# The effects of VAT reduction on prices of agricultural goods in Spain

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**Abstract**

This paper examines the consequences of a temporary value-added tax (VAT) rate reduction on basic agricultural goods announced by the Spanish government on 1 January 2023. Specifically, we investigate the price effects of this VAT rate reduction using a Harmonised Consumer Price Index weighted average of affected products. To identify causal price effects, we employ a Differences-in-Differences methodology by comparing the price developments in Spain with similar products in Portugal that were unaffected by the VAT reduction. Our findings reveal a significant price response to the VAT rate cut, resulting in a price decrease of approximately 5.23%. This suggests that nearly 100% of the tax cut was passed on to consumers. However, the paper delves deeper into the temporal dynamics of this effect. In the months following the VAT reduction, prices began to rise again, casting doubt on the long-term effectiveness of this fiscal policy measure in containing inflation within the basic food sector. Furthermore, we explore the impact of the VAT reduction on household expenditure. Our analysis reveals that lower-income deciles within the population benefited the most from the VAT reduction, indicating a positive effect on income distribution. In summary, while the VAT reduction initially had a positive impact on prices, inflation, and income distribution, its long-term effects were limited. Moreover, it primarily benefited lower-income workers, underscoring its progressive character.

***Keywords:*** *value added tax; fiscal policy; diff in diff; inflation; income distribution.*

***JEL Classification:*** *E310, H220, H250, D31, L66.*

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# 1 Introduction

As highlighted by Fuest, Neumeier, and Stöhlker (2021), the temporary reduction of VAT rates is a relatively new instrument of fiscal policy. As explained in Blundell (2009) and Crossley, Low, and Wakefield (2009), its objective is to stimulate demand mainly by creating incentives for consumers to frontload spending. Although, in the case of Spain, it has also been used as an instrument to control inflation and to cushion the negative social consequences of rising prices, derived from the reduction in the consumption capacity of the middle and low- income working classes. However, this can only work if the reduction in the VAT rate is passed on to consumers in the form of lower prices.

Therefore, this chapter aims to estimate the effects of the VAT reduction in Spain[1] on the prices of the goods affected by it and its effects on households' spending of agro-industrial googs in Spain. For this purpose, as usual in this type of study, a quasi-experimental Differences-in-Differences (hereafter, DiD) methodology will be used in which the causal effects of an event or measure on a study group compared to another with identical characteristics are estimated (Angrist & Pischke, 2014). This methodology will make it possible to identify whether the VAT reduction on certain commodities, promoted in Spain as of January 1, 2023[2], has been passed through to prices, the intensity of this pass-through and, moreover, its effect on households' spending. Consequently, if the VAT reduction has not been passed through to prices, it can be concluded that this tax reduction has favored the increase in corporate profits.

In theory, following Benedek, Mooij, Keen, and Wingender (2019), the effect of a VAT fluctuation is not unambiguous, it depends on the market structure: a partial equilibrium model in competitive markets may produce an effect on prices lower than the VAT variation (undershifting); in non-competitive markets and endogenously determined product quality, the pass-through may be more than complete (overshifting); it is even possible that the price of the good including taxes is reduced (the Edgeworth paradox or, possibly, in two-sided markets).[3]

With respect to timing, the theory offers several hypotheses that make it possible to evaluate that the pass-through not only occurs contemporaneously, but can also be anticipated or delayed in time. On the one hand, the substitution effect may produce a rise in prices in anticipation of the change in VAT. On the other hand, the response may be delayed in time because of the menu cost effect.

Although the impact of permanent VAT changes has been extensively studied, very little is known about the price effects of temporary VAT changes[4], not least because this instrument has rarely been used.

There are reasons to believe that the impact could be different in the case of temporary

[1] Royal Decree-Law 20/2022, of December 27, on measures to respond to the economic and social consequences of the war in Ukraine and to support the reconstruction of the island of La Palma and other situations of vulnerability.

[2] See Royal Decree-Law 20/2022.

[3] See, for example, Rysman (2009).

[4] See, for example, Benedek et al. (2019).

changes in VAT, especially because it would imply a double cost for the company, according to the hypothesis of menu costs, there would be an increase in costs in the decrease and another in the increase of VAT.

Therefore, the effect of a VAT change on prices and the time in which the impact becomes effective has become an empirical question. Benedek et al. (2019) present an excellent summary of the main empirical evidence in the literature. In summary, this empirical evidence presents results that argue that the pass-through of a change in VAT to prices is not total; although there is also evidence of a total pass-through to prices. Other studies, on the other hand, cannot reject the full pass-through hypothesis. The pass-through also depends on the VAT rate, the characteristics of the good or service, the market structure, the economic cycle, macroeconomic conditions and the time horizon of analysis.

