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Oil or gas discovery: short- and medium-term impacts on different economic emergence outcomes and the role of initial levels of diversification, human capital and governance

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Abstract

The empirical relationship between hydrocarbon wealth and each of the dimensions of economic emergence is not clearly understood.

This research aims to contribute to the debate on the economic impacts of oil and gas resource development, by addressing the following questions: What are the impacts of hydrocarbon resource discoveries in the short and medium term on the trajectory of economic emergence? What is the role in these impacts of initial levels of country diversification, human capital or institutional quality?

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Using lagged-effect panel models on a sample of 130 countries covering the period from 1980 to 2020, we estimate the causal link between giant hydrocarbon discoveries and a synthetic indicator of economic emergence, as well as its key indicators, whilst controlling for individual and time fixed effects. We also examine the potential heterogeneity of this relationship, as a function of the country's initial levels of export diversification, education level and governance indicators.

The results show that oil and gas production can have significant and positive impacts on economic dynamism and macroeconomic stability in the short and medium term, such as stimulating economic growth, investment and savings, as well as improving the current account and primary budget balances. However, in terms of diversification and structural transformation, negative impacts have been observed overall, particularly on cereal yields, the manufacturing value added and the export concentration index. However, the negative impacts on structural transformation indicators disappear when the discovering country is initially endowed with a diversified economy, a high level of human capital or a low incidence of corruption.

Keywords: oil and gas, economic emergence, structural transformation, resource curse, Dutch disease, delayed-effect panel models.

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2 Introduction

In recent times, it is common to find in the literature the terms "emerging countries" and "emerging markets" in reference to the most dynamic nations amongst developing countries that are the most integrated in the current global economy. According to the conceptual approach advanced by Moubarack LO (2017), economic emergence encompasses various aspects, each measured by a set of economic variables. For a country to emerge, it must create wealth and ensure that it benefits the entire population (inclusive wealth), sustainably stimulate its economic growth and maintain a stable macroeconomic framework (macroeconomic dynamism and stability), diversify and continuously improve its production structure (structural transformation aspect), and become a dynamic player in international markets (global economy insertion aspect).

The empirical relationship between hydrocarbon wealth and each of these dimensions of economic emergence is not clearly understood. Oil or gas discoveries may have a major and positive impact on economic activity, but the resource curse hypothesis suggests that they may also be detrimental to long-term economic growth. The first important theoretical contributions were made by Corden (1984). According to his basic model, during a resource boom, capital is diverted from other tradable goods, weakening the economy as a whole. The inflow of foreign capital into the booming resource sector causes an appreciation of the exchange rate. This appreciation results in higher prices throughout the economy, leading to a loss of foreign competitiveness for the non-resource tradable sectors.

The empirical literature on the resource curse emerged mainly after the work of Sachs and Warner (1995) and Warner (1995, 1997). These authors studied the relationship between economic growth and the share of exports, or GDP derived from commodity exports, and found a negative impact of natural resources on economic growth. Several studies have supported this view, arguing that natural resources can undermine economic performance by empowering powerful groups, undermining legal systems, increasing instability and encouraging opportunistic behaviour such as rent-seeking (e.g., Ross, 2001; Ramey and Ramey, 1995; Koren and Tonreyro, 2007; and Besley, 2006). Others have suggested that the beneficial or detrimental nature of natural resources depends on country-specific factors, including the quality of its institutions (e.g., Mehlum et al., 2006; Bhattacharyya and Hodler, 2010, 2014; Bhattacharyya and Collier, 2014) as well as the type of natural resources (Isham et al., 2005).

The many examples of resource-rich but income-poor countries seem to confirm these conclusions and this hypothesis has become generally accepted in media circles.

Recent economic literature, however, challenges these findings. Lederman and Maloney (2008) show that by controlling for fixed effects in a panel setting, the negative impact of natural resources disappears. Alexeev and Conrad (2009), contrary to the widespread view of the presence of a resource curse, find that large natural resource endowments have an overall positive impact on the country's long-term economic growth. A similar conclusion is put forward by Birdsall and Subramanian (2004), who argue that the oil and gas-rich Middle East has not experienced the resource curse.

Moreover, the empirical evidence on the resource curse remains remarkably inconsistent. A meta-analysis (Havranek et al, 2016) shows that about 40% of empirical papers find negative associations between resource endowments and economic growth, 40% find no association, whilst 20% find positive links. Lyatuu et al. (2021) argue that, in general, the negative relationship between natural resources and economic growth observed in Sachs and Warner's (2001) models, seems to disappear when individual fixed effects are introduced into the empirical models and when measurement issues are properly accounted for.

This paper contributes to the debate by exploring the following questions: What are the impacts of natural resource discoveries in the short and medium term on the trajectory of economic emergence? What is the role of initial levels of country diversification, human capital, or institutional quality in these impacts?

Several reasons might account for the contradictory findings in the literature regarding the relationship between natural resources and economic growth. Firstly, many studies have not taken into account that this relationship could be conditional, relying on other variables, such as institutional quality or education. Moreover, not controlling for fixed effects in panel data analyses might introduce biases. This could be due to overlooking unobserved country-specific characteristics and global trends or shocks. Lastly, the challenge of accurately measuring natural resource endowments led some studies to depend on trade-based proxies, which can be imprecise.

In response to these discrepancies in existing literature, our research takes a different approach. We investigate how the relationship between hydrocarbon discoveries and economic emergence varies, based on a country's initial conditions. This approach offers a nuanced understanding of resource impact. By incorporating individual and temporal fixed effects, we account for unobserved heterogeneities and global trends, ensuring more reliable estimates. Moreover, by focusing on actual hydrocarbon discoveries, we sidestep the errors linked to imperfect proxies.

More specifically, we use a panel data set covering the period 1980 to 2020 and 130 countries. We estimate the causal link between giant hydrocarbon discoveries and a synthetic indicator of economic emergence, as well as its key indicators, using lagged-effect panel models, while controlling for individual and time fixed effects. The relationship between oil and gas wealth and economic emergence may be influenced by other factors. Therefore, we also examine the potential heterogeneity of this relationship, as a function of the country's initial levels of export diversification, education level and World Bank governance indicators.

Our approach differs from the majority of existing studies in three respects. First, we examine the impact of hydrocarbon exploitation on a set of macroeconomic variables linked by the same conceptual framework, that of economic emergence and by the same methodological framework. Indeed, most studies have focused on the impacts on economic growth, trade balance, or fiscal revenues. Second, whilst studies typically examine the long-term effects of resource abundance by looking at the relationship over several decades, we explore the effects that might occur in the first decade after discovery. Third, while institutional quality is the factor typically studied to investigate the possibility of impact heterogeneity, we also examine the differentiating effect of initial levels of economic diversification and human capital.

The results show that oil and gas production can have significant and positive impacts on economic dynamism and macroeconomic stability in the short and medium term, such as stimulating economic growth, investment and savings, as well as improving the current account and primary budget balances. However, in terms of diversification and structural transformation, negative impacts are generally observed on cereal yields, as well as on manufacturing value added and the export concentration index. However, the negative impacts on structural transformation indicators disappear when the discovering country is initially endowed with a diversified economy, a high level of human capital or a low incidence of corruption.

The paper is divided into four parts. The first reviews the theoretical and empirical literature on the impacts of oil and gas development on economic emergence outcomes. The second presents the synthetic index of economic emergence (ISEME, or *Moubarack LO Index of Emerging Economies*). The third part presents the evolution of economic emergence indicators in some countries after the beginning of resource exploitation. It also compares the average performance, in terms of economic emergence outcomes of oil and gas producing countries to non-producing countries, over the period 1980 to 2020. The final section estimates the impacts of resource development on several indicators of economic emergence during the first decade of production and presents and discusses the results of the estimates.

3 Literature Review: Economic Emergence and Resource Wealth

Oil and gas production is an important topic in academic literature because of its potential impact on many key economic variables. In this literature review, we will examine how oil production can affect key dimensions of economic emergence: economic dynamics, macroeconomic stability, structural transformation and insertion into the global economy.

3.1 Economic dynamism and macroeconomic stability

Oil and gas discoveries can be a major shock to economic activity. Impacts can occur immediately after discoveries are made, even before production begins.

Under rational expectations, a giant oil or gas discovery should lead to a short-term jump in growth, both expected and actual, as the country moves to a new and stable production equilibrium, consistent with the associated increase in investment and economic activity. Indeed, expectations of higher income following a discovery can boost investment and consumption, as predicted by the following theoretical model: in an open economy with a simple endowment, news of a future increase in output should lead to an immediate increase in consumption and, thus, output, as well as an immediate decrease in the savings rate and current account (Arezki et al, 2016). The increase in economic activity can be directly linked to the activities of oil companies. Indeed, the years of preparation before extraction may involve increased investment in infrastructure, increased demand for services (law firms, environmental consultants), as well as the arrival of highly skilled labour from abroad (Hamilton, 2009). It may also be generated by expectations of higher revenues in other sectors, due to the expectation that investment in the resource sector will trickle down to the rest of the economy (Van der Ploeg, 2011). Another possibility is that firms expect governments and consumers to advance their spending and investments by borrowing (Van der Ploeg and Venables, 2013), using the newly discovered wealth as collateral. Discoveries would, thus, function as a signal leading to coordinated investment by many firms, possibly amplified by herding behaviour (Akerlof and Shiller, 2009).

A recent study by Arezki et al. (2017) pointed out that discoveries themselves can cause short-term economic booms, even before the windfalls begin to flow in. They find that GDP growth accelerates immediately after the discovery but the impact fades after a few years. They show that the current account deteriorates immediately after a discovery, as investment increases to develop the new field. The current account then improves very significantly once production begins. The fiscal balance is not affected initially but improves after production begins. Research by Cust and Mihalyi (2017) suggests that, overall, growth expectations are, on average, one percentage point higher in the four years following a giant discovery.

However, other studies have shown that the high revenue prospects associated with the discovery of natural resources can lead to economic behaviour that harms the country's **economy,** even before production of these resources begins: this effect is called the resource pre-curse. A 2012 World Bank study found that the prospect of oil revenues led to currency appreciation in African oil-producing countries, which hurt the competitiveness of other sectors, particularly agriculture (Aslaksen, Torvik, and Weng 2013). Another IMF study, conducted in 2014, found that revenue prospects from natural resource production led to increased government spending in Latin American countries, which contributed to higher inflation (Arezki et al., 2014). Results from a World Bank study (Cust and Mihalyi, 2017) show that for the five years following discovery, , on average, growth is 0.14 percentage points lower than in the same period before discovery, signalling a "disappointment effect" regarding both actual and expected growth.

In the long run, natural resources are often viewed by some of the literature as a curse, slowing economic growth in resource-rich developing countries (Venables, 2016). The literature on the resource curse emerged mainly after the study by Sachs and Warner (1995). One of the main explanations for the negative impact of natural resource discovery on economic growth is the "Dutch disease," which argues that the export of natural resources tends to increase exchange rates and, thus, decrease the competitiveness of manufacturing exports (Sachs and Warner, 1995; Gylfason et al., 1999; Van der Ploeg, 2011; Sala-i Martin and Subramanian, 2013). Other studies show that natural resource spillovers could decrease investment and openness, whilst having negative effects on education and economic growth (Papyrakis and Gerlagh, 2007). In addition, other studies argue that an influx of natural resources can have adverse effects on economies via the political process, such as increased rent-seeking (Velasco, 1997; Tornell and Lane, 1999). In addition, some studies focus on the increase in corruption and decrease in the quality of politicians, due to the abundance of natural resources (Brollo et al., 2010; Vicente, 2010). Some studies suggest that revenues from natural resources can potentially alter the incentives of leaders and cause them to act in a direction counter to the welfare of their society (Caselli and Cunningham, 2009).

Other authors, however, question the validity of the resource curse concept. Oil revenues can be used to finance investments in infrastructure and to support research and innovation in other sectors. This can stimulate economic growth by creating jobs and increasing productivity (Sala-i-Martin and Subramanian, 2003). Revenues from oil and gas development can also be used to fund public expenditures, such as health, education and social welfare programmes. This can help reduce poverty and economic inequality, which can improve people's lives and contribute to economic growth (Auty, 2001). Investments in the oil and gas industries can also have a positive impact on other sectors of the economy. For example, the construction of infrastructure such as pipelines, ports and refineries can improve logistics and transportation capabilities, which can stimulate growth in other sectors, such as agriculture, trade and tourism (Sachs and Warner, 2001). The discovery of oil and gas resources can attract foreign investment to the country, which can help stimulate economic growth. Investors may be attracted by investment opportunities in the oil and gas industries but also in other sectors, such as infrastructure, construction and hotels and restaurants. This can lead to job creation and increased production, which can stimulate economic growth (Brunnschweiler et al., 2008).

The exploitation of oil and gas resources can have an impact on the macroeconomic stability of a country. Commodity prices, including oil and gas, are often volatile. These price fluctuations can affect budget revenues and exports, which can impact macroeconomic stability. For example, a sudden drop in oil prices can reduce fiscal revenues, lead to a decrease in investment and employment in the oil sector, as well as leading to a reduction in domestic demand (IMF, 2016).

Oil production can have a significant impact on a country's fiscal balance. Oil revenues can provide important sources of income for governments. However, the relationship between oil or gas resource abundance and the fiscal balance could be negative for several reasons. First, oil or gas production can lead to fiscal dilution, which occurs when governments reduce taxes to encourage oil production (Ross, 2015). This can have a negative impact on governments' tax revenues, which can negatively affect the fiscal balance. Second, governments in oil- or gas-producing countries may tend to increase public spending in response to high oil revenues. This can lead to an increase in excessive government spending, which can negatively affect the budget balance. Governments may be tempted to finance this spending by borrowing or raising taxes, which can lead to adverse consequences for the economy and the welfare of citizens (Ouédraogo, 2014).

Oil and gas development can also have an impact on inflation. The increased wealth associated with oil and gas development can lead to increased demand for goods and services which, in turn, can lead to higher prices. This is known as the "wealth effect" and can contribute to increased inflation. According to a study by the International Monetary Fund (IMF, 2013), the wealth effect can also lead to an appreciation of the local currency which, in turn, can lead to an increase in imports and a decrease in the competitiveness of other sectors of the economy, which can lead to imported inflation.

