^{\delta} (L_t H_t)^{1-\delta} \quad (9)$$

The interaction between human capital and labor $(L_t H_t)$ can be interpreted as an input capturing efficient labor. From equation (9) we obtain the output per efficient worker as follows:

$$\frac{Y_t}{L_t H_t} = \tilde{y}_t = A_t \tilde{k}_t^{\delta} \quad (10)$$

Where $\tilde{y}_t$and $\tilde{k}_t$ are output per efficient worker and stock of physical capital per efficient worker, respectively. Taking log in equation (10) we get

$$\ln(\tilde{y}_t) = \ln(A_t) + \delta \ln(\tilde{k}_t) \quad (11)$$

Equation (11) is estimated in a similar way as above. The results are shown in Table 6 and, as can be seen, are very similar to those presented in Tables 3 and 5.

6 CONCLUSIONS

This paper analyzes Ecuador's total factor productivity (TFP) in the last six decades and its possible determinants. A nonlinear relationship between a TFP index and its potential determinant is proposed. In fact, TFP is assumed to be generated by a Cobb-Douglas function. Due to the lack of a longer time series for this country, the variables considered to be most relevant in explaining the growth of TFP have been used.

In line with the literature that determines the sources of TFP growth, the empirical results obtained in this article show that human capital has played an important role in Ecuador's TFP, as well as public

infrastructure. Furthermore, the results somewhat suggest that oil revenues positively affect Ecuador's economic growth through input accumulation rather than TFP. If oil prices have any effect on TFP, it might accrue indirectly through human capital and infrastructure. However, the first oil boom does seem to have caused a positive structural break on Ecuador's TFP. An interesting result is the positive effect of the ISI protectionist model on productivity since it is typically expected that the more closed a country is to the world, the worse its long-term economic performance. Along the same lines, the socialist government of Rafael Correa seems to have caused a negative structural break on TFP but no effect on GDP per worker is found. The results are robust to the estimation methods and the measure of TFP.

Conflict of Interest Declaration

The authors of the article state that have no conflict of interest to declare.

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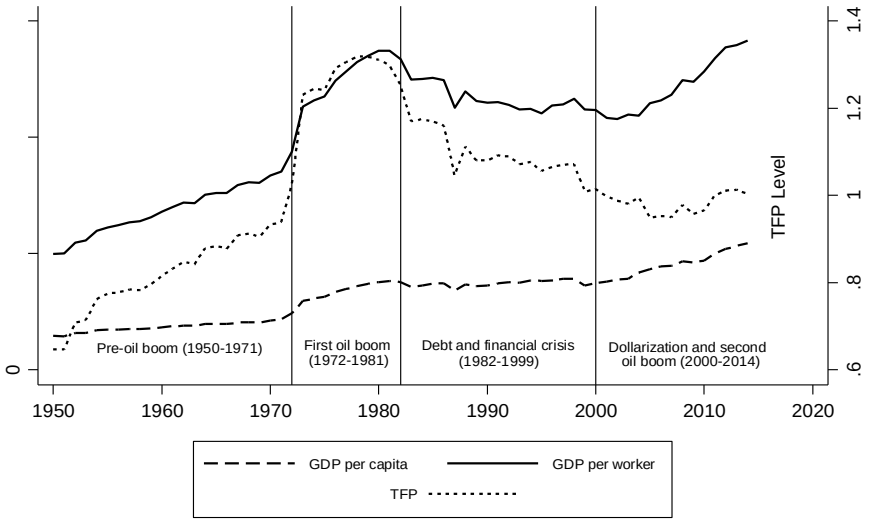
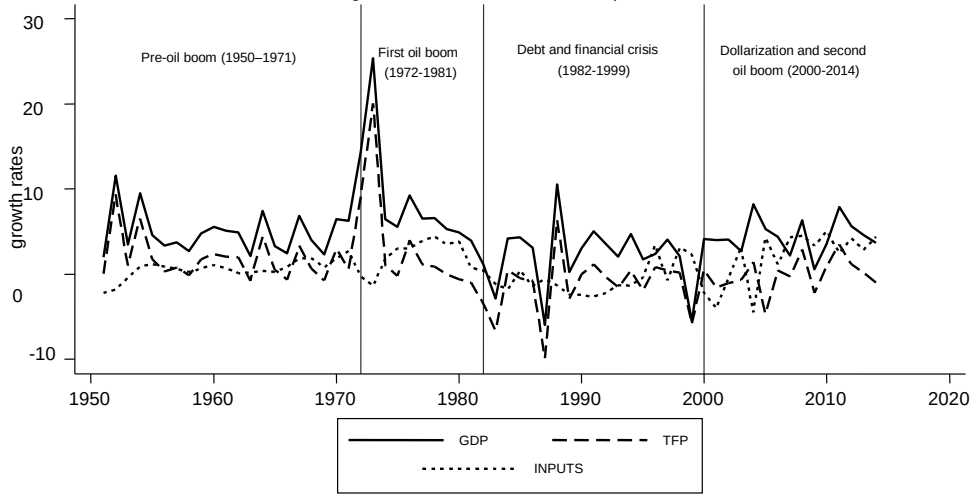
Figure 1
Real GDP per capita and per worker, and TFP level, Ecuador 1950-2014



