Oil and Economic Growth: Addiction to Shocks? The Ecuadorian Case (1972-2014)

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What is required to sustain growth should not be confused with what is required to initiate it.
(Rodrik, 2006)

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Abstract

This paper, using a VAR model and a new re-constructed dataset in a quarterly frequency of GDP and its component for the period 1965-2014, evaluates the impact of positive oil price shocks on the macroeconomy, with an emphasis on growth. The responses of GDP, government consumption and imports are positive and statistically significant, whereas the inflation response is negative, possibly distorted by subsidies policies, yet mainly not significant. The results indicate that, since 1990, the impact of positive shocks on growth has been larger, despite the fact the growth rates were higher during the 1970s. Indeed, the contribution of positive shocks to the variations in GDP is higher since 1990s. Hence, economic growth seems more dependent on oil prices, revealing a lack of significant changes within the economic structure since the 1970s. The condition of the economy at the moment of the shock, therefore, is essential. Oil price surges are important, but policies and the macroeconomic performance before the shock determine the magnitude of the effect. The similarities between the 1973 and the 2010 shock in terms of policy responses, with persistent fiscal and current account deficits despite high oil prices, show that historical lessons may have not been understood.

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Footnotes do not exceed 50 words)
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1 Introduction

Ecuador started its oil exports in 1972, and since then, economic growth and oil prices have shown a close relation. Indeed, as Table 1 shows, periods of elevated oil prices are the ones with the higher growth rates. This paper evaluates this relation by testing the impact of positive price changes on the macroeconomy and its evolution over time. Since 1972, oil exports have represented, on average, almost 55 percent of the country’s total exports. The beginning of the oil era also drastically increased government revenues that previously relied almost entirely on taxes. However, this event coincided with the first oil shock of 1973, where oil prices increased from $3 per barrel to $11\(^1\) in 1974. As a result of these two events, growth rates were boosted, at an average annual rate of 7 percent during the 1970s. This period also included the second oil price shock of 1979. During the 1980s and 1990s, nonetheless, the average growth rate fell to 2.5 percent, which coincided with a period of relatively low oil prices. Unsurprisingly, the growth rates started to accelerate again in the 2000s, when oil prices began to rise systematically. After the financial crisis of 2008, the price of the barrel fell from its highest point in almost 30 years; however, the recovery was rapid. Prices started to rise again, and the average oil price never fell from the $90 barrier, until the last quarter of 2014. During this period, the Ecuadorian economy achieved a growth rate of 4.3 percent. These historical episodes of oil prices increase, therefore, are closely related with periods of higher growth rates. However, the correlation does not reveal a clear pattern between the net oil price increases\(^2\) and growth rates when different periods are considered. In fact, the correlation nowadays has been increasing since the 2000s, in clear contrast with the zero correlation registered in the 1970s, when Ecuador had started its oil exports and two oil shocks occurred during that decade. Given these considerations, several questions arise. Has the impact of positive price changes on growth evolved over time? What role does the structure of the economy play at the moment of the shock? Is growth more dependent on oil prices nowadays?

The interest in assessing the impact of oil shocks on the economy was first seen in the developing economies, which generally are oil importers. The seminal paper of Hamilton (1983) concludes

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1 Oil prices are in nominal terms, unless it is indicated otherwise.
2 This concept will be developed latter in the text in section 4.2.
that oil prices have been an important driver in output variations since World War II. However, Mork (1989) was the first to point out that there are asymmetric effects between positive and negative changes in oil prices. Since then, most of the research efforts have been devoted to assess the impacts of price changes in macroeconomic indicators for developed countries. In this regard, several measures have been proposed by Mork (1989), Hoover & Perez (1994), Lee et al. (1995), and Hamilton (1996; 2003). Moreover, Kilian (2009; 2016) emphasises that there are differences between oil and demand shocks, so the effects will vary too. Regardless of the different oil shock measures, the effect emphasised in the literature for developed economies is negative in terms of output from a positive increase in prices and no effect from negative variations. However, as Blanchard & Gali (2007) argue, the effect has been diminishing over time owing to improvements in domestic policies in these countries. On the other hand, although the literature for net exporting countries is less abundant, there are recent findings that point to a positive effect of price increases in output and especially government spending. In that respect, the works of Eltony & Al-Awadi (2001), Farzanegan & Markwardt (2009), Iwayemi & Fowowe (2011), and Pieschacon (2012) provide important evidence for specific countries. The general approach, despite the differences in the price specifications, employs VAR models.

In the case of Ecuador, most of the research conducted has studied fiscal policy, rather than the effect of oil price shocks in macroeconomic variables. Moreover, owing to the lack of long and consistent datasets, it has not been possible to extent the analysis to a longer time span. Boye’s (2001) work represents the only preliminary effort that specifically tries to evaluate the impact of oil changes in macroeconomic variables. However, his study reveals several shortcomings, recognised by the author, related to the short dataset, the methodology, and the shock specification. In fact, the study identifies the variations in oil exports as the main variable through which the economy may be affected, instead of oil price changes, which has been the common approach in the literature. The author claims that oil exports have not been the major source of macroeconomic fluctuations, so oil does not affect the economy through the external sector. In any case, data availability clearly has been a major limitation when applying different research methods.

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and extending the studies to include longer time horizons. In this regard, Gachet et al. (2010) make a significant contribution by re-constructing the quarterly frequency data for GDP and its components for the period 1965–2008. The authors (Gachet et al., 2010, p.35) point out, “the results in this work can be employed in the development of structural models (e.g. VAR or SVAR)”. Therefore one aim of the present paper is to extend these series in order to incorporate the recent period of high oil prices to achieve a consistent dataset in a quarterly frequency for the period of 1965–2014.

In addition to the new dataset of GDP and its components, this paper also makes a contribution in two other areas. First, it discusses the historical background behind each oil shock in their classic definitions in order to understand the context and the policies that framed each episode, including the last oil shock. Second, using a VAR model, it evaluates the impact and persistence of positive oil shocks on GDP, government consumption, CPI, and imports in the period of 1965–2014, with a special emphasis on growth. The results show that positive oil price changes nowadays seem to have a greater impact on economic growth, in relation to the period previous to 1990. This is worth mentioning given the importance of growth rates that Ecuador registered during the 1970s with the beginning of oil exports. In fact, when the period of 1965–1989 is considered, the response is significant during the second year, whereas in the second period, i.e. 1990–2014, the main effect takes place during the first year. Furthermore, positive shocks explain the higher proportion of the variations in the GDP in the period after the 1990s. The responses of both government consumption and imports are also positive and significant, regardless of the period considered. Yet, the government purchases response after 1990 is less pronounced and there is a reduction in the contribution of oil shocks to its variations. Nonetheless, in both periods the results indicate a high impact of positive price change that may not be sustained over time, given the transitory effect of the increase in prices. The responses are closely related to the persistent fiscal and current account deficits despite the increase in prices registered historically. The negative response of inflation to oil shocks that becomes significant only after the second year, may be highly distorted by the government subsidies and perhaps the monetary system in both periods. The results, however, suggest that the responses of the macroeconomic variables
and specifically growth, will depend on how the economy is structured at the moment of the
shock and how this is managed in terms of policy. Moreover, the higher impact and the larger
the contribution of positive shocks in the second period, indicate that the economic structure has
not achieved a proper diversification that it may allow to break with the oil price dependence. In
fact, it seems this effect has increased. The focus on positive changes in oil prices allows to isolate
this impact in order to observe the responses of the macroeconomic variables and also how these
variations are explained by the shock. The fact that Ecuador has no influence on the oil price
setting, permits the use of oil shocks as completely exogenous events.

The results are consistent with the findings in other oil net exporting countries and also ques-
tion Boye’s (2001) findings for Ecuador. In general, the VAR model complements the historical
narrative by providing the complete picture of the responses from the macroeconomic variables
to the oil price positive shock specifications. Likewise, the historical section provides a better
understanding on why the impact of oil shocks has been different between periods. Even though
the transmission mechanisms point to an important role of government spending, this is an area
that requires further research. However, the higher reliance of growth on positive oil changes
reveals a pattern that is not sustainable over time, indicating that historical lessons have not been
learned. The Ecuadorian case, therefore, provides an interesting example of a small economy that
reveals a greater response of growth to positive oil price changes, but has not repeated the growth
rates of the 1970s despite higher prices.

The paper is organised as follows. Section 2 discusses the historical context behind each oil
shock in their classic definition. This includes an analysis of the Ecuadorian economy in each
case, considering the similarities and differences between them. Section 3 reviews the studies in
the literature on the impact of oil shocks on both oil-exporting and importing countries. Section
4 explains the data and the methodology that is used in the empirical part. Section 5 presents
and discusses the results obtained in the VAR model, for the complete period and for two the
sub-periods: 1965–1989 and 1990–2014. Section 6 presents some further research topics and
conclusions.
## 2 Historical Background

Ecuador started its oil exports in 1972, but the process initiated its vertiginous pace in 1967 when Texaco made major new finds (Gelb, 1988). Oil prices, for instance, have been closely related to the country’s history for almost 50 years. Interestingly, oil price increase presents a higher correlation with growth rates in the recent years, rather than in the 1970s (Table 1). This indicates that the economic situation of the country is important at the moment of the shock; thus, the response of the macroeconomic variables may depend on both the condition and the policies (e.g. fiscal) regarding shock management. This section, therefore, discusses the historical background of the three oil shocks since 1972 and how they were managed in terms of policy. Regardless of the differences between the periods, there are similar patterns especially between the first and the last oil shocks in terms of policy responses.

### 2.1 The First “Oil Shock” - 1973 to 1975

Hamilton (2011, p.16) argues that “while it is extremely important to view oil price increases of 1973–74 in a broader economic context, the specific timing, magnitude, and nature of the supply cutbacks were closely related to geopolitical events”. In 1973, Ecuador joined the OPEC, becoming its smaller member in terms of production. This has not changed during the years, as Figure 1 clearly shows. Ecuador production has represented, on average, 1.2 percent of total

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4For a detailed revision of this episode see Venn (2002).
OPEC output since 1972 until 2014. This implies that the country has little or no influence at all within the organisation, which normally is accountable to Saudi Arabia (Skeet, 1988).