Several studies suggest that there is a positive impact between inflation and oil and gas wealth in producing countries. A study conducted by the International Monetary Fund (IMF, 2009) examined the effects of oil and gas production on inflation and money demand in Libya. The authors found that oil and gas production had a negative impact on the demand for money in Libya, leading to an increase in inflation. Another study, conducted by Hernandez et al. (2018), examined the impact of oil and gas production on macroeconomic volatility and monetary policy in several Latin American countries. The authors found that oil and gas production can lead to increased macroeconomic volatility in these countries, making monetary policy more difficult to manage. Finally, a study by Khosravi et al. (2018) examined the long-term effects of oil price fluctuations on inflation in several Middle Eastern oil-exporting countries. The authors found that the long-term effects of oil price fluctuations on inflation can be significant in these countries, but that this impact can be mitigated by effective monetary and fiscal policy.

Other studies have found no impact of oil and gas production on inflation in producing countries. Arezki and Brückner (2012) studied the impact of oil production on inflation in the Organisation of Petroleum Exporting Countries (OPEC) and found that there was no conclusive evidence of a positive relationship between oil production and inflation. Hadiwijaya and Abdulla (2019) studied the impact of oil production on inflation in Indonesia and concluded that oil production did not have a significant impact on inflation. A study by Campillo and Núñez (2012) examined the impact of oil production on inflation in nine Latin American countries. The authors found that the impact of oil exploitation on inflation was negligible in most of the countries studied.

3.2 Diversification and structural transformation

The economic literature is relatively divided on the effects of oil development on export diversification. The classical theories of international trade by David Ricardo (1817), Eli Heckscher (1919) and Bertil Ohlin (1933) predict that countries will specialise and not diversify their exports; this pattern depends critically on factor endowments. If a country is abundant in oil, it is perfectly predictable that it will have an export structure dominated by oil. The extensive literature on Dutch Disease suggests that resource exports will lead to a contraction of the non-resource tradable goods sector. Max Corden (1984) discusses the theoretical impact of natural resource exploitation, including oil and gas, on economic diversification, arguing that rapid growth in one sector can lead to an overconcentration of resources in that specific sector of the economy, to the detriment of economic diversification. Bahar and Santos (2018) show that a higher share of natural resources in exports leads to export concentration, with a non-resource export basket dominated by capital-intensive products. Nouf Al et al. (2018) note a concentration of non-oil sector exports eight years after a discovery, but do not observe an effect on the structure of employment in the non-resource and manufacturing sectors. Each dollar of resource exports would reduce manufacturing exports by an average of 46 cents, services exports by 17 cents, and agriculture and food exports by six cents (Nouf Al et al, 2018). Democratic political institutions moderate the effects of oil discovery on export and employment concentration (Nouf Al et al, 2018).

However, some authors have argued that oil exploitation can have positive impacts on economic and export diversification. Ross (1999) argues that oil revenues can allow a government to finance infrastructure projects that can stimulate economic diversification. Arezki and Brückner (2011) showed that oil exports can stimulate diversification, by providing a financial base for research and development of new sectors of the economy. Khatibi and Tofighi (2013) argued that the oil industry can provide diversification opportunities for local firms that provide services to the oil industry, such as transportation, construction and maintenance services. Fardoust, Kim, and Sepulveda (2006) found that increased oil revenues can lead to increased domestic demand, which can stimulate diversification of the economy by increasing investment in other sectors.

A recent study by Djimeu et al. (2019) suggests that the impact of oil development on the export diversification process depends on the export structure before the oil or gas boom. The results of the study indicate that in countries with high levels of pre-boom diversification, an oil boom has no impact on diversification, whilst in countries with low levels of initial diversification, an oil boom tends to reduce export diversification. The results of this study, based on a sample of 134 countries, highlight the prior development of non-resource sectors as a key element that can influence the motivation of political elites towards diversification policies. In addition, the study points out that oil windfalls tend to be channelled towards public consumption, rather than investment, when the initial industrial base is weak.

Oil wealth can have theoretical impacts on innovation, which have been studied in several research studies. One study (Auty, 2011) found that natural resource wealth, including oil and gas, can have negative effects on innovation in resource exporting countries. This could be due to the propensity of natural resource sectors being less innovative than other sectors and the fact that revenues from these sectors may reduce the incentive to invest in research and development (Auty, 2011). However, these negative effects can be mitigated if the country invests in infrastructure and institutions to stimulate economic diversification (Auty, 2011). Furthermore, another study (Belderbos, Leten, & Suzuki, 2016) examined the impact of oil wealth on innovation in exporting countries. The results showed that oil wealth had a negative effect on innovation, mainly due to the reduced incentive to invest in research and development. However, this negative effect could be mitigated if the country adopts policies to encourage economic diversification and improve the quality of institutions (Belderbos, Leten, and Suzuki, 2016). In addition, another study (Gylfason et al., 2013) examined the effect of natural resource wealth, including oil and gas, on innovation in 50 developing countries. The results showed that natural resource wealth had a negative effect on innovation in countries with weak institutions, but a positive effect in countries with strong institutions (Gylfason, et al., 2013).

However, some studies have shown that oil wealth can have positive effects on innovation under certain circumstances. For example, Leten, Belderbos, and Suzuki (2018) showed that oil wealth can have a positive effect on innovation in oil-exporting countries, particularly in the information and communication technology sectors, by funding research and development in these sectors that are often more innovative than other sectors. However, the quality of economic institutions and policies plays an important role in this effect. Similarly, another study conducted in 2019 on OPEC oil-exporting countries found a positive effect of oil wealth on innovation in renewable energy-related sectors, due to oil-exporting countries' investments in these sectors to diversify their economies (Arezki, Fetzer, & Pisch, 2015).

Oil and gas wealth can have complex theoretical impacts on foreign direct investment (FDI) in other sectors. In the case of a country suffering from Dutch disease, an appreciation of the local currency, due to the export of natural resources, may lead to a decline in the competitiveness of other export sectors and an increase in economic dependence on the natural resource sector. This may reduce the attractiveness of FDI in other sectors. As a result, FDI may become more concentrated in the natural resource sector. Moran and Ghosh (2007) showed that oil wealth has a negative substitution effect on FDI in other sectors, as financial and human resources are diverted from manufacturing to the oil sector. However, this negative substitution effect can be mitigated if the country invests in infrastructure and institutions, which can improve the competitiveness of other sectors (Moran & Ghosh, 2007). Similarly, Elhorst and Stöhr (2014) have shown that oil wealth can have substitution and complementarity effects on FDI in other sectors, depending on the diversification of the oil sector and the quality of institutions. In countries with a highly concentrated and undiversified oil sector, oil wealth has a negative substitution effect on FDI in other sectors. However, in countries where the oil sector is diversified and well-integrated into the domestic economy, oil wealth may have positive complementarity effects on FDI in other sectors (Elhorst and Stöhr, 2014).

Several empirical studies have sought to examine the impact of oil wealth on foreign direct investment (FDI) in other sectors. The results of Aykut, Ratha, and Ulu (2015) showed that oil wealth had a negative effect on FDI in the manufacturing sector in oil-exporting countries, especially in countries where oil production was concentrated in a few large firms and institutional quality was low. Similarly, Mekonnen (2016) found that oil wealth had a negative effect on FDI in other sectors in sub-Saharan African countries, especially in countries with weak institutions and poor governance. The results of Narula, Nguyen and Santangelo (2018) also showed that natural resource wealth, including oil and gas, had a negative effect on FDI in other sectors, particularly in countries with weak institutional quality, but that this negative effect could be mitigated in countries with stronger trade and cultural ties to non-natural resource exporting countries.

Steven Poelhekke and Frederick van der Ploeg used a panel of several countries and studied the effect of natural resources on the different components of FDI. Their main findings are as follows. First, for countries that were not previously resource producers, the discovery of a resource leads to a 16 percent drop in non-resource FDI in the short term and a 68 percent drop in the long term. Second, for countries that were already resource producers, a doubling of resource rents induces a 12.4 percent drop in non-resource FDI. Third, on average, the contraction of non-resource FDI outweighs the boom in resource-related FDI. Overall FDI falls by 4 percent if the resource rent is doubled.

Some studies have found a positive relationship between oil and gas wealth and FDI in other sectors. In a study of 119 countries, Asiedu and Lien (2010) found that natural resource wealth, including oil and gas, had a positive effect on FDI in other sectors, particularly in countries with strong institutions and high competition. In another paper, Nunnenkamp and Öhler (2013) examined the impact of oil wealth on FDI in non-oil sectors in Africa and found that oil wealth had a positive effect on FDI in other sectors, particularly in countries with more developed institutions and higher political stability.

Overall, the existing literature on the impacts of hydrocarbon exploitation is complex and presents contradictory results, whatever the outcome indicator considered. This implies that the net effect of hydrocarbon exploitation on a given economy is difficult to assess, as it depends on many different and often contradictory factors.

3.3 ISEME: a multidimensional indicator of economic emergence

In order to know the position of each country in terms of economic emergence, the Synthetic Index of Economic Emergence (ISEME), designed on the basis of the theory of economic emergence developed by Moubarack Lô (2017), was used. According to this theory, emergence is both a process and an outcome. It is a process when it describes the dynamics set in motion by an underdeveloped country (which can be called an "immersed" country, to put it simply) to extricate itself from the trap that keeps it in poverty and evolve, upwards, to get its head above water and give itself the means to develop in the future. In this case, we can speak of an "emerging" country, to underline the fact that it is a process in progress. It is a vertical process that requires the mobilisation of a great driving force, to break down the handicaps that have prevented the country from developing until now. Economic emergence can also represent a result achieved by a country in its march towards integral development. Having made numerous efforts in the recent past to meet global competitiveness standards, the formerly poor country manages to get its head above water. It is becoming an "emerging" country. It can then, within the framework of a horizontal process, move serenely towards the shores of development and converge with the most advanced countries.

Based on the definition used above, economic emergence can be considered to include several aspects, each of which is measured by a set of economic variables. To emerge, a country must create wealth and ensure that it benefits the entire population (inclusive wealth), sustainably accelerate its economic growth and maintain a sound macroeconomic framework (dynamism and sound macroeconomic framework), diversify and continuously improve its production structure (structural transformation aspect) and become a dynamic player in international markets (integration into the global economy aspect). This index, ranging from 0 to 1, is constructed on the basis of an aggregation of sub-indices established on each of the selected dimensions. Each dimension contains several variables (see Table 1 and Box 1):

- **Inclusive wealth** is measured by GDP per capita in purchasing power parity (which quantifies the wealth of the country). To this variable, we can add life expectancy at birth, adjusted for income inequality, which is a good indicator of the inclusiveness of the wealth created.
- **Economic dynamism and a sound macroeconomic framework** are measured by GDP per capita growth (this is the quantification of the real evolution of this wealth), the sustainability of GDP per capita growth (this variable measures the stability of the evolution of wealth, as a country on the right path to emergence evolves continuously at a relatively constant rate), gross fixed capital formation as a percentage of GDP, the budget balance (internal stability), the current account balance (external stability) and the level of inflation, which must be kept under control in an economy that aspires to emerge.
- **The structural transformation** of the country is measured by grain yields, as well as the sectoral composition of value added (industrial and manufacturing value added, labour productivity in industry).
- **Good integration into the world economy** is measured by indicators of foreign trade and foreign investment received by the country. Integration into international trade is measured by the share of the country's exports in GDP, the share of services exports in GDP, the export concentration index (it is important that the country's exports are sufficiently diversified and processed to enable the country to be competitive), the share of medium- and high-tech goods and services in exports (the country must also incorporate technology in its exported products). The country's ability to attract foreign investment is captured by the weight of the country's foreign direct investment (FDI) in GDP and the share of FDI in the total received by the countries in the sample.

Table 1 below lists the set of variables selected for the construction of the ISEME.

Table 1:ISEME components

DIMENSION	UNDER DIMENSION	INDICATORS	SOURCE
INCLUSIVE WEALTH	RICHESSE	GDP per capita, (constant PPP US$ 2011)	WDI
		Inequality-adjusted life expectancy	HDR
DYNAMISM AND SOUND MACROECONOMIC FRAMEWORK	ECONOMIC DYNAMISM	GDP per capita growth (annual %)	WDI
		Sustained GDP growth	WDI
		Gross fixed capital formation (% of GDP)	WDI
	MACROECONOMIC STABILITY	Gross savings (% GDP)	WDI
		Budget balance (% GDP)	WDI
		Inflation (%)	WDI
		Current account balance (%GDP)	WDI
STRUCTURAL TRANSFORMATION	PRODUCTIVITY	Cereal yield (kg per hectare)	WDI
		Industry (including construction), value added (in % of GDP)	WDI
	INDUSTRY	Manufacturing, value added (% of GDP)	WDI
		Industry, value added (% of GDP)	WDI
		Medium and high-tech industry (including construction) (% of manufacturing value added)	WDI
INSERTION IN THE GLOBAL ECONOMY	FOREIGN TRADE	Country exports to country GDP (5-year average)	WDI
		Medium and high technology exports (% manufactured exports)	WDI
		Concentration index	UNCTAD
		Exports of manufactured goods (% of goods exports.)	WDI
		Services exports (% GDP)	WDI
	FOREIGN INVESTMENTS	Total FDI per capita country over 5 years/Total FDI per capita sample over 5 years	WDI
		Country FDI/GDP (5-year average)	WDI

Source: Moubarack Lô and Amaye Sy (2021), "Manuel de l'émergence économique", Ed. Harmattan, January 2021

Box 1: ISEME calculation formula

More formally, for a country i, let us note I_k (i) the value of the sub-indicator of the theme (or dimension) k (the method of calculating I_k will be specified later), the ISEME formula for country i is written:

$$ISEME(i) = \left[\frac{1}{\sum_{k=1}^{m} \lambda_k} \sum_{k=1}^{m} \lambda_k \, I_k^{\alpha}(i)\right]^{1/\alpha}$$

Where:

- m is the number of themes (here m is equal to 4).
- α which is a non-zero real number is chosen by simulation. This simulation consists in finding a value of α such that the ISEME is relatively robust to a small variation of α. Note also that α allows us to measure a degree of substitutability of the different components of the ISEME.
- I_k is the weight of the k-dimension of the emergence. This weight is determined by the factor analysis.

$$I_k(i) = \sum_{i=1}^{T} C_t^j V_t^i$$

Where:

- V_t^i is the value of the variable t for country i,
- C_i^j is the coordinate of the variable t on the j axis in question

$$V_t^* = \frac{V_t - N_t}{D_t}$$

Where Nt and Dt are respectively a level and a dispersion of reference. By taking Nt= MinV and Dt = MaxV - MinV (the range of the variable), we find the often used Min-Max transformation:

$$V_t^* = \frac{V_t - MinV}{MaxV - MinV}$$

Source: Moubarack Lô (2017), "Economic Emergence of Nations: Definition and Measurement," Ed. Harmattan, March 2017

4 Stylised facts

The descriptive analysis of the short- and medium-term impacts of the exploitation of hydrocarbon discoveries on the trajectory of economic emergence is conducted at two levels. First, we consider four producing countries - Ghana, Brazil, Equatorial Guinea and Qatar-and compare the status of economic emergence indicators in the first decade of exploitation, with that in the last decade before exploitation. In a second step, we look at all ISEME countries and compare the average evolution of indicators between producing and non-producing countries, for the period from 1990 to 2020.

