Has the Influence of Oil Price on the Economy Changed after the Crisis? Give an Empirical Evidence on Five European Countries

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Abstract

In this paper we will study the influence of oil prices on the economies of five countries both before and after the 2008 crisis. For this purpose, we will propose two asymmetric models using VAR models, which will allow us to measure the influence of positive and negative variations in the price and study the effect produced when the variation in the price occurs in periods with price growth or decrease. In addition, we have chosen countries with different productive structures, which will allow us to study if there are patterns of behavior among similar countries.

Keywords: Oil price, VAR, Assymmetric Models

JEL Classification: C32,E24,E23

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Has the Influence of Oil Price on the Economy Changed after the Crisis? Give an Empirical Evidence on Five European Countries

Nowadays, the oil is one of the most coveted materials on the planet. Their possession grants power while those who do not enjoy it leaves them in a situation of weakness. This material is the main source of energy worldwide, one third of all the energy produced in the world has oil as its main base. In addition, it is also the main element in the production of fossil fuels, with which the entire world transport system is supplied and, it is also present in the production process of other materials such as plastics and derivatives which are present in the daily life of most citizens.

The conflicts originated and provoked because of the control of this matter are not scarce in the last decades and have left a great amount of dead and devastated territories. The largest oil reserves are divided into a few points on the planet, which gives producers a great market power and influence.

The instability of the political governments is one of the points that characterizes the producing countries. The struggles for the control of this matter, both internal and external, have contributed to creating corrupt and unstable systems or, in other cases, to dictatorial systems which are not ruled by any law, rather than those that they enact, which entails that his behavior is, in many occasions, unpredictable.

Historically, it has been checked that the oil market is not ruled by the traditional economic laws of supply and demand. The scarcity of this matter, the concentration in few places of the planet, its importance in the productive system for practically all the countries of the world and the reduced elasticity of the demand, endow the producing countries with a high market power that causes on many occasions, the price of oil varies due to geopolitical or other conflicts that do not correspond to the functioning of a traditional competitive market and generates a great uncertainty, since predicting trends and price variations is a complicated task.

One of the biggest and most famous crises caused by the variation in the supply of oil was the one that occurred in 1973. During this year, the countries of OPPEP, the largest organization of oil-producing countries, - in those years it was formed almost exclusively by Persian Gulf countries - decided to limit the sale of oil to the United States and much of Western Europe in response to the war that Israel was waging against Egypt and Syria for the control of a part of the territory. This caused a sharp increase in prices and contributed to the start of a global economic crisis that reduced world economic growth.

In this Project, we will try to observe how variations in the price of oil affect the economic growth of countries.

We cannot think that the variation in the price of oil has the same incidence and consequences in all countries. For this, we have chosen five European countries; two of them, Belgium and Spain have the highest rates of dependence on oil at European level. On the other hand, Norway, a country with large oil reserves and an exporter of this material and the United Kingdom, which, although it is an oil producing country, does not cover its domestic demand and must import it. Finally, we will analyze the effects on Denmark, a country that produces the necessary oil to cover its internal demand and whose surplus sold in the market is practically insignificant.

To analyze the differences among countries, we will develop two different models, using VAR models. The first one will allow us to show the impacts caused by the oil price growth, differentiating between periods with positive and negative price growth. On the other hand, the second model will allow us to distinguish the consequences between increases and decreases in the price of oil.

In addition, we will observe if there are significant changes in the behavior of countries after the economic crisis of 2008, which altered the productive structure in a large part of the countries.

One of the most frequent criticisms of economists is that we focus on seeking efficiency in all areas and sometimes, we do not take into account the welfare of the person. therefore, we will study both GDP, a macroeconomic variable, and wages, which will allow us to measure more real social welfare.

Finaly, we will try to find significant differences in the behavior of countries, we will focus specifically on Spain to understand the dependence of our economy on the price of oil.

2. LITERATURE REVIEW

At present, it has been verified and checked that the variation of oil prices has an impact on the real production of most of the countries in the world. However, the impact is not the same in all countries, for oil exporting countries an increase in price may be beneficial, while in a country which does not possess this material and it must import it, it may have negative effects.

The Price variation does not only affect production, but it also affects investment and consumption. The increase of the price causes the raise of the costs for the companies and therefore it affects of a negative way the investment, in addition, some authors affirm that the growth of the oil price has a direct impact on the inflation. For example, Furceri et al. (2018) after analyzing the economies of more than thirty developed economies find that, on average, ten per cent of the price of the oil increases 0.1% the national inflation by 0.1%. Thus, the increase in price has also a negative effect on aggregate consumption.

Therefore, the variation in the price of oil affects most of the macroeconomic variables and it influences the economic cycle. As Hamilton (1983) states, statistical evidence has been found that in the last seven economic recessions suffered by the United States after the Second World War, they have been preceded by increases in the price of oil. We cannot say that these crises were caused by the increase in the price of oil, but they have been sharpened.

Once the importance of oil in the economy has been demonstrated, we must try to understand the way and the reasons which cause the variations in the price. Hamilton (1983) states that there is no evidence that the macroeconomic variables have changed their behavior during the previous year to the price increase. In addition, it cannot find any economic series that can validly predict the variation in the price of oil. Therefore, it concludes that the price of oil is not affected by the global economic situation. Finally, it finds evidence that the last significant changes in the price of oil have been caused by external events such as the seizure of Iran's assets, the Suez Channel crisis,the strikes by workers in this sector or other specific economic events in the oil sector.A few years later the same author, Hamilton (1985) finds evidence that the price of oil meets the requirements so that it can be considered exogenous in statistical and econometric terms.

The first studies carried out are based on establishing linear and symmetrical relationships between the price of oil and the economic growth. After the fall in oil prices in the 1980s, several authors find evidence that the impact of this price drop does not correspond to the predictions of previous studies as they observe that the effects caused by the decrease and fall oil price are - in most cases - statistically insignificant. Therefore, they begin to promote non-linear methods. For that reason, an increase in the price of oil has a negative influence on production, but a fall in the price does not have positive effects - on by default, to the same degree - on the economic cycle.

Mainly, we find three main models that have been followed and modified by more authors.

The first model which tried to explain and find empirical evidence of the existence of asymmetric relations between the price of oil and the real production was the one proposed by Mork (1989). In this study, the author takes as different and independent variables the periods in which oil growth is positive or negative. The conclusion that it obtains is that while the effects on production in the face of an increase in price are relevant for the US economy, the effects derived from a fall in price are statistically insignificant.

Years later, in another work, Lee et al (1995) propose a model called scaled specification in which the volatility of the oil price is taken as a variable, that is, the instability in the price is measured over a period of time. The result obtained in this study was that when there is an increase in the price of oil in a scenario with little instability in the price, with little variation, the negative impact on production is greater than when the price increase occurs in a scenario of high volatility.

Finally, the third model generally used to explain asymmetric relations between the price of oil and production is the one proposed by Hamilton (1996). To carry out this work, the author creates a new variable referring to the price of oil. For this, the value of a period corresponds to the amount in which this value exceeds the maximum value of the four previous periods (one year when referring to quartelrly data) In case the value of one period is not greater than another registered in the four previous periods, it automatically takes on the value of zero. The motivation of this work is to review the work of Mork (1989) since it considers that during the period analyzed by the author the growth in the price of oil was followed by long periods of falling prices.

The conclusions reached by the study suggest that there is still a correlation between oil price growth and the economic cycle, contradicting what Hooker (1999) states in his study, who rejected Mork's proposals and stated that after 1986 it is complicated to associate the increase in the price of oil with variations in production. On the other hand, this study finds evidence that an increase in the price of the same magnitude has less impact on the economy in the years that follow the year 1973 than in those preceding it.

Although the empirical literature is unanimous regarding the acceptance of non-linear models to explain the relationship between the price of oil and production, studies and

theoretical literature is scarcer and it has not been possible to obtain generally accepted conclusions.

Some authors have carried out works whose conclusions can be useful when trying to explain theoretically why such asymmetric and non-linear relations between the price of oil and economic growth occur. For this, although it will not be a relevant variable in our work, we can find a convincing explanation in various theoretical studies about the functioning of the labor market.

Hamilton (1998) carries out a study on the labor market whose conclusions can be used to explain why asymmetries occur. The author deals with the aspect of the costs derived from the relocation and reassignment of resources, something that can help us explain the asymmetric relationship that we have previously mentioned. When there is a variation in the price of oil, there is a transfer of resources from the least productive sectors, to which the price variation affects the most productive ones. However, this reassignment is not carried out instantly, it is likely that the workers are not willing to change jobs or are not qualified to do so, besides the fact of changing jobs entails a cost.The classical economy states that the value lost in the least efficient sector will be equal to the value generated in the efficient sector with the transfer of resources. However, we must include the cost of transferring those resources. Nevertheless, the value lost in the least efficient sector is not fully recovered in the efficient sector. Taking into account this effect, it may be coherent to think that when there is an increase in the price of oil, the cost of relocation resources sharpens the recession caused by the price increase while, when the price of oil falls, the cost of relocation slows the expansion caused by the fall of the price.

Another study, similar to the previous one and that can help us explain this phenomenon is the one carried out by Loungani (1986). In this work, the author creates a dispersion index to check the amount of resource relocation needed in each period. In turn, this index is formed by the necessary relocation caused by the variation in the price of oil and other residual part. The conclusion reached by the study is that a large part of the dispersion of employment is caused by the variation in the price of oil, therefore, with each change in the price of the oil, it is necessary to reposition of resources among factories. which, as we have explained previously, entails a cost and can help us understand the asymmetric relationship that we raised previously.

Finally, Davis (1987) offers another vision of the relocation of resources, but based mainly on the capital. The author concludes that the relocation of technology and capital between companies before a shock as the price of oil can be, also entails a cost and has a relevant impact on the economic cycle.

Once the current framework on which the vast majority of studies and works related to the economic growth and the price of oil. We are going to try to contextualize the model we have chosen and justify the use of each of the variables used, and the way in which they can affect the economic growth based on the empirical literature to which we have accessed.

Our work focuses on the performing of an asymmetric model for five European countries with different economic structures. Specifically two of them, Spain and Belgium are oil importers while the United Kingdom and Norway are oil producers and exporters. In addition, we are also going to analyze the effects in a country like Denmark, which produces enough oil for its supply and whose export surplus is practically insignificant.

First of all, we must justify the choice of the price of oil in real value, that is, taking into account inflation in each of the countries. This is captured by the totality of modern literature because, inflation causes the real price in each of the countries to be different and if we only chose the nominal prices we would be losing a part of the impact caused, not by the variation itself in the price of the oil but because of the different inflation rates that create differences in the real price between countries.

In our work, we are going to use two proxy variables to refer to the economic growth; the GDP per capita and the real wage per capita. The choice of these variables to refer to the economic growth will allow us, on the one hand, to see how the variation in the price of oil affects the production of the country and on the other hand, how it affects the standard of living of most citizens. The use of the salary in real terms is not arbitrary, with this adjustment we are measuring the variation of the purchasing power of the citizens through two ways, the variation of the nominal salary and the variation of the price level. The correlation between inflation and the increase in the price of oil is widely accepted among economists. Chen (2008) verifies this correlation by the effect it had on inflation of the increase in the price of oil which was lived in 2004 and adds that, if the authorities do not take the necessary monetary measures, the effect worsens. In addition, this variable is influenced to a large extent by the variation in oil prices. Keane et al (1996) find evidence that in the face of an increase in the price of oil by 20%, the real wage is reduced by 4%. Therefore, it is interesting to check the differences in this aspect between each of the countries.

On the other hand, another of the variables that we have chosen for our study is the effective real exchange rate. This index shows the exchange rate of a currency, discounting the effect of prices. This variable is also used in many studies on the subject. In the face of a variation in the price of oil, it seems coherent to think that a country with

a depreciated currency will find it even more expensive to supply itself with this matter, so, it is a variable that may have relevance. Cuñado (2014) finds evidence that the exchange rate influences when studying the impacts suffered by a country's economy due to variations in the price of oil.

Continuing with the contextualization of our model, we have chosen exports as a variable that influences the economic impact suffered by the economy in the face of the variation in the price of oil. This is another of the new and different aspects that our work can contribute to the current literature. There are few relevant works that take into account the importance of exports. A justification for its use is found in the work of Hamilton (1988) in which the author concludes that a shock in the price of oil affects both, consumer demand and investment goods. Given this statement, we cannot ignore that exports are affected by demand and international income, two factors that are altered by price changes and that, in addition, exports are an important part of the total production of the countries that we have chosen. So, it is interesting to see how this variable affects the total production in the face of a variation in prices.

Finally, we have chosen the public deficit as a variable to be able to observe the impact of fiscal policy. We cannot forget that the deficit consists of the difference between a country's level of expenses and its level of income. As we mentioned before, the literature states that; in the importing countries, before an increase in the price of oil, production is reduced and, therefore, public collection. Therefore, the reaction of the government in terms of taxes - reducing them to re-incentivize the economy, even if the deficit increases and must borrow - or the reaction with the level of expenses to relieve the fall in production, may have a direct influence on the level of production.

El Anshasi et al. (2012) find evidence that, in oil producing countries, in the face of an increase in price, public spending increases to a lesser extent than the additional income obtained by the price increase. With this affirmation, it is feasible to think that in the exporting countries, in view of an increase in the price of oil, the deficit is reduced. However, different levels of spending can cause different incentives for the economic growth. A producer country with one level of spending higher than another, reduces the deficit in this case to a lesser degree, which can encourage more the economic growth. For this reason, the public deficit can be a relevant variable when specifying our model.

3. VARIABLES AND DATA DESCRIPTION

To carry out this study, as we have previously introduced, we are going to use different variables that help us determine the impact of the variation in the price of oil on economic growth.

In the first place, the years that we are going to study in our work are the years between 1998 and 2017 and for that we are going to use all our variables in quarterly terms

We must specify that we are going to use two different parameters to refer to economic growth. The first of these, GDP per capita, shows the level of aggregate production that would correspond to each of the inhabitants of a country and, on the other hand, and the real wage per capita.

On the other hand, as it is a model of autoregressive vectors, we will need different variables that act as transmitters of impact -because they are affected by the variation in the price of oil and in turn affect economic growth- that will allow us to specify the reasons for the different impacts suffered by different countries.

These variables are: the growth of the deficit, the real effective exchange rate - which indicates the value of the exchange rate between two currencies, discounting the effect of the price level - and net exports.

These three variables together with GDP and salary, we have obtained from the Eurostat database and are adjusted temporarily to eliminate the effect of seasonality. All the variables are specified in euros.

It is important to clarify that the GDP is specified in volumes to obtain the value in real terms of this parameter and where the base year for its calculation corresponds to 2010. On the other hand, to obtain the growth of the deficit we have calculated its variation rate for each of the periods.

With the calculation of the real salary, we have downloaded the nominal salary and to transform our variable into real terms, we have downloaded the Consumer Price Index with base year 2010 from the Eurostat database, for each of the countries. This index is generally used to measure the value of inflation in each period. To obtain the real price for each of the countries, we have divided the value of the nominal wage by the index in each period and country.

Finally, to the main variable of our work, the price of oil, we have also applied different modifications to carry out the relevant study.

In the first place, the variable that we have used to measure the price of oil corresponds to the average value in euros of the price of the Brent Barrel for each of the quarters

between 1998 and 2017 and we have downloaded it from the Federal Reserve Bank of Saint Louis Data Base.

As we have explained in the previous section, it is coherent to study the price of oil in real terms and more specifically in our study, where we will compare different countries with different price levels.

To transform our variable into real terms we have performed the same procedure as mentioned above. In this case, we have multiplied the nominal price of the barrel of oil by the value of the CPI for each of the countries in each period. Finally, we have calculated the growth rate for each period.

4.METHODOLOGY

For the proposed model estimation, we will use the autoregressive vector system, commonly known as VAR. This method popularized by Sims (1980), can be considered halfway between univariate time series models and simultaneous equations.

We can define this method as a model of simultaneous equations formed by a system of equations of a reduced form without restricting.