The first oil shock coincided almost with the beginning of oil exports in Ecuador. The country started to export oil in August of 1972, whereas the shock in prices started in October of 1973. This means that the initial economic boost of the oil era was amplified by the fourfold rise in prices. Therefore, disentangling between the effects of the two events remains highly complicated. Nevertheless, the average growth rate was 4 percent between 1966 and 1971. This means that the economy was achieving important growth rates before these two events, which could be explained by the preparations for the initiation of oil exports that the Texaco discoveries produced since 1966. The fixed gross capital investment, for example, registered a growth rate of 25.1 percent in 1971. Hence, the economy was relatively well positioned to take advantage of the two events. The 1970s was the period with the highest growth rates in the country’s history, with an average yearly rate of 7.3. In per capita terms, the rate was also significant reaching a yearly growth of

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5Ecuador left OPEC in 1993 but returned in 2007.
4.2 percent.

Throughout this first shock, oil prices rose fourfold in nominal terms, whereas they doubled in real terms. Similarly, the external sector also benefitted from the new oil era; indeed, exports of goods and services grew at an annual rate of 71.7 percent in real terms between 1972 and 1974.\footnote{Eventually, this pace slowed down and the yearly growth rate between 1975 and 1981 was -0.9 percent, which could be associated with the declining production of oil.} Oil replaced bananas as the main export product, representing, on average, 51.8 percent of the total between 1972 and 1978. The government revenues increased drastically and the share of oil revenues in the government’s budget rose from 16 to 43 percent during this period (Fernandez & Lara, 1998). This was immediately reflected in a significant growth in government spending, that increased public investment but also oil subsidies that reached 3 percent of GDP in 1975, in contrast to the 1 per cent in 1973 (Gelb, 1988). Additionally, an excessive growth in bureaucratic positions took place during this period that, combined with a protectionist development model, did not match the dynamics in certain productive sectors (Fernandez & Lara, 1998).

The problems emerged quickly during the 1970s. Imports were stimulated by the government through a reduction in tariffs and, in some cases, also reinforced by the increase in international reserves and resource availability (Fernandez & Lara, 1998; Posso, 2004). However, these policies were not matched by a sustained growth in foreign direct investment nor a balanced budget, resulting in macroeconomic disequilibrium (Posso, 2004; Gachet et al., 2010). Despite the inflow of resources, the current account deficit surged from 1.1 to 5.6 percent of GDP between 1972 and 1975.\footnote{The situation did not change much in the rest of 1970s, with an average deficit of 5.2 percent of GDP in the period of 1976–1979.} Interestingly, this was a common trend among Latin American oil-exporting countries, such as Mexico or Venezuela (Bulmer-Thomas, 2014). The rapid deterioration in the external and fiscal accounts despite the initial boost in oil exports and the upsurge in oil prices, point to the type of policies that would not be sustained over time. Moreover they also diminished the possible positive effects of further price increases. In the last quarter of 1976, for example, the nominal price of oil increased almost by 10 percent in relation to the same period of 1975; yet the growth rate registered was 1.7 percent over the same period. The growth rate had already
dropped from the average of 3.1 percent\textsuperscript{8} between 1972 and 1975. The combination of external and fiscal imbalances eventually led to the deterioration of the economy that not even the second oil shock could reverse.\textsuperscript{9}

After the Hydrocarbon’s Law of 1971, the only remaining company in Ecuador was Texaco Gulf, and, since 1974, the State petroleum company (CEPE) was almost entirely in charge of oil exploration (Brogan, 1984, p.1). The inexperience of the new company and the increasing tensions between Texaco Gulf and the Government negatively impacted the oil production (Brogan, 1984). The 1972 level of production was not reached again until 1979, reducing the oil revenues and consequently undermining public finances. Indeed, during the first semester of 1975, oil exports declined by 50 percent in relation to the same period in the previous year. Thus, the current account deficit deteriorated even more and the external debt rose, which eventually led to an upsurge in popular unrest (Brogan, 1984, p.2). Based on the evidence, therefore, it is not surprising that the initial plan developed by the Planning Board\textsuperscript{10} for the 1973–1977 period and the expected goals expressed were not achieved. In fact, most of the decisions were responses to political pressures rather than coordinated policies (Gelb, 1988, p.181).

In the monetary sphere, inflation escalated to 12.1 percent in 1973, reaching a peak of 22.7 percent in 1974, in contrast to the 5 percent rate in 1970. The average inflation rate during the 1970s was 12.9 percent.\textsuperscript{11} Nevertheless, the inflation problem was a world phenomenon that was strongly related to higher oil prices. Even though inflation was increasing over 10 percent a year, it would become a greater problem in the next two decades. Overall, the 1973 oil shock had a positive impact on growth, yet the emerging internal imbalances undermined not only the growth process that began reducing its pace but also compromised the possible positive effects of future price increases. The reliance on high oil prices as a permanent condition plus macroeconomic imbalances were not part of a sustainable regime. As Brogan (1984, p. 7) states:

\textsuperscript{8}In both cases, it is the quarterly growth rate (t-4).
\textsuperscript{9}During the first oil shock, Ecuador was governed by General Rodriguez Lara, who took power after a military coup in February 1972 and remained in power until 1976, when a military junta replaced him.
\textsuperscript{10}Junta de Planificacion (JUNAPLA) in Spanish.
\textsuperscript{11}Inflation only went below the double digit barrier in 2003.
of external resources, so the external debt rose importantly. Between 1970 and 1975, the external debt doubled, but it increased 9-fold from 1975 and 1980 (World Bank, 1991, p.21). This pattern was replicated by the private sector even more aggressively. The amount of external private debt rose from $12.2 to $56.2 million between 1970 and 1975. However, this amount rose from $56.2 million in 1975 to $1,071 million in 1980, an 18-fold increase in 5 years, where the 4-fold increase
in 1978 was the most significant. These debts were in dollars, so this left the private and the public sector openly exposed to the variations in external conditions, which became clear in the debt crisis in the 1980s. This aggressive external debt pattern was observed despite the rise in the oil prices, clearly highlighting the government’s irresponsible management policies and also the reckless behaviour of the international banks. This was the common pattern within the region that consequently led to the debt crisis of the 1980s.

The oil shock of 1979\textsuperscript{12} impacted an economy that was already suffering from macroeconomic imbalances. The increase in oil prices compensated for the decline in non-oil exports especially coffee and cacao, but it had a lower impact than the 1973 shock (Gelb, 1989, p.185). The problem, therefore, was to maintain the continued flow of resources in order to sustain economic growth (Brogan, 1984, p. 9). However, changes within the structure of the economy were needed; indeed “oil wealth led the country’s military government to postpone the fiscal reforms that were long overdue” (Bulmer-Thomas, 2009, p. 370). This means that the investment and fiscal policies, in general, could not be sustained with the deterioration in trade that was affected by the reduction in exports growth, something that not even the rise in oil could compensate for. The deterioration of the development model along the 1970s and changing conditions in the international context, nonetheless, required further efforts from the government. Hence, the budget widened its deficit even further, regardless of higher oil prices (Gelb, 1988).

By 1981, when oil prices started showing a slight declining tendency, Ecuador’s growth rate reached a peak growth rate of 5.6 percent, suggesting a lagged effect from the shock of 1979. This growth rate was not surpassed until 2004 when, unsurprisingly, oil prices were rising again. The 1979 shock did not have the same impact as the first one owing to the macroeconomic imbalances, but positive growth rates were still registered during this period. Nonetheless, the economy revealed that although prices were relatively high during the 1970s, the possible effects were not as strong nor persistent as before, principally owing to internal factors. In fact, albeit the prices started to decline, they remained over $27 per barrel until 1985, but yearly the growth rate averaged 1.7 during that period. The internal imbalances accumulated during the 1970s,

\textsuperscript{12}Ecuador returned to democracy in this year.
therefore, eroded the possible effects of higher prices on growth in the same sustained mode, as in the case of the first shock. Past policies and conditions at the moment of the shock proved to be essential. The shock, though, was neither as persistent nor as drastic as the 1973 one (Figure 5). Additionally, external problems also surged, such as the 1981 war with Peru\textsuperscript{13}, unfavourable climatic conditions of “El Nino” in 1982–83, and, finally, the earthquake in 1987 that affected the Trans-Ecuadorian Oil Pipeline System (SOTE), impeding oil exports for 5 months (Albornoz & Anda, 2014, p.181). Hence, the two oil shocks had different outcomes: whilst the first one had a persistent impact on growth, the second was quickly reversed by internal and external causes. The two oil shocks of the 1970s can be analysed within the same business cycle. In fact, the period between the third quarter of 1973 and the first one of 1981 was the longest one (Gachet et al., 2010).\textsuperscript{14}

2.3 A Third “Oil Shock”? - 2010 to 2014

Before the international crisis of 2008, the value of oil had already achieved a sustained period of high prices since the beginning of the 2000s, relative to last few decades (Figure 3 and Table 1). Hamilton (2011, p.19) and Baumeister & Kilian (2016) note that this is closely related to the increasing demand from the emerging countries, especially from China which posted a 6.3 percent annual growth in oil consumption since 1998. Despite the reduction in the pace of its economic growth in relation to previous years, China still achieved rates over 7 percent per year, thus proving to be an ideal partner for many Latin American economies. The increasing demand of commodities from China assured economic resources to the region (World Bank, 2016). China also gave loans to the region totalling to an estimated $118 billion since 2005, from which Ecuador received 9.1 percent of the total (Hidalgo & Hurtado, 2016, p.136).

The price of oil, particularly, almost doubled since its low in 2009. Between 2010 and 2014, therefore, the price per barrel averaged $95 during the whole period in nominal and real terms. This period was unprecedented in terms of length and price, in relation to the previous two shocks of 1973 and 1979 though the increase was more systematic than the 1973 shock and not as drastic.

\textsuperscript{13}This episode is known as the Paquisha War.
\textsuperscript{14}This analysis only considers the period of 1965–2008.
Whilst it is possible to analyse the period between 2003 and mid-2008, this phase accounts for two separate cycles in the Ecuadorian economy. Indeed, as Erraez\textsuperscript{15} (2014, p.28) highlights, the economy started a new cycle in the third quarter of 2003 that lasted until the second quarter of 2007. The spike in prices in 2008, thus, seems to be part of a distinct phase of the cycle.