4.1 Case studies from Ghana, Brazil, Equatorial Guinea, Qatar

Appendix 1 compares the economic performance of each of the four countries, ten years before and ten years after giant hydrocarbon discoveries were made in that country.

Qatar experienced a significant improvement in all indicators of dynamism and stability after the discovery of natural gas in the 1970s. The country experienced an average annual growth in GDP per capita of 15.5 percent, an increase in GFCF as a share of GDP of 13.2 percentage points, an increase in the current account balance as a percentage of GDP of 30.3 percentage points, and an increase in the savings rate as a percentage of GDP of 14.3 percentage points between 1970 and 1980.

In Ghana, in 2007, the Jubilee oil field, the country's largest, was discovered off its coast, followed by other major oil and natural gas discoveries in the region. Oil exports began in 2010, marking a turning point in Ghana's economic history, which until then had been primarily focused on agriculture, with exports of cocoa and gold. The exploitation of oil in Ghana has had a significant impact on the country's economy. Since the start of hydrocarbon exploitation in 2010, economic growth has increased significantly, inflation has fallen sharply and the share of manufactured goods in merchandise exports has increased. However, on average, performance in terms of grain yield growth, primary fiscal balance and current account balance has deteriorated in the post-oil production period.

In Brazil, hydrocarbon exploitation took on particular importance in the late 2000s, especially with the discovery in 2008, 2010 and 2013 of so-called pre-salt oil fields off the country's coast. A comparison of economic performance before (2000-2010) and during (2010-2020) the hydrocarbon exploitation period shows a deterioration in most economic emergence indicators. GDP growth has slowed, the share of manufactured goods in merchandise exports has fallen sharply, grain yields have slowed, the Theil Index of Export Concentration has increased, whilst the fiscal and current account deficits have deteriorated significantly. The country's ISEME score also declined between 2010 and 2020. However, these results should be qualified by taking into account the global financial crisis of 2008 and the end of the commodity super-cycle that affected the Brazilian economy.

Equatorial Guinea began exploiting its hydrocarbon reserves in the 1990s, which has become an important pillar of its economy. Over the two periods considered (1980-1996 and 1996-2020), real GDP growth increased sharply, the current account balance improved, as did the ISEME score and the fiscal balance. The gross fixed capital formation ratio remained relatively stable between the two periods. However, the annual inflation rate increased slightly between the two periods.

Overall, the impact of hydrocarbon development in the short and medium term varies from country to country. Qatar saw a significant improvement in its economic performance after the discovery of natural gas in the 1970s. Ghana, which had previously been primarily agriculture-based, has experienced significant economic growth since the start of hydrocarbon development in 2010, although some performance has deteriorated. Brazil has seen a deterioration in most economic emergence indicators since the discovery of pre-salt oil fields in 2008, but these results should be qualified by taking into account the 2008 global financial crisis and the end of the commodity super-cycle that affected the Brazilian economy. Finally, Equatorial Guinea, which began exploiting its hydrocarbon reserves in the 1990s, has experienced strong growth in its real GDP and current account balance, as well as improvements in its ISEME score and fiscal balance, although the annual inflation rate increased slightly between the two periods under review.

4.2 Comparison of average economic emergence trajectories between oil and gas producing and non-oil and gas producing countries.

The figures in Panels A and B compare the evolution of key indicators of economic emergence, for the period from 1990 to 2020, between the average producing country and the average non-producing country. For each year of the period, a country is considered a producer, if its share of oil and gas rents, as calculated by the World Bank, is greater than 5% of its GDP. The figures are obtained by calculating, for each indicator and for each year, the medians of the producing and non-producing countries.

The figures in panels A and B show that over the period 1990-2020, the average producer country shows a favourable evolution in the following indicators: the budget balance, the current account balance, the savings rate, the weight of exports in GDP and, to a lesser extent, gross fixed capital formation and the weight of industry in GDP. The producer country shows a similar evolution to the non-producer country, in terms of GDP per capita growth and inflation.

However, the performance of the average producing country has declined relative to the average non-producing country in structural transformation indicators, such as grain yield, the weight of the manufacturing sector in GDP and the export concentration index. In 1990, the contribution of manufacturing to GDP was 15.85% for producing countries and 15.16% for non-producing countries. This gap between the two groups represented a 0.69 percentage point advantage in favour of producing countries in 1990 but, by 2020, it had shifted to a 1.12 percentage point disadvantage in favour of non-producing countries. Although manufacturing productivity declined in both groups relative to the initial situation in 1990, the decline was larger in the producing countries.

Despite an unfavourable position in 1990 for the average producing country (2159.7 kg per hectare for producers versus 1878 kg for non-producers), cereal yields increased rapidly in the average non-producing country. Whilst between 2005 and 2015, a remarkable decline in cereal yields was observed in the average producing country, the average non-producing country significantly increased its yields. Thus, in 2020, the gap between the two was found to be 614 kg per hectare in favour of the non-producing country.

In addition, the performance gap in the export concentration index widened to the disadvantage of the average producing country for the period from 1990 to 2020, from 0.16 points to 1.84 points.

In terms of ISEME scores, the median score for producing countries was above 0.45 points in 1990, whilst for non-producing countries it was 0.43 points. In 2019, the situation has reversed, as the median score for producing countries is about 0.53 points, whilst the median score for non-producing countries is 0.55 points.

PANEL A: Changes in key indicators of economic emergence, for the period 1990-2020, between the average producing country and the average non-producing country.

Figure A_ 4 Manufacturing industry's share of GDP

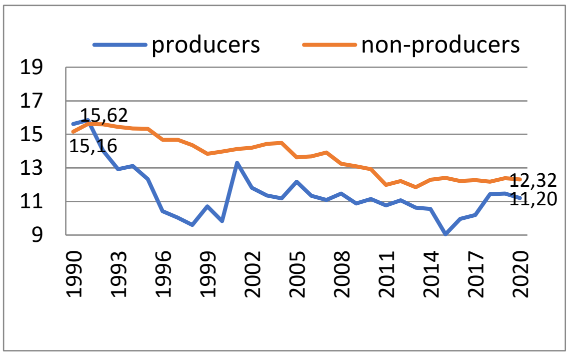


Figure A_ 1 Cereal yields in kg per hectare

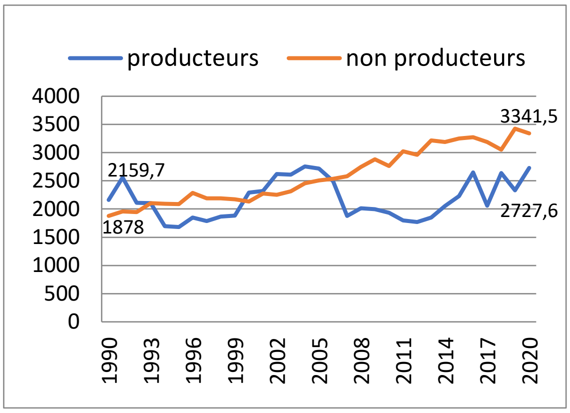


Figure A_ 5 Synthetic Index of Economic Emergence

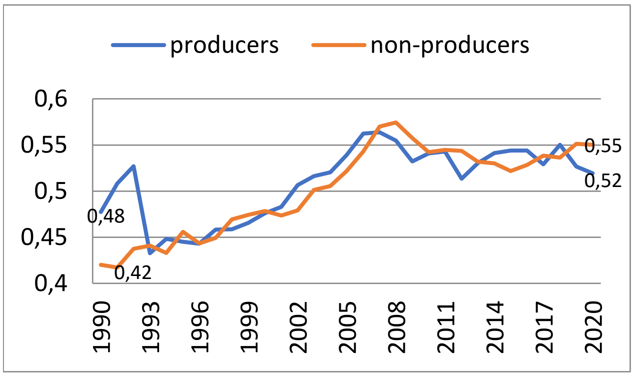


Figure A_ 2 Inflation rate

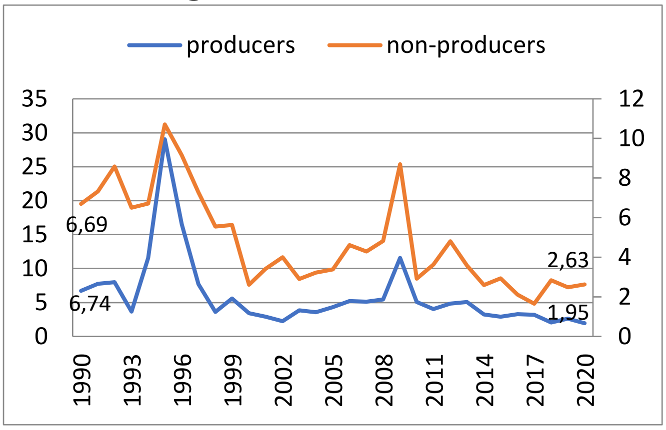


Figure A_ 6 Export concentration index

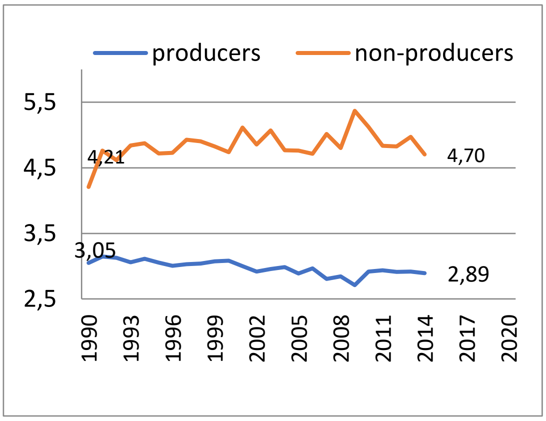
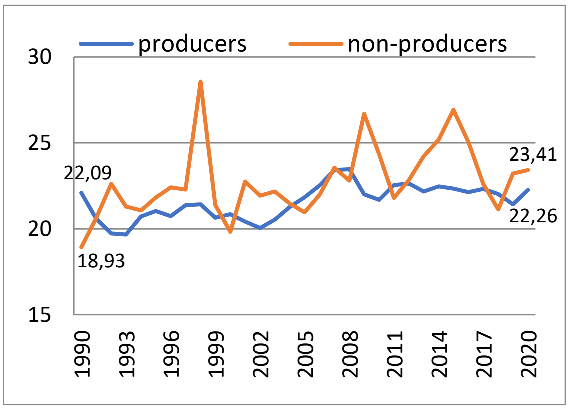


Figure A_ 3 gross fixed capital formation



PANEL B: Changes in key indicators of economic emergence over the period 1990-2020 between the average producing country and the average non-producing country.

Figure B_ 2 Industry's share of GDP, including construction

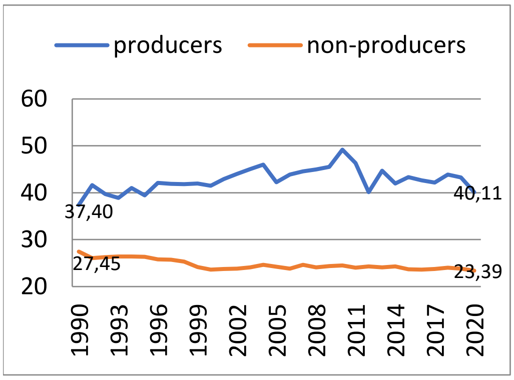


Figure B_ 1 Share of medium and high-tech industries in manufacturing

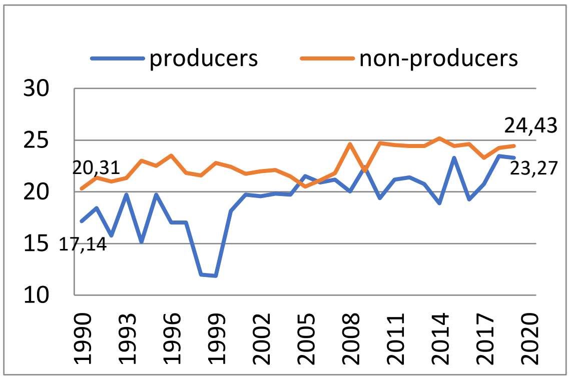


Figure B_ 5 Savings rate

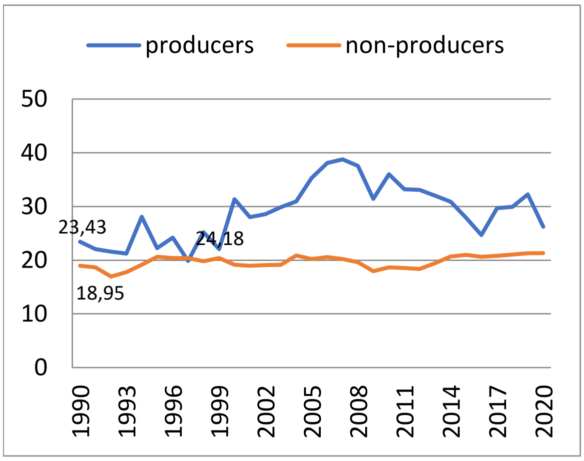


Figure B_ 6 Human Development Index

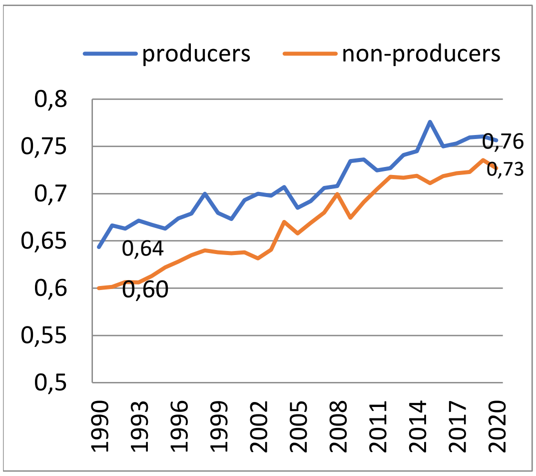


Figure B_ 3 Share of manufactured goods exports in total exports

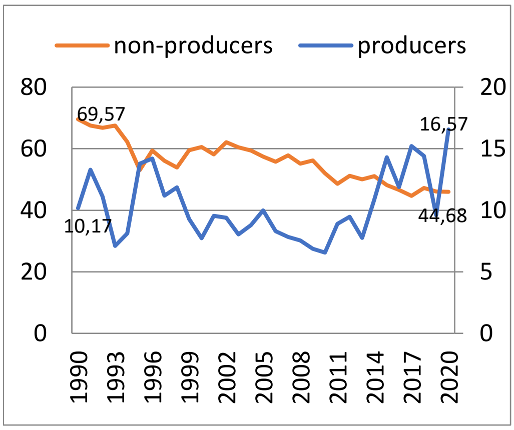
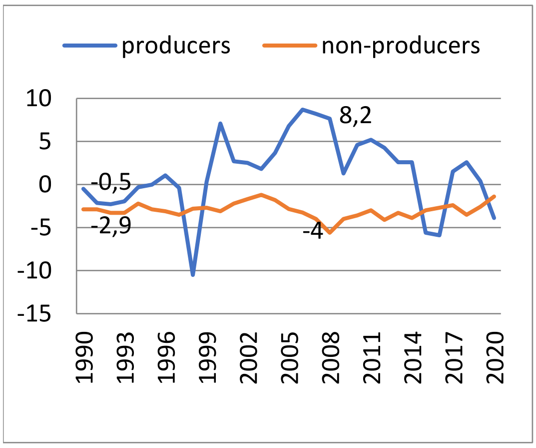