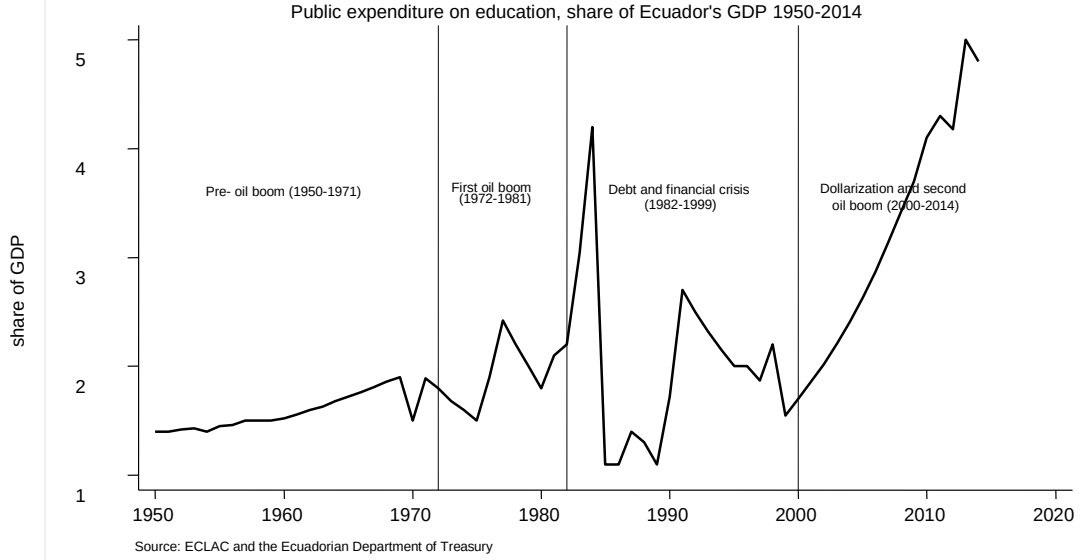
Source: UC Davis and Groningen Growth Development Centre's Penn World Table.
Note: At constant 2011, national prices

Figure 2
Ecuador's growth rate of GDP, TFP and Inputs, 1950-2014



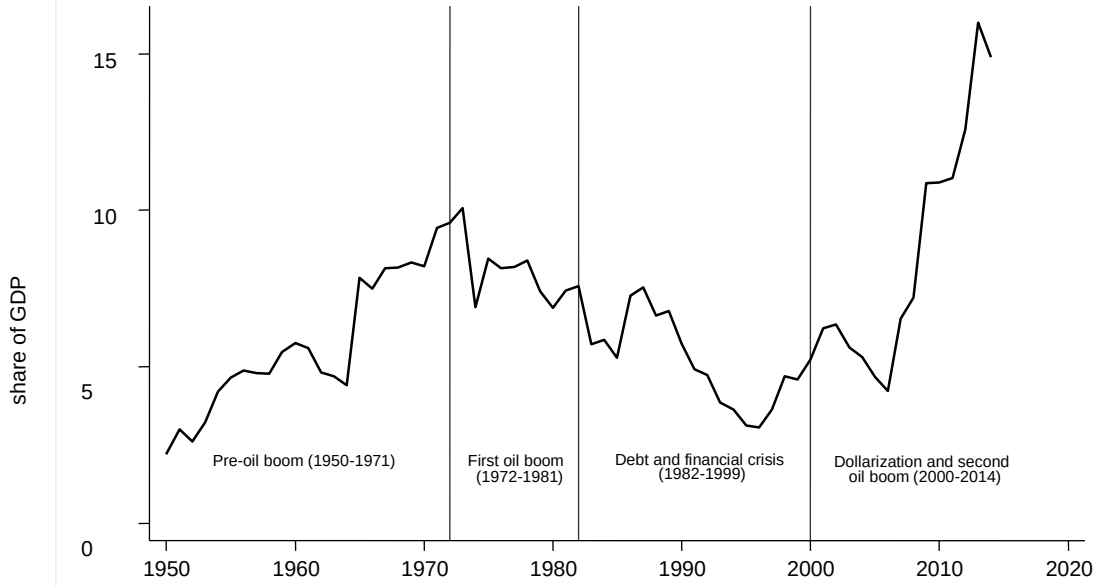
Source: Computations based on the UC Davis and Groningen Growth and Development Centre's Penn World Table.