One of the main characteristics of this type of mode l is that we must treat all variables as endogenous. This is because all the variables of the model are explained by the rest of the delayed variables and by their own delays.

$$y_{1t}=\beta_{10}+\beta_{11}y_{1-t}+\beta_{12}y_{2t-1}+m_{11}\,z_t+u_{1t}$$

$$y_{2t}=\beta_{20}+\beta_{21}y_{1-t}+\beta_{22}y_{2t-1}+m_{21}\,z_t+u_{2t}$$

Equation 1. VAR equation. Y_{1t} and Y_{2t} are stationary variables, Z_t is a vector of exogenous variables and the coefficients of the current values of y_t are the matrix identity.

Firstly, to be able to carry out the estimations and contrasts efficiently, we have made the necessary transformations to our variables to turn them into stationary.

The variables of GDP, exports and real wages are formalized by logarithms and they have been applied first differences. On the other hand, the exchange rate, since it is an index, has been expressed in its current values and first differences have been applied. Finally, the growth of the oil price (both positive and negative) and the growth of the deficit have been used at levels, since they are growth rates. Augmented Dickey-Fuller Test has been used to verify that all variables are stationary.

As we have explained previously, in this paper we are going to develop two types of non-linear models, the first of which we will call the Assymmetric Model in Periods, in which we have divided the oil price growth into two variables, one when it is positive and another when it is negative. This way, we can observe the different impacts when we are in periods where the price is positive and in periods where the price is negative.

To make this transformation, we create a dummy variable (equal), which takes value 1 when the growth is positive and value 0 when it is negative. Otherwise, to obtain the variables when the growth is positive and perform the same operation in reverse to obtain the values of the variables when the price growth is negative. This way we can obtain the values of each variable using the following formulas.

$$Xt^{+} = \begin{Bmatrix} \mathrm{Xt} \ \ si\ \Delta P_t > 0 \\ 0\ otherwise \end{Bmatrix}$$

$$Xt^{-} = \begin{Bmatrix} \mathrm{Xt} \ \ si\ \Delta \mathrm{Pt} < 0 \\ 0\ otherwise \end{Bmatrix}$$

Equation 2. X_t represents each of the variables and P is the oil price.

To carry out the estimation in this model, we will make separate estimations, one when the growth is positive and another when it is negative.

At the same time, we have divided the observations into two stages, one before the economic crisis, which comprises from 1998 to 2007, and a subsequent one from 2008 to 2018.

With the accomplishment of our second model, which we will call Assymmetric Model in Impact, the objective is different. In this case we try to observe the differences in the impact on economic growth when the price of oil suffers a positive or negative shock, that is, when there is an increase or decrease in the price given.

For this, the transformation is similar to what we have done previously, but with some variations. In this case, we also apply a dummy variable that takes value 1 when the price growth is positive and 0 when being negative and vice versa. However, in this case, this convertion does not affect the rest of the variables, which continue to have their real value regardless of whether they are in a period of positive or negative oil price growth. Therefore, through the following formula we observe the transformation made to the variable associated with the growth of the oil price.

$$Ot^{+} \begin{cases} P_t \; Si \; \Delta P_t > 0 \\ 0 \; otherwise \end{cases}$$

$$Ot^{-} \begin{cases} P_t \; Si \; \Delta P_t < 0 \\ 0 \; otherwise \end{cases}$$

Equation 3. Ot is the new oil price variable and P is the oil price.

When performing the VAR model, we will estimate a model with all the variables at once, both the positive and the negative growth. This way, we can check the differences by applying a positive or negative shock.

Once the model has been calculated, we must carry out a transformation that allows us to obtain the reaction of one variable against a shock in another. This process is performed by orthogonalization of the random disturbances. Through Cholensky decomposition, we can define an order of variables between which the contemporary shock in one of them only affects the subsequent variables and does not affect the previous ones.

For the estimation of our models we have chosen two different orders. For the model that takes as a variable to explain GDP, we have chosen the following order; Oil price, Exports, Deficit, GDP and Exchange Rate. The election requires certain justifications that we will develop next.

a) There are divergences among economists about whether GDP is affected at the same time by the variation in the price of oil. In our model, we have assumed that this contemporary impact is true. This is because, with the importance of oil in the current production process, any variation in the price can have a rapid impact on the level of such material supply in a country and therefore, in its level of production.

b) As Hamilton (1998) states, the demand for goods was one of the first parameters affected after the variation in the price of oil. Therefore, it is coherent to think that exports do receive a contemporary effect in the face of the variation in the price of oil.

c) The exchange rate is one of the most volatile macroeconomic variables, therefore, it can be quickly affected by any shock from the rest of the variables.

On the other hand, for the accomplishment of our second model, in which we use as proxy variable to measure real economic growth instead of GDP, we have made a slight change in order. This order is; Oil price, Exports, Real wages, Deficit and Exchange rate. For the election of this order, we must also consider some justifications.

The real wage is affected at the same time by the variation in the price of oil due to two factors.

a) The salary depends directly on the total productivity of the of the enterprises, therefore, any variation in costs directly affects productivity and, thus, nominal salary.

b) With the election of the real salary we are taking into account the price level. The current literature is unanimous in that inflation quickly affected by the shock in the price of oil, therefore, the real wage is also affected.

Firstly, we must specify the optimal number of delays. That is, the number of delayed periods that each variable appears as an explanatory variable in each of the equations. For this, we have used the Bayesian Information Criterion) and we have obtained that the optimal delay for all the equations is of a period.

		Belgium		**Spain**		**Denmark**		**UK**		**Norway**	
		GDP	**Real wage**	**GDP**	**Real wage**	**GDP**	**Real wage**	**GDP**	**Real wage**	**GDP**	**Real wage**
Assymmetric Model in Periods											
Before 2008	Xt^{+}	-12,0 -10,4 -0,16 -8,57	37,9 39,5 40,5 39,7	-6,3 -5,4 -3,7 -3,9	45,8 46,4 47,8 48,24	-8 -6,5 -5,6 -4,8	40,3 41,8 42,6 43,5	2,2 4,2 5,6 6,9	49,3 51,3 53,4 54,4	-5,2 -4,1 -3,0 -1,5	43,9 44 46 47,3
		-16,2 -14,9	-15,6 -14,3	-12,5 -11,3	-1,4 -1,0	-16 -14	-15,3 -13,4	-8,6 -7,5	-6,5 -5,4	-13,2 -12	-10 -9,4

	Xt^-	-12,8 -11,9	-13,2 -11,2	-9,9 -9,0	-8,9 -8,0	-12,8 -11,5	-4,8 -13,2	-6,7 -5,8	-5,2 -4,7	-12,1 -12,2	-9,1 -9,4
After 2008	Xt^+	-10,8 -9,30 -8 -8	40,4 41,9 43,3 44	-9,1 -7,8 -6,5 -6,2	42,8 43,9 43 45,2	-9,1 -7,4 -5,9 -5,1	40,5 42 43,6 44,6	-5,2 -4,3 -2,8 -1,4	49,8 51,7 53,4 54,4	-8 -5,6 -5,2 -5,5	41,9 43,3 44,7 44,8
	Xt^-	-12 -10,4 -8,6 -7,8	-13,4 -11,7 -10,1 -9,4	-10,5 -9,4 -7,7 -7	-11,4 -10, -8,9 -8,	-8,6 -7,4 -5,3 -4,4	-8,2 -7 -5,2 -4,1	-9,27 -7,9 6,27 -5,20	-6,8 -6 -4,6 -3,1	-10,6 -9,0 -7,3 -6,4	-8,7 -7 -5,6 -5
Assymmetryc Model in Impact											
Before 2008	Ot^+	-13,6 -11,6 -11,1 -12	-9,9 -7,6 -6,8 -7,1	-10,6 -8,6 -6,6 -10,6	-11,4 -9,5 -8,2 -7,7	-8,9 -7,4 -6,2 -7,1	-6,7 -4,3 -3 -3,1	1,6 3,7 5,1 5,4	-6,5 -4,6 -2,5 -1,2	-5,2 -3,8 2,5 -2,2	7,8 -6,1 -4,1 -4,5
After 2008	Ot^-	-12,5 -10,9 -9,6 -11,3	-8,9 -6,5 -5,9 -5,7	-6,7 -4,9 -3,8 -5	-6,7 -4,9 -3,8 -5	-8,6 -8 -5,7 -5,1	-5 -3,9 -2,6 -1,5	3,6 5,3 6,8 7,1	3,4 1,3 0,8 1,6	-3,9 -2,5 -0,9 -1,28	-6,8 -4,2 -2,6 -2,3

Table 1. Optimum lag selection. The lower coefficient represents the optimum number of delays.

Once the model is estimated, we perform the Wald test to observe whether the variation in the price of oil has a direct impact on GDP and wages. As a null hypothesis we assume that all the delayed coefficients of the oil price variable are statistically zero in all the equations. In Table 2, we can see how we accept the hypothesis in all cases.

		Belgium		**Spain**		**Denmark**		**UK**		**Norway**	
		GDP	**Real wage**	**GDP**	**Real wage**	**GDP**	**Real wage**	**GDP**	**Real wage**	**GDP**	**Real wage**
Assymmetric Model in Periods											
	Xt^+	0,45	0,89	0,27	0,86	0,25	0,18	0,01**	0,53	0,54	0,88

Before 2008	Xt^-	0,28	0,40	0,27	0,02**	0,02*	0,75	0,02*	0,47	0,85	0,31
After 2008	Xt^+	0,58	0,78	0,85	0,69	0,17	0,66	0,09	0,70	0,06	0,25
	Xt^-	0,85	0,38	0,64	0,08	0,83	0,79	0,85	0,25	0,84	0,99
Assymmetryc Model in Impact											
Before 2008	Ot^+	0,23	0,09	0,03*	0,56	0,19	0,60	0,06	0,13	0,27	0,34
	Ot^-	0,78	0,95	0,97	0,73	0,20	0,67	0,72	0,23	0,34	0,39
After 2008	Ot^+	0,23	0,24	0,52	0,13	0,96	0,74	0,006*	0,07	0,02*	0,55
	Ot^-	0,69	0,09	0,73	0,19	0,52	0,52	0,39	0,11	0,14	0,45

Table 2. P-value for all oil price variable coeficients in GDP an Real Wage equations. * Represents that this coefficient is significant at 5%.

As we can see, most oil price periods do not directly affect our variables. this fact is consistent with what is stated in current literature, which states that the variation in oil price does not directly affect GDP, but does so by influencing other variables.

5. EMPIRICAL RESULTS

Next, we will show the results obtained through the impulse response functions and to specify the differences in behavior between countries.

First, we are going to show the results obtained in the Asssymmetric Period Model in the GDP, in the period where the oil price growth is positive, that is, when we are in a period where the price is growing and we apply a positive shock, that is to say , an increase in the price.

It is important to specify that all the confidence intervals that we are going to use during work are going to be 68%.

- **Positive oil shock in GDP in a period with rising prices before the crisis**

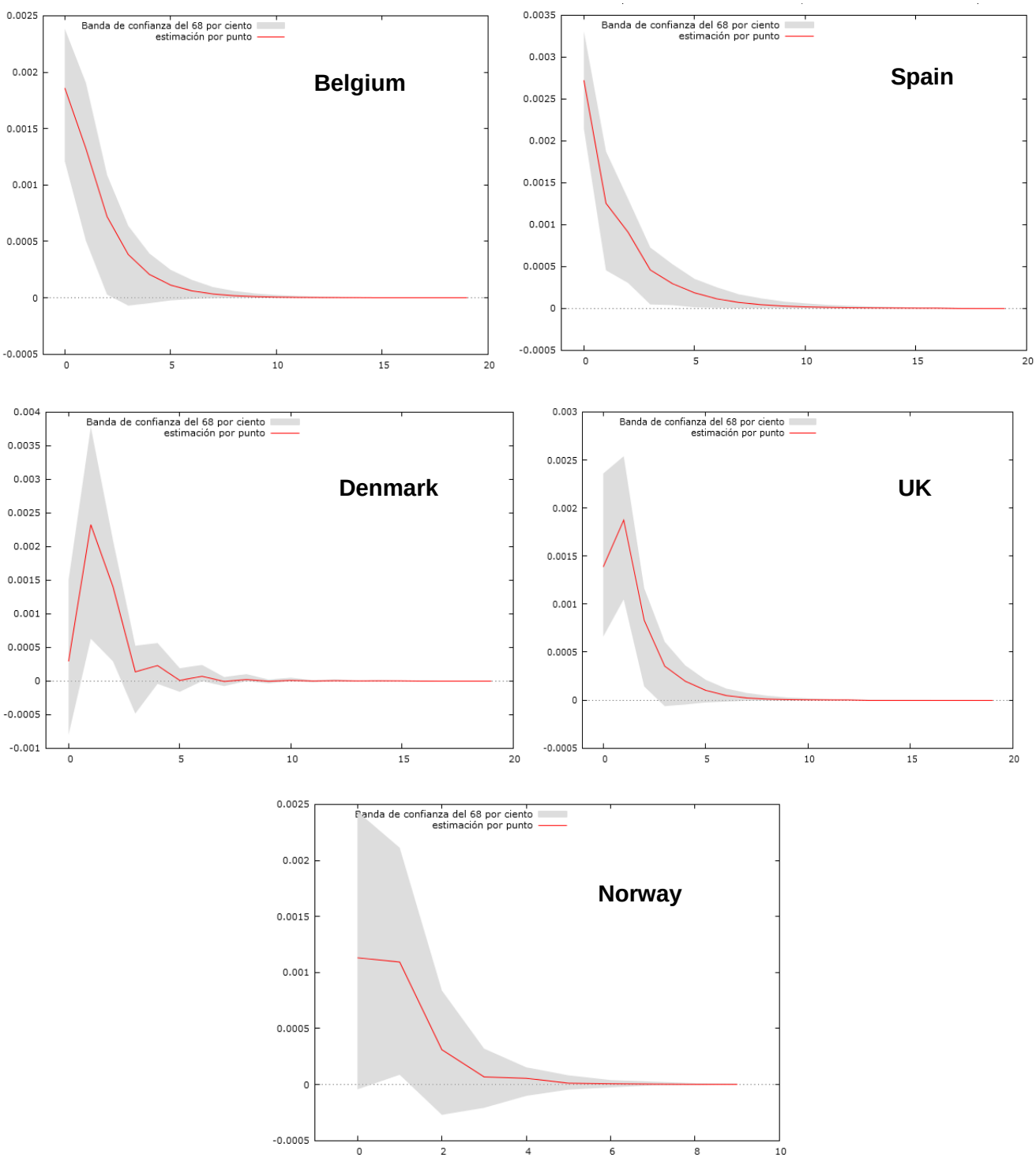


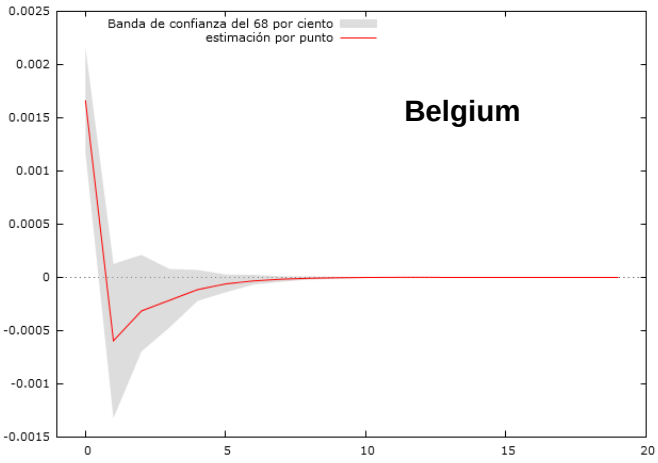
Figure 1. GDP responses to a oil price shock in a period with rising prices before the crisis.

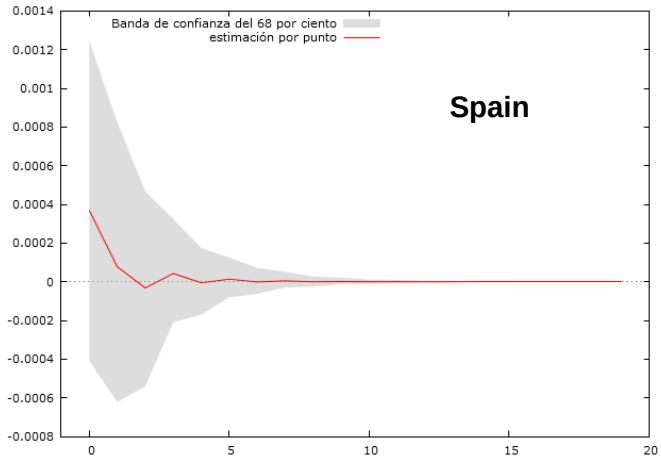
As we observed in Figure 1, before the crisis both Belgium and Spain, the two oil-importing countries have very similar responses. In both cases, GDP growth decreases, but it remains positive. On the other hand, in Denmark, the impact of the price increase is not significant, while in Norway and the United Kingdom the increase in the price of oil produces the GDP growth.

