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The international oil price trend: an interpretation model from the 1970s to the beginning of the shale revolution

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Abstract

This work aims at proposing an interpretation model of the international oil market and its price formation based on the classical surplus approach recovered by Sraffa, Garegnani and his followers. Therefore, we are dedicated to showing that the international oil price trend has been regulated by two production prices: (i) a floor, determined by American technology and production costs, plus an absolute private rent; and (ii) the production price, applied to periods of high demand, determined by the technology and production costs of the marginal producer, plus an absolute state rent. This interpretation model is illustrated in this work in the period that goes from the 1970s to the mid-2010s (beginning of the shale revolution).

Keywords: production price, production costs, classical surplus approach, oil**.**

JEL CODE: B12, B24, Q34, Q48

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Introduction

In addition to being an input that is directly and indirectly employed in the production of all other goods, a "basic good" according to Sraffa (1960), and as it is an important raw material for transport and industry, the relevance of oil is reinforced due to its geopolitical and military importance, established in the First World War. Given its relevance, several important empirical studies are carried out in order to understand its market and explain the short-term movements of its international prices. In contrast, the objective in this work is to contribute to a structural interpretation of the market and to study the trend of international oil prices in the long term, in an attempt to indirectly contribute to the conjunctural analyses themselves, focusing on the period comprising the 1970's to the beginning of the shale "revolution" (mid-2010s).

To this end, it is interesting to analyze the sector in order to integrate the economy and the geopolitics (AYOUB, 1994), and look for structural and persistent elements that can offer an interpretation of the trend in international oil prices. In this sense, it is argued that the classical surplus approach, recovered by Sraffa, Garegnani and their followers, can provide us with the necessary tools. According to this approach, the production price, a theoretical and long-term price, around which the observed market prices revolve (gravitate), reflects technology and production costs. Such costs are given, in turn, by the distribution of income among wages, profits and land rent, and the historical and social contexts in which the economy is inserted (GAREGNANI, 1977). Therefore, by understanding how the oil production price is defined, we can better comprehend the market price movements observed in practice.

Within this approach, an important element for the elaboration of the interpretation model for the trend of international oil prices proposed is the idea of classical competition linked to capital mobility. For example, we can see that a significant portion of the world demand is met by OPEC countries that have advantages in terms of quality, location and flow of oil. However, this group does not meet all of the world demand, causing regions of higher cost to be activated in times of heavy demand and high prices, as during the 1970s and 2000s. It is, therefore, an application of the Ricardian extensive rent theory, linked to competitive factors. It is important to highlight that the shortage of the best quality oil

considered in this work is artificially created by OPEC in order to sustain prices at the desired levels, as we will see.

In this context, the rent theory present in the classics, not only in Ricardo, but also in Smith and Marx, for example, is one of the foundations of the construction of the proposed model. For instance, in addition to the illustration above, the 1970s and 2000s demonstrate that, in those years of high prices, the bargaining power of oil field owners – the State, in general – increased, contributing to field nationalization processes and increasing the rent earned by producing countries, which Marx refered to as absolute rent (SERRANO, 2013; AGUILERA and RADETZKI, 2015).

In addition, the relationship between the United States and OPEC, especially Saudi Arabia, stands out as an essential element in this work. Americans are the world's largest consumer of oil and, since the 1960s, they have significantly increased their imports. Even before that, the country realized the geopolitical importance of oil and contributed to establishing the presence of its large companies in the Middle East, where large OPEC producers are concentrated (TREBAT, 2005). In exchange for military support, the country increased its presence in the region and developed an especially close relationship with Saudi Arabia, the Organization's largest producer and the largest holder of idle capacity. In return, a tacit agreement seems to have been signed: the Saudis, acting as a swing producer, have maintained an idle capacity in order to raise prices to a certain extent able to cover the costs of production in the United States and its largest exporters, such as Canada. (AYOUB, 1994; ROUTLEDGE, 2003; SERRANO, 2004). This relationship started to be shaken by the shale revolution in mid-2014, when the United States significantly increased its production, becoming less dependent on the world supply regulation by OPEC, which, in turn, contributed to the reduction of oil prices. (KALETSKY, 2015; CHANDRASEKHAR, 2016).

In this context and in order to study the trend of international oil prices according to the classical surplus approach, the work is divided into 3 (three) sections: in the next part, we briefly present the process of oil market price gravitation towards the natural price. Then, we present the idea of two oil production prices through the central aspects of classical theory of rent in order to build the interpretation model proposed in the work; finally, we

carry out a historical analysis focusing on the period between the 1970s until the mid-2010s (beginning of the shale revolution). The work then ends with the conclusions.

1 The gravitation process and the competition mechanism

The classical surplus approach, the theoretical foundation of this work, is based on a structural analysis of the economy, or even on a long-term method, which takes into account the persistence of the independent economic variables of its analytical structure: the real wage, technology and the social product. (GAREGNANI, 1976, 1977).

According to this approach, the natural production price is a theoretical long-term price, which reflects the costs of production given by technology and by the distribution of income among social classes: capitalists, who receive profits; landowners, who receive rents; workers, who receive wages. According to Smith (1983), the natural price is the lowest price that can be systematically set for a product, as it covers the costs necessary for production: rents, wages and profits at its natural rates. In contrast, market prices are empirical and conjunctural prices, for which products are commonly sold and for which it is difficult to draw a theory given their oscillation and unpredictability (SMITH, 1983; CICCONE, 1999).

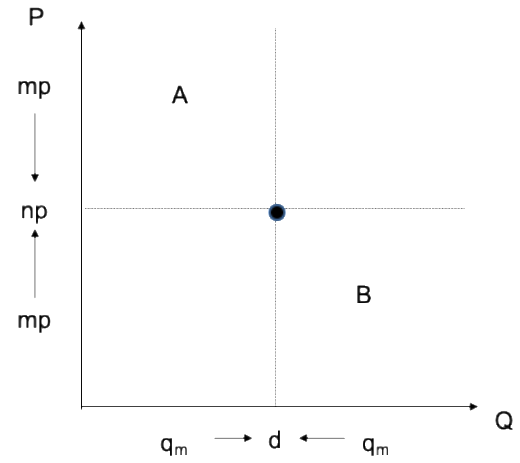
Given the assumption of the persistence of the long-term method, changes in the natural price tend to be slower than accidental and frequent changes in market prices, making it possible to analyze the gravitation[2] of the latter to the former: "(..) That persistence was tought to ensure that changes in the causes, if continuous, would be sufficiently slow as not to endanger the gravitation towards the (slowly moving) long-period values" (GAREGNANI, 1976, p.28). So, in general, given the impossibility of theorizing market prices, what is known about them is that their center of gravitation is the natural price, which reflects the sustainable price under competitive conditions. In this process, competition, understood as mobility, is central both to guaranteeing uniform prices and profits, and to determining the dominant technique and dividing the surplus among social classes (GAREGNANI, 1977).

[2]As references for the topic we have, for example, Gareganani (1976,1977), Ricardo (1985), Smith (1983), Vianello (1989), Ciccone (1999, 2011) and Eatwell (1982).

Therefore, considering that the speed of changes in the natural price is lower than the speed of changes in market prices, since the first reflects structural conditions (changes in technology and income distribution), which take longer to change, while the second reflects conjunctural conditions; we can expect that, as much as there are changes in the natural price, market prices will be attracted by its gravitational center, going towards it.

If we consider a model for only one sector[3] and assume the natural price remains unchanged, the process of gravitation can be simplified in the figure below.

Figure 1 – The process of market price gravitation towards the natural price



Source: Based on Garegnani (1983).

According to the discussion carried out by Garegnani (1983), in the northwest region that will be referred to as A, the quantity put in the market *qm* is below the effective demand *d*, so the *mp* market prices rise above the natural price *np*. Given this situation, the gravitation process will take place through the competition mechanism, given by the mobility of capital or other factors of production. For Smith[4] (1983), the three social

[3] For the case of gravitation involving more than one sector and its related problems, see Serrano (2003) and Caminati (1990).