The other stage began in the first quarter of 2010 and was reaching its ending by 2014 (BCE, 2014), which coincides with the beginning of the decline in oil prices. Hence, it seems appropriate to analyse the period after 2009. Nevertheless, it is worth mentioning that previous to the 2010 shock, the economy was achieving growth rates of over 4 percent. The fiscal accounts and the external sector were not in any particular imbalance. For example, the fiscal deficits of the central government did not reach even 1 percent of the GDP between 2001 and 2008, and the current account deficit presented a similar behaviour. Yet, the general government spending started to increase its presence within the economy. The government, moreover, was able to face the financial crisis of 2009 owing to the incorporation of the oil fund resources into its budget in 2008 that amounted $3.193 billion (Baquero & Mieles, 2014). Thus, despite the 2009 crisis, the economy was in a better position than in previous episodes to take advantage of an increase in prices when the 2010 shock occurred.

For Ecuador, this was the period with the highest oil prices since it became an exporter in 1972. The real GDP grew at 5.1 percent during these years, reaching a peak of 7.7 percent in 2011, whereas the yearly growth rate in per capita terms was 3.3 percent. The relation between oil and economic growth seemed to be at its strongest level. Indeed, the correlation between these two increased drastically, in relation to the previous periods, as it can be observed in Table 1 and Figure 2. In the same vein, Hurtado et al. (2015, p.165) pointed out that the correlation between the non-oil sector growth rate and the price of oil increased from 0.25 to 0.66, between the periods of 2001–2006 and 2007–2014. This suggests a higher dependence upon oil prices of the non-oil sector as well.

In general, the inflow of resources from oil allowed the government to increase its presence\textsuperscript{16}.

\textsuperscript{15}The analysis from Erraez (2014) considers only the period of 1993–2013, with a different approach from the one used by Gachet et al. (2010). However, owing to the lack of a complete business cycle analysis for Ecuador since 1965, this paper uses both works only as a reference.
within the economy (Hidalgo & Hurtado, 2016). In fact, when prices were high before 2010, the
general government as a percentage of GDP passed from 24 to 35 percent in just one year, between
2007 and 2008. Despite a minor reduction in 2009 owing to the international crisis, this relation
rose again in 2010 to 35 percent of the GDP and rapidly reached 40% in 2012, remaining at
that level. During these years, oil prices were always above the estimated figures in the approved
budget and only in 2014, when the oil price started to decline in the last quarter of the year,
the market price equalled the one established in the budget (Baquero & Mieles, 2014). Hence,
the central government deficit that was always under 1 percent of GDP between 2001 and 2008,
deteriorated to an average deficit of 3.5 percent after 2010, despite the fact that the prices were
over $100 per barrel. The increase in oil prices pressured the fiscal side also owing to the subsidies
that the government provides. In the external sector, imports registered a higher growth rate
than exports (Hidalgo & Hurtado, 2016), similar to the behaviour observed in the 1970s.

The external debt rose during this period, despite the positive context for oil prices. Furthermore, the debt acquired, mainly with China, had three important components: 1) The debt was
of the short duration, 2) oil was used as collateral\(^\text{16}\), and 3) this was a period of low interest rates
worldwide in response of the monetary policies implemented by the central banks in developed
countries. After the triple crisis of 1999, Ecuador adopted the US dollar as its currency.\(^\text{17}\) Thus,
the economy was under a fixed exchange regime, similar to the 1970s, but not in the same propor-
tion or scope. Inflation was not a major problem and although it climbed to 8.4 percent in 2009,
the average rate for the 2010–2014 period was 3.4 percent. This is a major difference in relation
to the other two periods, when inflation was over 10 percent.

There are several limitations in a fixed exchange regime such as dollarization;\(^\text{18}\) however, the
deprecated dollar during this period boosted the other export products, principally bananas,
cocoa, flowers, and shrimps. It was a positive period for the commodities and for the Latin
American region in general terms (World Bank, 2014). However, this led to a growth based
on factor accumulation, particularly labour, and not TFP, which compromised the growth rates
\(^{16}\)Ecuador negotiated anticipated sales of oil as collateral.
\(^{17}\)For a detailed analysis of this episode, see Jacome (2004).
\(^{18}\)Principally related to the incapacity in implementing the monetary policy and the exchange rate.
experienced by many countries in the region in future years (Sosa et al., 2013). Oil production, in this particular period, remained below the 2006 levels, so the increase in oil revenues was entirely due to a price effect. The condition of the economy at the moment of the shock, in terms of growth and balance in the macroeconomic variables, shaped the economy into a better position to take advantage of the surge in prices. However, the policies implemented show a similar pattern as in the 1973 shock, where decisions were taken as if rise in prices were a permanent condition, thereby increasing the dependence upon oil.

2.4 Historical Persistence

There are some similarities between the periods. Firstly, higher oil prices were closely related with growth accelerations. Then, drastic changes in oil prices, both positive and negative, were driven by external events on which Ecuador had no influence; hence, they were exogenous to the economy. The exogenous component of these events is supported by the fact that even though Ecuador was a member of the OPEC, it has no influence on the organisation’s decisions. In addition, production does not seem to be affected by oil price increases in any of three episodes. Indeed, in the first and last shock, production declined even further. The 1970s and the 2010s shocks present similar characteristics in terms of policy responses. An upsurge in prices was followed by a series of policies that increased the vulnerability to changes in external conditions. For example, persistent current account deficits and increasing external debt were observed despite the high oil prices. Moreover, the fiscal position of the central government was also negative regardless of the upsurge in prices, and the greater fiscal deficits emerged in the 2010 shock (Figure 2) when oil prices registered their higher value in real and nominal terms. These policies undermined the sustainability of growth rates, as the 1973 experience illustrates, because they compromised the fiscal and the external position by responding as if the price increases were a permanent condition. The 1979 shocks, hence, clearly reveal that policies that were implemented after the 1972 shock mattered. This indicates that the macroeconomic responses to an oil price increase would determine the reaction to further changes in prices. In the 1970s scenario, the initial reaction proved to be unsustainable and influenced the shock absorption at the end of
the decade. Finally, throughout the period of 1965–2014, the poor diversification in the supply offer of export products is clear. The combination of oil, banana, and cocoa exports represented 73 percent of the total exports during the 1972–1978 period, whereas this figure was 69 percent between 2007 and 2014. The structure of the external sector presents minor changes, which maintains its dependence on variations in commodities prices.

Figure 2: Fiscal Position of the Central Government as % of GDP

Notes: The data after 2010 is not comparable to the previous years series, due to a change in the methodology according to the Central Bank. However, for the purpose of this investigation, only the pattern is important and not a long time perspective.

On the other hand, among the differences, the persistence of oil shocks and the different GDP growth rates achieved in each period are, perhaps, the most important. The growth rates registered in the 1970s, particularly after first shock, have not been repeated. This could be due to the double effect of both the beginning of exports in 1972 and the rise in prices in 1974, so it is not possible to assess the net effect of prices only. This indicates, nonetheless, that each shock affected a different economic structure. For example, the first shock impacted an economy that was already achieving important growth rates before the beginning of the oil exports, thus
the effect in prices was amplified by this dynamic and the initiation of oil exports. The other two shocks impacted a country that was already a net exporter and that developed a structure that relied significantly on oil, as the poor diversification of the exports, for example, illustrates. However, the 2010 shock arrived when the economy, despite the international crisis of 2009, was achieving a yearly growth rate of over 4 percent since the banking crisis in the 2000s. Unlike the other two episodes, the 1979 shock impacted an economy that was in clear deceleration with several macroeconomic imbalances within the fiscal and external sector. Moreover, the increase in prices was rapidly reversed by 1981. Thus, these factors may explain, to a large extent, why growth rates were so different between periods. The timing is essential.

In terms of duration, the recent period arises as the most important. Skeet (1988) argues that as a shock to the international system, the 1979 shock was greater than the 1973 one. However, in terms of magnitude, measured as the increase in price both real and nominal, the first shock remains immovable (Figure 5). The differences between periods could also be observed in the prices of other commodities. Since 2008, commodities experienced a price increase, which is similar to the context of the 1973 shock, yet in 1979, whilst oil prices surged, the other commodities did not follow its lead (Carter et al., 2011). The international context also was different in each case. In the first two periods, the OPEC played a key role in the development of events, whereas in the last one, its role was not as significant. Oil prices, thus, seem to have a greater response to other factors beyond the OPEC’s control. Another difference is based on the key players in the international scene. China, particularly, emerged as an important actor owing to its accelerated and sustained growth process. Indeed, China became the most important creditor to Ecuador in the last shock. The emerging economies, in general, managed to sustain growth after the international crisis of 2008, in sharp contrast with the other two periods where these economies were suffering from their internal imbalances and there was a crisis in the developed countries as well.

In general terms, the oil shocks in their “classic” definition, despite their singularities, are closely related to the more important positive variations in growth rates for Ecuador (Figure 3). Definitions for each specification are provided later in the text.
These three shocks were characterised normally by substantial increases in oil prices that lasted for a relatively significant amount of time. The relevance of the historical events discussed above, therefore, rests on the fact that these allow a comparative analysis between episodes. Furthermore, the assessment of the condition of the economy and the policies taken in each episode, point to the importance of the timing of the effects that the shock may have. Yet, other episodes could also have had an impact in terms of prices. The Iran-Iraq War, which almost lasted throughout the entire 1980s, or the Gulf War in 1990–1991 are examples of events that positively affected the oil prices. Indeed, the Gulf War that began in August of 1990 produced an increase in oil prices of almost 8 dollars per barrel, 47 percent higher than that in July. It is necessary, for instance, to extend the analysis in order to include these “peaks” in prices and confirm empirically whether the effect on growth and other macroeconomic variables of positive changes in oil prices is significant between different samples and throughout the entire period. Given the importance of oil in the economic structure of the country, accounting for 55 percent of the total exports since 1972, and the historical narrative given above, focusing only on positive price variations appears to be an essential starting point.
3 Literature Review and Motivation

The literature interest to determine the impact of natural resources abundance on the economy was principally related to the Dutch Disease phenomenon.\(^{20}\) The Dutch Disease arises when a specific sector, based upon a price increase in commodities or new discoveries, produces an appreciation in the real exchange rate. Consequently, the competitiveness in the non-booming export sector is undermined (Magud & Sosa, 2013). On this subject, Sachs & Warner (1995; 2001) argued that countries with natural resources, particularly oil and minerals, tend to grow more slowly than countries that do not have this abundance.\(^{21}\) In the case of Ecuador, Gelb (1988)\(^{22}\) finds that the oil windfalls of the 1970s had a significant impact on growth and also produced a fragility in the economy after the boom years and a general mismanagement through several

\(^{20}\)For a recent revision in the literature related to Dutch Disease, see Magud & Sosa (2013).