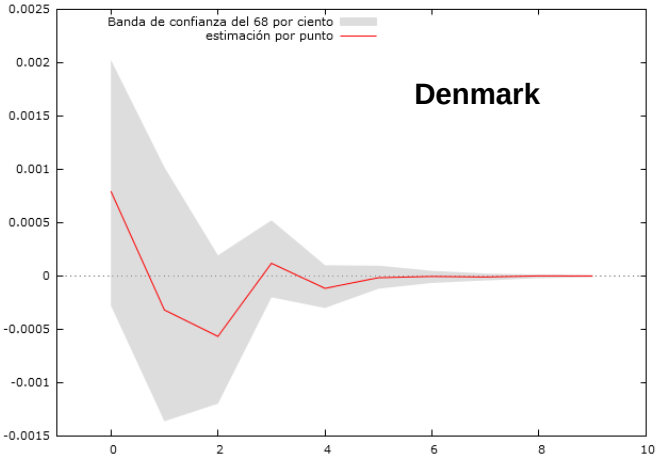
These effects are the expected ones before this price increase. For producer countries, an increase in price in a period where the price is already increasing,it is expected to increase its income to a lesser extent than if the increase occurs in a period of stability, as we can see in the Asymmetric Model in Impacts

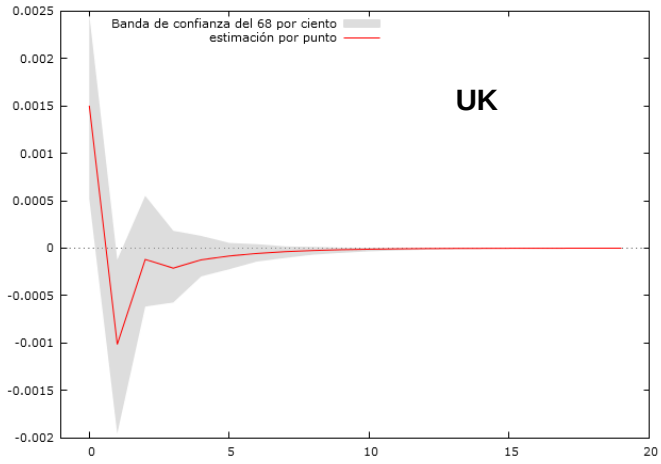
On the other hand, in the importing countries, this impact will also be less than when the price increase occurs in a period of stability, as we willl see below.

- **Positive oil shock in GDP in a period with rising prices after the crisis.**









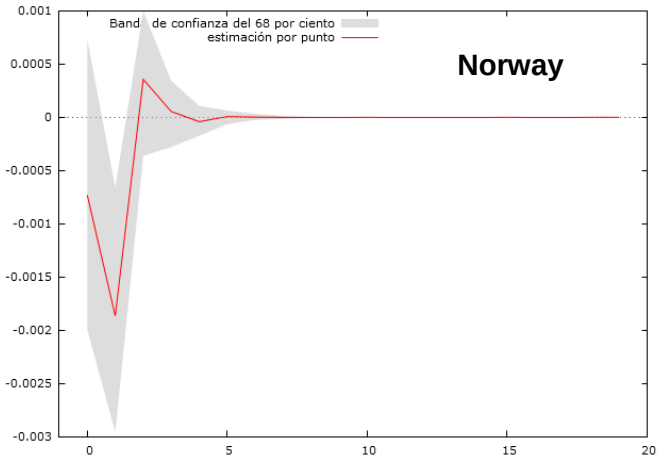


Figure 2.GDP responses to a oil price shock in a period with rising prices after the crisis.

When analyzing the graphs for each of the countries in Figure 2, we see how the impacts on GDP of the variation in the price of oil have changed after the economic crisis. As of 2008, the impact of a price increase in a period of positive growth becomes non-significant in all countries, except Belgium and the United Kingdom. In these countries, as we can see in Table 3, GDP rises in the first period, and then falls, however, if we check the aggregate response for the first four periods, we see how GDP has increased.

This indicates that rest of countries, at present, have worsened their position with respect to the increase in the price of oil since, it does not have significant effects on their level of production.

PERIOD	BELGIUM	SPAIN	DENMARK	UK	NORWAY
1	0,0016628	0,0003692	0,0007934	0,0015033	-0,000731
2	0,001064	0,0004467	0,00047195	0,0004886	-0,002598
3	0,000746	0,0004148	-0,00009733	0,0003694	0,0009649
4	0,000528	0,0004574	0,00001933	0,0001581	0,001018

Table 3. GDP cumulative responses for the first four periods after the crisis in a period with rising prices.

A possible explanation of why Belgium has a greater impact on its GDP than Spain, in the face of an increase in the price in positive periods can be found in the response of the GDP to a variation in the exchange rate. While the impacts on the GDP of the rest of the variables have similar behaviors, in the exchange rate we find a significant difference, as we can see in Figure 3.

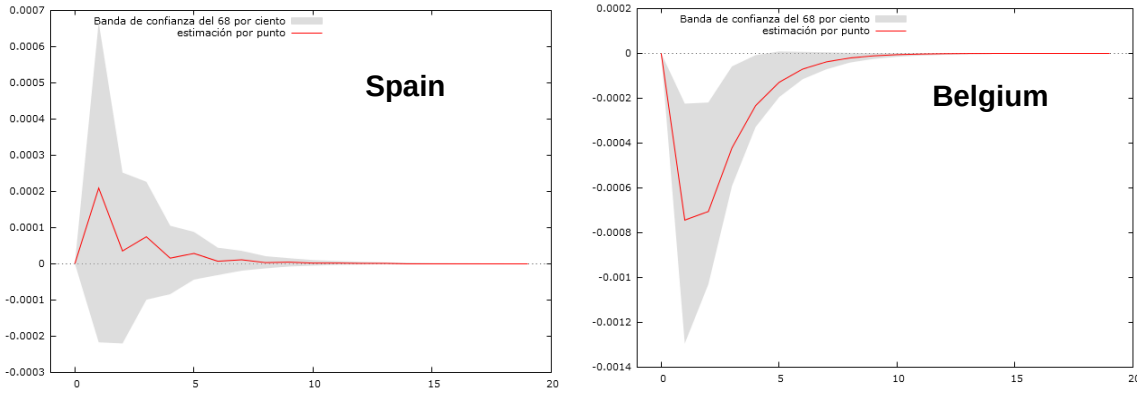
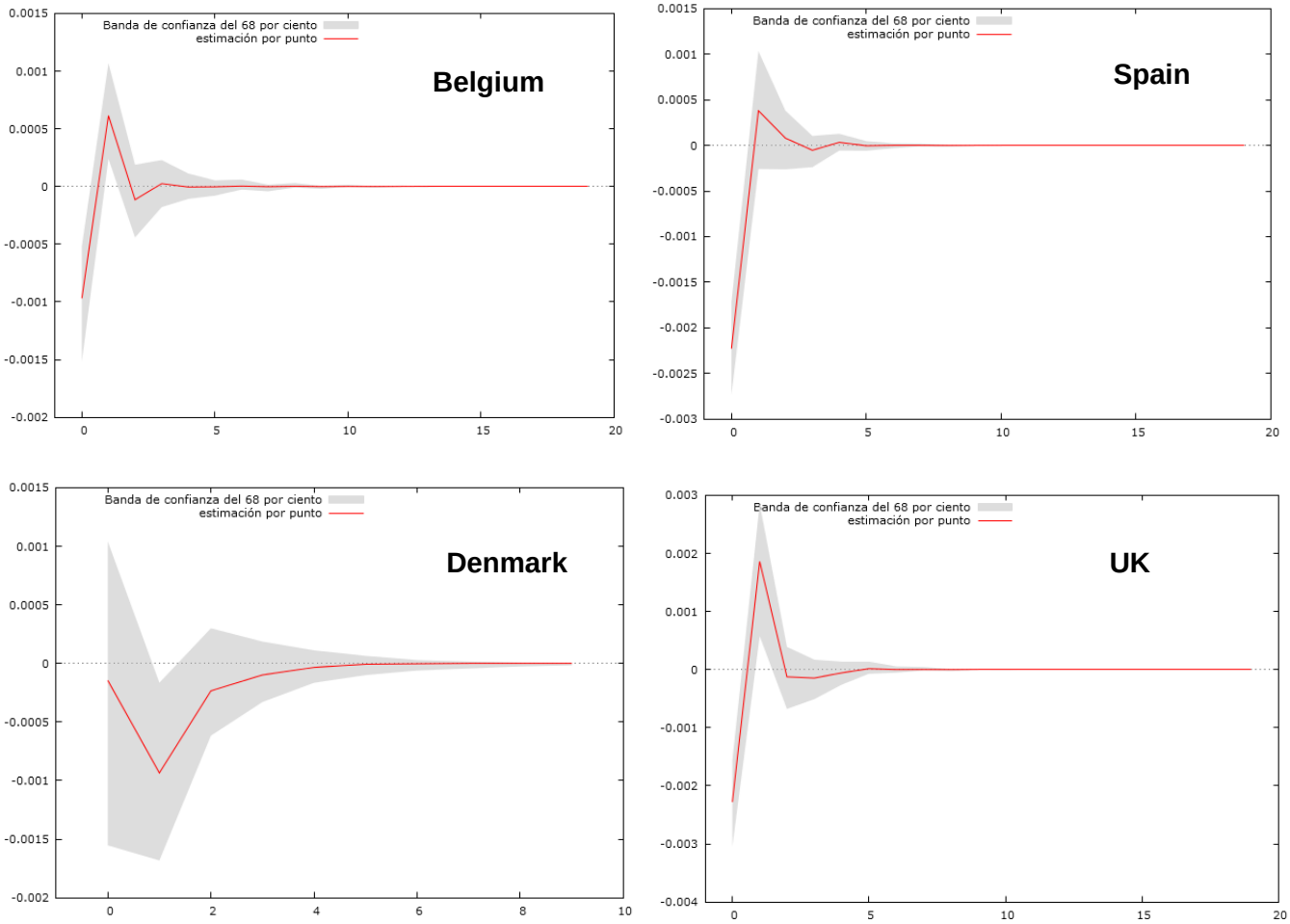


Figure 3. GDP response from Spain and Denmark from a shock in the exchage rate.

To continue with our analysis, we will show the results obtained when we are in a period of negative growth in oil prices. That is, the increase in the price of oil when we are in a time where the price of this matter is decreasing.

- **Positive oil shock in GDP a period with decreasing prices before the crisis.**



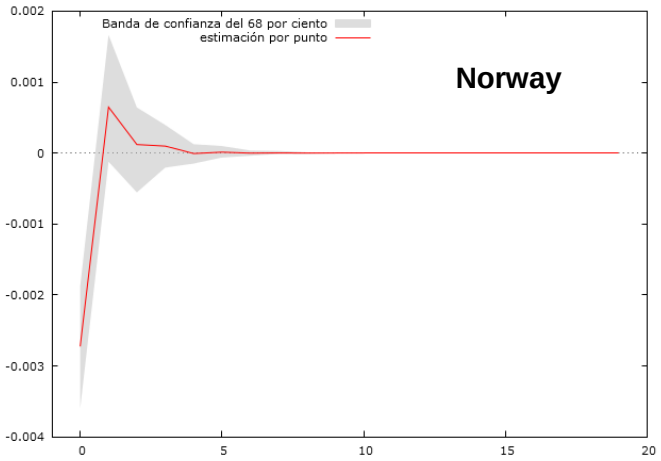
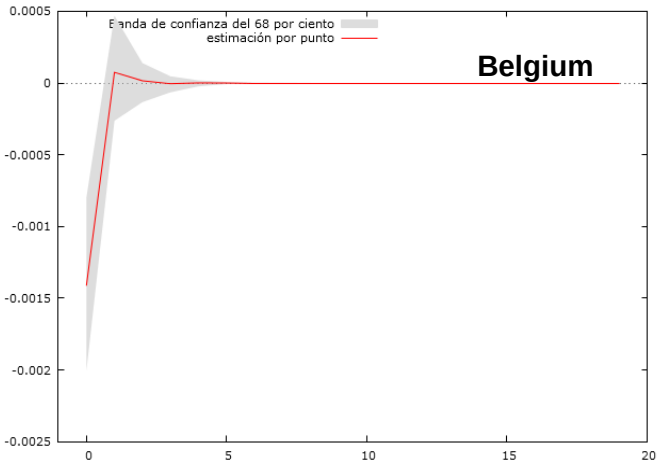


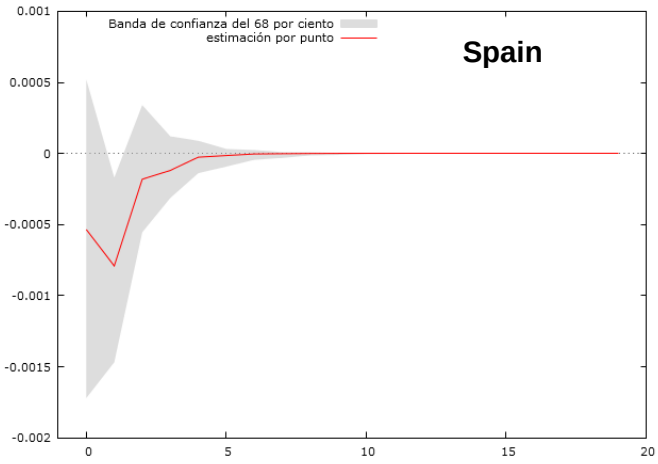
Figure 4. GDP respones of all countries to a change in the oil price when we are in a period with decreasing prices before the crisis.

Observing the results obtained in Figure 4, we see that an increase in the price when we are in a period with negative growth of prices reduces the production in all the countries of the study - except Denmark, where the effect is not significant.

This is contrary to what we obtained when price growth occurred in a period with positive price growth, where this effect led to GDP growth in all countries.