[4] "If at any time the quantity of every commodity brought to market exceeds the effectual demand, some of the component parts of its price must be paid below their natural rate. If it is rent, the interest of the landlords will immediately prompt them to withdraw a part of their land; and if it is wages or profit, the interest of

classes are agents of mobility. However, if we consider that the mobility of factors is triggered by the mobility of capital and assume that the profit rates are beyond the natural rate[5], other producers will be attracted to the sector and even those who are already within the sector will feel stimulated to increase production. As a consequence, the quantity put on the market *qm* increases and approaches the effective demand *d*. The opposite occurs when we start from B.

In this context, it is also important to clarify the transmission channel of the demand at the natural price according to the classical surplus approach. For this, two examples can be mentioned. First, in the example of Adam Smith's pin factory, the author shows that increasing the division of labor increases labor productivity and expands returns to scale. That is, the increase in production required to meet demand takes place at decreasing production costs. Thus, the greater effective demand is associated with a lower natural price. Market prices, in turn, fluctuate around the natural price during this process, tracing a downward trend.

Second, in the example of David Ricardo's land rent, the author shows that the increase in production required to meet demand is met by inferior (land) production methods, with decreasing returns to scale. In other words, the increase in production required to meet demand takes place at increasing production costs. Thus, greater effective demand is associated with a higher natural price. Such as in the previous case, but in the opposite direction, market prices, in turn, fluctuate around the natural price during this process, tracing an increasing trend.

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the labourers in the one case, and of their employers in the other, will prompt them to with- draw a part of their labour or stock from this employment. The quantity brought to market will soon be no more than sufficient to supply the effectual demand. All the different parts of its price will rise to their natural rate, and the whole price to its natural price". (SMITH, 1983, p.85)

[5] The competition understood as mobility considered in this example is more in line with the vision of Ricardo and Marx. Both conceive the mobility of factors triggered by capital mobility, in contrast to Smith, who conceives the three classes as agents of mobility. For details on this discussion, see Eatwell (1982) and Vianello (1989).

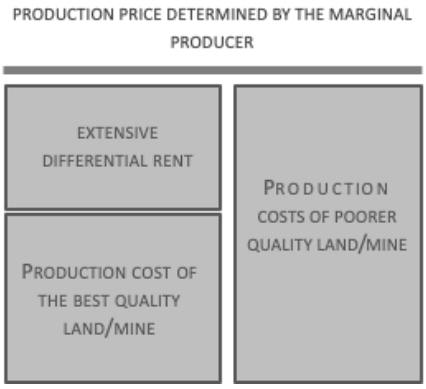
Therefore, as the market prices oscillate around the natural price, which reflects the production costs, we can say that, in general, those prices will tend to reach the production costs.

Furthermore, in this context, demand matters as it affects production costs through a change in method (either by improving the method, as in the Smith's pin factory; or by worsening it, through natural land scarcity, as in Ricardo – or even through "artificial scarcity" as we will see in the case of oil –, which lead to the use of inferior methods).

2 The central aspects of the theory of rent and the two oil production prices

The central objective of this Section is to present the main aspects of the classical theory of rent and the idea of the two oil production prices in order to build the interpretation model for the trend of the product's production prices. First, Ricardian extensive differential rent refers to the fact that land/mines of better quality or location are scarce[6]. Furthermore, Ricardo (1815, 1817) supposes the competition mechanism – given by the mobility of capital – is in operation, guaranteeing uniform profit rates and uniform prices. Then, when there is an increase in demand, market prices rise and enable production in poorer quality land/mines, which have a higher production cost and need to be used. As a result, there is an extensive differential rent on better quality land/mines, which have a lower production cost, and the natural production price is now defined by the marginal producer[7]. Such ideas can be summarized in the figure below.

Figure 2 – Extensive differential rent and the production price



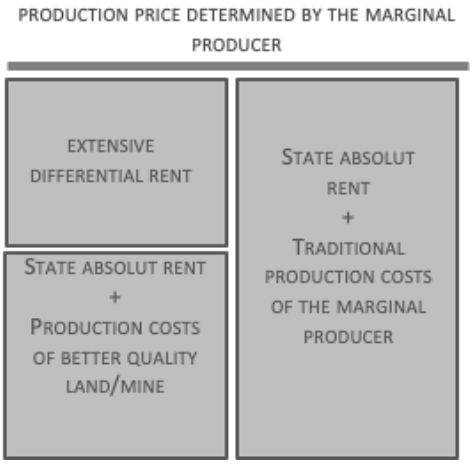
Source: Own elaboration. *traditional costs include normal profit

[6]As we will see later, in the case of oil, this shortage is artificially created by Saudi Arabia.

[7]As other references to deepen this result, we suggest Serrano and Freitas (2008) and Garegnani (1977). For Sraffian contributions on the topic see Kurz (1978), Sraffa (1985), Montani (1975), Fratini (2008, 2009) and Serrano (2010). For an analysis on intensive differential rent applied to non-renewable resources see Parrinello (2004).

The absolute rent, a concept originally developed by Marx (1909)[8], can be seen as a kind of "tax" the landowners charge from the capitalists who produce in their lands, even though the resource is abundant (not scarce). In this sense, it is associated with the relative bargaining power between resource owners and capitalists, and therefore depends on historical and political circumstances. In this context, it is important to emphasize the fact that the subsoil, from which minerals and main fuels are extracted, is, in most countries, property of the State, with the exception of the United States, where the subsoil is private. Thus, in addition to the payment of the differential rent due to the need to produce on less fertile land, the price determined by the marginal producer must cover the absolute rent. Since the price depends on absolute rent, then absolute rent must be taken for granted in order to determine the production price. In view of this, Fratini's (2009) suggestion is to treat absolute rent just as classical economists treated it, that is, as a fraction or part of the gross product of the land.

Figure 3 – Absolute rent and the production price



Source: Own elaboration.

* traditional costs include normal profit

[8]For the development of the concept of absolute rent, Marx (1909), Piccioni and Ravagnani (2002), Fratini (2009) and Ravagnani (2006) stand out.

Finally, another concept relevant to the development of the argument is the concept of monopoly rent. Originally developed by Smith (1983), the concept of monopoly rent relates to the circumstances in which market prices remain permanently above the natural price, or even above normal production costs, and the quantity brought to the market remains permanently below the effective demand, characterizing a state of scarcity or rationing, thus being incompatible with the competition. From an analytical point of view, monopoly rent is residually determined: as the difference between the exogenously determined price and the production costs (including normal profit). At this point, in order to move forward in defining one of the production prices of the oil market, we will use the case of this product as an illustration.

In this sense, Serrano (2004, 2013) discusses the relevance of the political strategies of different States, related, in turn, to the relationship between Saudi Arabia and the United States and to the American energy policy, in order to analyze the international oil market. As Saudi Arabia has the highest idle capacity among OPEC countries, it adjusts, in the period analysed in this work, the Organization's offer and, therefore, acts as a swing producer, so that the price does not fall below what would prevent production in the United States. In this sense, a price floor is maintained, which covers the costs of the United States and its main exporters (such as Canada), which are, in turn, higher.

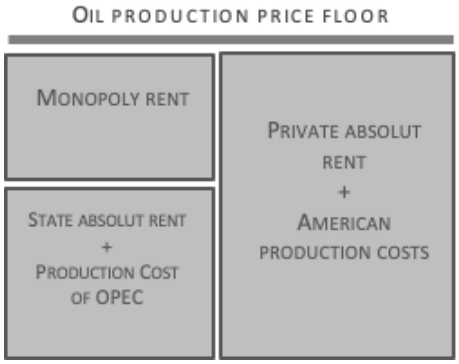
This floor[9] is similar to a "fixed price", determined exogenously by the political-economic relationship between Saudis and Americans, and generates a monopoly rent[10] for the OPEC countries. It is important to highlight that the owners of the resources, who receive the absolute rent of American companies, are the national private owners. This is

[9]This idea of a floor for oil production price as a consequence of the American energy policy is corroborated by Ayoub (1994), an author who considered a "bilateral oligopoly model", with Saudi Arabia and the United States as the main market players in the international oil industry. Regarding the floor price that the United States struggles to maintain – in exchange for offering military protection – the author highlights what is behind the strategy of the American energy policy: guaranteeing not only the feasibility of their own production, but also protecting their main import sources.