\(^{21}\)Alexeev & Conrad (2009), using levels rather than growth rates, find that contrary to the traditional belief, oil and other mineral resources have a positive impact in the long-term growth.

\(^{22}\)He analyses also Algeria, Trinidad y Tobago, Indonesia, Nigeria, and Venezuela.
channels. However, the World Bank (2015) emphasises that there is lack of evidence of a long-run Dutch-Disease in Ecuador. Therefore, the results are still inconclusive. In general, most of these studies rely on panel data techniques and the use of annual data. The critiques to these studies point out to a selection bias and, most importantly, endogeneity problems (Frankel, 2012). In that respect, the use of time series models, such as VARs, has some advantages. First, the VAR model allows to treat the variables in the system as endogenous and to observe their interactions. Second, using Impulse Response Functions (IRFs) analysis, it is possible to observe the reactions of some variables within a system to the unexpected changes in identified “shocks”. In that sense, where the data availability permits, it is possible to test the presence or absence of the Dutch Disease by assessing the response of the exchange rate to changes in prices of oil, minerals, etc. The main limitations of this analysis, nonetheless, are related to the shock identification and the assumptions behind it. For instance, the VAR literature that studies specifically the consequences of oil price changes on the economy has developed several efforts in that area.

The US ceased to be a net exporter in 1971 and by late 1973, like most of the developed world, was already highly dependent on imported crude from the Middle East (Kilian, 2014, p. 135). The interest in how oil shocks impacted the macroeconomic variables, thus, increased. In that sense, the seminal work of Hamilton (1983), employing a VAR, highlighted the non-spurious correlation between recession in the US and the rise in the price of oil. In fact, after World War II, seven out of eight recessions were preceded by the drastic changes in the price of oil (Hamilton, 1983, p. 245). Hence, oil was presented as one of the contributors to recession in the US. However, Mork (1989) argued that there is an asymmetric response to oil price changes, so he differentiates between positive and negative variations. He concludes that while there seems to be no evidence of the impact of oil price decrease, the negative correlation between a rise in oil price and output remains. In the same direction, Hooker (1996) stressed that price changes in oil are not reliable for analysing the macroeconomic performance after 1986. Therefore, Hamilton (1996) proposed to measure the impact of the net price increase. This variable is the net change of oil price in

\[ \text{Net Price Increase} = \text{Price Change} - \text{Expected Price Change} \]

\[ \text{Expected Price Change} = \text{Price Difference} \times \text{Price Elasticity} \]

\[ \text{Price Change} = \text{Price Difference} \]

\[ \text{Price Difference} = \text{Price at Time } t - \text{Price at Time } (t-1) \]

\[ \text{Price Elasticity} = \frac{\text{Percentage Change in Quantity}}{\text{Percentage Change in Price}} \]

For a detailed and updated revision of the literature, see Kilian 2014.
relation to peak value of the last four quarters, which eventually will be extended to 12 quarters (Hamilton, 2003). The results support previous findings, signalling that the correlation between recessions and price changes does not disappear.

In the same vein, Lee et al. (1995) proposed to measure asymmetric impacts including the unanticipated and the time-varying conditional components of price changes. Using a GARCH model, they concluded that positive shocks have a powerful effect on output, in contrast to the negative changes in oil prices in the US. Huntington (1998), using US data, argues that output and consumer prices respond asymmetrically to oil price variations but symmetrically to petroleum product or energy price increase in the former case. Bernanke et al. (1997), employing a VAR model, and Hamilton’s net price increase variable, suggest that the impact of oil shocks on inflation better explain the monetary response, rather than the shock itself. Hamilton (2003) stressed, based on the evidence, that a non-linearity approach should be used if the main objective is to forecast the GDP. Moreover, he supports previous results that acknowledge the significance of the impact of price increases on output. Jimenez-Rodriguez (2009) presents further evidence for the presence of a non-linear relation between oil price variations and output in the US. The impact of the shocks in the US is argued to be different owing to the changes within the economy and related to wages and the increase in the credibility of monetary policy (Blanchard & Riggi, 2013). A recent study by Baumeister & Peersman (2013), using a time-varying VAR approach, assessed the evolution of oil supply shocks on the US economy revealing that the oil demand has changed in relation to the 1970s. Furthermore, they found that the effect of oil supply shocks is economically relevant to real activity and inflation. Overall, the literature for the US separates between positive and negative oil price changes, concluding that, normally, positive variations have negative effects on output whilst negative shocks do not seem to have a significant impact.

The majority of the literature has focused on the US, as explained above. However, there is also a growing body of work on other regions. In the case of the OECD countries, Jimenez-Rodriguez (2008) concludes that in the UK, responses to oil price shocks are similar to those in the US, but in other countries, the evidence is not as clear. Cunado & Perez de Gracia (2005), analysing the situation of Japan, Singapore, South Korea, Malaysia, Thailand, and the Philippines, highlight the
negative impact of an oil price shock throughout the period of 1975–2002 on output and inflation. Their empirical strategy takes into account only positive changes in the price of oil, recognising the asymmetry that most of the literature discusses. In China, for example, Tang et al. (2010) found a negative impact of oil price increase on output and investment. They concluded that the price control exerted by the government is the main distortion in the transmission mechanism, extending the impact on real variables.

On the other hand, the literature on oil net exporting countries is less abundant. Eltony & Al-Awadi (2001) note that oil price increases have a positive impact on government expenditure, both current and capital though, the latter, related to public investment or development expenditure, seems to have been more influenced by oil prices. Their findings, based on a VAR and VECM model, also point out the role that the CPI develops in the variations in government expenditure. Farzanegan & Markwardt (2009), employing a VAR, concluded that oil price shocks have had a positive impact on industrial production and inflation in Iran since 1975. Moreover, they disentangle between positive and negative shocks, highlighting that negative price shocks have an adverse effect on industrial production, but an upsurge in inflation. Interestingly, this rise in inflation is due to a combination of the reduction in output and increase in the government’s deficit that is covered with borrowing from the Central Bank that leads to an expansion of the monetary base and the money supply according to the authors. They finally show evidence for the presence of Dutch Disease, based on the positive and statistically significant response of the exchange rate (appreciation) from a positive oil price shock. In the case of Nigeria, Iwayemi & Fowowe (2011) emphasise that the oil price changes do not reveal a significant impact on the macroeconomic variables, yet negative shocks appear to have a more marked effect. Nevertheless, Omojolaibi (2013) suggests that there is a positive outcome from positive oil shocks, although inflation stands as the main driver of fluctuations in GDP. Pieschacon (2012), analysing Norway and Mexico, finds that fiscal policy is a key transmission mechanism of oil shocks for small open economies. In fact, fiscal policy modifies the degree of exposure of each economy when counterfactual scenarios are tested. The use of oil prices as completely exogenous in the VAR, allows the author to assess the impact of the shock on macroeconomic variables without imposing
further restrictions on the model. Overall, the preferred empirical strategy in analysing oil shocks, for both oil-importing and net exporting countries is the VAR model.

For Ecuador, long-term studies on the impact of oil shocks on macroeconomic variables are scarce. Most of the papers focus on the fiscal responses and do not use a long-time perspective, given the lack of consistent datasets, even for GDP recorded in a frequency higher than the annual one.\footnote{Boye (2001) analyses the fluctuations in some macroeconomic variables and their relation with the oil sector for the period of 1972–1995. He argues that oil exports have not been the major source of macroeconomic fluctuations in Ecuador during this period. In addition, he points out that it is not through the external sector that the oil affects the economy. Boye (2001) employed a VAR to assess the impact of oil price changes in the Ecuadorian economy. The author used nominal oil exports to measure the possible effects, rather than oil prices, which is a common approach in the literature. The Hodrick-Prescott (HP) filter is used to detrend the data and the model encompasses six variables: nominal oil exports, real GDP, money supply, GDP deflator, external debt, and net foreign assets. However, he does not define what an oil shock specifically means. In the same vein, the selection of variables does not follow the literature in identifying other variables, for example, from the fiscal side. In general, the use of annual data in his VAR estimation does not appear robust enough to provide consistent results. In fact, he recognises (p.159) that “inverting it to measure the impulses of an oil shock turned out to be problematic, due, once again, to insufficient observations, that is why the modelling exercise ended up settling for a tractable first-order vector autoregression”. Finally, his variance decomposition accounts for a greater contribution of other variables in the real GDP change, rather than from the nominal oil exports.

The lack of a deeper investigation of the effects of changes in oil prices in a long-term perspective within oil-exporting countries, and specifically, small exporters since the first shock to recent one, leaves an open field for investigation. This paper intends to fill this gap by analysing the OPEC’s smaller member, which presents a history of a close relation between high oil prices and periods of significant growth rates since it became a net exporter in 1972. This paper, using a

\footnote{See Carrillo (2015) for a SVAR analysis of fiscal policy in Ecuador in the period of 1993–2009 or Garcia (2016) for an evaluation of the fiscal policy since 2000, also using an SVAR approach.}
VAR model, aims to contribute in two areas. First, it assesses the impact of positive oil shocks on growth and how persistent this effect can be. In addition, the impact of positive shocks on other GDP components is also discussed, by analysing to what extent the macroeconomic responses are explained by the shocks and whether or not the responses vary when different periods are considered. The study of the responses from certain macroeconomic indicators to positive shocks may shed light on why, historically, growth has not been sustained after the shock periods are over. Hence, the identification of only positive variations in prices is essential. Second, the historical analysis from Section 2 can be complemented with a formal empirical strategy. In this case, the analysis provides a long-term perspective by including the price increases throughout the period of 1972–2014. In that respect, the construction of a higher frequency data series represents an effort that enhances this approach and aims to exploit the empirical strategy. The use of historical events that shaped the Ecuadorian economy and examination of the persistence in the relation between growth and oil seems appropriate nowadays since the oil-exporting countries face what seems to be a new era of oil prices but most importantly of uncertainty. Thus, studies that evaluate the role of historical lessons can be valuable for this new context.