- **Positive oil shock in GDP in a period with decreasing prices after the crisis.**





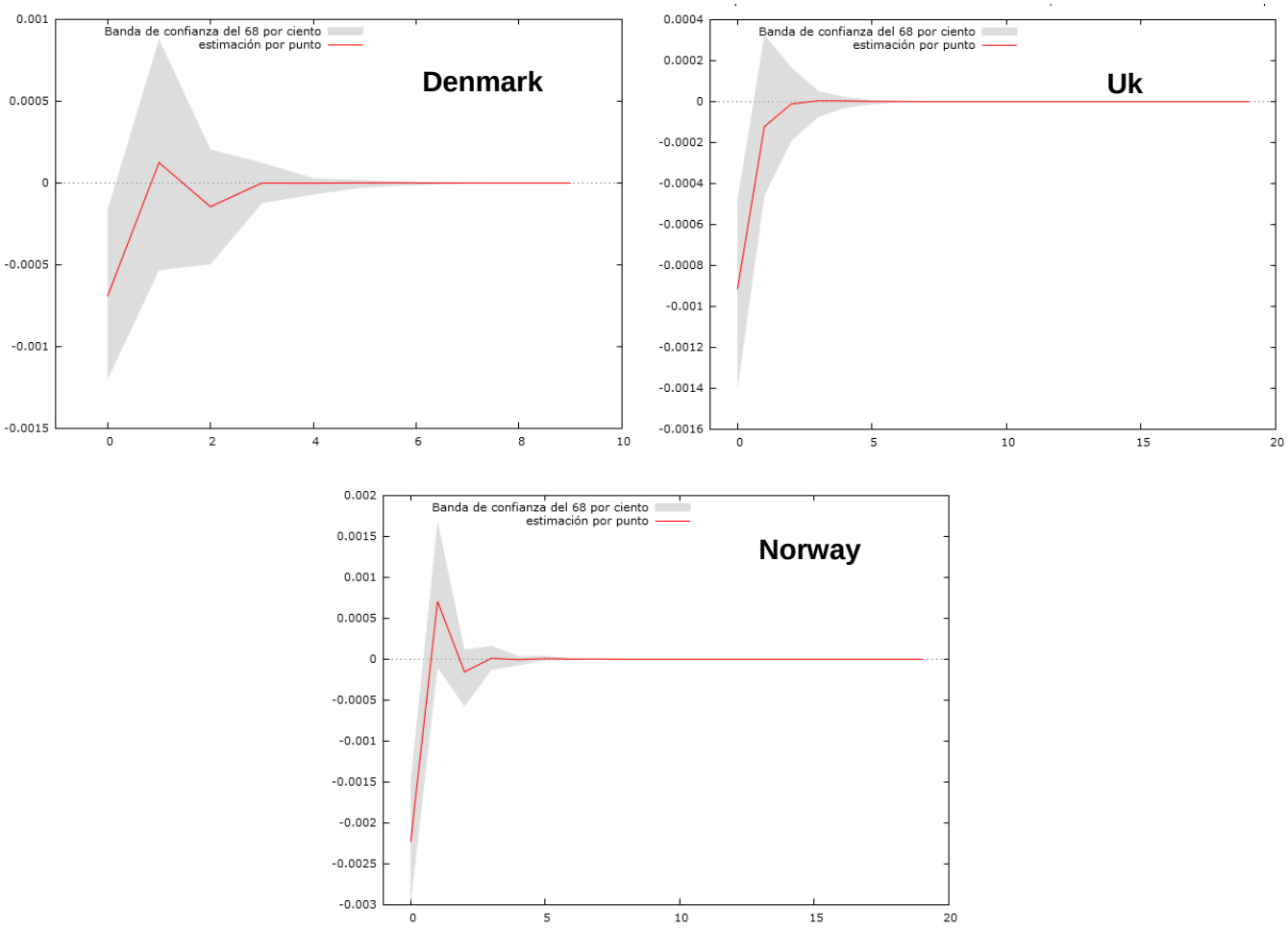


Figure 5. GDP respones of all countries to a change in the oil price when we are in a period with decreasing prices after the crisis.

After studying the graphs for each of the countries after the economic crisis (Figure 5) we observed that there are significant differences in the impacts on the GDP with respect to the previous years.

Firstly, Belgium strengthens its position. Specifically, in the years prior to 2008, an increase in the price in a standard deviation caused the reduction of production by 0.0004% while in the periods after 2008 the reduction in the GDP gets closer 0,001%.

If we look at Table 4, where we find the aggregate responses for the first 4 periods before and after 2008, we find that all countries improve their positions in the face of an oil price shock, except United Kingdom.

Noruega improves its performance compared to the previous period, however, the total effect remains negative

Spain improves its performance against oil price shocks. While before the crisis an increase in the price reported a fall in the GDP, after this period the effects of this shock become irrelevant in statistical terms.

In addition, Denmark worsens its situation since, the impact of the price increase becomes significant when in the years prior to 2008 they were not.

We find evidence that, when we are in periods of negative price growth - the price of oil is decreasing - a positive shock in the price of oil causes a greater fall in the GDP than if it happens in a period of growth of the price of positive oil. In many cases the effect is the opposite, because as we have seen, a price increase in periods of positive growth causes GDP to react in the same direction. Meanwhile, a price increase in negative periods reduces production in all countries.

	1998-2007				
PERIOD	**BELGIUM**	**SPAIN**	**DENMARK**	**UK**	**NORWAY**
1	-0,00090464	-0,0022283	-0,00014546	-0,0022804	-0,0027262
2	-0,00048898	-0,00184793	-0,00108065	-0,0004203	-0,00207954
3	-0,00083739	-0,00176826	-0,00131529	-0,00054555	-0,00195985
4	-0,00043987	-0,00182114	-0,001414504	-0,00069153	-0,0018629

	2008-2018				
PERIOD	**BELGIUM**	**SPAIN**	**DENMARK**	**UK**	**NORWAY**
1	-0,0014134	-0,0005352	-0,00069424	-0,0009176	-0,002236
2	-0,0013392	-0,0013270	-0,00057089	-0,0010411	-0,0015320
3	-0,0013242	-0,0015087	-0,00071732	-0,0010535	-0,0016899
4	-0,0013293	-0,0001198	-0,00071867	-0,0010569	-0,0016806

Table 4. Cumulative responses of GDP to a shock in oil price in a period with decreasing prices after and before the crisis.

Next, we will show the results obtained on the other variable that we have used to measure economic growth; the real salary. Following the procedure we have done previously, we will first show the results obtained when we are in periods with positive price growth.

- **Positive oil shock in Real wage in a period with rising prices before the crisis.**

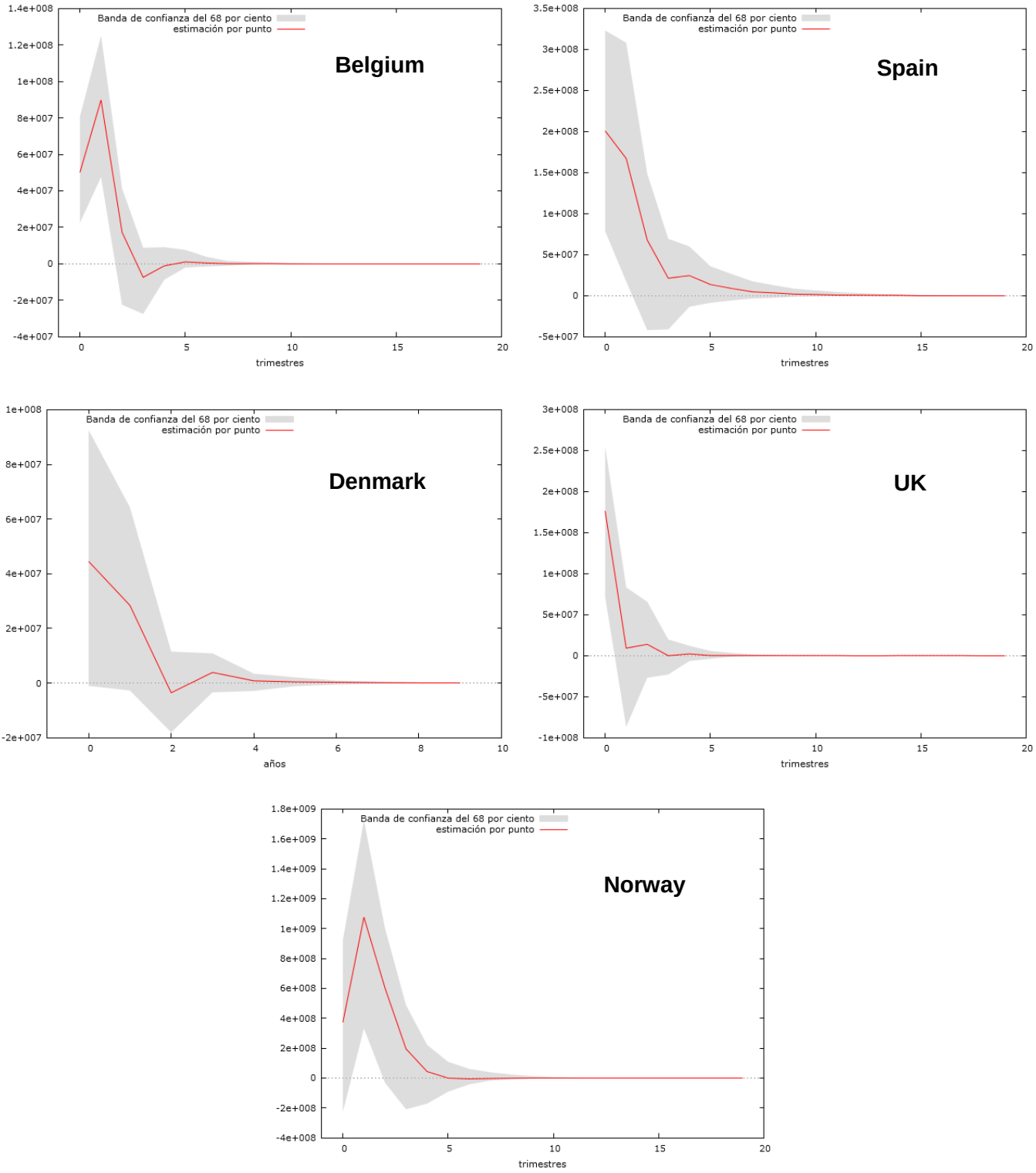


Figure 6. Real wage response to a shock in oil price in a period with rising prices before the crisis.

If we analyze Figure 6, we find that an increase in the price of oil in a period with increasing price levels leads to an increase in wages in all countries except the United Kingdom and Denmark, where the effects are not significant. If we look at Table 23, we

can see that the increase in wages is very low, so that a price increase in a period with rising prices leads to a scarce increase in wages.

- **Positive oil shock in Real wage in a period with rising prices after the crisis.**

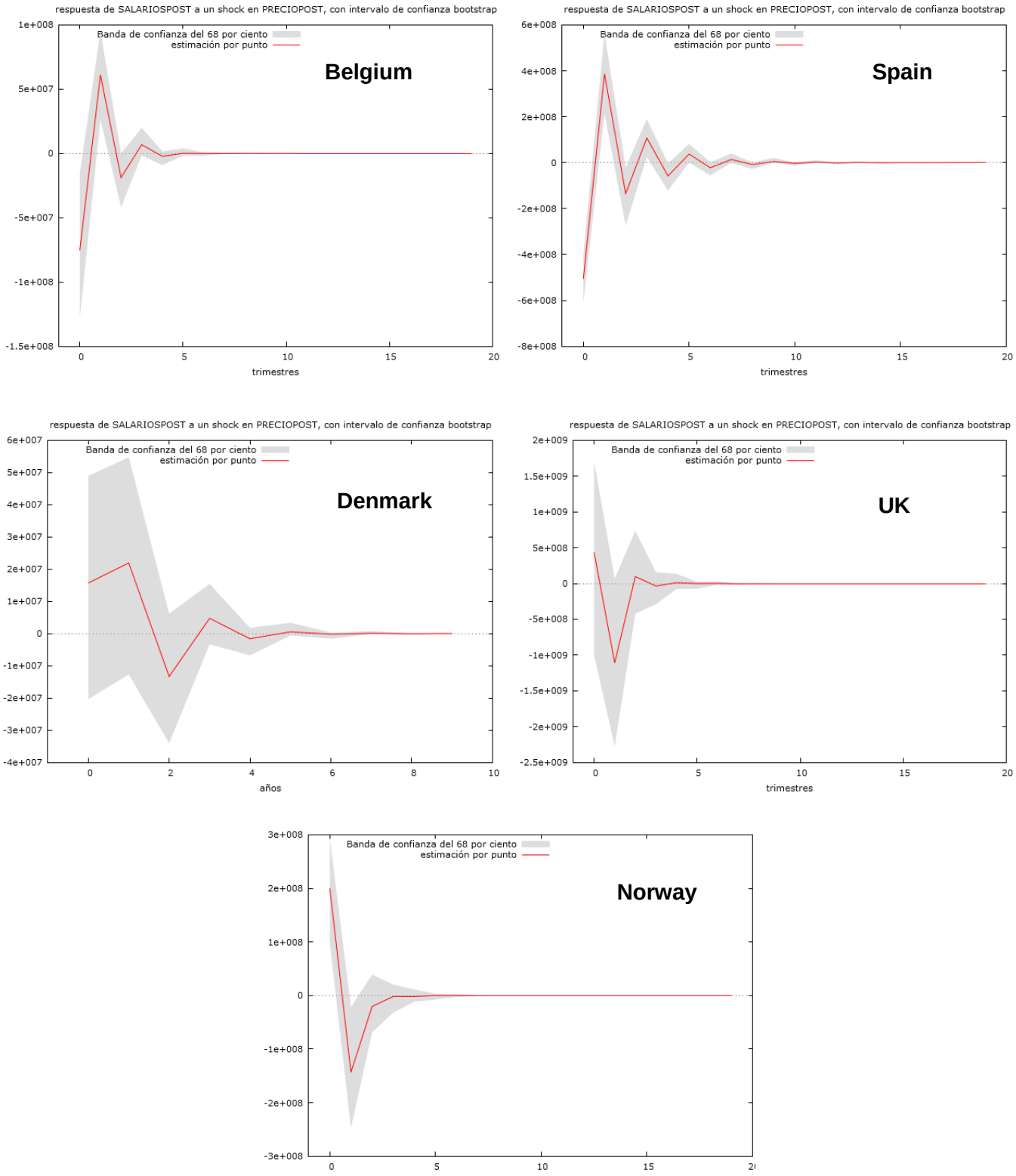


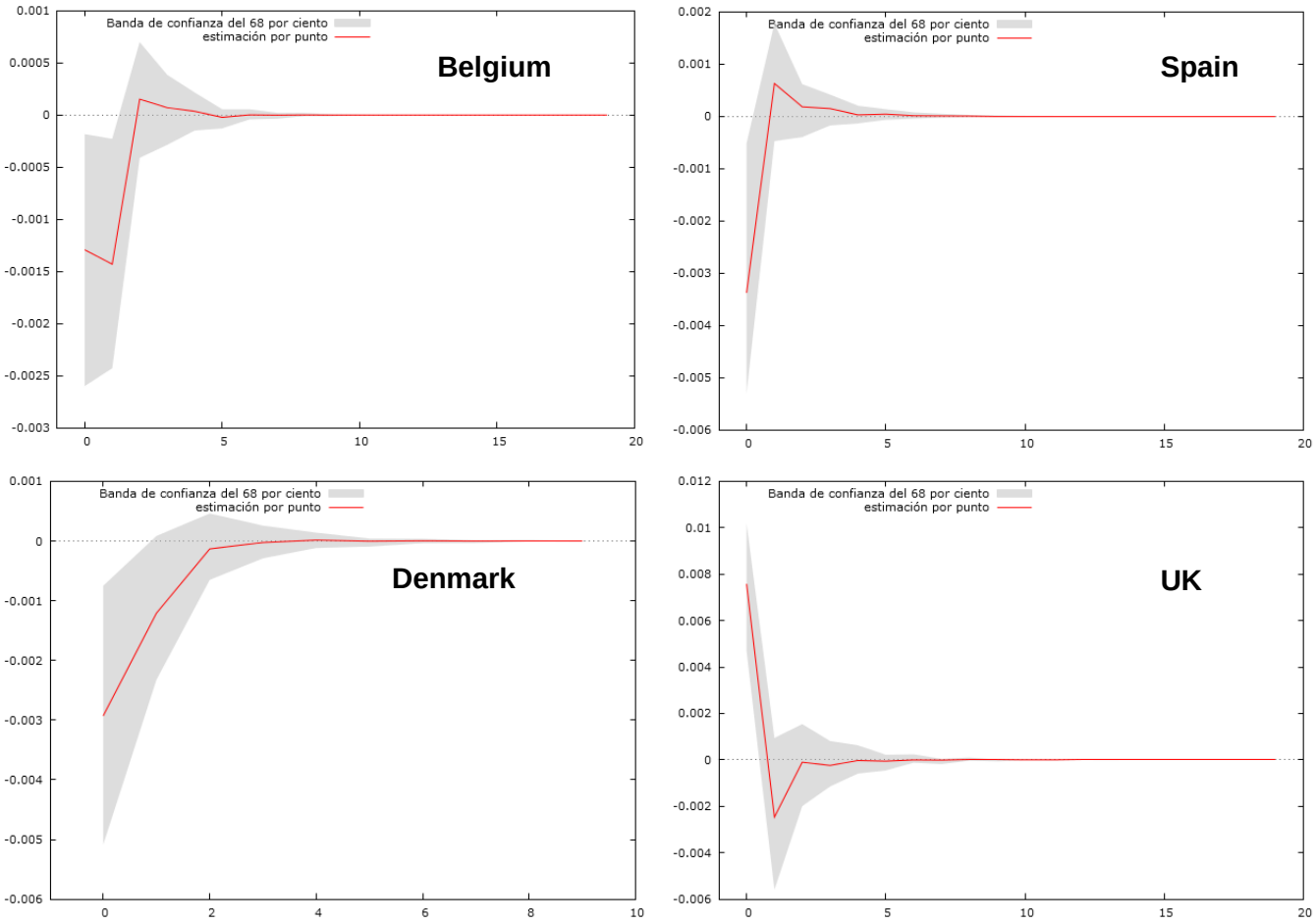
Figure 7. Real wage response to a shock in oil price in a period with rising prices after the crisis

As we can see in Figures 7, the impact caused by the increase in the price of oil in a period where price growth is positive has varied after the economic crisis. In Belgium and Spain, as we can see in Table 5, a price increase leads to a reduction in wages, while in Norway the effect is the opposite, and in the United Kingdom and Denmark the effects are not significant.