[10]As Fratini (2009) shows, in these markets, the normal price is a monopoly price which, therefore, is incompatible with situations of free competition, unlike absolute rent.

demonstrated by Rutledge, as shown by Rutlegde (2003): “In order to gain access to the subsoil mineral, the operator of an oil well must pay a royalty to the landowner. The value of this royalty was historically 12,5% of the value of the oil when sold”. (RUTLEDGE, 2003, p.05). A simplified model of this idea is presented below:

Figure 4 – Oil production price floor



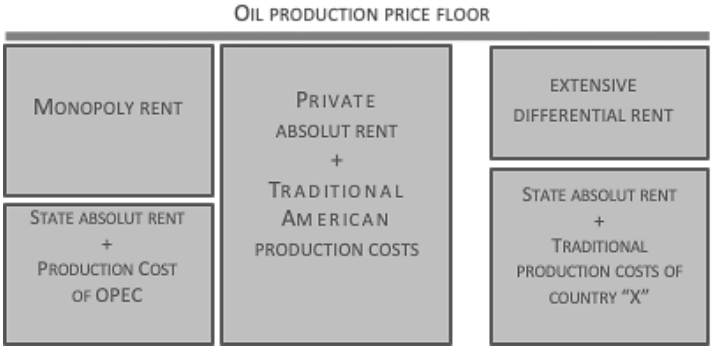
Source: Own elaboration.

* traditional costs include normal profit

The production price floor may change mainly according to the relative bargaining power between the United States and Saudi Arabia (impacting monopoly rent), but also due to changes in American production costs, or to changes in relative bargaining power among resource owners and American companies (impacting private absolute rent). Let us suppose, however, that it is a determined?? number. If, in this context, country X produces at a cost lower than the American cost (already including normal profit and absolute rent, which it must pay to the government (in most countries the subsoil belongs to the State), it will receive an extensive differential rent[11] – even if its cost is higher than that of OPEC – as shown below.

[11]Regarding the extensive differential rent applied to non-renewable resources, as argued by Kurz and Salvadori (2009), the capacity restriction depends on the quantity already extracted from a given mine and if the effective demand cannot be met only by the most productive mine. Therefore, the non-abundance (scarcity) of equally productive mines and the presence of a capacity constraint require the use of mines of different productivities, in order to meet the effective demand for the resource.

Figure 5 – Production at costs lower than floor in country X

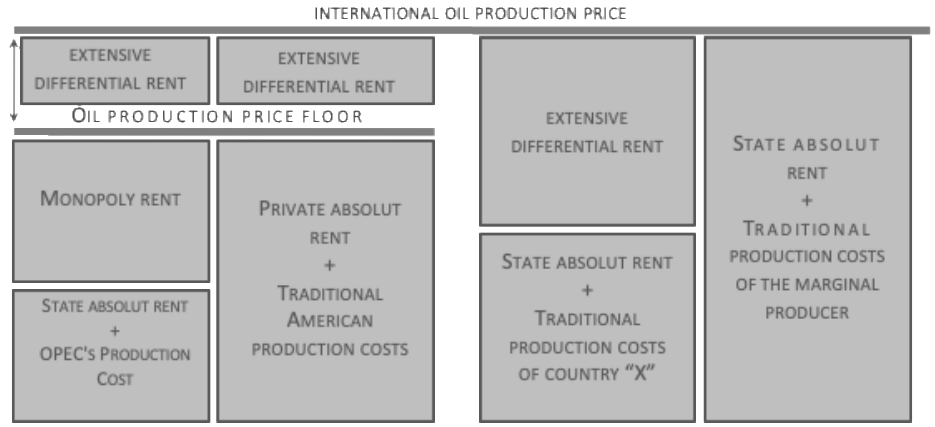


Source: Own elaboration.

* traditional costs include normal profit

Now, let us suppose, finally, that there is an increase in global demand. In view of this, production in other higher-cost regions becomes viable, raising the natural production price given by the cost of the marginal producer (the producer that needs to be activated to meet demand). In order to clarify the center of the argument, let us assume the production price floor does not change. As a result, Saudi Arabia and the United States receive an extensive differential rent, since they produce at a lower cost than the marginal producer, and country X starts to receive an extensive rent greater than in the previous case. This is demonstrated in the simplified model below.

Figure 6 - Increase in demand



Source: Own elaboration. * traditional costs include normal profit

Thus, it is suggested that there are two oil production prices: a floor, determined by technology and by traditional American production costs, plus an absolute private rent;

and the natural production price, determined by technology and the traditional production costs of the marginal producer, plus an absolute state rent.

In the next Section, we will illustrate the idea that the international oil price trend has been regulated by these two production prices, by analyzing the behavior of product prices between the 1970s and the mid-2010s (beginning of the shale revolution).

3 The historical evolution of the oil market and its price trends

At the end of World War II, the United States consolidated itself in the Persian Gulf region in order to directly control the region's reserves in exchange for military support (TREBAT, 2005). Thus, until the early 1970s, the oil price system was determined through concession contracts between large companies, predominantly American, and in Middle Eastern countries. With the increasing power of producing countries in relation to companies, whose control over oil production dropped from 99.4% in 1950 to 92% in 1957, according to Roncaglia (2015), governments started to claim the purchase of part of their rights to their country's reserves and some nationalized their fields.

3.1 The 1970s

As noted, until the 1960s, almost the entire global oil industry was privately owned, with the exception of that of the Soviet Union, which nationalized its fields in 1920; Mexico, in 1938; and Iran, in 1951. In the 1970s, several OPEC countries used the "direct participation" strategy to reduce the space of foreign companies, while others - such as Algeria, Libya, Iraq and Venezuela - nationalized their fields directly. As a result, according to Aguilera and Radetzki (2015), by 1979, 55% of the world's oil production had become state-owned.

According to Ayoub (1994) based on Penrose (1988): "[...] we can consider the abolition of the concession system and the nationalization of the oil companies in the OPEC countries as perhaps the most important turning point in the oil industry". With nationalization, in addition to regaining control over their reserves and production, states, especially those of OPEC, increased their bargaining power to the extent that they can extract as much rent as possible by increasing royalties (absolute rent).

At the same time, with the reduction of American idle capacity, the United States began to increase their imports of OPEC oil. Thus, in 1973, the country decided to discontinue its official import quotas and became strongly concerned with its energy policy. This

policy was intended not only to supply its market, but also to expand its reserves (SERRANO, 2004). In order to achieve these objectives, it was necessary to maintain the viability of its industry, with costs much higher than those of OPEC. According to Ayoub (1994), based on data from Adelman (1986): "(...) the replacement cost of a barrel of oil extracted in 1978 in the US was nearly 69 times higher than the corresponding cost in Saudi Arabia: $0.13/bbl in Saudi Arabia and $8.06/bbl in the US"(AYOUB, 1994, p. 55). Thus, in order to maintain the viability of their industry, it was in America's interest to keep oil prices high, and therefore they accepted the increase in royalties (absolute rent) charged by the Organization.

The Yom Kippur War took place at the beginning of the decade (in 1973): Syria and Egypt attacked Israel in retaliation for the Israeli annexation of Syrian and Egyptian territories in 1967 (among them, the Suez Canal). As a result, Arab members of OPEC, such as Libya and Kuwait, announced an embargo on exports to Western countries that supported Israel (especially the United States)[12]. In addition, they restricted production and broke concession contracts with companies. As a result, oil market prices rose substantially: from US$ 13/barrel in 1971 to US$ 55/barrel in 1974 (BP, 2016). Thus, American behavior was intensified by the Yom Kippur war, resulting in the 1973 oil crisis (RONCAGLIA, 2015, p. 157).