Figure 3
Public expenditure on education, share of Ecuador's GDP 1950-2014



Source: ECLAC and the Ecuadorian Department of Treasury

Figure 4
Public investment, share of Ecuador's GDP 1950-2014



Source: Central Bank of Ecuador and ECLAC

Table 1. GDP per capita and per worker and TFP growth rates in selected Latin America countries 1950–2014

Country	GDP per capita annual growth rate	GDP per worker annual growth rate	TFP annual growth rate
Ecuador	**2.12 (4.04)**	**1.67 (4.04)**	**0.70 (3.92)**
Seven largest LA countries	**1.68 (2.30)**	**1.39 (2.42)**	**0.09 (2.08)**
Argentina	1.25 (5.07)	1.08 (4.43)	0.06 (4.08)
Brazil	2.62 (3.61)	2.07 (3.77)	0.87 (3.38)
Chile	2.35 (4.83)	1.89 (4.08)	-0.08 (3.89)
Colombia	2.08 (2.23)	1.30 (2.24)	0.65 (1.98)
Mexico	1.85 (3.38)	1.20 (3.35)	0.07 (3.29)
Peru	1.62 (4.66)	1.08 (4.60)	-0.02 (4.27)
Venezuela	0.87 (5.31)	0.39 (4.75)	-0.53 (4.77)

Source: Author's calculations based on Penn World Table version 9.0 data
Note: The calculation for the seven largest Latin America countries does not include Ecuador

Table 2. Basic indicators for Ecuador, 1950–2014

Indicator/Stages	**1950-1971 (pre oil-boom)**	**1972-1981 (1st oil-boom)**	**1982-1999 (debt and financial crisis)**	**2000-2014 (dollarization and 2nd oil-boom)**
GDP[a]	4.91	8.83	2.11	4.48
GDP per capita[a]	1.95	5.93	-0.22	2.77
GDP per worker[a]	2.61	5.01	-1.07	1.61
Population[a]	2.88	2.73	2.34	1.67
TFP[b]	1.81	3.46	-1.33	-0.02
Inflation[c]	3.28	13.25	38.93	13.18
Openness[c]	0.30	0.31	0.41	0.57
GINI*[c]	0.41	0.60	0.47	0.50
Illiteracy[d]	33.18	19.51	12.05	7.48
Economic Structure	**1950-1971 (pre-oil boom)**	**1972-1981 (1st oil boom)**	**1982-1999 (debt and financial crisis)**	**2000-2014 (dollarization and 2nd oil boom)**
Agriculture*[e]	30.68	21.14	20.83	10.79
Industry*[e]	20.39	25.51	27.59	35.46
Services*[e]	48.93	53.34	51.58	53.75

Source: Central Bank of Ecuador, World Bank, ECLAC, United Nations.
Note: *Data available since 1960; a) growth rate, average; b) annual growth, average; c) Index, annual average; d) as percent of population, average; e) share of GDP, annual average.

Table 3. Model 1: Determinants of TFP growth for Ecuador, 1950–2014

	Estimations			
	Coefficients	**OLS SE**	**White SE**	**Newey-West SE**
Constant	-2.4886	0.6202***	0.4663***	0.6001***
Human Capital	1.3037	0.2911***	0.2353***	0.2778***
Infrastructure-KMS	0.1115	0.0478**	0.0405***	0.0534**
FDI	0.0037	0.0075	0.0062	0.0065
Fertility	0.1030	0.1785	0.1201	0.1467
Corruption	0.0909	0.0678	0.0860	0.0742
Price Index	-0.0590	0.0113***	0.0104***	0.0120***
Oil Price	0.0371	0.0151**	0.0309	0.0231
Dummy Boom	0.1968	0.0268***	0.0655***	0.0458***
Dummy Crisis	0.1470	0.0441***	0.0709**	0.0549***
Dummy Dollar	0.0873	0.0574	0.1044	0.0862
Dummy ISI	0.0972	0.0212***	0.0122***	0.0126***
Dummy Socialist	-0.0710	0.0213***	0.0268**	0.0320**
R^2	0.9744			
DW	1.7849			
Portmanteau test	31.6207 *(0.3368)*			
Wu-Hausman	0.8368 *(0.5093)*			
Sargan	4.6843 *(0.3213)*			
Basmann	3.6599 *(0.4540)*			