Figure B_ 4 Current account balance (% of GDP)



5 Estimated impacts

In this section, we present the data used, the impact estimation strategy and the results obtained. The section ends with a discussion of the results.

5.1 Data

This document combines data from a number of sources. In this section, we briefly present the main sources of the data.

An indicator of the discovery of at least one massive oil or gas field in a given country, in a specific year, serves as the main explanatory variable. We use the Horn data, which provides information on more than 900 massive oil and gas fields discovered onshore and offshore between 1868 and 2018. This data includes the date of discovery, the name of the discovering country and a variety of other factors. The analysis reveals that, during the period from 1980 to 2018, Asia accounted for 40% of major discoveries, followed by Europe (19%), Africa (17%), South America (10%), North America (9%) and Oceania (5%).

The economic indicators, that are the dependent variables, come from the World Bank database.

The sample consists of 130 countries. In order to avoid the disruptions caused by the two oil shocks of 1970, we focus on the period from 1980 to 2020. Thus, the discovery episodes, which represent only about 5% of the total sample, are not very frequent.

Table 2: descriptive statistic of main variables

Variable	Years	Maximum number of countries	Number of non-missing observations	Min	Median	Max
ISEME	1990-2020	81	2511	0.17	0.50	0.97
GDP growth (%)	1998-2020	130	4835	-50.3	3.6	151.6
Gross fixed capital formation as a share of GDP (%)	1980-2020	130	4430	-2.42	21.91	93.55
Inflation rate (%)	1980-2020	130	4466	-17.64	5.05	23773.13

Current account balance (% GDP)	1980-2020	125	4792	-242.20	-2.40	125.50
Gross Savings rate (% GDP)	1980-2020	105	3717	-236.27	21.19	87.10
Primary budget balance (% GDP)	1990-2020	125	3436	-557.50	-2.54	43.30
Cereal yield (kg per hectare)	1980-2020	130	5015	0.10	2158.60	36761.90
Share of manufacturing value added in GDP (%)	1980-2020	115	4137	0.23	13.34	49.88
Share of value added of medium- and high-tech industries in manufacturing (%)	1990-2019	112	3408	0.25	21.58	77.68
Weight of merchandise exports in GDP (%)	1980-2020	130	4631	0.01	28.39	133.34
The weight of inward foreign direct investment (FDI) in GDP (%)	1980-2020	125	4964	-40.09	1.48	279.35
Exports concentration index (Theil Index of Exports)	1980-2014	130	4163	1.14	3.37	6.42

5.2 Modelling

To test the impact of short- and medium-term discoveries on indicators of economic emergence, we estimate the following regression model.

$$Y_{i,t} = \alpha_i + B(Q) * D_{i,t} + \gamma_i + \rho_t + \varepsilon_{i,t}$$

where $Y_{i,t}$ is the dependent variable for country i at time t, (Q) is a delay operator of order q. $D_{i,t}$ is an indicator variable that indicates whether a discovery has occurred in country i at time t and γ_i and ρ_t are the individual and time fixed effects, respectively. This specification aims to trace the impact of a discovery over several years by including a large number of lags. It is similar to a quasi-experimental impact assessment that takes, at each date, the performance of countries that have not recorded discoveries as a counterfactual to the performance of countries with discoveries. Thus, the identifying assumption is that after controlling for the control variables, prior to treatment, the trends in the dependent variable within nations without field discoveries and within nations with field discoveries are the same.

In addition, it controls for country and year fixed effects such as individual country characteristics that are time invariant (geology, geography, culture) and time shocks common to all countries (oil and gas price movements, global recessions, pandemics...) One of the advantages of using an individual and time fixed effects model is that it can help improve the precision of estimates, by controlling for unobservable or unknown factors that may affect the results. This can be particularly important when studying complex economic phenomena, which may be influenced by external factors that are difficult to measure. In addition, a model with individual and time fixed effects can help solve common problems in econometrics, such as correlation between errors and explanatory variables, as well as non-stationarity of time series. This can lead to more reliable and robust estimates of the causal relationships between the variables under study.

Our period of analysis is 1980-2020, except for the regression with ISEME as the dependent variable, which is estimated for the period 1990-2020. In our baseline regressions, we choose a lag length of 10 years after the start of production, set at 5 years after discovery. Thus, the time dimension is reindexed, such that in the following equation, t is the number of years after the start of production.

We adjust the standard deviations of the regression coefficients to account for autocorrelation of the error terms for a given country. Error autocorrelation can impact the estimates of the regression coefficients, leading to biased standard errors and incorrect confidence intervals. By adjusting the standard deviations of the regression coefficients, this technique improves the accuracy of hypothesis testing and avoids estimation bias. To do this, we compute a robust estimate of the standard deviation that accounts for the correlation of errors within each unit of observation. Essentially, the variance of the errors is estimated separately for each unit and then averaged across all units.

We do not include a lagged dependent variable. The disadvantage of including the lagged dependent variable is the bias known as Nickell (1981). Since the bias is of order (1/T) and we have a relatively long panel of over 30 years, this is acceptable.

The ISEME and its indicators, for which data is available over the period 1980-2020 for the countries in the sample, are the dependent variables: variables of economic dynamism (GDP per capita growth, gross fixed capital formation), macroeconomic stability (inflation, gross savings rate, current account, fiscal balance), diversification and structural transformation (grain yield, weight of manufacturing value added in GDP, export concentration index, weight of medium and high technology industries in the manufacturing industry), insertion in the world economy (weight of exports of goods and services in GDP, weight of medium and high technology exports in total exports of goods, weight of foreign direct investment inflows in GDP).

Our basic assumption is that large-scale oil discoveries are exogenous and, thus, orthogonal to the nation's underlying economic conditions. However, an alternative hypothesis might argue that the discovery of oil or gas deposits depends on exploration effort which, in turn, depends on pre-existing economic conditions. Therefore, the causal influence could run the other way, from economic emergence to oil or gas discovery. However, while a country's characteristics may influence whether or not exploration activity occurs (Cust and Harding, 2014), as well as whether or not a large discovery is feasible, the timing of such a discovery is difficult to predict and may be viewed from a country's perspective as an unexpected shock. Therefore, we argue, in agreement with others in the literature (Harding et al., 2016), that the uncertainty surrounding explorations and the limited ability of nations and firms to initiate massive discoveries, make it plausible to assume that the timing of individual discoveries within a nation is exogenous.

5.3 Results

This section describes the results of various regression estimates of the impacts of oil and gas discoveries on the ISEME and its key indicators over a period of 15 years following the discovery, which corresponds, on average, to 10 years of production of these discoveries. These results will be interpreted and discussed in the following section.

Table 3: the results of various regression estimates of the impacts of oil and gas discoveries on the ISEME and its key indicators over a period of 15 years following the discovery

1. Impacts on Economic Dynamism and Macroeconomic Stability
- ***GDP per Capita Growth:*** In a discovering country, the growth is, on average, 4.27 percentage points higher in year 5 and 1.37 percentage points higher in year 6 after discovery.
- ***Gross Fixed Capital Formation (GFCF):*** - Positive impacts in all years, though not significant at the standard 5% threshold. In year 8, there's an increase by 0.86 percentage points in the share of gross investment in GDP.
- ***Inflation Rate:*** Impacts are not significant, on average, at the 5% or 10% threshold in all years.
- ***Current Account Balance*****:** Increases by 1.87 percentage points of GDP in year 2 and by 1.91 percentage points in year 5.
- ***Savings Rate:*** Significant increases in years 1, 4, and 6 with respective growths of 2.19 pp, 2.02 pp and 2.6 pp of GDP.
- ***Primary Budget Balance:*** **-** Year 2: +1.30 pp of GDP at the 5% threshold. - Year 4: +0.80 pp of GDP at the 10% threshold.
2. Impacts on Diversification and Structural Transformation
- ***Cereal Yields:*** Negative impacts, especially significant in years 1, 2, 3, 4, 8 and 9.
- ***Manufacturing Value Added in GDP:*** - Drops by 0.3 pp from years 8 to 10.
- ***Medium and High-Tech Industries****:* - A decrease starting year 2. - Significant drops of 1 pp, 0.8 pp and 0.84 pp in years 2, 3, and 8 respectively.
3. Impacts on Integration into the Global Economy
- ***Weight of Exports in GDP:*** Increases by 1.8 to 2.3 pp, on average, in years 1, 2, 5, 8, 9, and 10.
- ***Theil Index of Exports:*** Positive coefficients indicating increased concentration of goods sold abroad.
- ***FDI Weight in GDP:*** Irregular patterns with only year 5 showing significant impacts.
4. Impacts on Economic Emergence
- ***ISEME:*** Significant increase in the first six years of production by 0.01 points annually

5.3.1 Impacts on economic dynamism and macroeconomic stability.

Figures 1-6 in Panel C show the coefficients of interest for the regressions with the indicators of economic dynamism and macroeconomic stability as the dependent variables. Each figure shows the coefficient B_n corresponding to the impact on the dependent variable after n years of development of the discovered deposit. The figures also show the p-value and the 95% confidence interval (the horizontal bars) associated with each coefficient. Thus, a coefficient is significantly different from zero, if the associated horizontal bar does not meet the vertical line.

Figure C_2 in Panel C shows that the GDP per capita growth of the oil-discovering country is, on average, significantly higher than that of the counterfactual scenario in years 1, 2 (i.e., 5 and 6 years after discovery), 5 and 6, with a threshold of 5 percent. Thus, compared to the counterfactual scenario of no oil or gas discoveries, GDP per capita growth in a discovering country is, on average, 4.27 percentage points and 1.37 percentage points higher in years 5 and 6 after discovery, respectively. Similarly, GDP per capita growth is, on average, 1.35 percentage points of GDP and 1.31 percentage points of GDP higher than in the counterfactual scenario in years 5 and 6 respectively. It is important to note that all coefficients are positive, although some of them are not significant at standard confidence levels. This could be due to a true zero impact on average or heterogeneity in the exact timing of post-discovery development (set at 5 years prior to year 1 of field development). However, small increases in individual growth rates may not be significant, but still have a significant effect on the level of GDP per capita. At least two lags are statistically significant, indicating a significant increase in the level of the dependent variable.

The impacts on gross fixed capital formation as a share of GDP (GFCF), whilst positive in all years, are not significant at the standard 5 percent threshold, with the exception of year 8, where the share of gross investment in GDP increases by 0.86 percentage points relative to the counterfactual scenario (see Figure C_1). At the 10 percent threshold, the impacts are significant in years 4 and 9, with respective increases in the share of GFCF in GDP of 0.84 percentage points and 1.06 percentage points.

The impacts on the inflation rate, relative to the counterfactual scenario, are not significant, on average, at either the 5% or 10% threshold in all years (see Figure C_3).

PANEL C: Coefficients of interest for regressions with indicators of economic dynamism and macroeconomic stability as dependent variables.