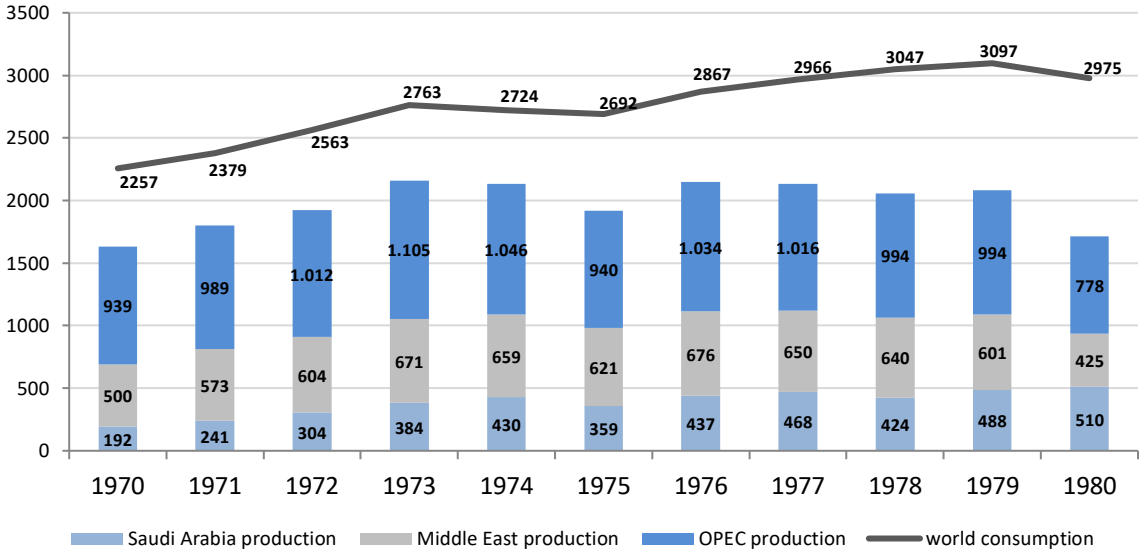
Ayoub (1994) argues that if, on the one hand, high prices - largely due to American choices - fostered nationalization and greater market control by OPEC, they also attracted new producers with higher production costs (such as Norway, Mexico, Egypt and some African and Asian countries), affecting the oil production price. As a result, we can see the weakening of OPEC when comparing its market share in the early 70s (almost 50%) to its decline after the middle of the decade, which was accentuated mainly in the 80s, when it came to represent only 30% of the market (BP, 2016).

We can see from the graph below that world demand continuously increased during the decade, with a slight decrease between 1974 and 1975. However, this increase in demand was not followed by the production of the best quality and lowest cost fields from OPEC

[12]The Saudi embargo would be lifted in 1974 through an agreement between the Americans and Egyptians.

and the Middle East in general. This effort fell mainly on Saudi Arabia which, in addition to carrying out the greatest expansion, increased its relative participation. This indicates a greater Saudi idle capacity.

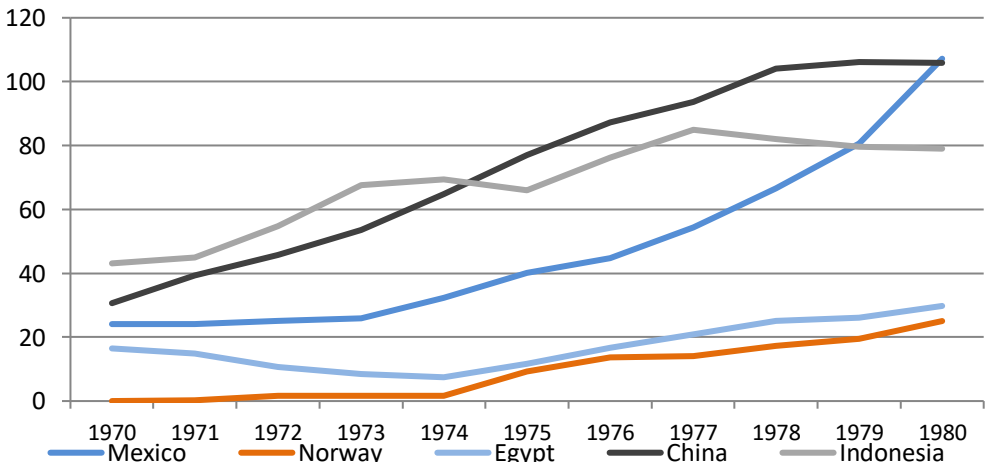
Graph 1 - Production of the best quality fields and global oil consumption in the 1970s



Source: Own elaboration based on data from British Petroleum (2016). * in millions of tons; *Middle Eastern and OPEC production excludes Saudi Arabian production

As previously mentioned, given the high prices and the lack of demand for the best quality fields, production moved to higher cost regions. This is demonstrated in the chart below.

Graph 2 - Production of the worst quality fields and global oil consumption in the 1970s



Source: Own elaboration based on data from British Petroleum (2016). * in millions of tons

As a result, we can see that the oil production price during the 1970s was strongly impacted both by the increase in absolute rent due to the nationalization process, and by the production of oil in poorer quality fields. These observations, therefore, illustrate our model, according to which the oil production price is explained by the production costs of the marginal producer (including a normal profit) plus absolute rent.

Finally, with regard to market prices during the decade, in addition to the impact of the 1973 oil crisis, it is necessary to highlight the impact of the Iranian Revolution in 1979. Due to the Revolution, Iranian production was interrupted, "... with departures of foreign personnel employment in the oil industry, strikes, informal expropriations and other disorder" (AGUILERA and RADETZKI, 2015, p.69), contributing to the reduction of global supply and to rising oil market prices which increased from US$ 51/barrel in 1978 to US$ 103/barrel in 1979.

3.2 The 1980s

For the oil market, the 1980s began with the war between Iran and Iraq in 1981, which led to a decrease in production in both countries and contributed to a slight increase in oil market prices: US$ 103/barrel in 1979 to US$ 105/barrel in 1981. However, this was not a long-lasting effect. As Serrano (2004) argues, Paul Volker's interest shock in 1979 in the United States which led to an appreciation of the dollar that lasted until 1985 (the beginning of Reagan's conservative and recessive management of the country), in addition to the consequences of the Second Oil Crisis, contributed to a period of global recession in the 1980s.

In addition to this, two other factors are worth highlighting. (i) The increase in oil prices in the previous decade contributed to a significant increase in production: between 1970 and 1980, world production went from 48 mbd to 66 mbd, with an emphasis on the growth of Mexican production which more than quadrupled, reaching 2 mbd, and Saudi production, which almost tripled, reaching 10 mbd (BP, 2016). And (ii) the fact that OPEC's situation was not only difficult in relation to non-OPEC countries that were increasing production, decreasing the Organization's market share. OPEC's situation was

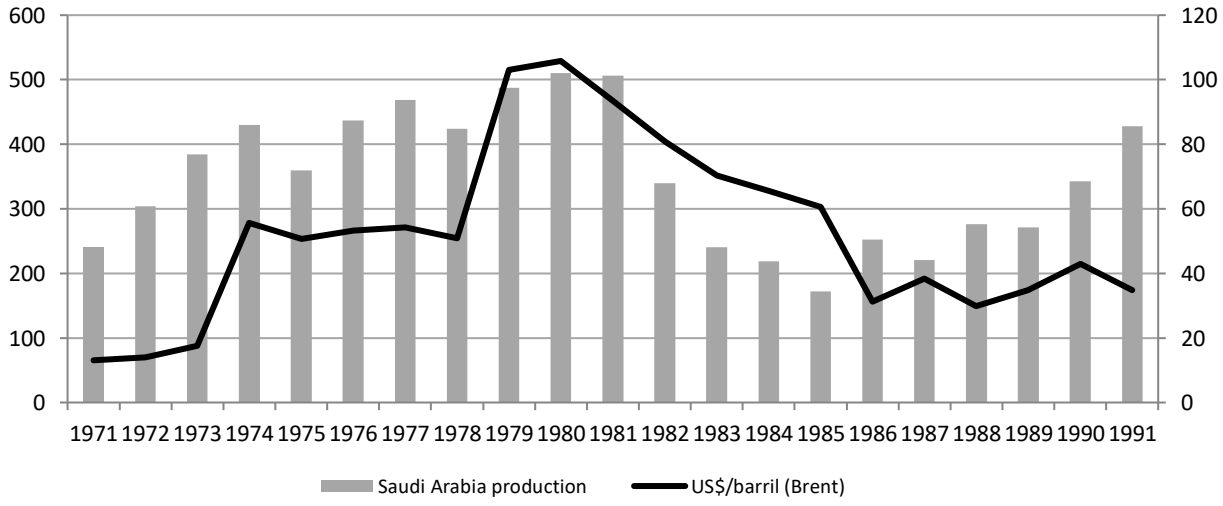
also difficult among its own members, who were seeing their revenues decline, contributing to non-cooperation between them.