However, the values of the answers, which we observe in Table 8, are very close to 0. Therefore, we can affirm that despite the fact that after the crisis the effects on wages have varied, the influence on wages is practically zero since the values are close to 0 in both cases.

Next, we show the responses of real wages when there is a positive shock of the price of oil in a period with decreasing price increases.

- **Positive oil shock in Real wage in a period with decreasing prices before the crisis.**



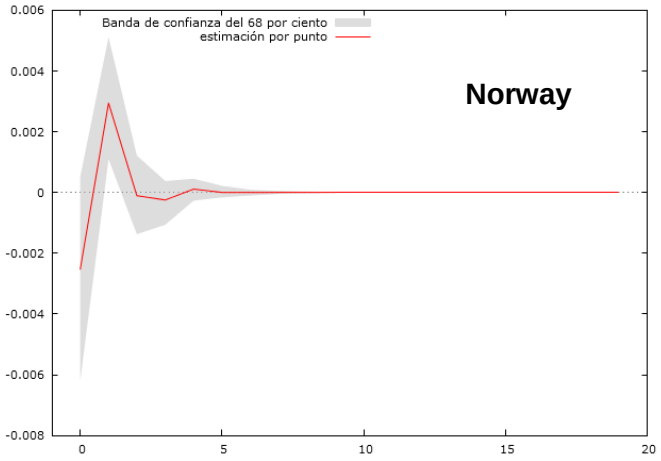


Figure 8. Real wage response to a change in oil price in a period with decreasing prices before the crisis.

If we study the graphs in Figure 8, we find that in the face of an increase in the price of oil in a period with decreasing prices, wages are reduced in Belgium, Spain and Denmark, while in the United Kingdom they are increased and in Norway they have no significant effects.

In Table 5, where we collect the aggregate responses for the first four periods, we find that the most damaging country is Belgium, where the increase in the price of oil in a value equal to a standard deviation reduces the real wage by 0.0026%, closely followed by Spain.

PERIOD	BELGIUM	SPAIN	DENMARK	UK	NORWAY
1	-0,001294	-0,0033798	-0,0029298	0,0075794	-0,0025407
2	-0,0027251	-0,0027510	-0,0012101	0,0051116	0,0004047
3	-0,0025728	-0,0025679	-0,00013408	0,0050081	0,00029857
4	-0,0026450	-0,0024183	-0,000026378	0,0047669	0,00005029

Table 5. Real Wage cumulative responses for the first four periods to a change in oil price in a period with decreasing prices before the crisis.

- **Positive oil shock in Real wage a period with decreasing prices after the crisis.**

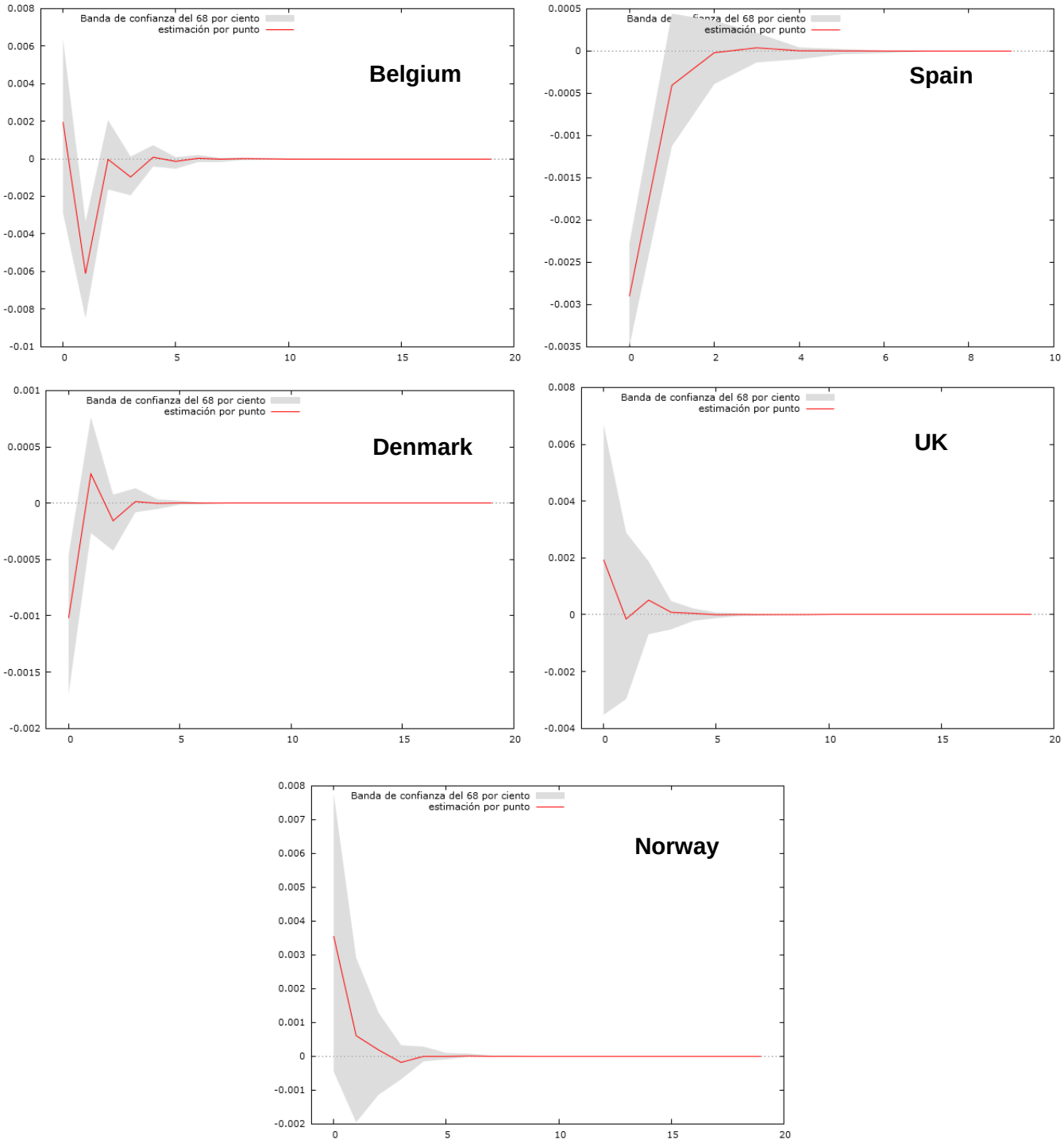


Figure 9. Real wage response to a shock in oil price in a period with decreasing prices after the crisis.

If we analyse the results obtained for the post-crisis period, as shown in Figure 9, we find that Spain has improved its position with respect to the price of oil, since an increase in oil prices in periods of decreasing prices has no effect on the level of real wages. On the other hand, the position of Belgium and Denmark remains similar while, after the crisis,

in the United Kingdom the effects are not significant and in Norway there is an increase in wages.

In the same way that it happened when we analyzed the GDP, we found that, when the increase of the oil price takes place in a period with decreasing prices, it is much more detrimental for the economy in the importing countries - Belgium and Spain - and Denmark. However, for the exporting countries, the United Kingdom and Norway, the results are not as conclusive.

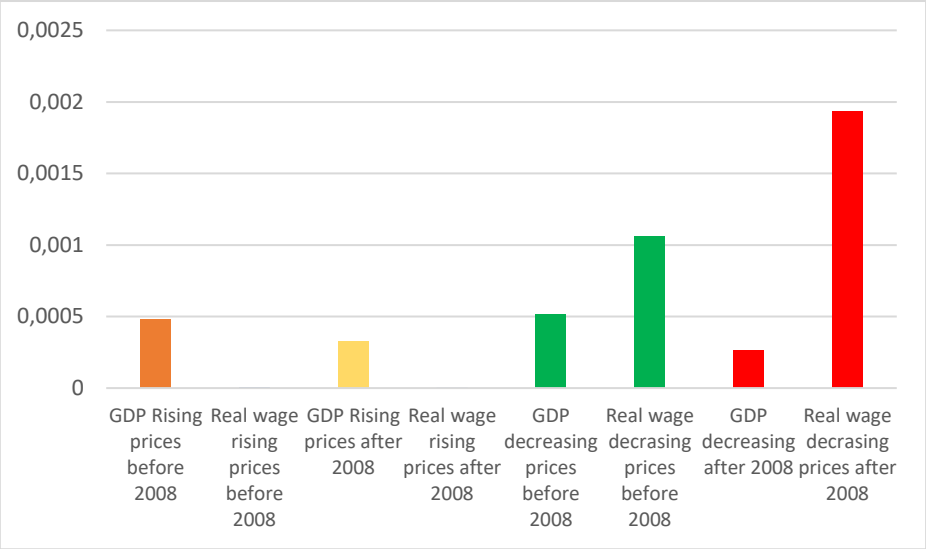
If we analyze the results obtained in the first model we developed, we find several conclusions.

First, as we can see in Table 6, there is no correlation between real wages and GDP in practically any country. Only in periods where price variation occurs in periods with price decreases do we find a positive and statistically significant correlation for most countries.

	Period	Belgium	Spain	Denmark	UK	Norway
Rising prices before 2008	-1	0,3763	-0,2790	-0,0156	-0,5519	-0,442
	0	0,6048	0,4394	0,5006	-0,2817	,7127
	-1	0,4631	0,2472	0,1761	0,0548	0,4283
Rising prices after 2008	-1	-0,0004	0,2424	-0,5374	-0,5470	-0,6690
	0	-0,2311	-0,4798	0,1864	0,0059	-0,5501
	1	0,0234	0,1738	0,0203	0,0092	0,0410
Decreasing price before 2008	-1	0,8524	-0,1688	-0,1640	0,0348	-0,6997
	0	-0,2215	-0,9993	0,1876	-0,2966	0,8350*
	1	0,11161	-0,1344	0.8961**	0,9165**	-0,1256
Decreasing prices after 2008	-1	-0,3127	0,2120	0,796	0,4336	0,0385
	0	0,9633**	0,5668	0,9147**	-0,8291**	0,9993**
	-1	-0,0510	-0,4898	0,2510	-0,1097	0,3317

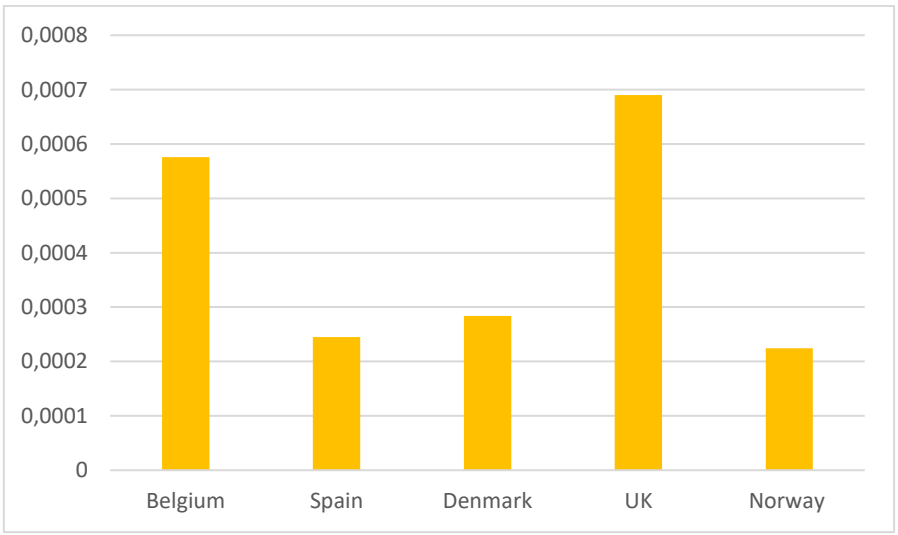
Table 6. Correlation coefficients for each country. * represents that it is significant at 10% confidence level and ** at 5%.

In Graph 1, where the average responses are represented in absolute value, we observe how, faced with variations in price in periods with increasing prices, greater average influence is expected on GDP, while when the variation in price occurs in periods where the price is decreasing, the real wage is more affected.



Graphic 1. Mean respones for each period

On the other hand, in Graph 2, we have represented the average expected responses for each country, we can observe how the country most affected in the price variations for this model is the United Kingdom, which indicates that this country is the most exposed to variations in the price of oil when we are in unstable periods in the level of prices



Graphic 2. Mean responses for each country.

In the following model, which we have previously called the Impact Asymmetric Model, the objective we pursue is different. While in the model that we just analyzed in order to try to observe the effects of applying a shock, both in periods with positive growth of prices and periods with negative growth, now we will try to estimate the different effects of applying a positive shock and a negative one on the price.

As we have previously introduced, we are going to estimate the model through a VAR system where we include as variables both the positive and the negative price.

We start by showing the effects provoked by a positive shock in the price of oil.

- **Positive shock in GDP before the crisis.**

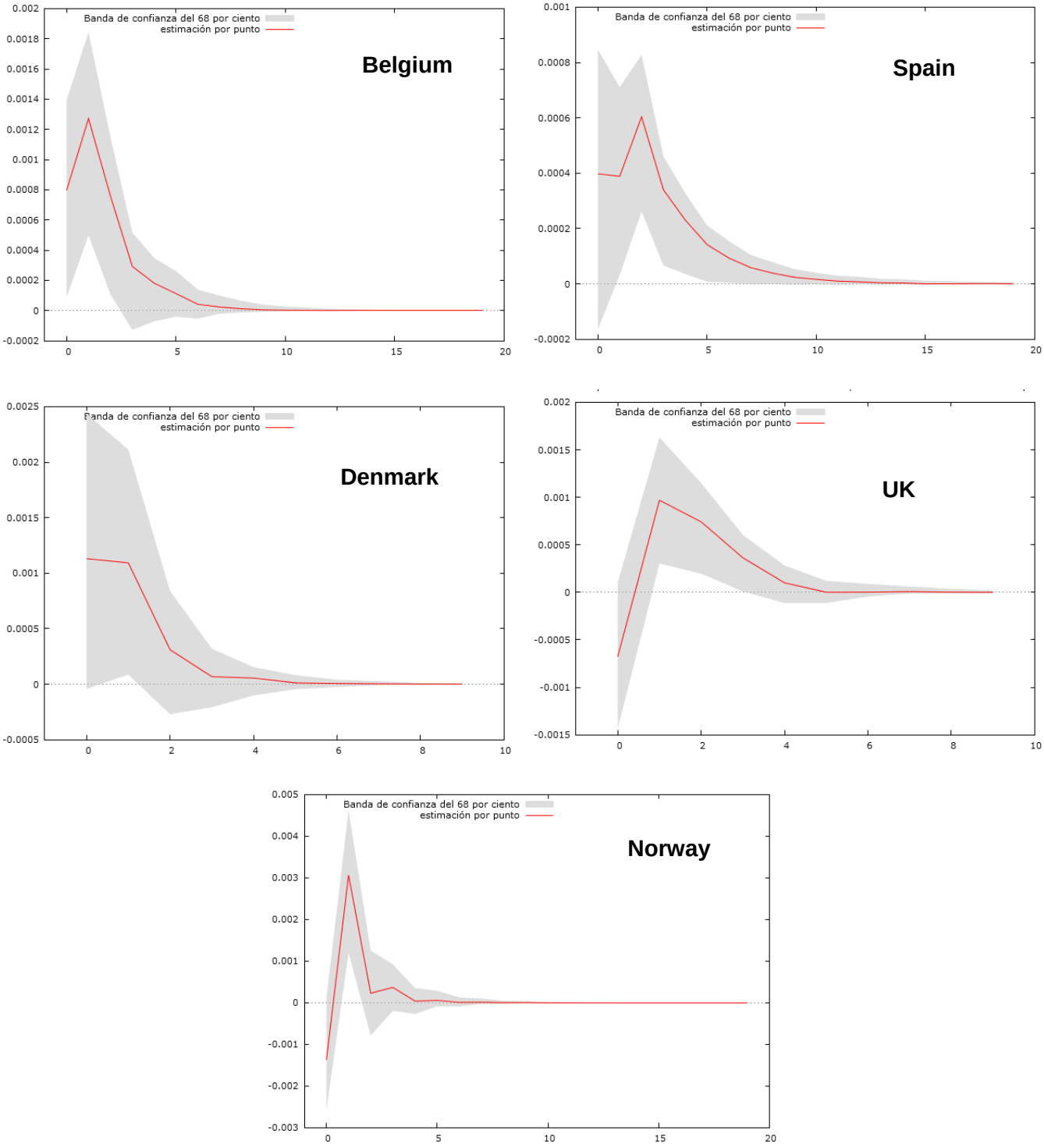


Figure 10. GDP responses to a positive shock in oil price before the crisis.