4 Data and Methodology

4.1 Data

4.1.1 Annual vs. Quarterly Data

One of the main limitations in analysing macroeconomic variables throughout a specific period of time in Ecuador is the lack of consistent datasets. In fact, economic series in high frequency are only available since the year 2000. This can be attributed to the adoption of the US dollar as the official currency in 2000, so data for the previous years and in higher frequency is denominated in sucre, the official currency until that year. The Central Bank of Ecuador (CBE, 2012), therefore, in an effort to produce longer and comparable data, released a revised series in the document “85 Years of Statistical Information”. The GDP components are presented in nominal and real terms, and the latter figures use 2007 as the base year. However, these series rely on annual frequency
and this could be a limitation owing to the loss of information and lack of efficiency for empirical analysis (Muller & Watson, 2008). Indeed, since oil prices are highly volatile and the purpose of this paper is to assess the impact of oil shocks on economic growth and other macroeconomic variables, the use of higher-frequency data is required. In order to meet this requirement, a new dataset for GDP and its components is built using the work of Gachet et al. (2010). The authors, in their work that takes into account for the stylised facts in the Ecuadorian economy, constructed series for GDP and its components in quarterly frequency for the period 1965Q1–2007Q4, using the Central Bank’s information.\textsuperscript{26} The methodology employed is an “interpolation that respects the original variations in each series” (Gachet et al., 2010, p. 8). The author’s, hence, provided series in real terms that use 2000 as the base year.

The present paper, using the same approach, has extended the original datasets for GDP and its components in two ways.\textsuperscript{27} First, it aggregates the 2007–2014 period, and second, all the series are denominated in the new 2007 base year. For instance, whilst the original variations are maintained, a longer time perspective is offered that includes the last period of high oil prices, based on the latest information from the Central Bank. On the other hand, one possible drawback of this approach is that while it respects the original variations, the revised annual values do not necessarily match the “old” ones in the quarterly frequency. However, it should not be a major concern given that the main trends remain for the Ecuadorian economic series since 1965. Figure 4 plots the annual data revised by the Central Bank (left side) and the quarterly data built for this paper for GDP and two of its components. Clearly, the series present a similar behaviour, despite some changes in the values. This suggests that there are no drastic changes in the series variations. For instance, since a VAR model is employed, the use of higher frequency data seems appropriate notwithstanding these disparities. Nevertheless, the possible significant differences in the values are taken into account in the model by using dummy variables, e.g. 1972 or 1987.\textsuperscript{28} Overall, the construction of higher frequency data is a topic that warrants further research in order to study other questions regarding the Ecuadorian economy, but it is beyond the scope of

\textsuperscript{26} The series were kindly provided by Ivan Gachet.
\textsuperscript{27} See the Appendix for a description of the variables.
\textsuperscript{28} An explanation of these and other dummy variables is in the Appendix section.
4.1.2 Variable Selection and Unit Root Tests

The dataset, for instance, includes the GDP and its components, the real oil price, and the consumer price index (CPI)\textsuperscript{29} in quarterly frequency. All the variables are presented in logs and the sample covers the period 1965Q1–2014Q4.\textsuperscript{30} The specific variables analysed are real oil prices (LOIL), real GDP (LGDP), real government consumption (LGOV),\textsuperscript{31} consumer price index (LCPI), and real imports of goods and services (LIMP). This selection was based on two elements that are closely connected: the literature approach and the economic criterion.

The economic criterion would imply the use of a model that contains the real, monetary, external, and fiscal indicators in order to identify the impact of price shocks in each economic area. Hence, the use of these variables, given the data limitations in the Ecuadorian case, seems appropriate in this regard.\textsuperscript{32} Nevertheless, the selection was also made following the literature that implements a VAR analysis for net exporting countries. For example, Farzanegan & Markwardt (2009) and Iwayemi & Fowowe (2011) employ a VAR model with a similar approach in order to test the impact of oil shocks on the macroeconomy for Iran and Nigeria, respectively. While Iwayemi & Fowowe (2011) use net exports instead of imports, the general idea to use an external variable in the VAR remains unchanged. Eltony & Al-Awadi (2001), on the other hand, assess the impact of oil price fluctuations on some macroeconomic variables and although they do not include GDP in their analysis, the VAR model encompasses the other variables maintaining the general approach.

Overall, the variable selection seems consistent with the economic and literature criteria. In order to verify whether the chosen series are stationary or not, the Augmented Dickey-Fuller (ADF) test and Phillips-Perron (PP) were performed. As Table 2 shows, all the variables follow an I(1) process, except for the LCPI, if a constant and trend are used in the ADF test although

\textsuperscript{29}The sample for the CPI goes from 1969Q1 to 2014Q4. For more details, see the data appendix.
\textsuperscript{30}See the Appendix for a detailed description of each variable.
\textsuperscript{31}This is the government purchases extracted from the aggregate demand components, not the general government spending normally used in other papers as reference. See the Appendix.
\textsuperscript{32}Several studies test the presence or absence of the Dutch Disease phenomena by including the real exchange rate. For Ecuador, unfortunately, there is no consistent information in a frequency higher than the annual one.
Figure 4: Annual vs Quarterly Frequency Data (variations) in selected series

Sources: Central Bank of Ecuador. Real variations using series in 2007 dollars. See the text for an explanation on how the quarterly series were constructed.
the PP test provides evidence to reject the unit root hypothesis at the 1% confidence interval. On the other hand, the oil shocks series, defined in the next section, follow an I(0) process. This means that the series are already stationary and that will have implications for the VAR model, as it will be discussed later. Finally, the quarterly growth rates \((t - 4)\) for the same variables were also tested. The results reveal that they are stationary. Therefore, the model could use these variables given that the oil shocks series are already stationary as well.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Log-Levels</th>
<th>Phillips-Perron</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ADF</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Constant</td>
</tr>
<tr>
<td>LOIL</td>
<td>-2.20</td>
<td>-2.44</td>
</tr>
<tr>
<td>LGDP</td>
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<td>-1.99</td>
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<tr>
<td>LGOV</td>
<td>-2.22</td>
<td>-1.70</td>
</tr>
<tr>
<td>LIMP</td>
<td>-1.16</td>
<td>-2.72</td>
</tr>
<tr>
<td>LCPI</td>
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<td>-0.89</td>
</tr>
<tr>
<td></td>
<td></td>
<td>First Difference</td>
</tr>
<tr>
<td>LOIL</td>
<td>-10.41***</td>
<td>-10.38***</td>
</tr>
<tr>
<td>LGOV</td>
<td>-11.86***</td>
<td>-11.94***</td>
</tr>
<tr>
<td>LIMP</td>
<td>-12.14***</td>
<td>-12.12***</td>
</tr>
<tr>
<td>LCPI</td>
<td>-3.01**</td>
<td>-3.11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Growth ((t - 4))</td>
</tr>
<tr>
<td>OIL</td>
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<td>-4.79***</td>
</tr>
<tr>
<td>GDP</td>
<td>-4.10***</td>
<td>-4.38***</td>
</tr>
<tr>
<td>GOV</td>
<td>-3.03**</td>
<td>-3.15*</td>
</tr>
<tr>
<td>IMP</td>
<td>-5.69***</td>
<td>-5.69***</td>
</tr>
<tr>
<td>CPI</td>
<td>-2.89**</td>
<td>-2.83</td>
</tr>
<tr>
<td></td>
<td>Oil Shocks</td>
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<tr>
<td>RPOS</td>
<td>-11.71***</td>
<td>-11.89***</td>
</tr>
<tr>
<td>NPOS4</td>
<td>-11.55***</td>
<td>-11.56***</td>
</tr>
<tr>
<td>NPOS12</td>
<td>-11.80***</td>
<td>-11.77***</td>
</tr>
</tbody>
</table>

Notes: Significance level: *10%, **5%, ***1%. Lag length based on SIC. 8 lags was the maximum established for the ADF test. The oil shock variables are latter defined in the text. However, they account for positive oil price increases (RPOS), oil net price increases in the last four (NPOS4) and twelve quarters (NPOS12).
4.2 Empirical Strategy

4.2.1 Oil Shock Definitions

Baumeister & Kilian (2016, p.141) define an oil shock as “the gap between the price that was expected and its eventual outcome”. The authors argue that the common approach in the literature is to construct the oil price expectations by relating this variable to its own past values. In this sense, three types of shocks are defined in the literature (Figure 5). The first type is a linear shock and is stated in the spirit of Hamilton (1983) and adaptation by Cunado & Perez de Gracia (2005). Thus,

$$\triangle oil_t = \ln oil_t - \ln oil_{t-1}$$  \hspace{1cm} (1)

where is $\ln oil_t$ log of real oil price at time $t$, therefore this is just the change or first difference. However, Mork (1989, p.740) argues that it is possible to have asymmetric responses to oil price increases and decreases. For instance, following Mork (1989, 1994) and the adaptation by Cunado & Perez de Gracia (2005), only positive shocks are defined as follows:

$$r_{pos} = \max(0, \triangle oil_t)$$  \hspace{1cm} (2)

This implies that $r_{pos}$ takes its original value if it is positive, otherwise it equals zero. Hamilton (1996), on other hand, claims that Mork’s definition is not entirely satisfactory because after 1986, most of the price increases have been followed almost instantly by larger reductions. Therefore, in the spirit of Hamilton (1996; 2003) and adaptation by Farzanegan et al. (2009), two additional oil shock definitions are proposed as follows:

$$n_{pos4} = \max[0, (\ln oil_t) - \ln(\max(oil_{t-1}, ..., oil_{t-4}))]$$  \hspace{1cm} (3)

$$n_{pos12} = \max[0, (\ln oil_t) - \ln(\max(oil_{t-1}, ..., oil_{t-12}))]$$  \hspace{1cm} (4)
In this case, the price of oil is compared to the maximum value observed during the preceding four quarters (12 quarters for $n_{pos12}$). Thus, if the value of the current quarter exceeds the previous year’s (three years) maximum, the percentage change over the previous year’s (three years) maximum is plotted; otherwise, it takes the value of zero (Hamilton, 1996, p.217). Therefore, as Hamilton emphasises (1996; 2003), this accounts for the net increase in the price of oil. Figure 5 plots each definition and Table 3 (in previous section) presents and discusses the ADF and PP tests for each one of them.