These elements led oil prices to reach a market level below those of OPEC official prices. With that, OPEC started to set quotas in 1983, with the goal of lowering production levels among its members. According to Aguilera and Radetzki (2015), this system, however, is not consistent: the authors, based on Molchanov (2003), show that the production between 1983 and 2001 exceeded 6.9% on average in relation to that determined by the quota system, reaching 15% in some periods; and, furthermore, that OPEC members had worked close to full utilization of capacity, with the exception of Saudi Arabia, in particular. This happened in the 1980's because, with low prices and the adoption of the quota system, members started to have significant losses of revenue, aggravating internal conflicts due to quarrels over quotas or simply leading countries to breach them.

On the other hand, these conflicts were eased until 1985, with Saudi Arabia acting as a swing producer, adjusting its sales in order to maintain the oil production price floor. As shown by Roncaglia (2015) and according to the graph below:

> "As a matter of fact, the weight of the control of the market was left to fall on Saudi Arabia alone, on the grounds that it has enormous reserves and very low production costs, but also a limited population, so that it could allow itself not to exploit its oilfields at the maximum rate. Thus, in order to avoid excess supply, Saudi Arabia gradually decreased its own production, from 10 to 2.2 million barrels per day in the interval between the end of the 1970s and August 1985". (RONCAGLIA, 2015, p.158)

Graph 3 - Saudi Arabia's role as a swing producer.



Source: Own elaboration based on data from British Petroleum (2016). Production in millions of tons

However, in 1985, it became clear that it was difficult for Saudi Arabia to sustain this strategy, due to a huge drop in its revenues. So, as shown in the graph above, even with low prices, the country increased its production:[13]

> However, in 1985, it became clear that it was difficult for Saudi Arabia to sustain this strategy, due to a huge drop in its revenues. So, as shown in the graph above, even with low prices, the country increased its production:[14]

However, pressure from other OPEC members and American pressure on Saudi Arabia resulted in the re-establishment of the coordination in the oil market:[15]

> supply chain, financial institutions and state governments - were suffering more from the reduction in international prices than the Gulf countries [...]. In a meeting with the Saudi government, Bush warned about the possibility of the USA, Japan and Europe taking advantage of the opportunity created by the low prices to increase the tax on imported oil. Thus, there would be a transfer of resources from the Treasuries of the exporting countries to those of the importers". (TORRES FILHO, 2004, p.332).

As a result, as shown in the graph, prices rose from approximately US$ 30/barrel to US$ 40/barrel. As shown by Serrano (2004): "[...] prices returned to nominal levels closer to what was compatible with the American energy security strategic policy". (SERRANO, 2004, p.28). Thus, the performance of Saudi Arabia is clarified, preventing the price of oil in dollars from staying below the cost of oil production in the USA for too long: setting the floor for the international price of the product, as Ayoub (1994) observes:

> "Even during the price war of 1986, prices went down to $7/bbl for only a few days, while for the whole of 1986 the average price was about $14/bbl.

[13]In 1986, world production increased 5% considering the Saudi increase, and 2.4%, disregarding it, according to data from British Petroleum (2016).

[14]In 1986, world production increased 5% considering the Saudi increase, and 2.4%, disregarding it, according to data from British Petroleum (2016).

[15]In return, the political-military issue in the Middle East came to be administered directly by the United States. According to Torres Filho (2004), the first step was taken by the request of the Kuwaiti government for military protection for its tankers in the face of Iraqi threats.

> Looking closely, there seems to be some-sort of floor price that has not been pierced during the period under consideration". (AYOUB, 1994, p.54)

Finally, in regard to market prices, they suffered the impact of the war between Iran and Iraq and started to oscillate more due to the more unregulated environment. This happened because, in 1988, oil market prices started to be predominantly determined by quotes in the stock market (AGUILERA and RADETZKI, 2015). This environment would be further strengthned in the 1990s, as shown below.

3.3 The 1990s

Prices were kept low throughout the 1980s and the international scenario of the 1990s continued this trend[16]. The trend was briefly interrupted when Iraq invaded Kuwait, increasing its control over global reserves. The conflict substantially reduced Kuwait's production in 1991: according to Torres Filho (2004), six million bpd were being consumed by fires.

However, (i) the international situation and (ii) the increase in global production, led by OPEC (with emphasis on Saudi Arabia, which increased production by more than 50% between 1989 and 1991 - as shown in Figure 3 of the previous Section); contributed to low market prices.

In this low price scenario, something concerned the US Department of Commerce: the sharp fall of production and reserves in North America. The country had to progressively raise its oil imports and the external scenario was not conducive to production increase:

> "[...] the reduction in exploration, dwindling reserves, falling production, and the relatively high cost of US production all point toward a contraction of the US petroleum industry and increasing imports from OPEC sources. Growing import dependence in turn, increases US vulnerability to supply disruption because non-OPEC sources lack surge production capacity; and there are at present no substitutes for oil-based transportation fuels. Given the above factors the Department finds that petroleum imports threaten to impair the

[16]For more details, see Serrano (2004,2008) and Medeiros and Serrano (1999).

> national security." (DEPARTMENT OF COMMERCE, 1994, apud RUTLEDGE, 2003, p.15)

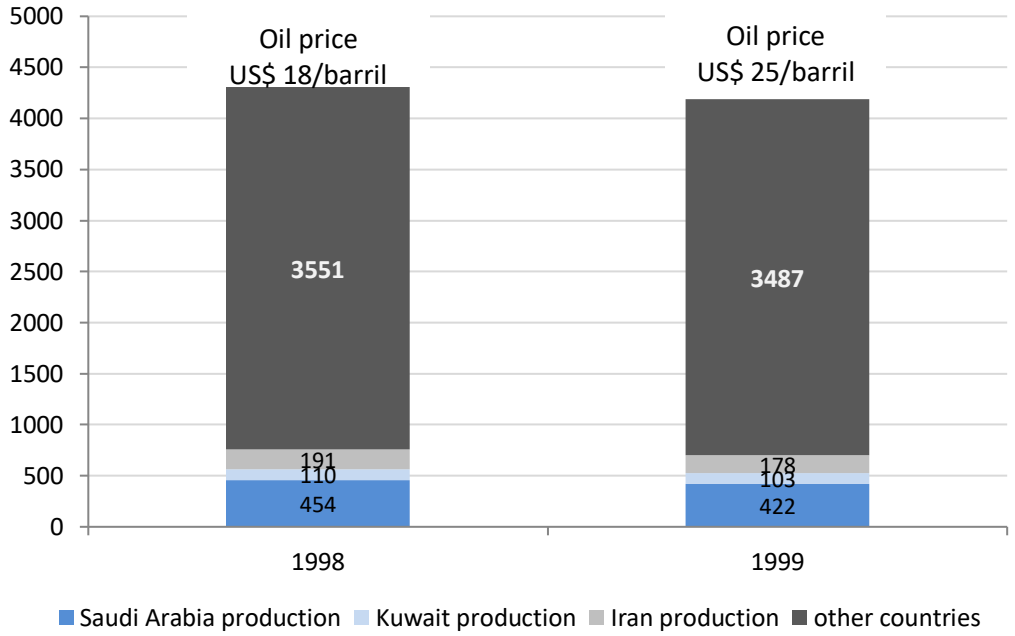
According to data from British Petroleum (2016), American production fell by almost 20% in comparison to 10 years earlier (1984) and, in the same period, reserves fell by 18%: the reliance on imports to meet consumption was now more than 50%. The situation would worsen a few years later.