Notes: Number of observations: 63. All variables in logs (except for dummies). P-values in italics.
*** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

Table 4. Engle-Granger ECM

	Estimations	
	Coefficients	**OLS-SE**
Constant	0.0198	0.0266
Human Capital	-0.0850	1.9123
Infrastructure-KMS	0.0110	0.0635
FDI	-0.0003	0.0066
Fertility	0.1806	0.1504
Corruption	0.1616	0.0695
Price index	0.0990	0.0514
Oil price	-0.0012	0.0166
Dummy Boom	0.0202	0.0153
Dummy Crisis	-0.0599	0.0240**
Dummy Dollar	-0.0232	0.0253
Dummy ISI	-0.0022	0.0212
Dummy Socialist	0.0075	0.0200
Lagged residual	-0.8595	0.1409***
R^2	0.5834	
Engle-Granger(i)	|6.850|	

Notes: Number of observations: 60. All variables in logs (except dummies) *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.
(i): Critical values at: 1%: |6.353|; 5%: |5.625|; 10%: |5.264|

Table 5. Main determinants of GDP per worker growth for Ecuador, 1950–2014

		Estimations		
	Coefficients	**OLS SE**	**White SE**	**Newey-West SE**
Constant	4.5568	1.5332***	1.4027***	1.3847***
Human Capital	2.0660	0.2713***	0.2052***	0.2278***
Infrastructure-KMS	0.1168	0.0516**	0.0446**	0.0489**
FDI	-0.0004	0.0067	0.0055	0.0055
Fertility	0.0002	0.1746	0.1350	0.1678
Corruption	0.1017	0.0605*	0.0740	0.0532*
Price index	-0.0807	0.0123***	0.0115***	0.0128***
Oil price	0.0523	0.0146***	0.0300*	0.0195***
Dummy Boom	0.1741	0.0243***	0.0602***	0.0366***
Dummy Crisis	0.1169	0.0394***	0.0636*	0.0432***
Dummy Dollar	0.0810	0.0512	0.0890	0.0608
Dummy ISI	0.0933	0.0192***	0.0124***	0.0123***
Dummy Socialist	-0.0145	0.0238	0.0181	0.0176
Capital per worker	0.2149	0.1422	0.1345	0.1176*
R^2	0.9932			
DW	2.0752			
Portmanteau	26.3768	*(0.6053)*		
Wu-Hausman	0.8730	*(0.3550)*		
Sargan	0.2957	*(0.5866)*		
Basman	0.2241	*(0.6360)*		

Notes: Number of observations: 63. All variables are in logs (except dummies). P-values in italics.
*** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

Table 6. Main determinants of GDP per efficient worker for Ecuador, 1950–2014

		Estimations		
	Coefficients	**OLS SE**	**White SE**	**Newey-West SE**
Constant	4.5555	1.5330***	1.3994***	1.3788***
Human Capital	1.2815	0.3417***	0.2878***	0.2905***
Infrastructure-KMS	0.1165	0.0516**	0.0445**	0.0487**
FDI	-0.0005	0.0067	0.0055	0.0055
Fertility	-0.0000	0.1746	0.1348	0.1675
Corruption	0.1015	0.0605*	0.0740	0.0532*
Price index	-0.0807	0.0123***	0.0114***	0.0127***
Oil price	0.0523	0.0146***	0.0301*	0.0195***
Dummy Boom	0.1741	0.0243***	0.0603***	0.0366***
Dummy Crisis	0.1168	0.0394***	0.0637*	0.0432***
Dummy Dollar	0.0808	0.0512	0.0891	0.0609
Dummy ISI	0.0933	0.0192***	0.0124***	0.0123***
Dummy Socialist	-0.0146	0.0238	0.0181	0.0175
Capital per efficient worker	0.2153	0.1421	0.1342	0.1169*
R^2	0.9818			
DW	2.0774			
Portmanteau	26.3581	*(0.6063)*		
Wu-Hausman	1.0206	*(0.3177)*		
Sargan	0.1290	*(0.7195)*		
Basmann	0.0974	*(0.7549)*		

Notes: Number of observations: 63. All variables in logs (except dummies). P-values in italics.
*** significant at the 1% level; ** significant at the 5% level; * significant at t