Figure C_ 2 Impact of natural resource discoveries on GDP per capita growth

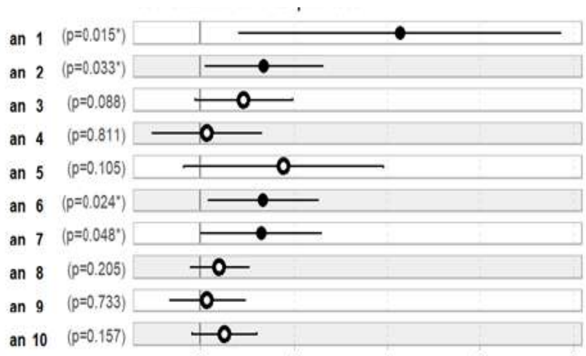


Figure C_ 1 Impact of natural resource discoveries on gross fixed capital formation

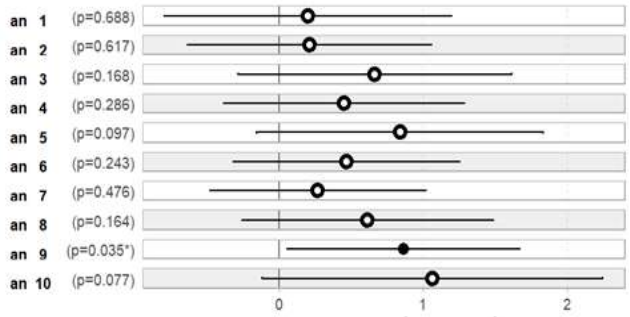


Figure C_ 4 Impact of natural resource discoveries on the inflation rate

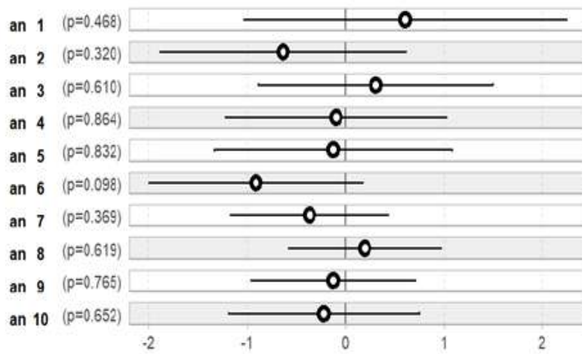


Figure C_ 3 Impact of natural resource discoveries on the budget balance

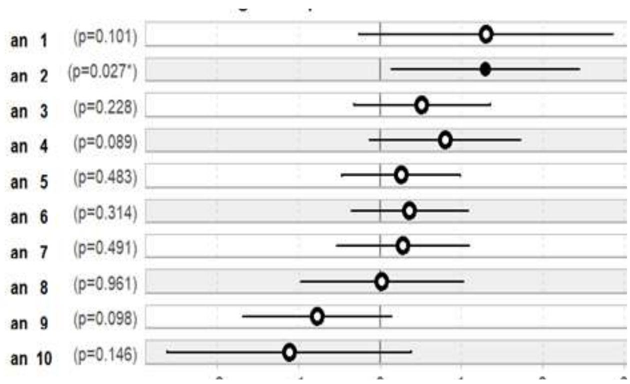


Figure C_ 6 Impact of natural resource discoveries on the savings rate

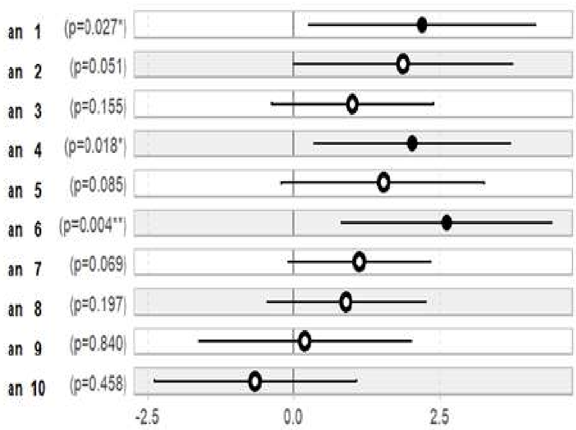
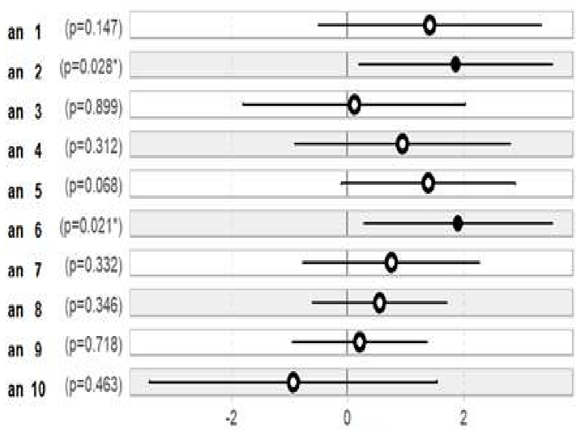


Figure C_ 5 Impact of natural resource discoveries on the current account balance



On the other hand, the current account balance increases significantly relative to the counterfactual scenario, by 1.87 percentage points of GDP, on average, in year 2 and by 1.91 percentage points of GDP, on average, in year 5, at the standard threshold (see figure C_5). Moreover, the impact on the current account balance is significant and positive in year 4, with an average increase of 1.39 percentage points of GDP compared to the counterfactual no-discovery scenario, at the 10% threshold. It is worth noting that all coefficients are positive in all years, indicating in the short and medium term an improvement in the current account balance, relative to the counterfactual scenario in the first decade of production from the discovered field five years before year 1, on average.

The savings rate shows significant increases, on average, at the standard threshold, in years 1, 4 and 6, of 2.19 percentage points of GDP, 2.02 percentage points of GDP and 2.6 percentage points of GDP, respectively. In addition, the impacts are positive and significant, at the 10% threshold, in years 2, 5 and 7. The impact on the primary budget balance is positive and significant in year 2, at the standard threshold, with an increase of 1.30 percentage points of GDP and in year 4, at the 10% threshold, with an increase of 0.80 percentage points of GDP.

In total, all the economic dynamism and macroeconomic stability variables studied, except for inflation, show positive dynamics, on average, relative to the counterfactual scenario, at least until year 7 of development.

5.3.2 Impacts on diversification and structural transformation.

Panel D shows the figures for the coefficients of interest in regressions, where the dependent variable is an indicator of diversification or structural transformation.

The coefficients associated with the impacts on grain yields are negative in all years and significant at the standard level in years 1, 2, 3, 4, 8 and 9. Similarly, all impacts on the share of manufacturing value added in GDP are negative over the whole decade. They are significant at the end of the period, from year 8 onwards at the standard threshold. Thus, the share of manufacturing value added in GDP is significantly lower than in the counterfactual scenario, by almost 0.3 percentage points of GDP for each year of the period from year 8 to year 10. At the 10 percent threshold, it is also significantly lower than in the counterfactual scenario, by 0.3 percentage points of GDP. The share of value added of medium- and high-tech industries in manufacturing falls earlier, starting in year 2. It drops significantly at the 5 percent threshold, by 1 percentage point, 0.8 percentage point and 0.84 percentage point in years 2, 3 and 8 respectively. At the 10 percent threshold, it drops significantly in all other years, except years 5 and 10.

PANEL D: Coefficients of interest in regressions where the dependent variable is an indicator of diversification or structural transformation.

Figure D_ 3 Impact of natural resource discoveries on grain yields

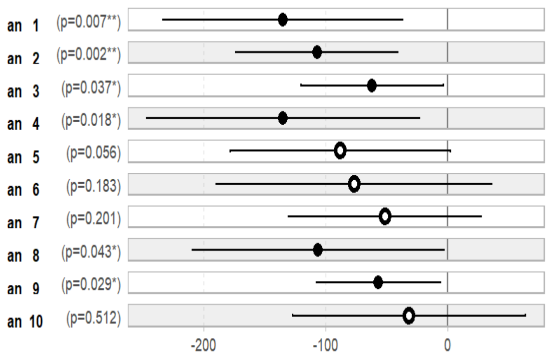


Figure D_ 2 Impact of natural resource discoveries on the weight of manufacturing value added in GDP

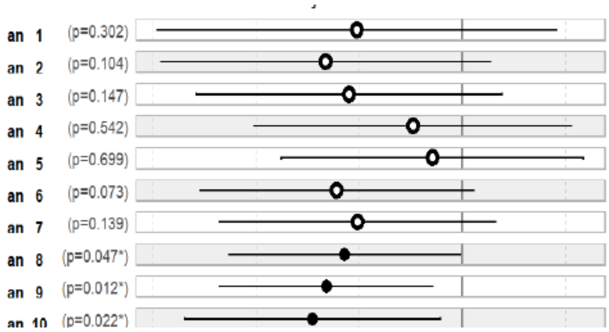


Figure D_ 1 Impact of natural resource discoveries on the weight of the industry in the GDP

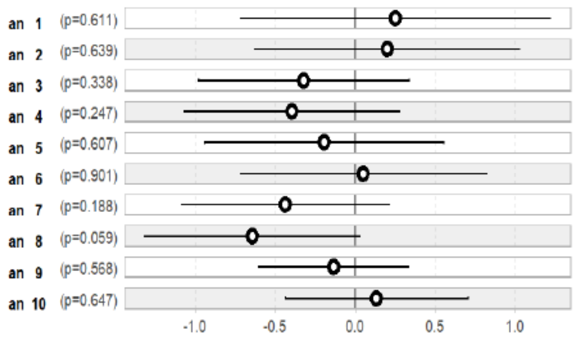
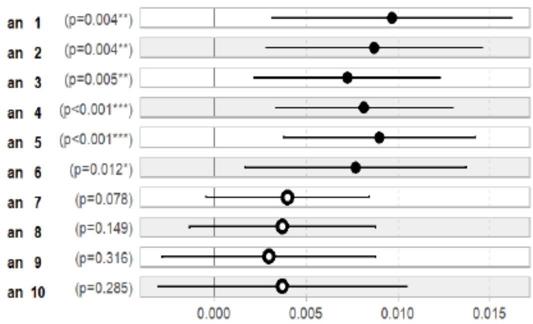


Figure D_ 4 Impact of natural resource discoveries on the ISEME



5.3.3 Impacts on integration into the global economy.

Figures E_1 to E_4 in panel E show the figures relating to the coefficients of interest of the regressions, whose dependent variable is an indicator of insertion in the world economy. The coefficients associated with the impacts on the weight of exports of goods and services in GDP are positive for all years and significant at the standard threshold for years 1, 2, 5, 8, 9 and 10. Thus, the weight of exports in GDP is significantly higher than in the counterfactual scenario by 1.8 to 2.3 percentage points of GDP, on average, in years 1, 2, 5, 8, 9 and 10 of production. This increase in the weight of total exports goes hand-in-hand with an increase in the concentration of goods sold abroad, as the coefficients associated with the impacts on the Theil index of exports are all positive in all years.

PANEL E: Coefficients of interest for regressions with an indicator of insertion in the world economy as the dependent variable

Figure E- 1 Impact of natural resource discoveries on the weight of exports in GDP

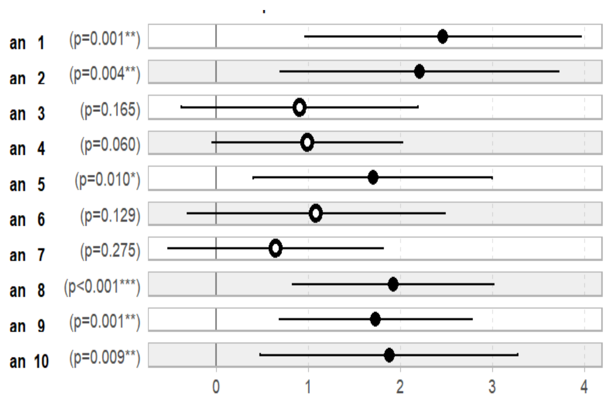


Figure E- 2 Impact of natural resource discoveries on the Theil index of exports

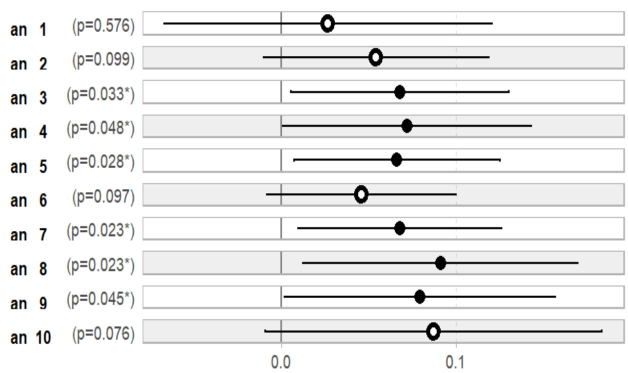


Figure E- 3 Impact of natural resource discoveries on FDI

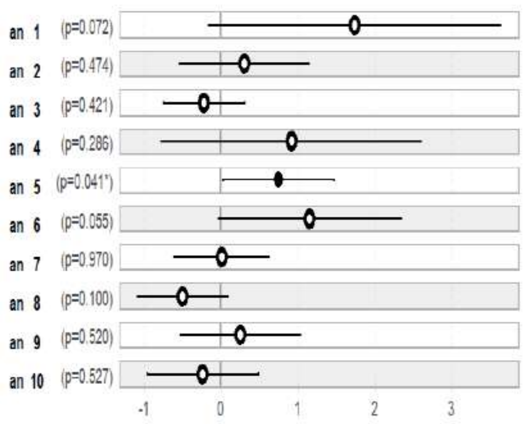
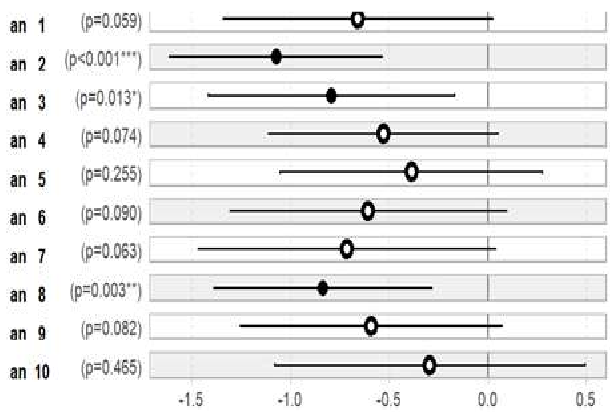


Figure E- 4 Impact of natural resource discoveries on the share of medium and high technology industries



They are significantly positive in years 3 to 5 and 7 to 9. As for the impact on the weight of inward foreign direct investment (FDI) in GDP, the signs of the associated coefficients do not describe a regular pattern and are not significant, except in year 5 of production. As a result, the increase in FDI is offset by an increase in GDP, thus showing an overall zero impact on the weight of FDI in GDP.

5.3.4 Global impacts on economic emergence

Figure D_4 in Panel D above presents the coefficients of interest associated with the regression of the Synthetic Index of Economic Emergence (ISEME) as the dependent variable. The coefficients are positive in all years and are significant at the standard threshold in years one through six. Thus, in the first six years of production, the ISEME increases significantly, on average, each year by 0.01 points relative to the counterfactual. This result shows the substantial short- and medium-term impact of oil and gas discoveries on the trajectory of economic emergence. For example, for a country that is pre-emerging and has a score of 0.5, such an increase each year for six years takes it more than halfway to joining the club of emerging nations.

5.3.5 Role of diversification, governance, human capital

Previous results have shown negative impacts of oil and gas development in the short and medium term on structural transformation variables, such as grain yields, the weight of manufacturing and the degree of export diversification. However, it should be noted that the results may vary according to specific contexts.