In 1998, as a result of the Russian crisis (Serrano, 2004) and the increase in Iraqi production, there was another collapse in the international oil price. In view of this, the United States pressured OPEC to decrease its production in order to keep prices above those determined by "market forces" (RUTLEDGE, 2003), or better, above the floor of the oil production price:

> "The American government, once again, acted directly by putting pressure on Saudi Arabia in support of greater OPEC coordination with the aim not only of recovering the previous price level, but also of pushing up the price to higher levels. This rise was seen as necessary to make the international oil price compatible with the new production costs of the American industry [...]. The oil price recovery strategy worked and there was a big increase in the international oil price in 1999-2000. (SERRANO, 2004, p.31)

In fact, the fall in world production (1.8%) in 1999, stimulated in turn by low prices after 1980, suffered a great impact as a result of the drop in OPEC production (3.8%), especially in Saudi Arabia (which cut 7% of production in 1999, when compared to 1998), followed by Kuwait and Iran. This is demonstrated in the chart below.

Graph 4 - Performance of OPEC in 1999 and oil prices



Source: Own elaboration based on data from British Petroleum (2016). Production in millions of tons.

Rutledge (2003) investigates the impact of these low oil prices on American industry, taking into account the negative expectation of the sector, in order to emphasize the importance of OPEC in making the United States' energy policy viable.

According to Rutledge, the average productivity of a field in the United States between 1998 and 2000 was 10.9 barrels/day, 160 barrels/day in Venezuela and 6,500 barrels/day in Saudi Arabia. The impact of low prices on the many fields with higher costs at the end of the decade is demonstrated: “On the eve of the oil price collapse of 1998, 436,000 of 573,000 oil wells in the US (76%) were stripper (marginal) wells, producing less than 10 barrels per day”(RUTLEDGE, 2003, p.04).

It was in this context that, in 1998, the oil price reached the lowest historical level in 53 years, leaving the sector quite pessimistic that prices would remain low[17]. According to data gathered by the author[18], the rate of return, which had been 12.5% on average in

[17]See Rutlegde (2003).

[18]Data from the Oil&Gas Journal, EIA and the Interstate Oil & Gas Compact Commission.

1997, fell to 0.5% in 1998 and, for smaller companies, it was negative; and the losses of 150 medium-sized companies reached almost US$ 3.6 billion.

In addition to affecting American domestic production in the most expensive fields, these terrible results made unviable many new investments necessary for the continuity of the country's energy policy. According to Rutledge (2003), data from the survey by the Independent Oil Producers of America shows that 2/3 of the fields surveyed had extraction costs of around US$ 9/barrel and prices collapsed to US$ 8/barrel in December 1998, causing 136,000 camps to halt their activities.

With the fall in prices and production, the affected regions had lost substantial tax revenues (about US$ 1.8 billion in 33 states) and the author presented the Texas case: “To quantify the damage in the state of Texas, for example, in 1998, 2,127 oil wells were shut in or idle, 11,500 oil industry jobs were lost, drilling permits fell by 33% and the states revenues from oil severance taxes fell by 35% compared with the previous year” (RUTLEDGE, 2003, p.14).

In general, the episodes of 1998 and 1986 show the importance of the relationship between the United States and Saudi Arabia in maintaining the oil production price floor. However, this was not enough for the Americans to maintain the objectives of their energy policy: ensuring the viability of their industry and the safety of their imports.

The late 1990s ended with the repeal of the Glass-Steagall Act in the United States in 1999, by President Clinton, initiating a new and profound phase of financial deregulation. In this context, we turn to the 2000s.

3.4 The 2000s

If, at first, the low growth of the previous decade was initially deepened by the American recession in 2001 and by Argentina’s default on its debts in 2002, the American recession was short, and soon the sharp growth of China - which started to heavily invest in infrastructure - and India - which also increased investment spending and domestic demand - began, in addition to the more expansionist policies of other Southeast Asian

countries. The reestablishment of the demand for oil and a lower level of production pressured the market prices of the product, whose rise was amplified by speculation. Furthermore, it is important to remember the growing American concern about low prices, which had been weakening its powerful industry.

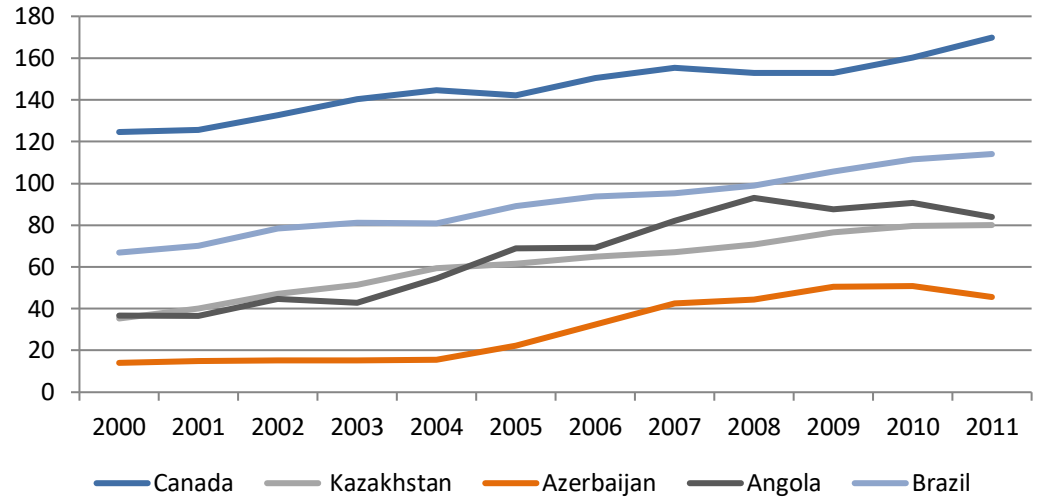
In this context, Serrano (2008, 2012, 2013) shows that much of the price recovery of the 2000s came from the North American fear that prices would be below the floor price as in 1998. Therefore, they pressured the Organization to decrease production and investment in capacity expansion (to reduce idle capacity)[19], substantially contributing to the rise in market prices:

> "[...] The objective appeared to be raising prices to levels that would make economically feasible a larger oil exploration in new areas in the United States, which have high production costs [...]" (SERRANO, 2008, p. 154-155)

The idea that increases in price were encouraged by Americans in order to both (i) increase investment in domestic resources and (ii) diversify their import sources in regions such as West Africa or the Caspian, and also (iii) secure power over OPEC so that it would keep prices "above market-dictated levels" is discussed, for example, in Rutledge (2003). In the same vein, as also pointed out by Serrano (2008, 2013), the high prices of the decade made possible production in other regions with more expensive production costs, such as tar sands in Canada and the Brazilian Pre-Salt, and even the synthetic oil in South Africa as shown in the chart below:

[19]Faced with this set of concerns, the United States also indirectly impacted oil supply in 2003, during the Iran-Iraq war. As Ayoub (1994) stated, when presenting the American strategies to defend its energy policy: "[...] they were not excluding the use of military power in the last resort to protect the security of their oil supplies at a reasonable price" (Ayub, 1994, p.56). Although several arguments are raised (war on terrorism, drugs, or even humanitarian interests, for example), the defense of oil concessions from its competitors and the military protection of pipelines are the great justification for the acquisition of new bases: "One of the main reasons for the existence of more than 725 American bases in the world is the growing American dependence on the supply of foreign oil" (JONHSON, 2004 apud TORRES FILHO, 2004).