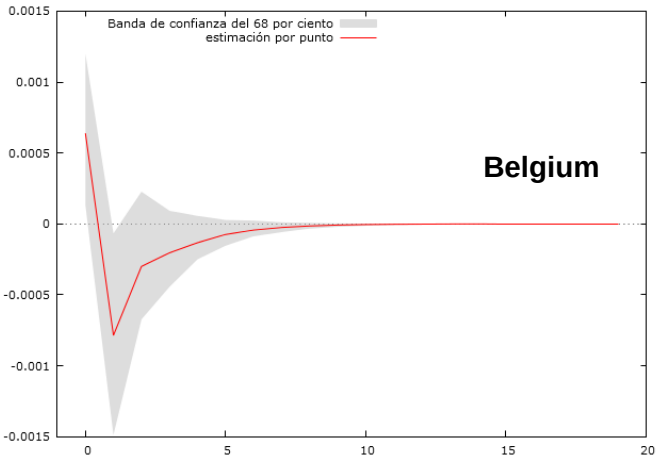
Analyzing the graphs represented in Figure 10, we found that, in the periods prior to the economic crisis, an increase in the price of oil equal to a standard deviation only had significant effects in Belgium, increasing its level of production.

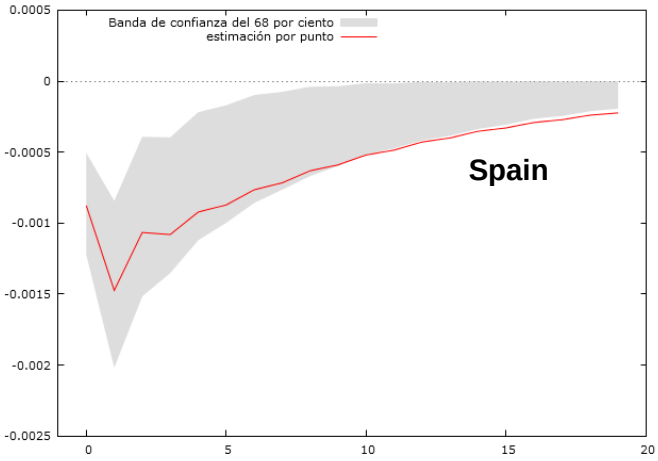
On the other hand, in Norway, despite the fact that, at first, the reduction in price reduces GDP, production increases rapidly in the second period and, as we can see in Table 7, the aggregate response after 4 periods is positive. Therefore, the price increase has positive effects on production in Norway.

PERIOD	BELGIUM	SPAIN	DENMARK	UK	NORWAY
1	0,0007964	0,0003974	-0,000076306	-0,0006780	-0,0001377
2	0,00092357	0,000786	0,000749074	0,00029016	0,00292551
3	0,00168338	0,0013893	0,000808942	0,00103111	0,00315108
4	0,001976	0,0017284	0,000851506	0,00139377	0,00351534

Table 7. GDP cumulative reponses to a positive shock in oil price before the crisis.

- **Positive shock in GDP after the crisis.**





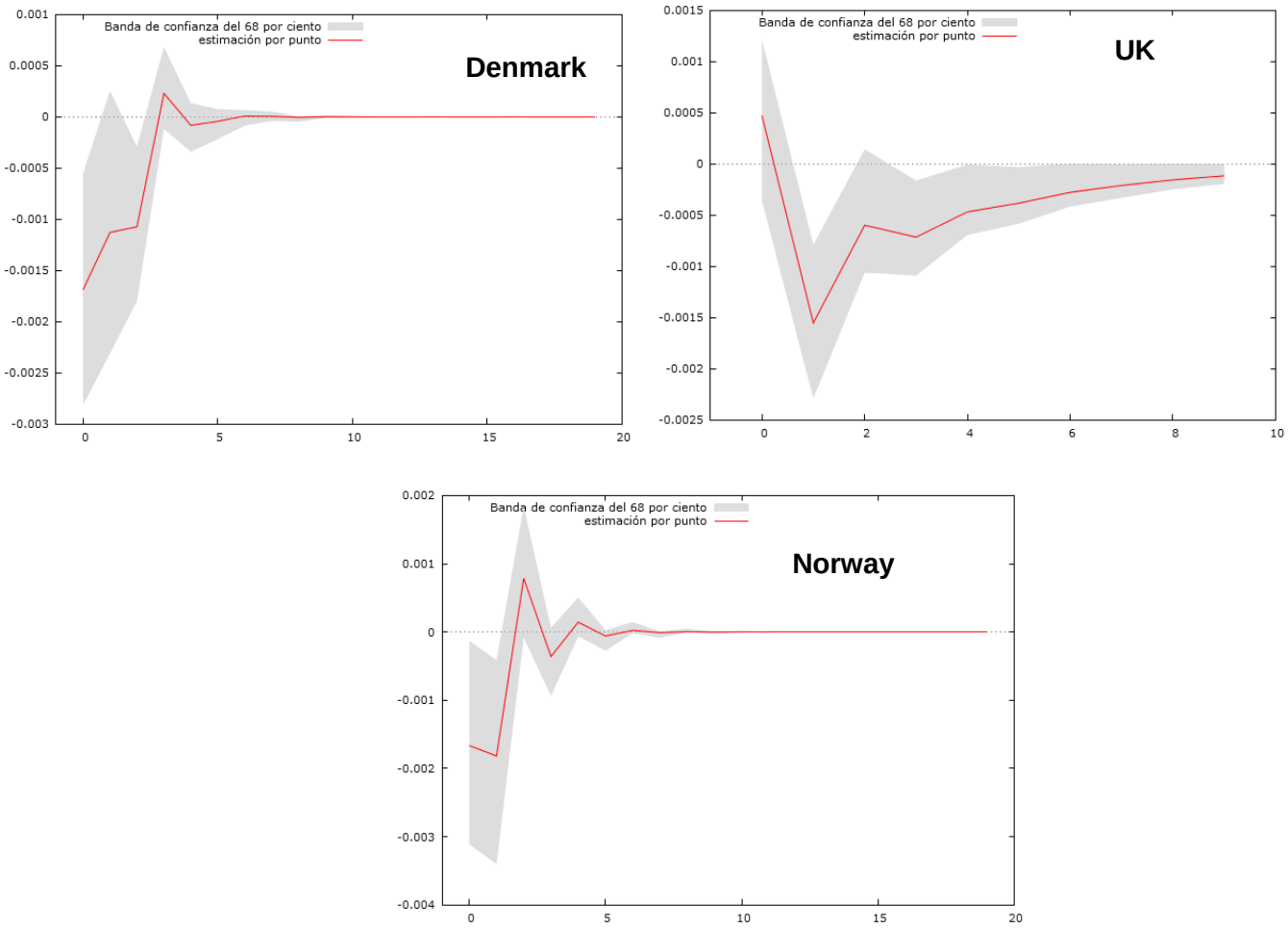


Figure 11. GDP response to a positive oil price shock after the crisis.

In Figure 11 we have the graphs that represent the impact on production in the face of a variation in the price of oil in the years after the crisis. If we compare the results with those obtained in the previous period, we find substantial differences. If in the previous period, the price increase only caused significant effects in Belgium were positive, in this period we observed how the effects are very different.

In all countries the effects are statistically significant - except in the United Kingdom - in the face of an increase in the price of oil, and there is a reduction in the level of production.

Despite the fact that in the first period the price increase increases production, it quickly leads to a drop in GDP and the aggregate response in period 4 is negative, as can be seen in Table 8.

On the other hand, we also note that the country most affected by the price increase after the economic crisis is Spain, where GDP is reduced by 0.0044% due to the increase in the price of oil.

PERIOD	BELGIUM	SPAIN	DENMARK	UK	NORWAY
1	0,000063861	-0,0008768	-0,0016899	0,00047352	-0,0016666
2	-0,000722709	-0,002352	-0,0028192	-0,0010804	-0,0034858
3	-0,001023399	-0,0034184	-0,0038932	-0,0016795	-0,0027009
4	-0,001227939	-0,0044694	-0,00366433	-0,0023949	-0,0030617

Table 8. GDP cumulative responses to a positive oil price shock after the crisis.

Jiménez et al (2005) find evidence that an increase in the price of oil has positive effects on the level of production in Norway while, in the United Kingdom, the effect is the opposite. In our study, we have not found evidence that a price increase has negative effects in the Anglo-Saxon country- with 68% confidence level-, therefore, we can conclude that the United Kingdom has improved its performance with respect to positive changes in the price of oil. On the other hand, in this period, the price increase has negative effects on Norwegian production, contrary to what was stated in that study and to what we observed in the previous period, therefore, the position of Norway before a positive shock of the oil price has changed abruptly after the crisis.

According to the authors, one of the main causes of this difference between Norway and the United Kingdom lies in the response of the Real Exchange Rate to a variation in the price of oil.

Next, we will show the results when the shock produced on the price of oil is negative, that is, when a price fall is induced.

- **Negative shock in GDP before the crisis.**

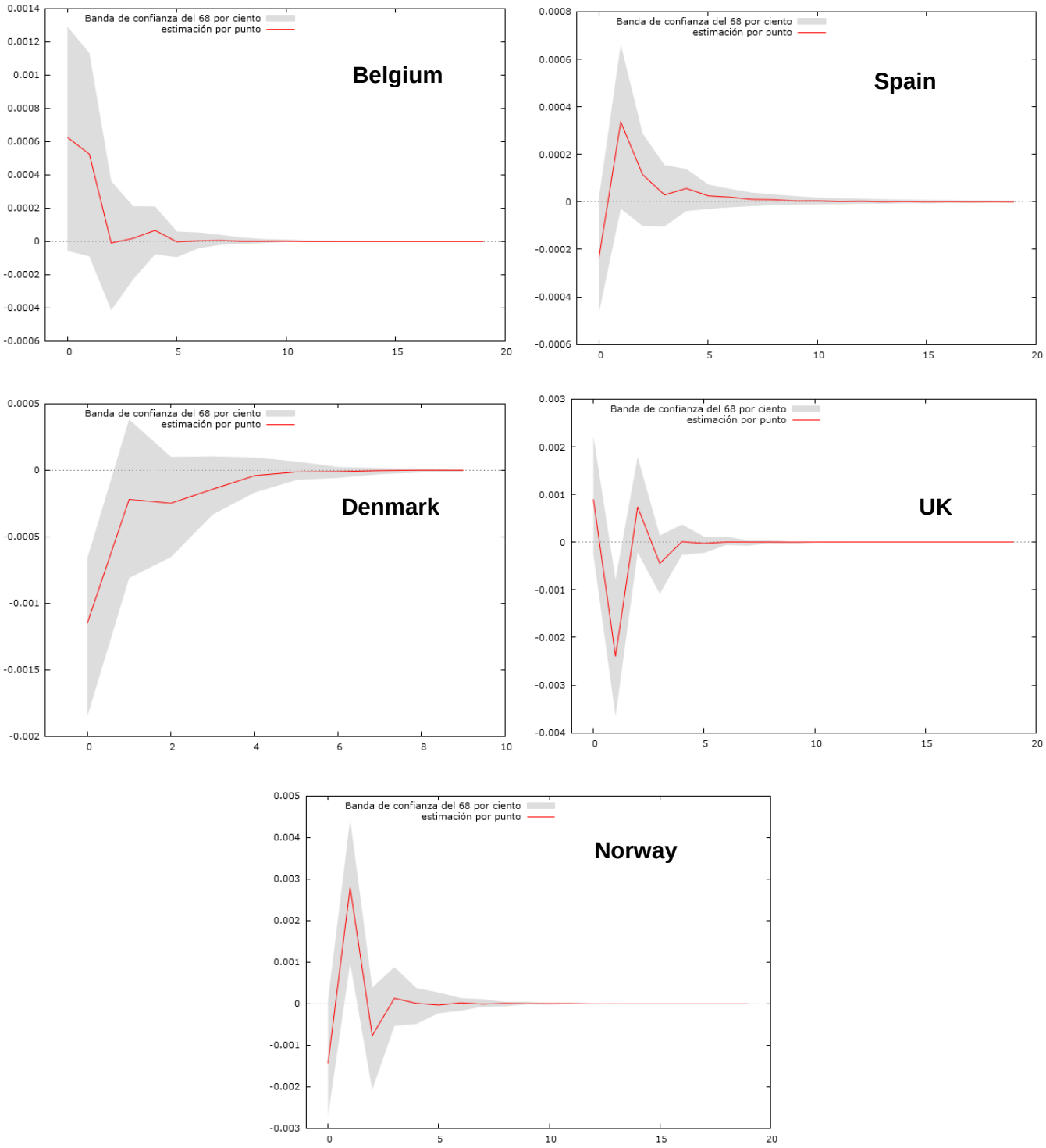


Figure 12. GDP responses to a negative oil price shock before the crisis.

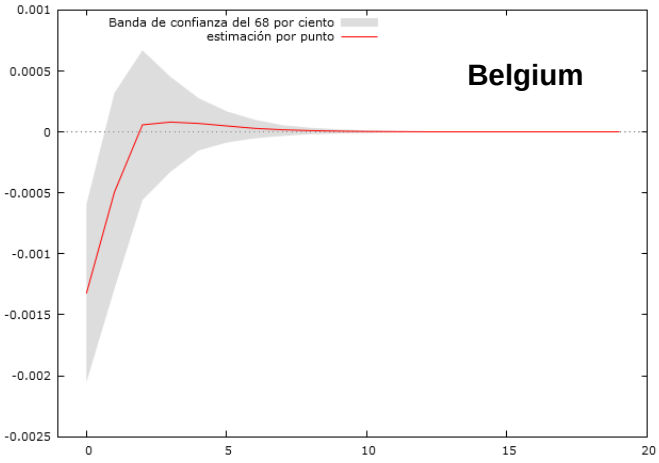
When we interpret the graphs in the face of a negative shock, it is important to clarify that we must do it in the opposite direction.

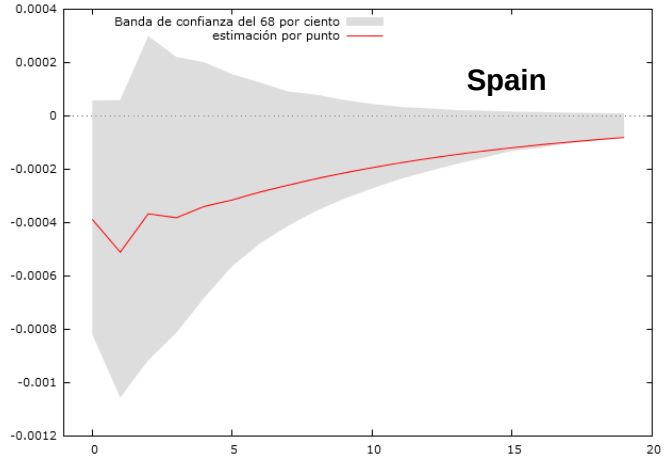
As we can see in Figure 12, the effects of a negative shock on the price of oil only have a significant statistical effect in the United Kingdom. This fact, agrees with the current

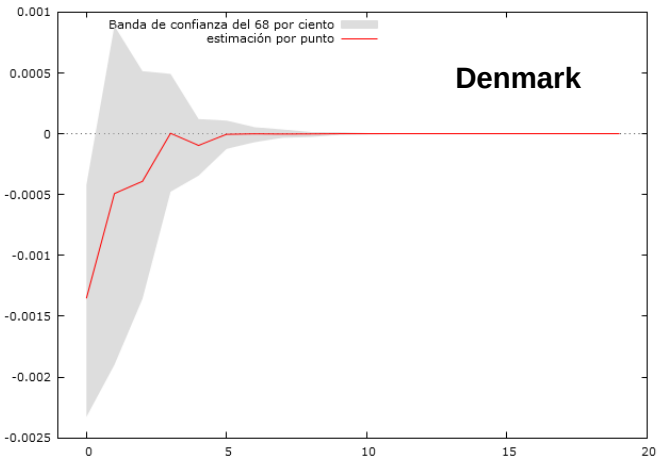
literature that affirms that the negative shocks on the oil price have no significant effect on the production of the countries. In addition, Jiménez et al (2005) find that only in the United Kingdom the effects caused by this shock are relevant.