This section analyses the differentiated impacts according to the initial level of countries, in terms of economic diversification, governance and human capital. To do this, the sample is partitioned at the beginning of the period into two groups according to an indicator of economic diversification, governance or human capital. The regressions are then re-estimated with grain yield, the weight of the manufacturing industry and the degree of export diversification as dependent variables in each of the sub-samples. The indicators of economic diversification, governance and human capital used to partition the sample are, respectively, the Theil export index, the World Bank corruption index and the average number of years of schooling of the human development index. These indicators were chosen for their availability of data over a long period of time for most of the countries in the sample. The following table presents the thresholds associated with each indicator for dividing the sample into two groups. For example, for the criterion of economic diversification, the two groups are determined according to whether the Theil index, which ranges from 1 to 7 in the sample, was above or below 3 in 1980.

Table 4:Thresholds associated with the indicators for segmenting the sample into two groups for the differentiated analysis of short- to medium-term impacts on structural transformation variables

Indicators	Threshold	Sample start year	Country close to the threshold in the sample start year
Theil index of export concentration	3 over a data range of [1; 7].	1980	Kenya, Pakistan
Corruption Level index	1 on a range from [-1.5; 2.5].	1996	Botswana, Uruguay
Average number of years of schooling	6 on a range from [0; 13]	1990	Mexico, Malaysia,

Panel F in the Appendix presents the results for the economic diversification criterion. For the two structural transformation variables of grain yield and Theil index of exports, the impacts are negative in each year for the group of countries with low diversification in 1980, whilst they are largely zero or positive for the group with relatively high initial diversification in 1980. Thus, for the group with low diversification in 1980, the coefficients associated with cereal yields are all negative in every year and significant at the standard threshold for years 1, 2, 3, 4 and 9, whilst for the second group, the coefficients are not significant in every year, except for year 10 where the impact is even significantly positive. As for the differential impacts on the Theil index of exports, the coefficients are not significant for the group with high initial diversification, whilst they are significantly positive in years 4, 6, 8 and 9 for the group with low diversification in 1980, signalling an increase in export concentration. In contrast, the heterogeneity of the impacts on the weight of manufacturing value added between the two groups is weaker. Thus, the coefficients associated with the regression, with the share of manufacturing value added in GDP as the dependent variable, are significant and negative at the end of the period for both groups, although this occurs earlier for the group with low initial diversification.

Panels G and H in the appendix present the differential impacts on the three structural transformation variables, when the sample is divided successively according to the initial level of corruption or the average number of years of initial education. They show overall heterogeneous impacts that follow the same pattern, as when the sample is divided by the initial diversification criterion. However, the heterogeneity of impacts between the two groups increases with the corruption criterion relative to the diversification criterion. On the other hand, there is less heterogeneity in impacts between the two groups with the criterion of the initial level of human capital, compared to the criterion of the initial level of economic diversification.

5.4 Discussion of results

The results presented in the previous section suggest that oil and gas production can have significant impacts on economic dynamism and macroeconomic stability in the short and medium term, such as stimulating economic growth, investment and savings, as well as improving the current account and primary fiscal balances. These results are consistent with some of the academic literature on the economic effects of oil and gas production in the short and medium term.

These results are also consistent with developments in some countries during the first decade of oil exploitation in some countries. Norway experienced a significant improvement in all indicators of economic dynamism and macroeconomic stability over the ten-year period following the discovery of oil in the North Sea in 1969 (Olsen and Ugelvik Larsen, 2017). Another example is Qatar, which experienced a significant improvement in all indicators of dynamism and stability over a ten-year period after the discovery of natural gas in the 1970s (World Bank, 2021). These results were made possible by massive investments in infrastructure, education and health, as well as prudent management of oil and gas revenues (Mazraani and Nizar, 2020).

On the other hand, while Equatorial Guinea experienced a significant improvement in its economic growth, GFCF and primary fiscal balance after the exploitation of its oil and gas resources in the 1990s, this was accompanied by an increase in inflation and a deterioration in the current account balance and savings rate.

The economic mechanisms that explain the positive results of the economic dynamism and macroeconomic stability dimension are complex and may vary according to the specific context of each country. However, here are some possible explanations.

The increase in GDP per capita growth in oil and gas discovering countries can be explained by several economic mechanisms. First, the exploitation of these resources can lead to increased tax revenues and exports, which can be reinvested in the domestic economy and stimulate economic growth (Arezki and Brückner, 2011). In addition, the exploitation of natural resources can stimulate investment in the infrastructure needed to exploit these resources which, in turn, can stimulate economic growth (Ouedraogo, 2018). However, it should be noted that dependence on commodity exports can lead to increased vulnerability to external shocks, which can have negative consequences for long-term economic growth (Ross, 1999).

Oil and gas production can stimulate investment in the economy in the short term, in a number of ways. For example, oil and gas companies may need to invest in infrastructure, equipment and technology to extract and process hydrocarbons. In addition, oil and gas production may generate business opportunities for other related industries, which may stimulate investment in those sectors. Finally, oil and gas production can also stimulate investment by improving investor confidence in the economy.

Oil and gas production can improve the current account balance by increasing exports and reducing oil and gas imports. This can have a positive effect on the balance of trade and balance of payments, which can help improve the current account balance. In addition, oil and gas production can also generate revenue for the government in the form of taxes, royalties and equity in oil and gas projects, which can also help improve the current account balance.

Oil and gas production can stimulate savings in the economy in several ways. For example, revenues generated by oil and gas production can increase the disposable income of households, which can increase their ability to save. In addition, oil and gas companies may also save a portion of their revenues to finance future investments in the oil and gas industry.

However, in terms of diversification and structural transformation, the results show overall negative impacts on the indicators examined in the short and medium term. Negative impacts are noted on the yield of cereals, as well as on the share of manufacturing value added and the share of value added of medium and high technology industries in manufacturing.

The overall negative impacts of oil and gas development on structural transformation can result from several factors. Oil and gas production can negatively impact agriculture in several ways. First, oil and gas production can lead to competition for land use, which can reduce the amount of cultivable land and affect crop yields. In addition, oil and gas production can lead to environmental pollution, including water pollution, which can affect crop yields and crop quality. Finally, oil and gas production can result in intensive use of water resources, which can reduce access to water for irrigation and affect crop yields.

Oil and gas production can negatively impact the manufacturing industry in several ways. First, oil and gas production can lead to an overvaluation of the domestic currency, which can make manufactured exports less competitive in international markets. In addition, oil and gas production can lead to higher production costs, especially due to higher raw material and energy prices, which can affect the competitiveness of the manufacturing industry. Finally, oil and gas production can lead to de-industrialisation, due to the concentration of investment and jobs in the oil and gas sector rather than in manufacturing.

However, the results show that the negative impacts on structural transformation indicators disappear when the discovering country is initially endowed with a diversified economy, a high level of human capital, or a low incidence of corruption.

It is possible to identify some mechanisms that may explain why the negative impacts of oil and gas development on structural transformation indicators disappear when the discovering country is initially endowed with a diversified economy, a high level of human capital, or a low incidence of corruption.

First, a diversified economy may be able to offset the negative effects of natural resource exploitation by providing other opportunities for growth and employment. For example, if the country has a developed manufacturing industry or a vibrant service sector, it may be able to maintain or increase output and employment in these sectors despite the expansion of the extractive industry. This can help mitigate the negative effect of resource dependence on the structural transformation of the economy.

In addition, a high level of human capital can help mitigate the negative effects of natural resource exploitation by improving the quality of workers and promoting innovation. For example, if the country has a large number of well-trained workers and high-level researchers, it may be better equipped to develop new technologies and economic sectors, which can promote economic diversification and structural transformation.

Finally, a low incidence of corruption can help mitigate the negative effects of natural resource exploitation by allowing for more responsible use of revenues generated by the extractive industry. If governments are less likely to use extractive industry revenues for personal or political gain, they may be more likely to invest in economic and social development projects that can foster structural transformation of the economy.

6 Conclusion

The relationship between hydrocarbon wealth and economic emergence remains a complex and controversial debate in the economic literature. Whilst some authors have asserted the existence of a resource curse, others have emphasised the beneficial effects of natural resource exploitation. In this context, this research aimed to contribute to the debate on the economic impacts of oil and gas resource development by estimating, using lagged-effects panel models on a sample of 130 countries covering the period from 1980 to 2020, the causal link between giant hydrocarbon discoveries and a synthetic indicator of economic emergence, as well as the key indicators of which it is comprised. We also examined the potential heterogeneity of this relationship, as a function of the country's initial levels of export diversification, education level and governance indicators.

The results show that oil and gas production can have significant and positive impacts on economic dynamism and macroeconomic stability in the short and medium term, such as stimulating economic growth, investment and savings, as well as improving the current account and primary budget balances. However, in terms of diversification and structural transformation, negative impacts have been observed overall, particularly on cereal yields, manufacturing value added and the export concentration index. However, the negative impacts on structural transformation indicators disappear when the discovering country is initially endowed with a diversified economy, a high level of human capital or a low incidence of corruption.

In summary, this study has helped inform the debate on the relationship between hydrocarbon wealth and economic emergence. The results showed that the economic impacts of oil and gas production can be both positive and negative, depending on the indicators examined and the country's initial levels of export diversification, education levels and governance indicators.

Following the exploration of the ties between hydrocarbon discoveries and economic emergence, the impact of governance structures and corruption emerges as a pivotal area of inquiry. How might the quality of governance modulate the positive or negative effects of these discoveries on economic emergence? And, in a context where education has already been identified as a key variable, a deeper exploration of how hydrocarbon wealth impacts educational infrastructure and opportunities could provide illuminating insights. Moreover, whilst our research spanned a broad sample of 130 countries, a regional analysis might refine our understanding. The cultural, political and economic specificities of regions, such as the Middle East, Africa and South America could uniquely influence the relationship between hydrocarbon wealth and economic emergence.

The policy implications of this study are important for governments of resource-rich countries seeking to achieve economic emergence. The results suggest that governments need to put in place effective economic and fiscal policies to capture the benefits of oil and gas production, whilst mitigating the negative effects on diversification and structural transformation.

An important first policy implication is the need for governments to strengthen institutions and governance, to ensure accountable and transparent management of natural resources. Governments should work to improve transparency and accountability in the management of natural resources, ensuring that oil and gas revenues benefit the population as a whole and combating corruption and opportunistic behaviour, such as rent-seeking. Indeed, weak or corrupt governance can lead to negative effects on the economy and society, such as the enrichment of a few at the expense of the majority of the population, misallocation of resources, political and social instability, as well as a negative perception of foreign investment.

A second policy implication is the need for governments to promote economic diversification, to mitigate the negative effects of oil and gas production on the economic structure. Economic policies should aim to improve the quality of institutions, promote economic diversification and invest in human capital, in order to stimulate innovation and growth in non-oil sectors. Indeed, an economy that is overly dependent upon oil and gas can make the economy vulnerable to fluctuations in commodity prices and global market volatility, thereby limiting diversification and innovation in other economic sectors.

A third policy implication is the need for governments to establish sovereign wealth funds, to manage oil and gas revenues in a prudent and sustainable manner, investing in non-oil sectors and diversifying revenue sources to prepare for the future and mitigate the risks of commodity price volatility. SWFs can help governments manage oil and gas revenues responsibly, ensure efficient and equitable use of natural resources and preserve wealth for future generations.

In conclusion, the policy implications of this study highlight the need for governments in resource-rich countries to put in place effective economic and fiscal policies to manage oil and gas revenues, whilst promoting economic diversification and investing in human capital. These policies can help resource-rich countries achieve economic emergence in a sustainable and inclusive manner, maximising the benefits of oil and gas production.

7 Bibliography

- Alexeev, M. and Conrad, R. (2009). The elusive curse of oil. Review of Economics and Statistics, 91(3),
- Arezki, R., & Brückner, M. (2012). Resource windfalls, political regimes, and political stability. European Economic Review, 56(6),
- Arezki, R., & van der Ploeg, F. (2014). Do Natural Resources Depress Income Per Capita? IMF Working Paper, WP/14/59.
- Arezki, R., Brückner, M. (2012). Commodities boom, volatility and Dutch disease: Evidence from Africa. Journal of Development Economics, 97(1),
- Arezki, R., Hadri, K., Loungani, P., & Rao, Y. (2014). Testing the Prebisch-Singer Hypothesis using Primary Commodity Prices. IMF Working Paper, WP/14/202.
- Auty, R. M. (2001). The political economy of resource-driven growth. European Economic Review, 45(4-6),
- Bhattacharyya, S. and Hodler, R. (2010). Natural resources, democracy and corruption. European Economic Review, 54(4),
- Bhattacharyya, S. and Hodler, R. (2014). Natural resources and state fragility. Journal of Development Studies, 50(7),
- Bhattacharyya, S., Collier, P., and Hodler, R. (2014). Adding fuel to the fire? Social spillovers and political conflict in oil-rich countries. OxCarre Research Paper, Oxford Centre for the Analysis of Resource Rich Economies, University of Oxford.
- Birdsall, N. and Subramanian, A. (2004). Saving Iraq from its oil. The Brookings Institution Policy Brief, No. 128.
- Brollo, F., et al. (2010). Political connections and preferential access to finance: The role of campaign contributions. Journal of Financial Economics, 97(3),
- Brunnschweiler, C. N., & Bulte, E. H. (2008). The resource curse revisited and revised: A tale of paradoxes and red herrings. Journal of Environmental Economics and Management, 55(3),
- Brunnschweiler, C. N., et al. (2008). An empirical test of the Dutch disease hypothesis using a gravity model of trade. The Journal of Development Studies, 44(8),
- Caselli, F., & Cunningham, T. (2009). Leader behaviour and the natural resource curse. Oxford Economic Papers, 61(4),
- Corden, W. M. (1984). Booming sector and Dutch disease economics: survey and consolidation. Oxford Economic Papers, 36(3),
- Cust, J., & Mihalyi, D. (2017). How do oil discoveries affect international capital flows? Journal of International Money and Finance, 73,
- Gylfason, T., et al (1999). Natural resources and economic growth: The role of investment. Scottish Journal of Political Economy, 46(2),