Graph 5 - Increase in production in higher cost fields in the 2000s



Source: Own elaboration based on data from British Petroleum (2016). Production in millions of tons.

In addition, the high prices of the decade stimulated a "Return of Natural Resource Nationalism"[20] and state-owned companies started to hold about 90% of world reserves in 2010, according to Aguilera and Radetzki (2015). The consequence, as Serrano (2013) argues, was: "This process increased state control over oil reserves and substantially increased royalty rates and, therefore, the absolute rent component of the oil production price". According to data from the Oil and Gas Journal presented by Aguilera and Radetzki (2015), in 2010, Aramco of Saudi Arabia was the leader in proven reserves (260 billion barrels), followed by PDVSA of Venezuela, with 210 billion barrels; the National of Iran, with 140 billion barrels; the National of Iraq, with 110 billion barrels; and KPC of Kuwait, with 100 billion barrels. Russia's Lukoil, the first private company, would only occupy the 11th position, with 10 billion barrels.

A prominent example in the process of the Return of Natural Resource Nationalism in the decade was Russia. There was a substantial increase in its production during the 2000s, which in 2014 accounted for 12.7% of world production, only behind Saudi Arabia

[20]See Medeiros (2012).

(12.9%). In addition, as its consumption remained relatively stable, the country considerably increased its exports.

Thus we can see that oil production price during the 2000s was strongly impacted both by the increase in absolute rent due to the Nationalization process and by oil production in poorer quality fields. These observations illustrate our interpretation model which suggests that, in periods of high demand, oil production price is explained by the marginal producer's production costs (including a normal profit) plus the State's absolute rent.

We saw that production in higher cost fields is also associated with American energy policy. In addition to the United States' influence on market prices in the decade, other political and military conflicts also had an impact on the production and the productive capacity in the period, and consequently on prices. We can mention, for example, the strike in Venezuela in 2003, the conflicts in Nigeria, or even the Civil War in Libya (AGUILERA and RADETZKI, 2015; YERGIN, 2014).

In the 2010s, supported by high oil prices, the United States initiated the Shale Revolution, and also started to employ new technologies in traditional oil production, as we will see below.

3.5 The beginning of the shale revolution

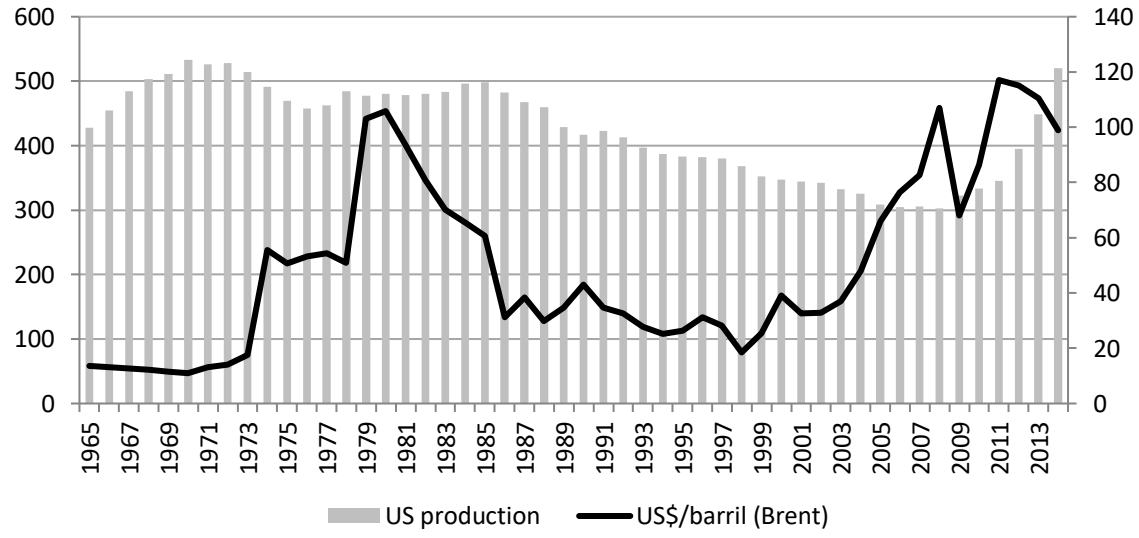
Contrary to the 2000s' trend of extremely high prices, oil market prices started to plunge significantly as of 2012: 55.7%, from November 2014 to November 2015. The main driver of this movement was the Shale Revolution[21], carried out mainly by the United States, which once again became the largest global producer after Saudi Arabia and Russia. As a consequence, this scenario helped reduce the country's dependence on exports from other countries.

[21]Oil could be found and extracted from a rock called shale through the simultaneous use of horizontal drilling and hydraulic fracturing or fracking.

The concentration of the Revolution in the country is due not only to the abundance of the resource (as other countries also own it), but also to the experience with (i) conventional oil exploitation, (ii) the institutional infrastructure, (iii) lower population density (more sparse) that contributes to a lower perception of the environmental impacts of the activity, for example. In addition, in 2005, with the Energy Policy Act signed by Bush, the oil industries, especially shale ones, started to receive new environmental exemptions to foster production. Some examples are the Clean Water Act, the Safe Drinking Water Act (SDWA) and the National Environmental Policy Act (NEPA). In addition, despite the dominance of state-owned companies in the world (about 90% of reserves in 2010, according to Aguilera and Radetzki, 2015), the new scenario built as a consequence of the Shale Revolution has increasingly opened space to private companies, especially the North American ones.

In this context, as shown in the graph below, North American production, which had been falling since the mid-1980s, began to grow in 2008 and, in 2014, production almost reached the historic peak of 1970. We can also observe that, as this process intensified, mainly as of 2012, oil prices that had been high since the beginning of the 2000s began to change trajectory.

Graph 8 - United States' production and oil prices.



Source: Own elaboration based on data from British Petroleum (2016). Production in millions of tons.

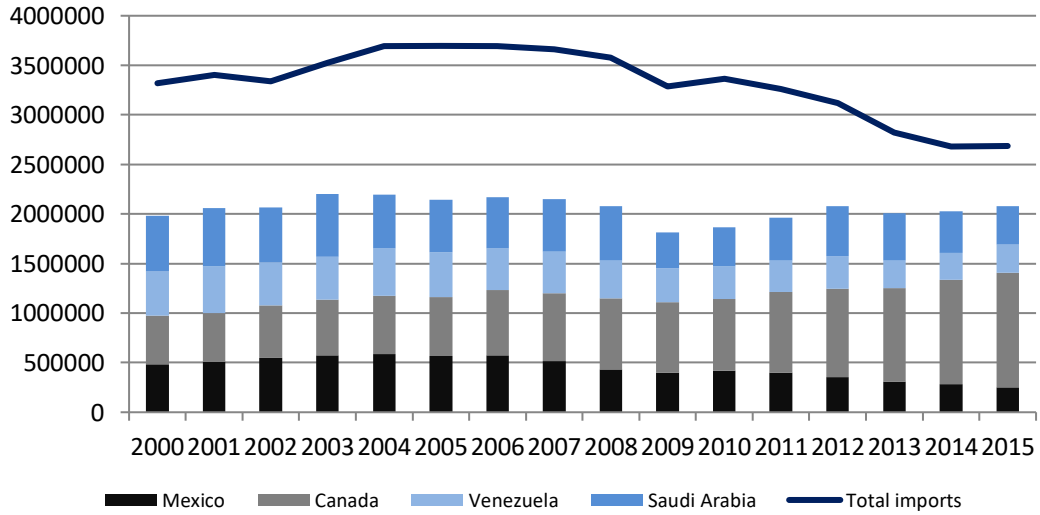
With regard to shale production costs, Aguilera and Radetzki (2015) claim they are lower than those of oil extracted from Canada's tar sands or of oil extracted from Brazilian pre-

salt, which are around US$ 70/barrel. In the United States, the average cost of shale is US$ 50/barrel, reaching between US$ 30/barrel and US$ 40/barrel in the best quality fields, such as Bakken and Eagle Ford. In this context, the authors emphasize the role of technology, whose productive results were better than expected, contributing to the decrease in extraction costs.