Figure 5: Oil Shocks Specifications

Notes: $n_{pos4}$ and $n_{pos12}$ account for the net oil price increase in four and twelve quarters, respectively; $r_{pos}$ represents only the positive oil changes. See the text for the definition of each specification.

In general terms, the major strength of the $r_{pos}, n_{pos4}$ and $n_{pos12}$ characterisations is related to the identification of positive shocks. This allows one to assess the impact of only positive shocks on growth and other macroeconomic variables and to determine whether they produce significantly different results by employing a VAR. This is a clear benefit in relation to the oil price changes.
specified in equation (1). The possible weaknesses, especially for equation (2), briefly mentioned above are linked to the fact that “previous turbulence in prices causes the marginal effect of any given change to be reduced” (Hamilton, 2003, p.376). The net price increase definitions, for instance, perform as a better approach to deal with this drawback as Hamilton (1996; 2003) acknowledges. In addition, given the possible poor performance of \( rpos \) and \( npos4 \) in capturing a stable linear nonlinear relation between GDP and oil prices as argued by Hamilton (2003, p.386) for the US data, the \( npos12 \) “do seem to capture this relation adequately”. For the purpose of this paper, \( rpos \) and \( npos4 \) will be the preferred specifications and \( npos12 \) will be used to verify the robustness of the results. Given that the main aim of this work is to assess the impact of positive oil price changes on macroeconomic variables, from now onwards, the terms positive shocks will be used indistinctly to refer to both the positive changes (\( rpos \)) and the net price increase (\( npos4 \)).

### 4.2.2 VAR

The VAR model can be expressed as follows:

\[
y_t = A(L)y_{t-1} + \varepsilon_t
\]

where \( y_t \) is a vector of macroeconomic variables, \( A(L) \) is a matrix polynomial in the lag operator \( L \), and \( \varepsilon_t \) is a vector of reduced form errors. The VAR uses the standard Cholesky decomposition to identify the shocks to the macroeconomic variables. In fact, the model uses the \( npos4 \) specification\(^{33}\) as the shock, ordering it first in the VAR. The oil shock, therefore, does not react contemporaneously to shocks in the remaining variables of the system.

The rest of the system is ordered as follows: GDP, GOV, CPI, and IMP. These variables represent, as defined above, the gross domestic product, government consumption, CPI, and the imports of goods and services, respectively. All the variables are in quarterly frequency and expressed in terms of their annual growth rates \((t-4)\). The ordering of the variables was based on the literature for oil-exporting countries and the economic criterion. Given that Ecuador has only represented, on average, 1.2 percent of the OPEC’s total production since 1972, it is safe

\(^{33}\)This applies also for the \( rpos \) and \( npos12 \).
to assume oil shocks as being exogenous. This is supported by Pieschacon (2012, p.256), who argues that this seems to be a reasonable assumption for small open economies. In fact, the author based her argument considering Mexico and Norway, who produce 8 and 6 percent of the total among the top 10 producers, respectively. Ecuador’s oil production, on average, represented 14 percent of Mexico’s total production between 1972 and 2014. Thus, Ecuador has no influence in the international oil price setting despite the fact that the country is a member of the OPEC.

The next variable in Cholesky ordering is government consumption, which seems a fair assumption given the important role of the public sector within the economy and its close relation with oil prices, as discussed in the historical section. The general government spending would be desirable in this case, but given the data limitations for Ecuador, government consumption, which is a component of the aggregate demand, appears to be a consistent proxy variable. The GDP is placed after considering that output may react to oil shocks and also to fiscal policy, given that the oil sector is managed by the government. Finally, the CPI and the imports close the system, relying on the reaction of oil shocks and the rest of the variables. Nonetheless, different orderings were also performed to test the robustness of this specification.

Given the evidence that the variables follow the I(1) process (see Table 2), the literature would suggest the use of a Vector Error Correction Model (VECM). This means that the model could be estimated in levels, considering the possible stationary relationship between the variables. If this is true, it would indicate that the series are cointegrated. However, here, it is important to notice two things. First, the main interest of this paper is to assess the impact of positive oil shocks on the macroeconomic variables. Second, considering this purpose, three oil shock specifications were constructed (equations \(2\), \(3\), and \(4\)). These variables are already stationary as it can be observed in Table 2, so any estimation from the VAR using these definitions and the other variables in levels that are not-stationary would not be efficient. Based on this evidence, it would seem more appropriate to estimate the VAR using the first difference, which would be the variation \((t - 1)\) or the annual growth rates \((t - 4)\), both of which are stationary. In that

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34. The author assumes strict exogeneity of oil prices to estimate a partially identified SVAR.
35. Even in the cases of Iran or Kuwait, who are larger oil producers, the oil price setting is argued as being exogenous (Eltony & Al-Awadi, 2001; Farzanegan & Markwardt, 2009).
sense, the preferred model employs the growth rates that account for annual variations \((t - 4)\), as stated above, that provide more precise estimations. This could be related to the fact that in one quarter only, the effect of the oil shocks definitions is not fully captured, whereas in the annual growth rate, this effect might be better included. Furthermore, considering the net oil price increase definitions proposed by Hamilton (1996; 2003) as mentioned in equations (3) and (4), which account for the net variations in relation to the previous year (three years), the use of the annual growth seems a suitable approach. The estimation, for instance, would indeed be capturing whether the positive shocks had a higher growth effect in relation to last year’s values. In addition, the model includes event dummies in order to capture possible effects from specific historical episodes during this period, which are discussed in more detail in the data appendix.

The IRFs are presented with 68% confidence intervals, following Sims & Zha (1999), and an important part of the literature that analyses the impact of oil shocks. Overall, the general approach does not neglect the possible impacts of negative shocks. Indeed, the historical evidence show that oil price decreases have been followed by periods of reduction and stagnation in terms of economic growth. Nevertheless, given that the responses to positive shocks might shape the economy in the first place and this would affect the management of future downturns in oil prices, the effects of negative shocks, for now, are left as an open area for further research. Finally, the lag selection is based on the Schwarz’ Bayesian Information Criterion (SIC) and the Hannan-Quin Information Criterion (HQ), which pointed to 2 lags for the estimations in the complete and the sub-period samples in all the specifications.

5 Results

5.1 IRF’s

The analysis of IRFs presents the response of some variables of interest to an identified shock in other variable within the system. The graphical analysis indicates that if the zero line (red...
in this case) is between the confidence intervals, the response is not statistically significant or different from zero. The IRFs of the macroeconomic variables to the oil shock identifications, based on equations 2 and 3, are presented in Figure 6 and 7. This covers the complete period of 1965–2014. In both cases, the responses of the four variables are remarkably similar. The GDP, for example, presents a delayed response that is positive and significant after the first year only, and the effect persists until the tenth quarter.\textsuperscript{38} Government consumption (GOV) and imports (IMP), on the other hand, reveal a positive and strong reaction, especially during the first year. The effect persists, in some cases, until the second year depending on the variable. Interestingly, the \textit{npos4} specification seems to have a small but significant lasting effect in the case of GDP and GOV, in relation to \textit{rpos}. The imports response, unlike GOV’s reaction, does not shows a clear peak, but it exhibits a more U-shaped effect throughout the first year. This is also true for the GDP response that does not exhibits a clear peak. Finally, the inflation response is mainly negative. However, it is only statistically significant after the second year and seems to persist until four years after the shock.\textsuperscript{38}

\textsuperscript{38}While the initial negative response remains puzzling, it is not significant.
Figure 6: Impulse Response to $rpos$

Notes: Orthogonalized Impulse Response Functions (IRF). 68% Confidence Intervals (Dash Lines)
The general pattern, therefore, is consistent across these two oil specifications.\textsuperscript{39} The results do not contradict the historical evidence and an oil price increase has a positive impact on GDP, GOV, and IMP. In the case of the former, the response becomes significant after the first year but persists even to the first part of the third year, which could indicate that the impact depends on the reaction of other variables. Meanwhile, the responses of GOV and IMP are significant throughout the first year and normally reach a peak after two quarters. Here, it is important to notice that these responses are closely related to the fact that historically, regardless of higher oil prices, there are persistent fiscal and current account deficits during the “booming” years. The increase in oil prices, hence, rapidly translates into higher government spending that could be also associated with the positive response of imports. A priori, given these reactions, it can be

\textsuperscript{39}The net oil price increase with the 3-year horizon, \textit{npo12}, produced similar results to the \textit{npo4} specification which are presented in the appendix.
argued that government spending is one of the main channels of transmission through which oil shocks affect the Ecuadorian economy, as Pieschacon (2012) found in the case of Mexico and Norway. The response in inflation, on the other hand, can be highly distorted by the fact that the government subsidises gasoline prices.

5.2 Variance Decomposition

The variance decomposition analysis in Tables 3 and 4 reveals that when the complete period is considered, the oil shock specifications account for less than 2 percent of the variations of GDP. This suggests that the impact of oil shocks on GDP is mainly transmitted through other variables, as the IRF analysis showed. The GOV could be one important channel. Indeed, the \( npos4 \) shocks account for as much as 24 percent in the end of the first year and still 19 percent after 4 years of the variations in government consumption. The share is less with the \( rpos \) specification, albeit it still explains 15 percent of the variations in the GOV variable after 4 years. The variations in imports can be attributed by 6 percent, in both specifications, to an oil shock innovation. The variations in inflation, meanwhile, have almost no contribution from the oil shocks.\(^{40}\) The results are consistent with the evidence found for other net exporting countries that find a significant contribution of oil price increases in either fiscal indicators or imports. However, whether the oil shocks have the same impact when the specific periods are considered remains unanswered.