- Gylfason, T., Herbertsson, T. T., & Zoega, G. (1999). A mixed blessing: Natural resources and economic growth. Macroeconomic Dynamics, 3(2),
- Hamilton, J. D. (2009). Causes and consequences of the oil shock of 2007-08. Brookings Papers on Economic Activity, 1,
- Hamilton, J. T. (2009). Oil prices, exhaustible resources, and economic growth. Handbook of Energy and Climate Change, 1,
- Havranek, T., Irsova, Z., and Janda, K. (2016). Publication bias in the literature on the resource curse. Energy Economics, 57,
- Hernandez, L. F., et al. (2018). Oil and macroeconomic volatility in Latin America and the Caribbean: A multivariate GARCH approach. Journal of Applied Economics, 21(1),
- IMF. (2009). Libya: Selected issues paper. IMF Country Report No. 09/169.
- IMF. (2016). Staff discussion note: Rethinking macroeconomic policy. IMF Country Report No. 16/003.
- Isham, J., Woolcock, M., Pritchett, L., and Busby, G. (2005). The varieties of resource experience: natural resource export structures and the political economy of economic growth. World Bank Economic Review, 19(2),
- Khorsravi, B., et al. (2018). Long-run relationship between oil prices and inflation in Iran, Iraq, Kuwait, and Saudi Arabia. Energy Economics, 74,
- Koren, M. and Tenreyro, S. (2007). Volatility and development. Quarterly Journal of Economics, 122(1),
- Lederman, D. and Maloney, W. F. (2008). Neither curse nor destiny: introduction to natural resources and development. World Bank Publications.
- LO Moubarack and SyAmaye (2021), "Manuel de l'émergence économique", Ed. Harmattan, January 2021
- LO, M. (2017). Economic emergence and development prospects: Essay on the structural transformation of the Senegalese economy. L'Harmattan.
- Lyatuu, G., Morrissey, O., and Sinning, M. (2021). The resource curse: A meta-analysis. Energy Policy, 149, 112036.
- Mehlum, H., Moene, K., and Torvik, R. (2006). Institutions and the resource curse. Economic Journal, 16(508), 1-20.
- Ouédraogo, R. (2014). Do natural resources depress income per capita in the long run? Review of Development Economics, 18(4), 651-663.
- Papyrakis, E., & Gerlagh, R. (2007). Resource abundance and economic growth in the United States. European Economic Review, 51(4),
- Ramey, G. and Ramey, V. A. (1995). Cross-country evidence on the link between volatility and growth. American Economic Review, 85(5),
- Ross, M. L. (2001). Does oil hinder democracy? World Politics, 53(3),
- Ross, M. L. (2015). What have we learned about the resource curse? Annual Review of Political Science,

- Sachs, J. D. and Warner, A. M. (1995). Natural resource abundance and economic growth. National Bureau of Economic Research Working Paper, No. 5398.
- Sachs, J. D., & Warner, A. M. (2001). The curse of natural resources. European Economic Review, 45(4-6),
- Sala-i Martin, X., & Subramanian, A. (2003). Addressing the natural resource curse: An illustration from Nigeria. IMF Working Paper, WP/03/139.
- Sala-i Martin, X., & Subramanian, A. (2013). Addressing the Dutch disease: Policy options. In Managing the China Challenge (Springer, New York, NY.
- Van der Ploeg, F. (2011). Natural resources: curse or blessing? Journal of Economic Literature, 49(2),
- Van der Ploeg, F., & Venables, A. J. (2013). Natural resource wealth: the challenge of managing a windfall. Annual Review of Economics, 5,
- Velasco, A. (1997). The resource curse: A misunderstanding? The World Bank.
- Warner, A. M. (1995). Economic growth and natural resource abundance: A cross-country analysis. International Centre for Economic Growth Working Paper, No. 95-12.
- Warner, A. M. (1997). Natural resource dependence and economic performance in the 1960-1990 period. World Development, 25(8),

8 Appendices

8.1 Appendix 1: List of the 130 countries in the sample

Afghanistan	Argentina	Azerbaijan	Benin
Albania	Armenia	Bahrain	Bolivia
Algeria	Australia	Bangladesh	Botswana
Angola	Austria	Belgium	Brazil
Brunei	Cabo Verde	Central African Republic	Congo (Brazzaville)
Bulgaria	Cambodia	Chad	Congo, Dem. Rep.
Burkina Faso	Cameroon	China	Croatia
Burundi	Canada	Colombia	Cyprus
Czechia	Equatorial Guinea	Gabon	Greece
Denmark	Ethiopia	Georgia	Guinea
Ecuador	Finland	Germany	Guinea-Bissau
Egypt	France	Ghana	Guyana
Haiti	Indonesia	Israel	Jordan
Honduras	Iran	Italy	Kazakhstan
Hungary	Iraq	Ivory Coast	Kenya
India	Ireland	Japan	Korea, Rep.
Kuwait	Lithuania	Mali	Moldova
Lebanon	Madagascar	Mauritania	Mongolia
Liberia	Malawi	Mauritius	Morocco
Libya	Malaysia	Mexico	Mozambique
Myanmar	New Zealand	Norway	Peru
Namibia	Nicaragua	Oman	Philippines
Nepal	Niger	Pakistan	Poland
Netherlands	Nigeria	Papua New Guinea	Portugal
Qatar	Saudi Arabia	Spain	Switzerland
Romania	Senegal	Sri Lanka	Syria
Russia	Sierre Leone	Sudan	Tajikistan
Rwanda	South Africa	Sweden	Tanzania
Thailand	Turkiye	Ukraine	Uzbekistan
Togo	Turkmenistan	United Kingdom	Venezuela
Trinidad and Tobago	UAE	United States	Vietnam
Tunisia	Uganda	Uruguay	Yemen
Zambia			
Zimbabwe			

8.2 Appendix 2: Case Studies

GHANA

In 2007, the Jubilee oil field, the country's largest, was discovered off the coast of Ghana, followed by other major oil and natural gas discoveries in the region. Oil exports began in 2010, marking a turning point in Ghana's economic history which, until then, had been primarily focused on agriculture, with exports of cocoa and gold. It is interesting to compare Ghana's economic performance ten years before and ten years after the start of hydrocarbon development in the country. On average, over the period from 2010 to 2019, the economic growth rate increased significantly to 6.7% from an average of 5.3% between 2000 and 2010. The growth of value added in the manufacturing industry also accelerated between 2010 and 2020 (8.89%) compared to the period from 2000 to 2010 (1.37%). Inflation fell sharply from an average of 21.25% between 2000 and 2010 to 11.97% between 2010 and 2020. The share of manufactured goods in merchandise exports increased to 29.99% between 2010 and 2020, whilst 10 years ago it stood at 22.07%. The share of GFCF in GDP has remained almost at the same level, with an average over the period from 2010 to 2020 of 20.61%, compared to 20.82% over the period 2000-2010. However, performance in terms of grain yield growth, primary fiscal balance and current account balance deteriorated, on average, in the post-oil production period. Grain yield growth slowed, on average, from 3.44 percent between 2000 and 2010 to 0.8 percent, on average, between 2010 and 2020. The primary fiscal balance averages -7.48 percent of GDP for the 2010-2020 period, whilst the average was -4.04 percent of GDP for the 2000-2010 period. Ghana's current account balance remained negative, on average, for the 2010-2020 period at -5.24 percent of GDP, higher than the 2000-2010 period of -4.67 percent. Theil's index of export concentration increased slightly between the two periods. Overall, in terms of economic emergence, the country's ISEME score increased from 0.35 to 0.41 between the two periods. Ghana has, thus, become an aspiring emerging country.

In conclusion, oil development in Ghana has had a significant impact on the country's economy. Since the start of hydrocarbon exploitation in 2010, economic growth has increased significantly, inflation has fallen sharply and the share of manufactured goods in merchandise exports has increased. However, performance in terms of grain yield growth, primary fiscal balance and current account balance has deteriorated, on average, in the post-oil production period.

Level of economic emergence indicators	GHANA		Comparator countries: (Benin, Burkina Faso, Ivory Coast, Senegal and Togo)	
	2000-2010	2010-2020	2000-2010	2010-2020
Real GDP growth (annual percentage change)	5.57	5.92	3.11	5.12
Annual inflation rate	21.25	11.97	2.64	1.13
Gross fixed capital formation (% of GDP)	20.82	20.61	16.57	22.48
Exports of manufactured goods (% of merchandise exports)	22.07	29.99	26.02	2.,47
Manufacturing, value added (% of GDP)	8.34	9.79	13.06	11.68
Medium and high technology manufacturing value added (% of manufacturing value added)	1.37	8.89	18.97	18.51
Annual growth in grain yields (%)	3.44	0.80	8.37	7.95
Grain yield (kg per hectare)	1446	1803	1109	1454
Exports of goods and services (% of GDP)	33.77	32.14	22.28	27.22
Budget balance (% of GDP)	-4,04	-7.48	-1.45	-3.46
Current account balance (% of GDP)	-4.67	-5.24	-4.63	-4.29
Theil index of exports	3.92	4.1	3.52	3.61
ISEME	0.34	0.41	0.35	0.4
HDI	0.53	0.6	0.42	0.5

BRAZIL

Brazil has a long history of exploiting its natural resources, including hydrocarbons. However, this activity became particularly important for the Brazilian economy in the late 2000s, especially with the discovery in 2008, 2010 and 2013 of so-called pre-salt oil fields off the coast of Brazil. The exploitation of pre-salt oil fields began in 2008, after the discovery of large reserves of oil and natural gas in this region. Today, the pre-salt oil fields produce a large portion of Brazil's oil and natural gas production, making the country one of the leading hydrocarbon producers in Latin America. Below is a comparison of Brazil's economic performance before (2000-2010) and during (2010-2020) the hydrocarbon exploitation period. GDP growth is 0.95% between 2010 and 2020, whilst it was 3.41% 10 years before. Gross fixed capital formation (as a % of GDP) has remained almost stable, rising from 20.82% of GDP to 20.69%. Exports of goods and services fell from 13.21% to 12.77% of GDP. The weight of the value added of the manufacturing industry in the GDP remained almost stable, passing from 35.04% to 34.77% between the two periods. The share of manufactured goods in merchandise exports fell sharply to 32.06% between 2010 and 2020, from an average of 50% over the previous decade. Growth in grain output slowed from 4.2% to 3.3%. The Theil index of export concentration increased from 2.0 to 2.6 during the period, explaining less diversified exports. The fiscal and current account deficits deteriorated sharply, each doubling their pre-salt levels. The country's ISEME score declined between 2010 and 2020 (0.667 to 0.610), whereas it had increased sharply between 2000 and 2010 (0.587 to 0.667).

Level of economic emergence indicators	Brazil		Reference countries: Canada, Argentina, Germany, France, Denmark	
	2000-2010	2010-2020	2000-2010	2010-2020
Real GDP growth (annual percentage change)	3.41	0.95	1.58	1.078
Gross fixed capital formation (% of GDP)	17.93	17.97	20.3	20.35
Exports of goods and services (% of GDP)	13.21	12.77	33.84	35.22
Grain yield (kg per hectare)	3172.22	4718.67	5264.44	5838.6
Exports of manufactured products (% of goods)	50.03	32.6	63.44	60.38

ISEME	0.62	0.64	0.72	0.71
HDI	0.69	0.75	0.87	0.9
Annual inflation rate	6.7	5.82	1.83	1.35
Budget balance (% of GDP)	-3.39	-6.72	-0.93	-2.2
Current account balance (% of GDP)	-0.77	-2.7	2.02	1.94
Theil index of exports	2	2.55	1.87	2.04
Manufacturing, value added (% of GDP)	13.81	10.77	15.17	13.49
Medium and high technology manufacturing value added (% of manufacturing value added)	35.04	34.77	42.49	46.32
Annual growth in grain yields (%)	4.20	3.26	12.04	8.75

EQUATORIAL GUINEA

Equatorial Guinea is a country that began to exploit its hydrocarbon reserves in the 1990s. Indeed, oil deposits were discovered in the country's territorial waters in 1991. Since then, the exploitation of hydrocarbons has become an important pillar of the country's economy. Oil and gas account for over 90% of Equatorial Guinea's exports and over 60% of its GDP. Equatorial Guinea's economic development has been mixed during the two periods under review, 1980-1996 and 1996-2020. The gross fixed capital formation ratio remained relatively stable between the two periods. In contrast, real GDP growth increased sharply, from an average of 7.71 percent between 1980 and 1996 to an average of 19.94 percent between 1996 and 2020. The Theil index of export concentration also increased sharply, from an average of 4.96 to an average of 5.69 between the two periods. The current account balance improved, from an average of -19.9% of GDP to -13.3% of GDP. The ISEME score and the fiscal balance also improved from 0.45 to 0.54 and from -297.08 percent of GDP to 2.21 percent of GDP, on average, respectively. The annual inflation rate increased slightly, from 2.81 percent to 4.27 percent. In summary, Equatorial Guinea experienced strong economic growth between 1996 and 2020, but with continued dependence on the oil industry. The country has also improved some of its economic indicators, such as the current account balance and the fiscal balance. However, challenges remain in diversifying the economy and improving human development.