Most studies focus on the effect of a change in VAT on some specific products, not on the entire universe of consumer goods and, moreover, are limited to a certain region or country. The analysis methodology may, on the other hand, produce non-robust estimates and identification problems arising from the choice of similar products (Benedek et al., 2019).

The paper is structured as follows. Section 1 serves as the introduction. Section 2 conducts a comprehensive literature review, summarizing relevant studies in the field and discussing the existing body of knowledge related to the research questions. In Section 3, the DiD methodology and the event study is elaborated upon. Section 4 covers the sources of data and the sample used in the study. This section is also dedicated to presenting the results of the study. Following the previous results, in Section 5, the paper delves into a counterfactual inflation analysis. Section 6 focuses on the analysis of income distribution. Section 7 concludes the paper by summarizing the key results and their significance. Finally, the paper includes an appendix containing additional graphs.

## 2 Literature review

It is important to review some important evidence, such as that of Benedek et al. (2019), which uses monthly observations of consumer prices and VAT rates for about 70 commodity groups in 17 Eurozone countries over the period 1999-2013. Their main objective is to identify the degree of impact of various types of VAT changes, including the standard VAT rate. Its results show that the impact on prices varies systematically and sharply depending on the type of VAT reform. It finds a higher probability of full pass- through in the case of changes to the standard rate; however, the impact of reduced rates is significantly lower. This study also shows that the effect depends on the type of good, being higher for durable goods than for non-durable goods. Finally, other factors that may have an effect on the magnitude of the pass-through include market structure and export intensity. Macroeconomic variables also play an important role, i.e., the business cycle and, if countries are members of a monetary union, the exchange rate regime and monetary policy.

A very striking study is that of Fuest et al. (2021), for Germany. That study tries to

assess the price effects of the temporary VAT reduction (implemented between June 3, 2020, and January 1, 2021, in Germany), using a dataset that includes daily prices of about 130,000 supermarket products. To identify causal price effects, they compare price developments in Germany with those in Austria. The authors show evidence of an asymmetric price response to a reduction in the VAT rate and a subsequent increase. The VAT rate reduction resulted in a price decrease of about 1.3%, implying that about 70% of the tax reduction was passed on to consumers. In contrast, the VAT increase was only about half. They also show that market structure is key to understanding the impact of VAT changes, as they find evidence that pass-through is stronger in more competitive markets with a large number of competing products.

Regarding the time period of effect of the measure, these authors have found evidence of anticipatory behavior of firms, i.e., that the impact of the VAT reduction on prices was greater and immediate from the week prior to the tax reduction. In addition, they also show that supermarket prices did not rise again until the VAT reduction was repealed. Finally, they show that the increase was not complete, representing only half of the VAT rate reduction.

Crossley et al. (2009) analyze price adjustments in response to a temporary VAT reduction of 2.5 percentage points for 13 months in the United Kingdom during the 2008/2009 financial crisis. The authors compare monthly inflation in the UK with inflation in 15 other OECD (Organization for Economic Co-operation and Development) countries. Their results indicate that the tax cut had a temporary effect, lowering prices for a limited period of time, with the effect disappearing even before VAT recovered its initial value.

Montag, Sagimuldina, and Schnitzer (2020) also focus on the VAT reform in Germany and trace the impact of the tax reduction on fuel prices. The authors compare the evolution of prices at German and French gas stations. They find that the impact in the case of diesel is around 80%, while it is lower in the case of gasoline, a result that is due to the lower price elasticity of diesel compared to gasoline.

Gaarder (2019) analyzes not only the impact of VAT on prices, but also its redistributive effect in a study of the effects of a sharp change in VAT on food in Norway. Using a regression discontinuity design, the author estimates the direct impact of the policy change on consumer prices of food items, as well as any cross-over effects on the prices of other goods. His results show that taxes levied on food are fully passed through to consumer prices, while prices of other goods are not materially affected. To understand the redistributive effects of VAT reform, the author uses expenditure data and presents evidence that reducing VAT on food attenuates inequality in consumer welfare, in part because households adjust their consumption patterns in response to price changes.

In turn, Benzarti and Carloni (2019), present evidence for France, taking as a starting point the VAT reduction applied to French restaurants in 2009. Unlike previous studies, which only focus on the effects of VAT reforms on prices, these authors also estimate the effects of the VAT reduction on four target variables: workers, firms, consumers and suppliers of material goods. Using a DiD methodology on firm-level data, they find that: busi-

ness owners pocketed more than 55% of the VAT reduction; consumers, material goods sellers and workers shared the rest of the expected gains, with consumers benefiting the least; and employment effects were limited.