<table>
<thead>
<tr>
<th>Period</th>
<th>GDP</th>
<th>GOV</th>
<th>CPI</th>
<th>IMP</th>
</tr>
</thead>
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<td>2.73</td>
<td>0.02</td>
<td>0.15</td>
</tr>
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<td>4</td>
<td>0.41</td>
<td>17.89</td>
<td>0.05</td>
<td>6.07</td>
</tr>
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<td>8</td>
<td>1.08</td>
<td>15.74</td>
<td>0.24</td>
<td>6.24</td>
</tr>
<tr>
<td>12</td>
<td>1.24</td>
<td>14.97</td>
<td>0.71</td>
<td>6.21</td>
</tr>
<tr>
<td>16</td>
<td>1.26</td>
<td>14.85</td>
<td>0.87</td>
<td>6.22</td>
</tr>
</tbody>
</table>

\(^{40}\)The results in the \( npos12 \) are similar to the \( npos4 \) specification, with a greater contribution of the shock in the variations of imports.

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Table 4: Variance Decomposition (percentage) to a npos4 shock

<table>
<thead>
<tr>
<th>Period</th>
<th>GDP</th>
<th>GOV</th>
<th>CPI</th>
<th>IMP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.55</td>
<td>3.09</td>
<td>0.03</td>
<td>0.00</td>
</tr>
<tr>
<td>4</td>
<td>0.53</td>
<td>23.63</td>
<td>0.09</td>
<td>6.60</td>
</tr>
<tr>
<td>8</td>
<td>1.43</td>
<td>20.63</td>
<td>0.20</td>
<td>6.79</td>
</tr>
<tr>
<td>12</td>
<td>1.60</td>
<td>19.62</td>
<td>0.69</td>
<td>6.76</td>
</tr>
<tr>
<td>16</td>
<td>1.62</td>
<td>19.44</td>
<td>0.89</td>
<td>6.76</td>
</tr>
</tbody>
</table>

5.3 Robustness Checks and Sub-periods

Owing to the instability inherent in the VAR models, changes were made to the order of the variables. The main results were similar to the baseline specifications, which indicate that the estimations based on the VAR model are robust enough. In addition, the VAR was also estimated using the npos12 specification, which produced similar results that are available in the appendix section.

On the other hand, the same models from section 5.2 were estimated, but the sample was divided in two periods. The first one goes from 1965 to 1990 and the second period comprehends the years 1991–2014. The sample, therefore, is divided in two equal parts in terms of duration, which provides almost the same number of observations for the estimations. However, from a qualitative perspective the periods are significantly different from at least two dimensions. They differ between each other from the historical perspective discussed in section 2 and from the oil shock specifications defined in section 4.2. The first period, taking into account only the historical events, covers the two oil shocks of 1973 and 1979, and also includes the beginning of oil exports in Ecuador in 1972. The second period includes the third oil shock. Nevertheless, using the positive shock specifications observed in Figure 5, it is clear that the second period presents a higher number of “peaks” in prices than the first one. Thus, considering these differences, it may be important to assess whether there are significant changes in the baseline estimation that analysed the whole period. It also allows to evaluate the possible differences between the two periods. 

41Given that the analysis considers the annual growth rates, the first period covered 1966–1989.
Figure 8: Impulse Responses to npos, 1965Q1-1989Q4

Notes: Orthogonalized Impulse Response Functions (IRF). 68% Confidence Intervals (Dash Lines)

Impulse Responses to npos, 1990Q1-2014Q4

Notes: Orthogonalized Impulse Response Functions (IRF). 68% Confidence Intervals (Dash Lines)
Figure 8 presents the results for the $n \times 4$ specification only because the $r \times 4$ produced similar responses that are available in the appendix section. The first period results are almost identical to the ones in the previous section. In fact, the greater difference appears to be related to the inflation response that is no longer significant. Nevertheless, there are marked differences between the two samples. The GDP in the second period exhibits a strong significant response that peaks in the third quarter after the shock, albeit the effect is now only significant until the sixth quarter. The GOV response, meanwhile, is not as strong as in the first period. Furthermore, it is significant only until the end of the first year. Inflation is negative and significant between the mid-second year and the end of the fourth year, which is similar to the baseline estimation. The imports reaction is also similar to the baseline scenario in both periods, with only what seems to be a more pronounced peak in the second period. Overall, the most important difference between the periods seems to be the GDP response, yet the general pattern appears consistent across periods.

5.4 Discussion

In general terms, the reactions suggest that positive variations in oil prices may have an effect on growth mainly through other variables, especially between 1972 and 1989. In fact, an important channel of transmission appears to be the increase in government consumption. This effect, however, could not be sustained given the transitory condition of the shock itself. For instance, the boost in government purchases could have an adverse impact on the fiscal accounts in the medium and long-term horizons, when the initial effect on the prices eventually disappears. The potential consequences on growth, therefore, would vary depending on the magnitude of the shock and also on the policy regarding the spending level. Thus, this reaction and the historical evidence suggest that this policy of almost an immediate response to positive shocks is not sustainable over time, given the volatility that is inherent to oil prices. In the same vein, the imports response also presents a pattern that may not have positive effects on growth in a longer time span. For example, the positive effect on imports could be translated into persistent

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42 Following the original model, two dummy years were used in the estimation for the first period: 1972 and 1987. Meanwhile, two dummy years were used for the second period: 1999 and 2009. The lag selection was 2, as was stated before using the SIC and HQ criteria.
current account deficits, despite the high revenues due to the oil price increase. Indeed, this has been the normal pattern since 1972. Although it is also possible that this response is partly explained by the increase in the petroleum derivatives,\textsuperscript{43} the response could be explained by other factors. Given the reaction of government consumption, for example, it seems possible to argue that this also translates into higher imports. Indeed, a positive reaction on imports could have an adverse effect on GDP, given that this component must be subtracted from exports in order to get the net effect of the external sector on growth. The negative responses of inflation may be explained by the distortion that subsidy policies could have had on the shock effects. Other factors may be driving inflation rather than the oil prices, for example, a fixed exchange regime such as dollarization since the 2000s. However, this point requires further investigation. Overall, a more persistent and significantly positive effect on GDP growth would require better policies to absorb the shock in order to construct a stronger position and be able to deal with normal times or even downturns in the oil prices.

The effect of positive shocks on GDP seems stronger and significant in the second period, especially in terms of GDP growth. This is similar to what other authors found for oil-exporting countries, as it was discussed in the literature reviews and can be observed in Table 5. Pieschacon (2012), for example, found that an oil shock had a positive impact on output in Mexico when analysing the period of 1980–2006. Yet, the effect is not as strong in Norway that is considered a developed economy, which indicates the important role of fiscal policy in transmitting the shock. Farzanegan & Markward (2009) show the positive response of GDP and the marginal reaction of government expenditures in the case of Iran. Each result was obtained using different methods and oil shock identification and considered different periods. In that respect, one important feature of the present paper is that it divides the data into two periods and assesses the oil shock impacts on both samples, considering a larger time span. However, in general, the results seem consistent across the studies that normally analyse the period after the 1980s. The main findings point out to a positive effect of oil shocks on growth and government spending. On the other hand, these results challenge the evidence presented by Boye (2001) who argued that oil does not affect the

\textsuperscript{43}Ecuador has to import petroleum derivatives because it has a limited capacity to refine oil.
economy through the external sector. In fact, the external sector, proxied by imports in this case, presents a clear effect of positive changes. Moreover, the direct effect of oil prices on GDP, especially in the second period, question Boye’s results.

Conversely, the results are in contrast with the evidence presented by Blanchard and Gali (2007) for some advanced economies. The authors found that after 1984, the effect of oil shocks on advanced economies is less pernicious. Since they are oil-importing economies, a positive shock normally has a negative effect on macroeconomic performance. They argue that this may be related to a decrease in the wage rigidities, a better management of monetary policy, and a decline in the share of oil in the economy. For instance, in the case of Norway, despite being an oil exporter, the modest reaction of output and government spending could be largely explained by its domestic policies, as Pieschacon (2012) argues. This could also be the case for Kuwait, which has accumulated reserves, and this may explain why the response of government expenditures is not as strong as expected (Eltony & Al-Awadi, 2001). In general, the economic structure and the policies shape the reaction of the economy in different periods to oil shocks.

Therefore, it is possible to argue that also the greater contribution of positive price shocks may be due to changes in the structure of the Ecuadorian economy and in the international conditions. For example, during the first period, despite the historical shocks of 1973 and 1979, there were not as many price increases as in the second period (see Figure 5). However, the growth rates were higher than those in the second period. This could be explained by the increase in prices and also by the effect of the initiation of the oil era in 1972. Indeed, the initial boost of the beginning of oil exports appears to be more than important than the shock itself. Thus, the 1973 shock may account only partially for the reaction in GDP, for example, which can be appreciated in Table 6. During the 1980s, the OPEC struggled to regain its protagonist role acquired during the 1970s but without success given the lack of coordination among its members (Venn, 2002, p.53). The result, hence, was a period of almost no increases in terms of prices (Figure 5). Therefore, this may also explain the relatively small contribution of the shocks to the variations in the variables for this period. Indeed, the results point out to other factors as the main drivers of the growth process during this period, rather than the oil prices itself. The 1979 shock, for example, was rapidly
<table>
<thead>
<tr>
<th>Author(s) - Year</th>
<th>Country</th>
<th>Period</th>
<th>Method</th>
<th>Main Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farzanegan &amp; Markward (2009)</td>
<td>Iran*</td>
<td>1975-2006</td>
<td>VAR</td>
<td>Asymmetric effects of price shocks. Positive reactions of output and marginal effect on government expenditures. Evidence of Dutch Disease, assessed through the appreciation of the exchange rate</td>
</tr>
<tr>
<td>Bjørnland (2009)</td>
<td>Norway</td>
<td>1993-2005</td>
<td>SVAR</td>
<td>Positive effect of oil price shocks on stock returns. The effect is modest in other variables such as inflation or unemployment.</td>
</tr>
<tr>
<td>Berument et. Al. (2010)</td>
<td>MENA Countries**</td>
<td>Depends on the country</td>
<td>SVAR</td>
<td>Positive and significant impact of oil shocks on growth in the net exporting countries.</td>
</tr>
<tr>
<td>Omojolaibi (2013)</td>
<td>Nigeria</td>
<td>1985-2010</td>
<td>SVAR</td>
<td>Domestic policies explain most of the variations in inflation. Oil price shocks have a moderate impact on GDP and money supply, and there is no significant impact on price level.</td>
</tr>
</tbody>
</table>

* For the main analysis they considered the period 1990-2006. They interpolate the series to extend the analysis to 1975.