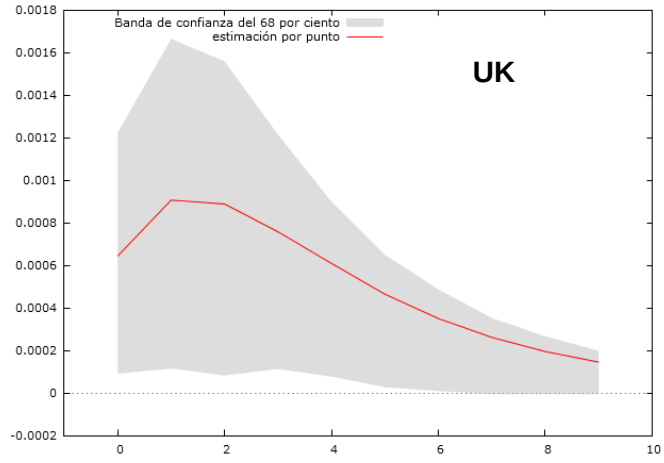
This is one of the evidences that we can observe about the asymmetries in the GDP before positive and negative variations in the price of oil. Literature, both in the last years of the 20th century and in the first years of the 21st century, shows that the effects on the GDP of positive variations do not have the same magnitude as if the price variation is negative and, in many cases, when the variation in the price is negative, the effect onthe GDP is not significant, as we have seen in this analysis.

- **Negative shock in GDP after the crisis.**









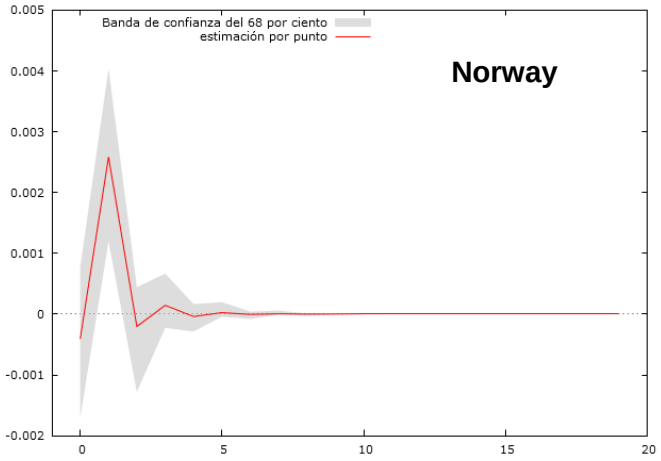


Figure 13. GDP responses to a negative oil price shock after the crisis.

As it happened when we estimated the model for positive shocks in the price, we found differences between the impacts before and after the year 2008.

On the one hand, in the Figure 13, we find that in Spain and Norway the effects are not significant while in Belgium and Denmark the GDP gets a slight increase. On the other hand, in the United Kingdom and Norway, in the face of a fall in the price of oil, the GDP reacts in the same direction and also decreases.

Therefore, we can affirm that, unlike what happened during the first years of the 21st century, after the economic crisis, a negative shock does have statistical impact on most of the countries.

However, we continue to find asymmetries in the price of oil and production. Although the effects of a fall in the price of oil have become significant in most countries, they are still less intense than when the oil price shock is positive. In other words, in the face of a positive shock in the price of oil, the reduction in GDP is greater than the increase that occurs when the shock in prices is negative.

Once the different responses of the GDP have been studied after inducing positive and negative variations in the price of oil, we are going to carry out the same process to obtain evidence about the impact of these variations on the real wage. Following the same process that we have developed so far, first, we are going to show the impacts of a positive change in the price of oil.

- **Positive shock in Real wage before the crisis.**

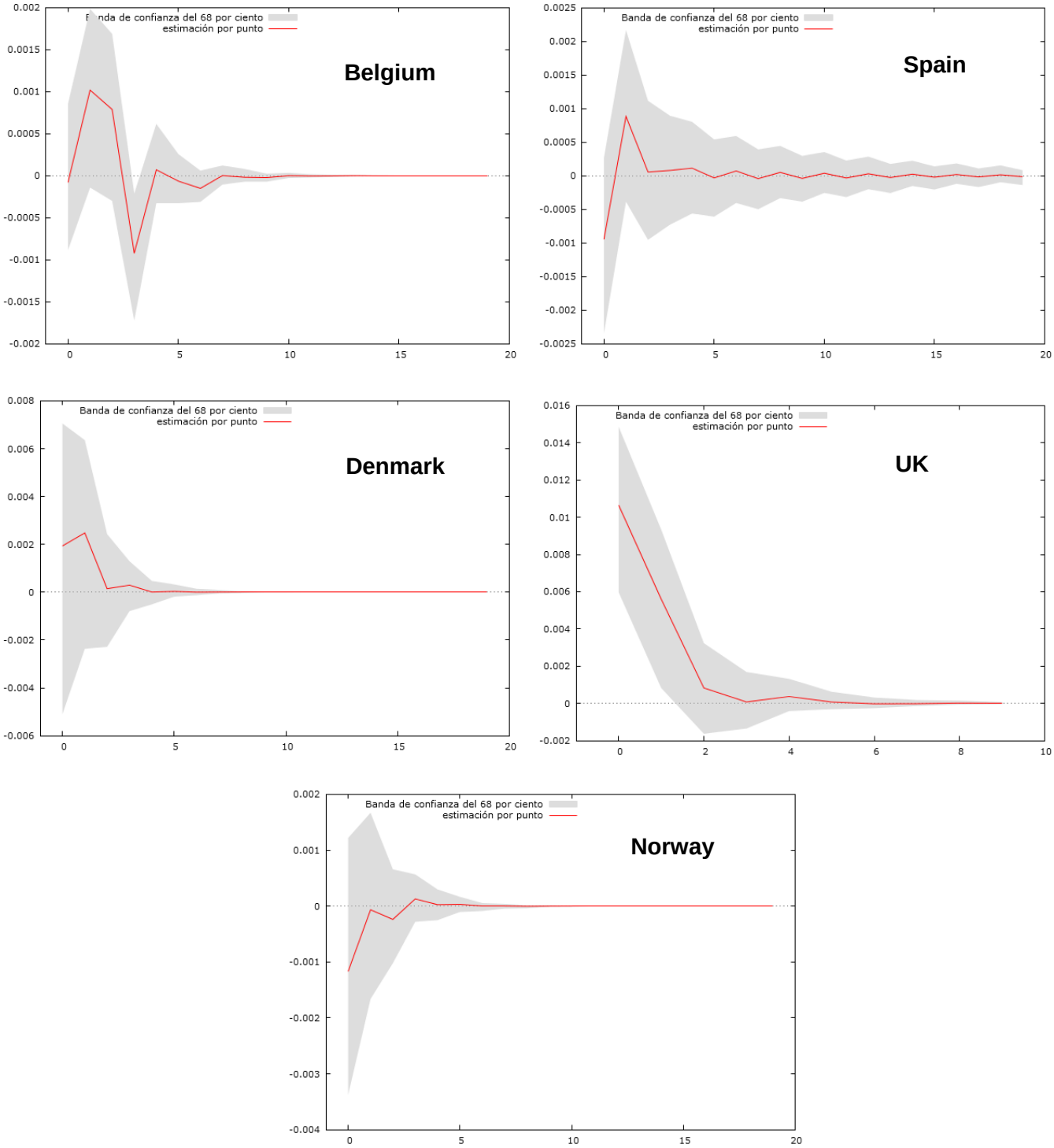


Figure 14. Real wage responses to a positive oil price shock before the crisis.

In Figure 14, the graphs of response of wages to the increase in oil prices are represented. A positive shock on the price of oil has no impact on the wage level of the study countries, except the United Kingdom, in the first stage of the study.

- **Positive shock in Real wage after the crisis.**

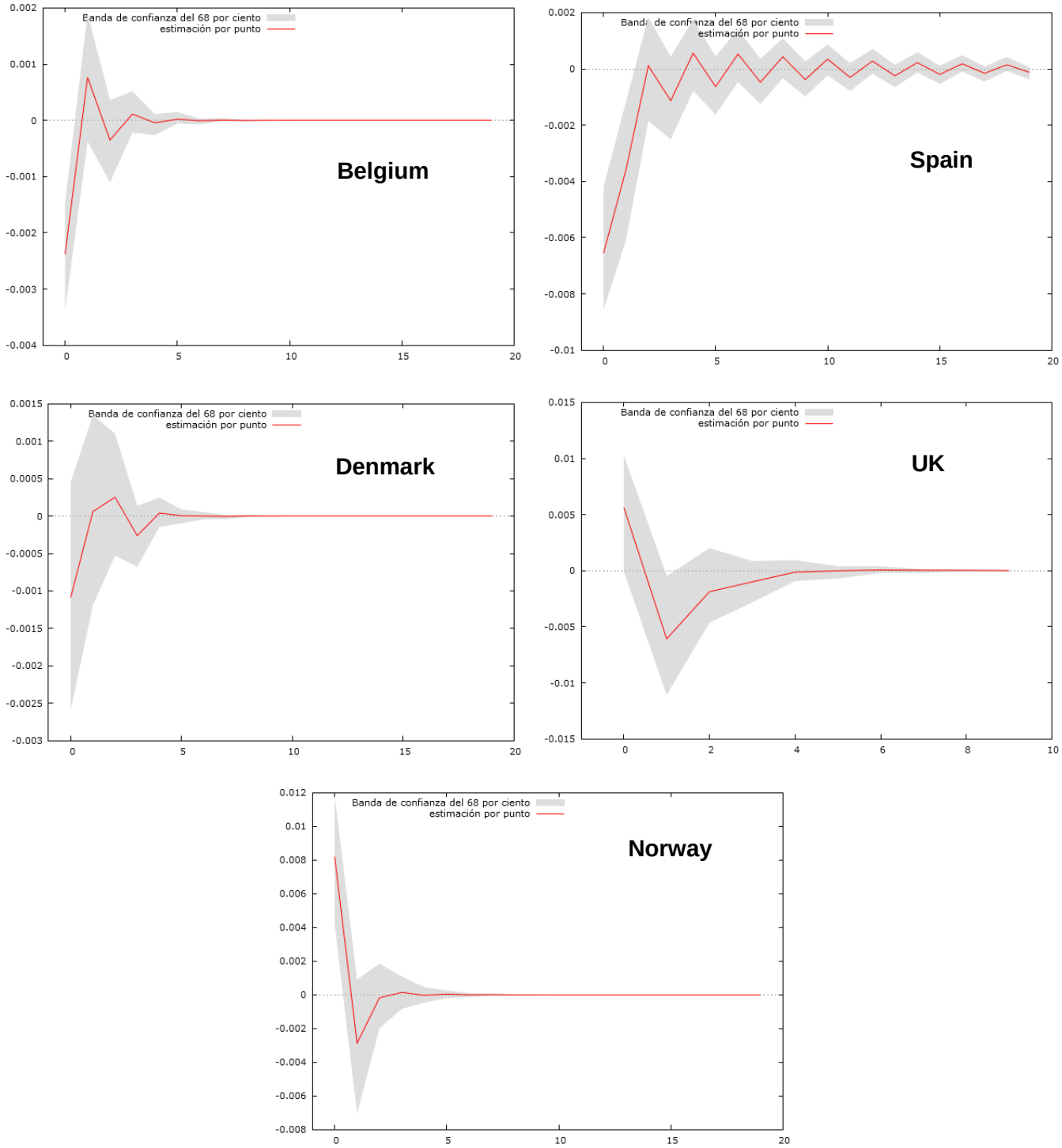


Figure 15. Real wage responses to a positive oil shock after the crisis.

If we study the results obtained after the economic crisis, we observe how the results have changed significantly. As can be seen in Table 9, Spain is the country that suffered the greatest fall in wages in the first period, followed by Belgium.

On the other hand, in Norway and the United Kingdom, despite the fact that in the first period wages increase, they fall rapidly afterwards. However, the aggregate effect on real wages in Norway is positive, while in the UK it remains negative.

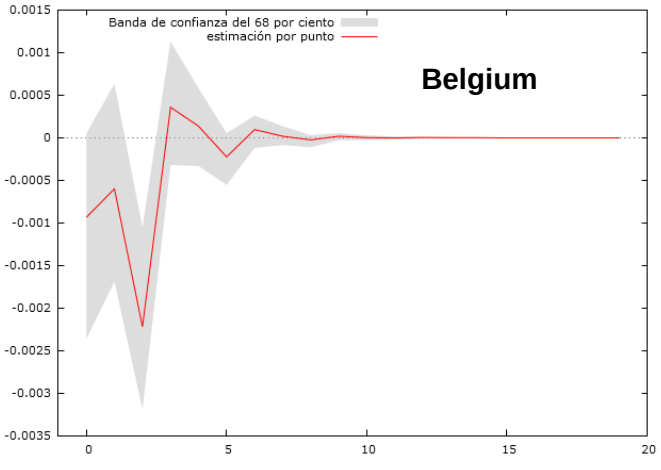
PERIOD	BELGIUM	SPAIN	DENMARK	UK	NORWAY
1	-0,0023787	-0,0065581	-0,00108	0,0056282	0,0082081
2	-0,0016143	-0,0101546	-0,00101987	-0,0004556	0,0013342
3	-0,0019648	-0,0100469	-0,00076734	-0,0023356	0,00114978
4	-0,0018540	-0,0111801	-0,00102925	-0,0033384	0,00129607

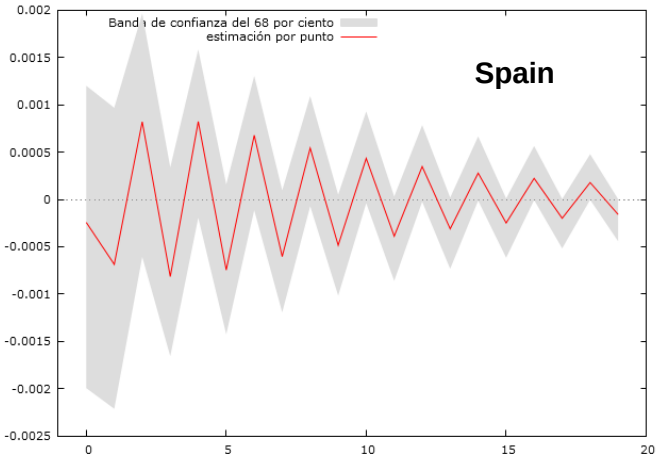
Table 9. Real wage cumulative responses to a positive oil price shock after the crisis.

This effect in Spain may be derived from the effect of inflation. As we have previously introduced, an increase in inflation can lead to a reduction in real wages. Some papers like Castro *et al* (2012) and Álvarez *et al* (2011) conclude in their studies that, after an increase in the price of oil, Spain is one of the countries in which the inflation rate increases most and most rapidly due to the increase in the price of oil. Due to this effect, the reduction in real wages is greater in Spain than in other countries.

Below, we show the results obtained on the aggregate wage level when we introduce a negative shock on the price of oil.