Level of economic emergence indicators	Equatorial Guinea		Reference countries: Congo, Cameroon, Equatorial Guinea, Gabon, CAR	
	1980-1996	1996-2020	1980-1996	1996-2020
Gross fixed capital formation (% of GDP)		27.97	21.73	23.26
Real GDP growth (annual percentage change)	7.71	19.94	2.53	2.93
Export Diversification Index (Index)	4.96	5.69	5.026	5.094
Current account balance as a percentage of GDP (Percentage of GDP)	-19.9	-13.3	-0.68	2.33
ISEME	0,.5	0.54	0.33	0.39
HDI		0.57	0.47	0.48
Annual inflation rate	2.81	4.27	6.1	2.7
Budget balance (% of GDP)	-297.08	2.21	-4.76	0.5
Manufacturing, value added (% of GDP)		19.24	9.26	10.53

8.3 Appendix 3: Tables of regression results

	Dependent variable		
	GDP per capita growth rate (%)	Grain yield (% GDP)	Manufacturing VA weight in GDP (%)
	(1)	(2)	(3)
Year 1	4.276**	-131.472*	-0.096
	(1.762)	(74.840)	(0.296)
Year 2	1.366**	-93.113**	-0.235
	(0.639)	(37.791)	(0.273)
Year 3	0.916*	-48.906	-0.129
	(0.537)	(34.594)	(0.234)
Year4	0.143	-113.249**	0.018
	(0.597)	(51.733)	(0.231)
Year 5	1.775	-85.193	-0.038
	(1.096)	(57.116)	(0.238)
Year6	1.352**	-58.209	-0.256
	(0.599)	(55.344)	(0.227)
Year7	1.306**	-72.240	-0.208
	(0.661)	(64.078)	(0.204)
Year8	0.403	-78.867	-0.330**
	(0.318)	(58.948)	(0.166)
Year 9	0.139	-69.316*	-0.399***
	(0.407)	(37.736)	(0.153)
Year 10	0.509	-13.286	-0.519***
	(0.360)	(62.996)	(0.185)
Observations	3.908	4.016	3.558
F Statistic	14.148*** (df = 10; 3741)	1.244 (df = 10; 3847)	1.708* (df = 10; 3389)
Note:			*p<0.1;** p<0.05;*** p<0.01

	Dependent variable

	Gross savings rate (% GDP)	Primary budget balance (% GDP)	Current account balance (% GDP)
	(1)	(2)	(3)
Year 1	2.185**	1.305	1.419
	(0.990)	(0.796)	(0.978)
Year 2	1.868*	1.297**	1.866**
	(0.958)	(0.586)	(0.851)
Year 3	1.006	0.516	0.124
	(0.707)	(0.428)	(0.976)
Year4	2,021**	0.803*	0.956
	(0.856)	(0.472)	(0.946)
Year 5	1.525*	0.260	1.394*
	(0.883)	(0.371)	(0.765)
Year6	2.612***	0.368	1.908**
	(0.915)	(0.365)	(0.828)
Year7	1.132*	0.286	0.754
	(0.622)	(0.415)	(0.777)
Year8	0.890	0.025	0.555
	(0.690)	(0.509)	(0.590)
Year 9	0.187	-0.772*	0.214
	(0.927)	(0.467)	(0.592)
Year 10	-0.654	-1.114	-0.927
	(0.882)	(0.765)	(1.264)
Observations	1.997	2.282	2.143
F Statistic	5.921*** (df = 10; 1847)	3.366*** (df = 10; 2126)	2.728*** (df = 10; 1988)
Note:			*p<0.1; ** p<0.05; *** p<0.01

8.4 Appendix 4: Figures on differentiated impacts according to the initial level of countries, in terms of economic diversification, human capital and governance

PANEL F: differentiated impacts according to the initial level of countries, in terms of economic diversification

Figure F_ 1 Impact of natural resource discoveries on cereal yields (high diversification country group)

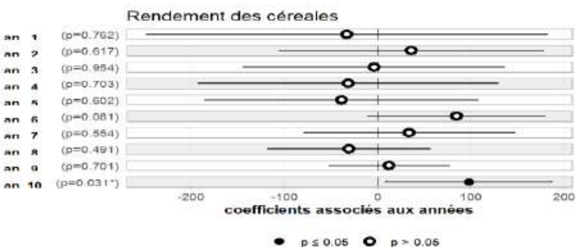


Figure F_ 2 Impact of natural resource discoveries on cereal yields (low diversification country group)

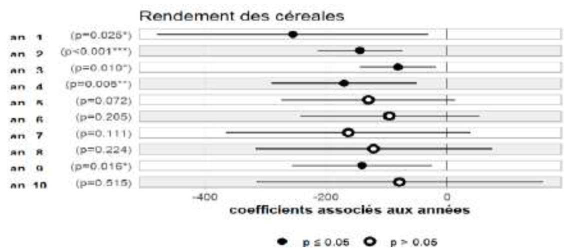


Figure F_ 4 Impact of natural resource discoveries on the Theil index of exports (low diversification group)

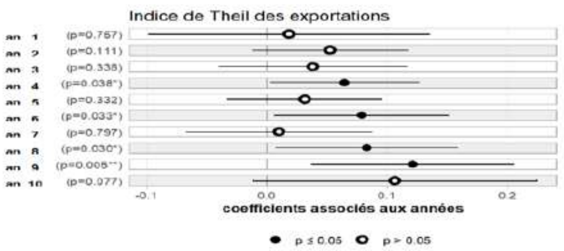


Figure F_ 3 Impact of natural resource discoveries on the Theil index of exports (high diversification group)

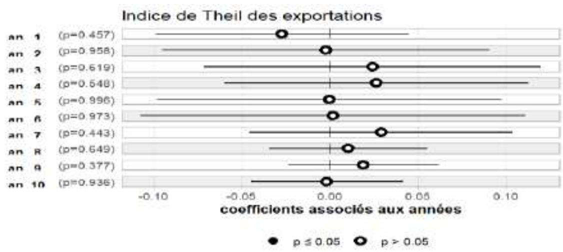


Figure F_ 5 Impact of natural resource discoveries on the weight of manufacturing value added (high diversification country group)

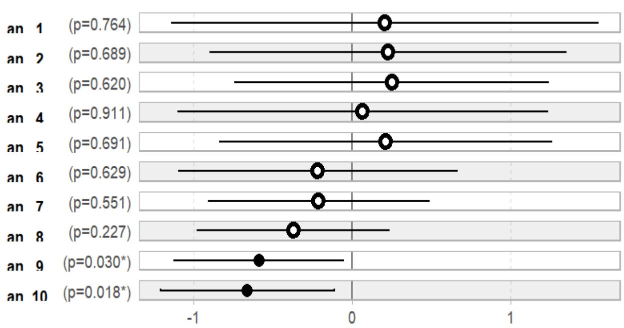
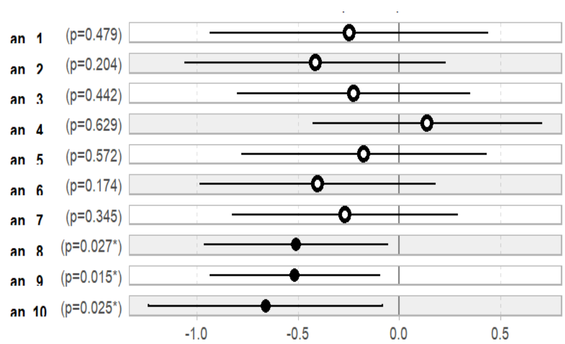


Figure F_ 6 Impact of natural resource discoveries on the weight of manufacturing value added (group of countries with low diversification)



PANEL G: Differentiated impacts according to the initial level of human capital in countries

Figure G_ 2 Impact of natural resource discoveries on the Theil index of exports (group of countries with high initial human capital)

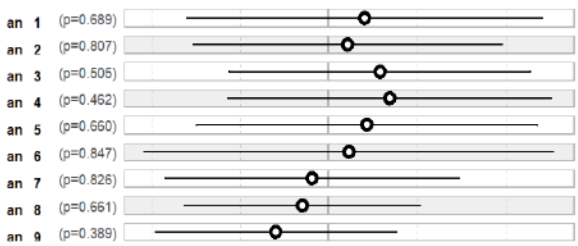


Figure G_ 1 Impact of natural resource discoveries on the Theil Index of exports (group of countries with low initial human capital)

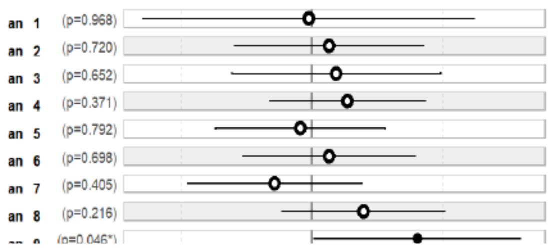


Figure G_ 4 Impact of natural resource discoveries on grain yield (group of countries with low initial human capital)

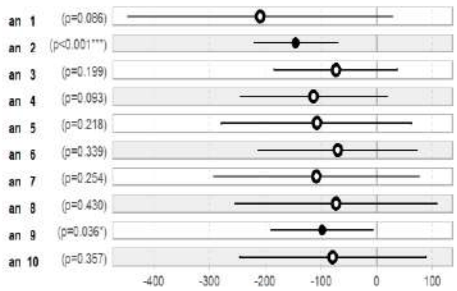


Figure G_ 3 Impact of natural resource discoveries on grain yield (group of countries with high initial human capital)

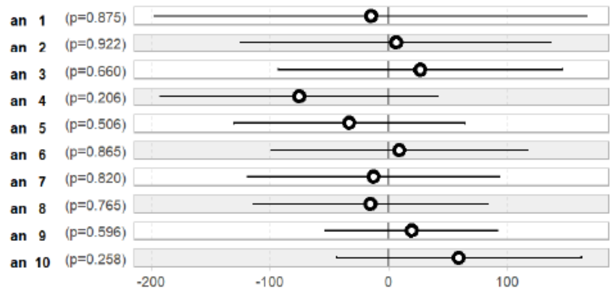


Figure G_ 6 Impact of natural resource discoveries on the weight of manufacturing value added (group of countries with high initial human capital)

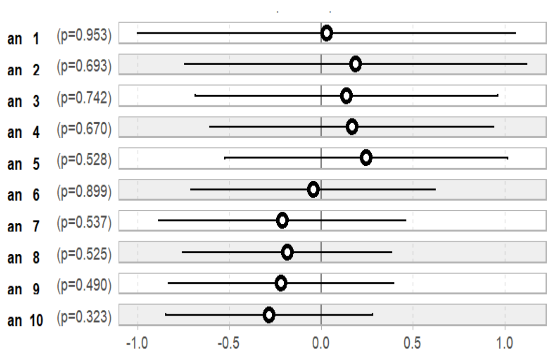
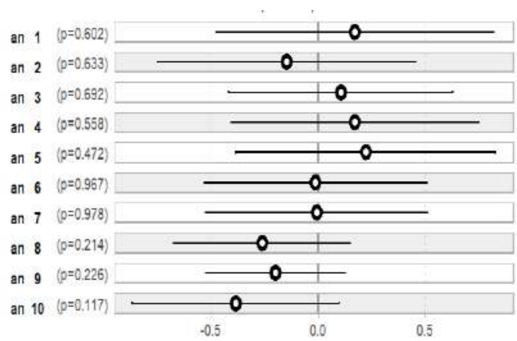


Figure G_ 5 Impact of natural resource discoveries on the weight of manufacturing value added (group of countries with low initial human capital)



PANEL H: Differentiated impacts according to the initial level of governance of countries

Figure H_ 2 Impact of natural resource discoveries on the Theil index of exports (group of countries with low initial corruption)

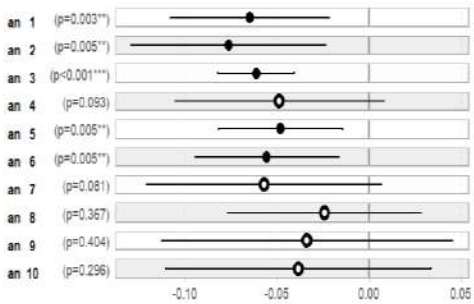


Figure H_ 1 Impact of natural resource discoveries on the Theil index of exports (group of countries with high initial corruption)

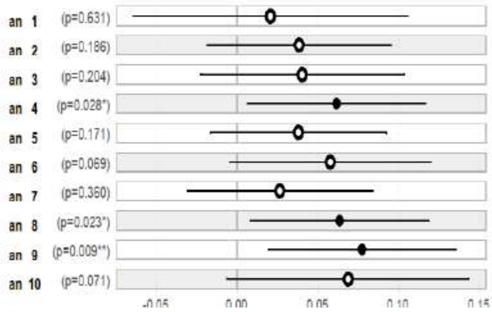


Figure H_ 6 Impact of natural resource discoveries on grain yields (group of countries with low initial corruption)

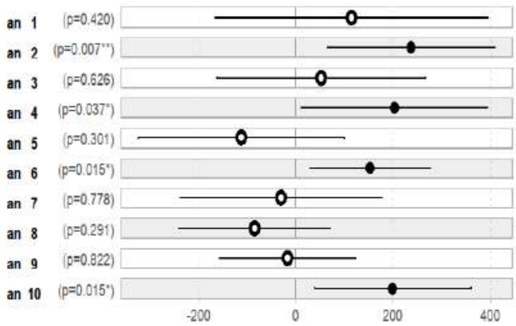


Figure H_ 3 Impact of natural resource discoveries on grain yields (group of countries with high initial corruption)

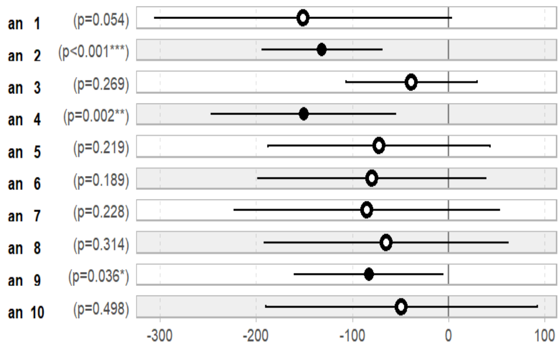


Figure H_ 5 Impact of natural resource discoveries on the weight of manufacturing value added (group of countries with low initial corruption)

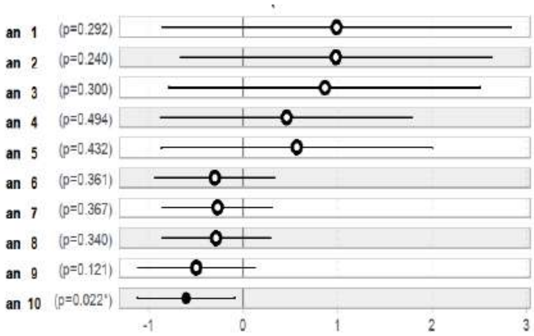
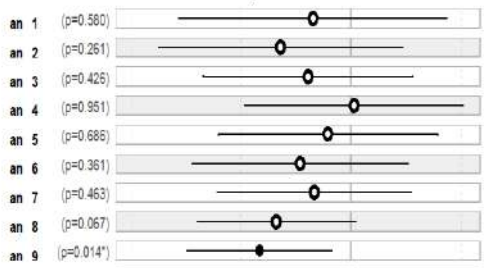


Figure H_ 4 Impact of natural resource discoveries on the weight of manufacturing value added (group of countries with high initial level of corruption)



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- Macroeconomic policies and employment creation;
- Private sector, micro, small and medium –sized enterprises development, entrepreneurship and social business;
- Digital economy;
- Healthcare policy;
- Human capital development, education, innovation, skill mismatch and migration;
- Labor markets, employment and employability;
- Finance, financial inclusion and the real economy;
- Sustainable development;
- Regional integration;
- Euro-Mediterranean economic partnership;
- Scenarios analysis and foresight.

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