** 16 countries, both oil net exporters and importers. Exporting countries with positive responses in growth: Algeria, Iran, Iraq, Kuwait, Lybia, Oman, Qatar, Syria and UAE.
reversed in terms of prices, and both internal imbalances and external factors, such as natural disasters or war, eroded any possible benefits of the price increase. The variance decomposition analysis confirms what was exposed in the historical section, i.e. the benefits of a rise in prices depend on the structure of the economy at the moment of the shock.

On the other hand, the second period exhibits more peaks in terms of prices (Figure 5). In this period, the economy was already a net exporter for almost 20 years. Thus, the structure was set to receive benefits from an increase in prices and, possibly, be greatly affected by downturns. In fact, as Cueva (2008, p.6) highlights, the fiscal accounts received a boost after 2000 owing to the recovery in oil prices and the combination of growth and favourable international conditions. This implies that if the contribution of oil to the government revenues rises, the effect could be translated into higher government spending that may positively impact growth. Nevertheless, this situation poses two problems. The first one is that more spending does not necessarily translate into higher growth rates, so it would be important to investigate the fiscal multipliers in each period. The second problem is related to the fact that this behaviour may not be sustainable in the longer term, considering that high prices eventually end. Both are left as open fields for further research.

Nevertheless, the second period reveals a more significant impact of the oil shocks on GDP growth. The recurrence of these increases in oil prices, especially after 2000, may have made economic growth more dependent upon these shocks, confirming the first impression observed in Table 1. The impact is significant and persistent in the second period and explains up to 8 percent of the variations in GDP in the second period, as shown in Table 6.\footnote{The results are similar to the findings of Pieschacon (2012) for Mexico in terms of the tradable products. She differentiates between tradable and non-tradable output. The results are higher than those observed by Farzanegan & Markwardt (2009) for Iran.} However, as the historical section discussed, during this period, the prices were higher and growth rates were not as high as in the 1970s. Thus, although oil prices have a greater impact on growth and explain its variation to a large extent, this does not necessarily mean a better performance in terms of growth. This indicates again, as was discussed in Section 2, that the structure of the economy and the policies implemented at the moment of the shock matter, in terms of the possible effects
and their duration in the different macroeconomic variables. Interestingly, oil shocks explain the variations in government consumption to a significantly lower extent and a greater part of imports and inflation variations in the second period. One possible explanation for the reduction in the share of oil shocks in GOV could be related to the fact that now policies regarding fiscal measures, for example, are more important than the shock itself. This may be a problem if there is a positive and persistent response (Figure 8) of government consumption because it would indicate that the impact is driven by other factors that do not necessarily consider the temporary condition of the shock, but this topic deserves further research. The greater contribution of positive shocks to imports variations may be due to the increase in the price of oil derivatives, as mentioned above. However, this higher share indicates that any possible imbalances in the external sector have to consider oil prices as a more important factor. Therefore, given that the economy is dollarized and as this implies a rigid exchange rate, policies regarding the external sector have to promote exports and, most importantly, diversification in order to face any possible disequilibrium’s in the balance of payments.

Table 6: Variance Decomposition (percentage) to npos4

<table>
<thead>
<tr>
<th>Period</th>
<th>GDP</th>
<th>GOV</th>
<th>CPI</th>
<th>IMP</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
<td></td>
<td></td>
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<td>25.13</td>
<td>1.69</td>
<td>4.24</td>
</tr>
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<td>12</td>
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<td>1.74</td>
<td>4.33</td>
</tr>
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<td>16</td>
<td>2.28</td>
<td>24.19</td>
<td>1.72</td>
<td>4.43</td>
</tr>
<tr>
<td>1990Q1-2014Q4</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>1</td>
<td>0.64</td>
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<td>6.07</td>
<td>5.66</td>
<td>9.59</td>
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</table>

This analysis reveals that while the impact on growth is significant in the first period, there are other factors driving the growth rates especially during the 1970s. There are other events that are worth considering within the analysis. For example, given the closeness between the beginning of
the oil exports in 1972 and the first oil shock of 1973, the impact is shared between the two events. Moreover, the low prices of the 1980s and the absence of shocks during that decade (Figure 5) also may have affected the growth responses in this period. Meanwhile, the second period exhibits a greater effect of the positive shocks on GDP and also a larger contribution to its variations, yet lower growth rates were achieved in relation to the 1970s. For instance, higher oil prices do not necessarily translate into higher growth rates because the effect of shocks depends on the structure of the economy at the moment of the shock. However, the fact that growth nowadays seems more dependent upon positive shocks, suggests the lack of diversification in the economic structure since the beginning of the oil era. The responses of the rest of variables in the second period, furthermore, indicate that price increases are still managed as permanent.

6 Conclusions

This paper has discussed the effect of positive oil prices from the historical and the empirical perspectives for Ecuador in the period of 1965–2014. The historical section analysed the context in which the classic “oil shocks” emerged and how they impacted the Ecuadorian economy in terms of not only growth but also other macroeconomic variables. The general picture in the historical section reveals a close association between growth and periods of high prices and also showed policy implementations that could not be sustained over time. The results in the VAR model confirm this and suggest that the structure of the economy at the moment of the shock and the policy reaction are, perhaps, the main elements in the process of absorbing the shock. Moreover, the greater response of growth to positive shocks and its larger contribution to its variations since 1990 indicate that the economic structure has not achieved significant changes in modifying its dependence upon oil prices. In fact, this appears to have increased. The response is positive mainly in the first year and significant until the second year, especially in terms of growth, government consumption, and imports, whereas the response of inflation is negative, though not significant until the second year after the shock. This pattern is consistent among different oil shock specifications.

When the sample is divided in two periods, 1965–1989 and 1990–2014, the effects present some
differences in terms of effect and duration, but remain consistent. The response of GDP to an oil shock is stronger in the second period, and indeed, the variations in growth are explained up to 8 percent by the shocks. There is a less pronounced response of government purchases in this second period and the contributions of oil shocks to the variations in government consumption are considerably lower in the second period; this could be attributed to a greater role of the policies in the reaction than in dealing with the shock itself. The oil shocks may have affected the growth through other variables in the first period, especially in the 1970s. The shock in prices appears to have a more direct impact on growth in the second period, particularly since the 2000s.

Therefore, further research that assesses specific periods with greater detail is needed. The next logical step would be studying the impact of negative shocks in the Ecuadorian economy, considering that the response to positive changes would be an important driver in that respect. The investigation of fiscal policy in a longer time span is necessary. Also, the reconstruction of a consistent series of the real exchange rate in order to assess the presence of a Dutch disease is warranted. Nonetheless, any effort should include data reconstruction for several macroeconomic series in Ecuador in order to overcome one of the main shortcomings that arise in the investigation of the country’s economic historic.

The main findings are consistent with the results that other oil net-exporting countries exhibit. However, this study considers a longer time span and complements its empirical analysis with a detailed revision of the historical analysis of the principal oil shock episodes experienced by Ecuador. In that respect, the use of higher frequency data also enhanced the empirical strategy. The importance of the study of only positive shocks relies on the fact that the responses may shape the economic structure and policies within the country, which will set the basis for sustaining growth. After 1990, and especially since 2003, the period presents a higher number of peaks in terms if oil prices, which appear to have a greater impact also in terms of growth. Therefore, growth now appears to be more dependent upon oil prices despite the fact that higher rates were achieved before. The 1970s proved to be unsustainable and prices eventually went down, but the
historical lessons may have not been fully understood.

References


- Banco Central del Ecuador. Several Issues.


• Gelb, A. (1988). *Oil windfalls: Blessing or curse?*


Appendix

Data Sources

- Oil Nominal: West Texas Intermediate (WTI) price, which is the reference for the Ecuadorian oil price. The series was extracted from the International Financial Statistics published by the IMF in quarterly frequency.

- Oil Real ($2014): The nominal data was converted into real using the historical Consumer Price Index from the US, published by the Bureau of Labor Statistics. Table 24.


- Real GDP: This data was obtained in quarterly frequency from the Ecuadorian Central Bank (BCE) since 2000Q1 in the new base year 2007. For the period since 1965 there was only annual data available based on the new revision. Therefore the data for the previous years was obtained from Gachet et. al. (2010), who uses 2000 as a base year. These series were kindly provided by the author. Following Gachet et.al. (2010) the two series were spliced maintaining the original variations. For a detailed revision of the method see Gachet et. al. (2010) appendix A.

- Government Purchases: The methodology was the same as in the real GDP series.

- Imports: The methodology was the same as in the real GDP series.

- CPI: This data was obtained from the Instituto Nacional de Estadística y Censo (INEC). The historical data covers the period 1969-2014, and uses 2014 as the base year.

- Population: Extracted from the BCE and INEC.

Dummy Variables

- D72: This dummy takes the value of 1 since the last 1971Q4 until the 2014Q4. In August of 1972 Ecuador started its oil exportations, thus there was a drastic change in the growth rate pattern.
• D87: In this case the dummy takes the value of 1 in 1987Q2 and 1987Q3 due to the Earthquake that occurred in March of 1987 and caused over a thousand deaths, and more than 5000 evacuations (ECLAC). Moreover, it provoked several damages to the Trans-Ecuadorian Oil Pipeline (SOTE) inhibiting the country to export oil for five months.

• D09: This dummy was used in order to capture any possible effects from the International Crisis, but it did not change significantly the results.

Robustness Checks
Figure 10: Impulse Responses to $r_{pos4}$, 1965Q1-1989Q4

Impulse Responses to $r_{pos4}$, 1990Q1-2014Q4

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