- **Negative shock in Real wage before the crisis.**





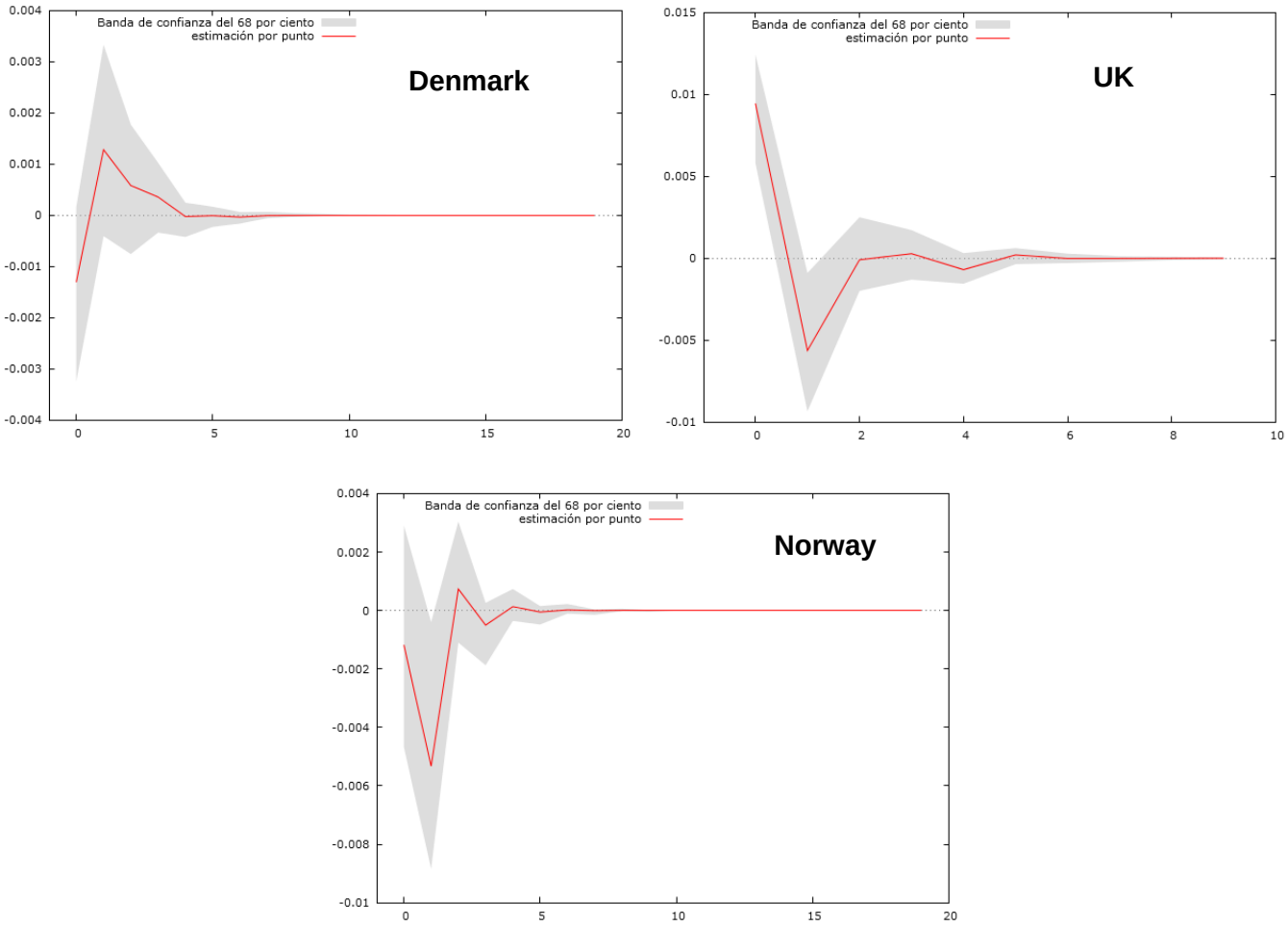


Figure 16. Real wages responses to a negative oil price shock before the crisis.

The same effect that we observed when estimating the model before a positive shock in the years before the crisis, as we can see in Figure 16, we find when we do the same before a negative shock. Only in the United Kingdom, a decrease in the price of oil has a significant effect on wages. In addition, it is consistent with what was previously obtained, an increase in the price of oil decreases wages while a decrease in the price increases them.

On the other hand, in the rest of the countries a negative impact on the price of oil does not affect the real wage. Therefore, we can affirm that in the years prior to the economic crisis the real wage was not affected by shocks in the price of oil in all countries except the United Kingdom.

- **Negative shock in GDP after the crisis.**

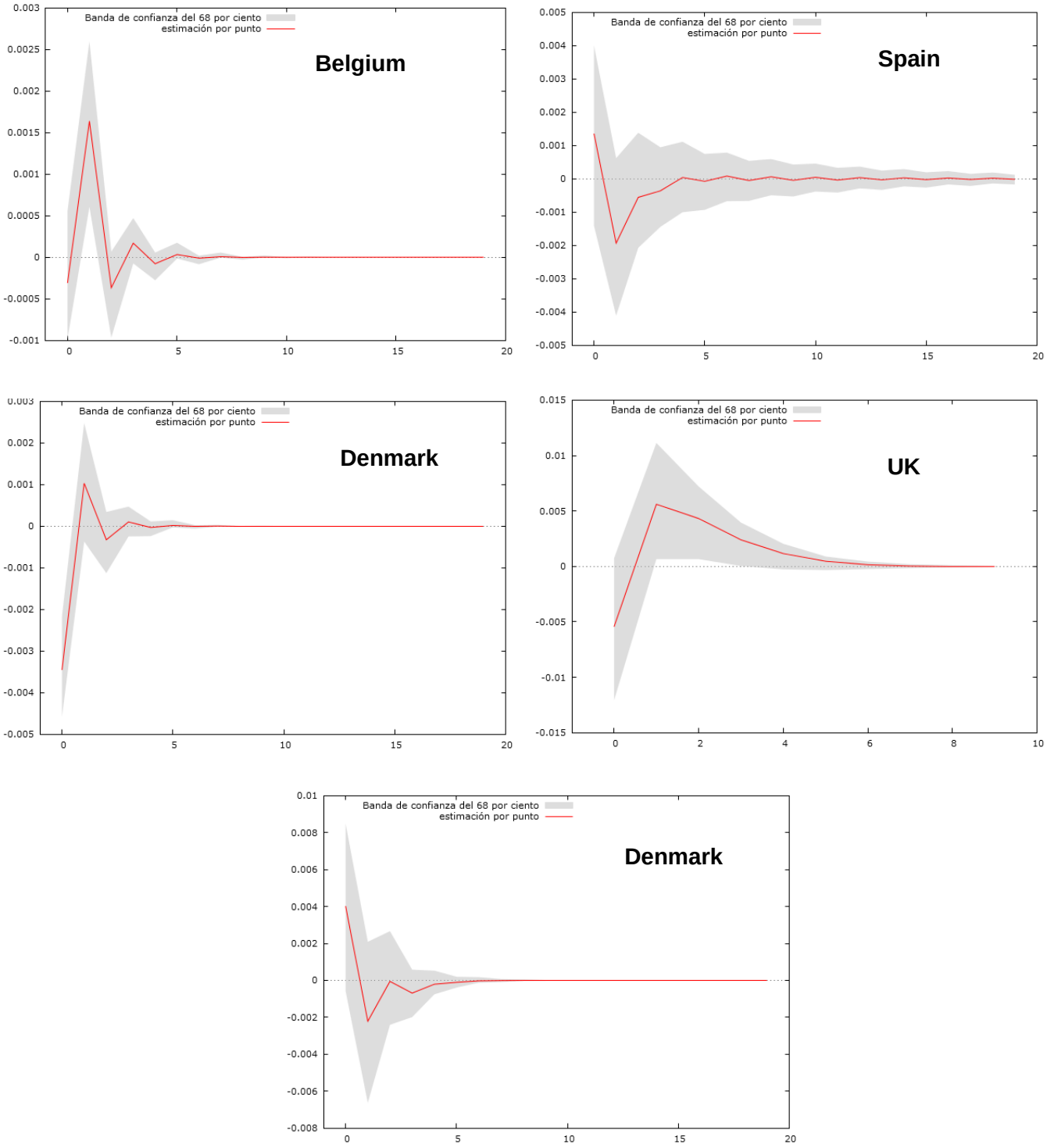


Figure 17. Real wage responses to a negative oil price shock after the crisis.

When we compare the results obtained in this model (Figure 17), we refute the idea that the real wage level is not affected by the impact of a negative shock on the price of oil in most countries - except in Denmark.

As we have shown in our analysis, variations in the price of oil is a very unimportant variable when it comes to explaining the level of real wages. Both when we induce a positive price shock and when the shock is negative, the effect on wages is negligible in most countries. In Denmark, a country whose role in the oil market is practically residual, the impacts caused by the variations in the price also do not follow a clear pattern and vary depending on the model and the period.

In addition, they have opposite effects for these countries. While a reduction in the price of oil, at first, reduces wages in Norway, to increase them in subsequent periods, in Denmark the effect is different, a reduction in the price of oil increases wages.

Once the model has been made and the impacts in each of the countries have been observed, we are going to show some of the conclusions we have reached. First, we have calculated the correlation between GDP and wage response for each of the countries and stages.

	Period	Belgium	Spain	Denmark	UK	Norway
Positive Price shock before 2008	-1	0,2071	-0,007	0,1039	-0,4739	-0,6303
	0	0,9515	-0,0473	1,1244	-0,5670	0,3892
	-1	0,8874**	0,0559	-0,9117**	0,5045	0,3473
Positice Price shock after 2008	-1	0,8001*	-0,3925	-0,2322	0,3738	0,2261
	0	-0,8442*	0,0580	0,1882	0,9894*	-0,2936
	1	0,1556	0,7003	0,0037	-0,4871	-0,7970
Negative Price sock before 2008	-1	-0,0378	0,4805	0,1133	0,1171	0,6703
	0	-0,11661	-0,0706	0,7438*	0,2216	-0,9310**
	1	0,0598	-0,0244	0,8372*	-0,3795	0,3622
Negative Price shock after 2008	-1	-0,7340	-0,1515	-0,2967	-0,2012	0,5238
	0	0,0005	-0,0752	0,8314*	0,9800**	-0,9940
	-1	0,1738	-0,1291	0,1659	-,2138	0,5134

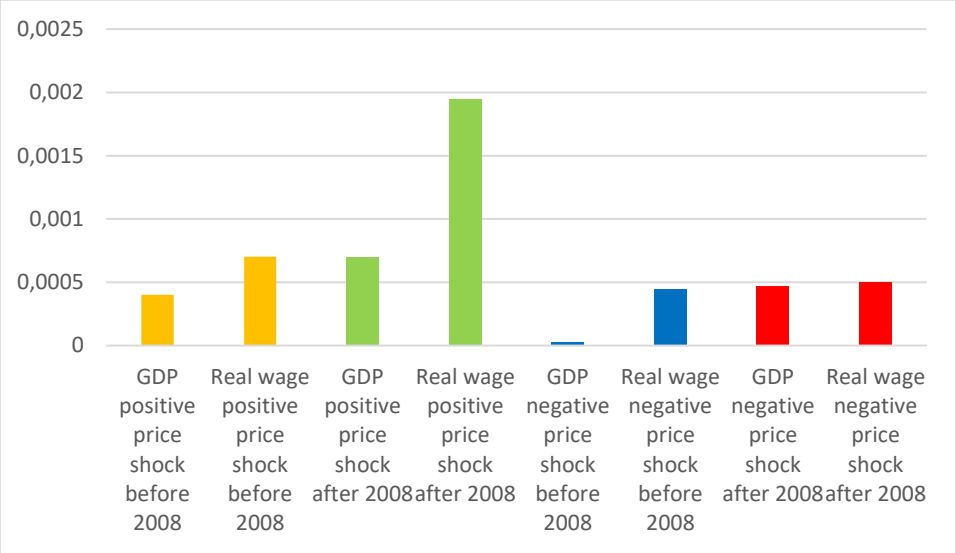
Table 10. Correlation coefficients for each country. * represents that it is significant at 10% confidence level and ** at 5%.

As we can see in Table 10, the correlation between the behaviour of these two variables in the face of an oil price shock is scarce for all countries. This indicates that the behaviour of GDP and wages do not follow the same pattern or cycle.

Furthermore, we find that in many of the cases where we find statistically significant correlation, the value is negative, which indicates that GDP and wages have inverse behaviors.

On the other hand, we have found evidence that in the face of a variation in the price of oil, the variation in the level of real wages is greater than that of GDP. To this end, we have calculated the average of the responses of the two variables in absolute value for each period.

As we can see in Graphic 3, the level of salaries suffer a greater impact on both positive and negative variations in the price of oil. On the other hand, we can also observe how the responses to a positive increase in the price, both in GDP and in wages, are greater than if the shock in the price is negative.



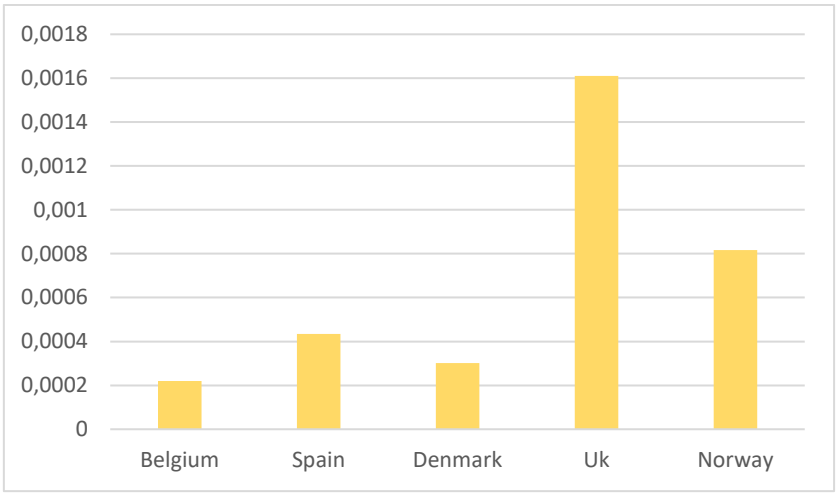
Graphic 3. Mean responses for each variable and period.

Another noteworthy effect is that, after the economic crisis, changes in the price of oil - both positive and negative - have a greater effect on GDP and real wages than in the periods prior to the crisis. Therefore, we can say that, in general, after the economic crisis, the economy is more dependent on the price of oil because the effects on GDP and the level of real wages, caused by a change in price, have increased.

In previous sections of the paper, when we exposed the asymmetric models, we indicated that a negative shock on the price of oil had practically no influence on the production of countries. However, after the economic crisis, this effect is significant in

most countries, however, the response is less than when a negative shock occurs. Therefore, we can affirm that the asymmetries, generally accepted by literature, have been reduced after the economic crisis.

Finally, in Graph 4, we find that the countries with an average response for each period are the United Kingdom and Norway, therefore, we can affirm that in this model, faced with a positive or negative price variation, the effect is greater on the producing countries than on the importers.



Graphic 4. Mean responses for each country.

6. CONCLUDING REMARKS

Once the two models have been exposed, we can affirm that the variation in the price of oil has a different influence in each of the countries and has varied substantially after the economic crisis.

We found that the United Kingdom is the country most dependent on oil price variations, as in both models it is one of the countries with the highest average expected response.

On the other hand, we generally cannot establish groups of countries with similar behaviour, such as, for example, between exporters and producers as we anticipated in the introduction, since the behaviour of each of the economies in the face of the variation in the price of oil depends on other factors and on their own economic structure.

We can also say that wages are more affected in practically all periods and models analysed - except when we induced a positive price shock for periods with rising prices

- than GDP. The greatest influence on wages occurs when we introduce a positive shock in a period with decreasing prices.

We have found evidence that, after the economic crisis, negative shocks on the price of oil do have an influence on the production of most countries, something that did not happen in previous periods.

Another of the objectives of the study was to know the behaviour of Denmark, a country whose presence in the international oil market is residual. As we have verified during the study, it does suffer alterations in the GDP and the real salary derived from the variations in the price of oil. In fact, in neither of the two models that we have carried out in this work is the country with the least influence. Therefore, we can affirm that the influence of this variable in Denmark is remarkable.

Finally, if we analyze the behavior of Spain, we find that despite being one of the most oil-dependent countries in Europe, it is not the country most affected by price variations in either model. However, one of the negative effects is that, currently, in the face of a price increase, Spanish wages are the most affected (the reasons have been explained above). In addition, in the asymmetric impact model, it is the country with the lowest correlation between the responses of wages and GDP, which may indicate that in the face of GDP increases the level of wages does not correspond to the same extent.

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