In addition, the possibility of using shale technology for conventional oil was noted, giving rise to the "Revolution of Conventionals". According to the authors, about 300 fields are using new technologies, among them, 51 are aged fields, which already benefit from having an installed infrastructure, and where tapping can be resumed. In spite of the Revolutions' growth trend, a limit to this process can be given by the growing environmental concern and its regulatory impacts.

The decrease in American imports obviously directly impacted its main exporting countries. Such retraction is mainly focused on the case of light oil since the country's refineries are predominantly adapted to heavy oil: roughly speaking, Algerian exports to the United States dropped 98%; Nigerian exports dropped 94%; and Angolan exports 73% between 2008 and 2014 (EIA, 2016). However, imports of heavy oil from Canada which, along with Venezuela, Saudi Arabia and Mexico, is one of the largest oil exporters to the United States, increased, as shown in the graph below.

Graph 6- American oil imports in mbbl (thousands of barrels)



Source: Own elaboration based on EIA data (2016)

It is interesting to note that, according to American strategic policy, oil production prices have to guarantee the production of its current main exporter, Canada. In this context, according to the article Rigonomics, published in the British magazine The Economist, the shale industry kept some drilling rigs idle to decrease production[22] and slightly increase prices, since low prices were discouraging some producers and could affect the Canadian production. The result was achieved and market prices rose to US$ 50/barrel in June 2016. The article in The Economist considers the greater elasticity of short-term fracking:

> "[...] fracking has brought a new dynamic to global oil markets: the ability to flex output up and down more quickly than conventional oil drilling, rather like factories responding to changes in demand. Conventional oilfields take years to develop and then produce oil for decades, leaving oil output relatively unresponsive to short-term price movements. *Shale* wells, in contrast, take just a few weeks to drill and frack, and have a lifespan of only a few years, so production quickly falls if drilling abates". (THE ECONOMIST, 2016, p.01)

In any case, production seems viable even at low prices. According to Aguilera and Radetzki, (2015): "[...] many observers believe that hypothetical sustained price in the US$ 50-US$ 70/bl neighborhood for the next few years impede, to various degrees, continued expansion" (AGUILERA and RADETZKI , 2015, p.104). However, the authors argue that, for existing projects, it is enough that prices do not fall below US$ 30/bl, which covers the costs of continuing production, including new fracturing. The Economist magazine itself considers: "Per Magnus Nysveen of Rystad Energy, a consultancy, says producers have become so much more efficient and drilling contractors so much cheaper that American shale firms can, on average, make a healthy 10% return with WTI at $39 a barrel, down from $82 in 2013". (THE ECONOMIST, 2016, p.02). This therefore indicates a reduction in the oil production price floor and a greater bargaining power for the Americans, contributing to the decline in OPEC monopoly rent.

[22] Bakken case: "In the seven months between september 2014 and april 2015, the numbers of rigs plunged dramatically by around 55%". (AGUILERA and RADETZKI, 2015)

The greater bargaining power of Americans in relation to OPEC, in general, and Saudi Arabia, in particular, can also be seen in Chandrasekhar (2016) and Kaletsky (2015), which show a reduction in Saudi relevance as a swing producer. Chandrasekhar (2016) argues that Saudi Arabia's stance in maintaining supply was taken in order to preserve the market share of lower-cost OPEC producers:

> "[...] rather than cut production to reverse the price fall, Saudi Arabia argued that the fall was a way in which markets were correcting for excess supply by forcing more expensive sources out of production. If OPEC members and Saudi Arabia in particular were to serve as "swing" producers who adjusted (in this case cut) production in order to stabilize prices, they would be giving up market share in favour of US producers, of high-cost *shale* in particular, in order to restore prices". (CHANDRASEKHAR, 2016)

This strategy proved to be successful, as prices stopped falling even without Saudi action. This happened thanks to both the great elasticity of the American supply in the short term and to the fact that it is large enough to impact prices, bringing them back to the production price floor. Likewise, Kaletsky (2015) argues:

> "[...] the only way for Opec to restore, or even preserve, its market share is by pushing prices down to the point that US producers drastically reduce their output to balance global supply and demand. In short, the Saudis must stop being a "swing producer" and instead force US frackers into this role". (KALETSKY, 2015)

According to the author, there is a new "ceiling" for oil market prices: the cost of producing American shale, the "floor" of the production price proposed in this work. He states that the slow growth in Chinese demand and the recession of several countries contributed to the deactivation of production in higher cost fields, and to the "ceiling" of market prices having become the production cost of American shale. This is possible because, in addition to the slowdown in demand, shale has great elasticity of supply in the short term, as previously discussed and also indicated by the author: "[...] shale production can be cheaply turned on and off". (KALETSKY, 2015). So, a larger share of the demand can quickly be met by shale production.

In this sense, for Kaletsky (2015) there would also be two production prices, although the author does not shed light on the relationship between Saudi Arabia and the United States for the definition of the production price floor: "[...] the marginal cost of US shale oil

would become a ceiling for global oil prices, whereas the costs of relatively remote and marginal conventional oilfields in Opec and Russia would set a floor." (KALETSKY, 2015).

In parallel, in our terms, the production price floor is given by the American production costs, plus an absolute private rent. We have seen, based on these latest discussions, that such a floor, which was once guaranteed essentially by the Saudis, has also been guaranteed by the Americans themselves. Therefore, with slower demand, and the large and elastic supply of shale, higher-cost producers tend not to be activated, increasing the breadth of the demand range in which market prices tend towards the production price floor.

Conclusion

The overall objective of this work was to bring together theoretical elements, with the classical surplus approach, and empirical elements, through historical analysis, in order to study the trend of international oil prices from the 1970s to the beginning of the shale revolution (mid-2000's).

In line with the classical surplus approach, we saw that in the 1970s and 2000s, periods in which high oil market prices met the growing demand were made possible through production in higher cost regions, affecting the marginal producer's production cost and, therefore, the production price. In addition, in these periods, the component related to the absolute state rent of the production price increased due to processes of nationalization.

In the 1980s and 1990s, the lower growth in demand contributed to the fall in prices and the unfeasibility of production in some regions of higher costs, affecting the production cost of the marginal producer and, therefore, the production price. As a consequence, especially in the 1980s, the state absolute rent component fell, as demonstrated by the weakening of OPEC and its internal disputes over production quotas.

Finally, as of 2012, the technical change in American production, resulting from the shale revolution, contributed to its lower demand for imports and this, together with the Saudi reaction of not reducing its supply until mid-2016, contributed to the fall in prices, making regions with higher production costs unviable. Furthermore, with the reduction in American production costs and the fall in oil production price, there was a reduction in American dependence on the Saudis and OPEC's monopoly rent was also reduced.

Together, these elements related to oil production prices intensified in the 1970s and 2000s, weakened in the 1980s, in the 1990s, and at the beginning of the shale revolution. This indicates that, despite strong fluctuations, oil market prices have been regulated by two production prices: the floor and the price related to periods of high demand.

We also note the relevance of the United States and its energy policy in determining the two production prices. The United States, in order to maintain the survival of its industry at costs relatively higher than those of OPEC, and to maintain its supply, increasingly

dependent on imports, created a tacit, non-formal agreement with OPEC, in particular with Saudi Arabia: the Saudis would maintain a planned idle capacity to cover American production costs, thereby determining a production price floor in exchange for military protection.

Therefore, we can observe, according to the classical surplus approach, that the international oil price trend has been regulated by two production prices: (i) a floor, determined by American technology and production costs, plus an absolute private rent; and (ii) the production price, in periods of high demand, determined by the technology and the production costs of the marginal producer, plus an absolute state rent.

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