For the case of Spain, in July 2018, the Spanish government implemented a modification to the Value Added Tax (VAT) structure that affected film activities. Specifically, the general tax rate was reduced from 21% to the reduced rate of 10%. In a study conducted by Moral-Arce and Gómez-Antonio (2020), the impact of this measure on prices and consumption related to these activities was explored. The researchers used the Consumer Price Index (CPI) as a tool to calculate the theoretical price reduction, assuming a 100% tax pass-through rate. The results of this analysis revealed that producers of film activities only passed on a modest 27.2% of the tax reduction to consumer prices.

Additionally, in the Spanish context, de Amores-Hernández, Barrios, Speitmann, and Stoehlker (2023) carried out the first evaluation of the 2023 temporary VAT reduction. In this case, they used products from a supermarket chain operating in both Spain and Germany as a control group, using the products in Germany as a reference. The results of their study revealed a degree of pass-through of approximately 93%, indicating a higher absorption of the tax benefit by consumers compared to the previous study conducted by Moral-Arce and Gómez-Antonio (2020) in 2018.

There is also another evaluation of the VAT reduction on basic foods, in Almunia, Martínez, and Martínez (2023). The authors analyze the data collected by the Datamarket platform, which includes daily prices of all foods on the websites of large supermarkets that account for 40% of the total market share. The conclusions they reach is that during January and February, they observe that the VAT reduction was overwhelmingly (more than 90%) passed on to final prices in large supermarkets. The redistributive impact is progressive because it means higher savings for low-income households as a proportion of their total expenditure. However, they conclude that a targeted income transfer policy to low-income households would have been more effective from a distributional point of view, and cheaper from a budgetary point of view. This is because they find a much smaller effect due to several drawbacks.

In summary, as highlighted above, the study of the impact of a VAT tax policy reform is an essentially empirical problem, since the results may fluctuate depending on a number of microeconomic and macroeconomic factors.

## 3 Methodology

The DiD method is a quasi-experimental design, in which the causal effects of an event or measure on a study group are estimated: how does variable X cause variable Y? This methodology was born to solve a problem that until then had no solution, to quantify the effect of a treatment by comparing two groups that are not exactly the same from the start (Angrist & Pischke, 2014). In 1855, the physician John Snow proposed this method to elucidate what was the origin of cholera, a disease that devastated London in the mid-19th

century. The doctor had the idea that this meaning came from water contamination, although he did not have the opportunity to test it until he came across a quasi-experiment that allowed him to develop this methodology. Two water supply companies were operating in the UK capital at the time. One of them started supplying from a different source than the one they were using at the time, a source that was not contaminated with cholera. These two water supply companies operated in different districts, districts that had different values of cholera deaths, but which followed the same trend within the series, since they were very similar to each other. Following the technical language, these companies fulfilled the necessary assumption of parallel trends. Snow could not compare from a simple difference these districts, since they started from different origins, but, since this assumption was met, he could compare the changes that had occurred within each district as the source of the water changed. In this way, John Snow proved that cholera came from contaminated water and popularized the DiD method (Angrist & Pischke, 2014; Cunningham, 2021).

This method has been widely used in economics ever since and is currently one of the most widely used methodologies in the social sciences. This is exemplified by the Nobel Prize awarded to David Card in 2021, justified by the use of this methodology to study the causality between the rise in the Minimum Wage (MW) and the evolution of employment (Card & Krueger, 1994).

Technically, what is desirable when using this methodology is to find what would have happened in the treatment group if the measure had not existed (the scenario known as counterfactual). In this sense, one looks for a group that has been affected by some measure, known as the treatment or treatment group, while the control group has not been affected by the policy in question. The choice of treatment and control group should be randomized, which would guarantee finding the counterfactual without any bias. The latter is known as a "natural experiment". All DiD designs are based in some way on a natural experiment. If the choice is not random, the characteristics of the individuals make them eligible for the measure, which induces a selection bias.

There may even be treated and untreated individuals who are different in characteristics unobservable to the investigator. We might think that the situation could be solved in this context by observing the treated individuals before and after the establishment of the measure. In this way, we use the treatment group before the measure as the control group and the treatment group after the measure as the treatment group. The problem is that another bias arises. Certain events may be occurring between the two periods, contaminating the result. However, one could use the group of untreated individuals as a control group and compare it with the group of treated individuals and see the differences before and after. It is on this idea that the DiD method is based. The difference in the mean values of the variables of interest between the "after" and "before" is calculated for each of the treatment and control groups. Finally, the difference between these two mean differences is obtained.

A simple linear regression will identify our mean treatment effect with two time peri-

ods. We assume no explanatory variables to simplify the analysis:

$$Y_{it} = \beta_i + \beta_0 + \beta_1 D_i + \beta_2 T_t + \delta D_i \cdot T_t + \varepsilon_{it} \tag{1}$$

Where $\beta_i$ are the fixed effects of individuals, $D_i$ is a treatment dummy variable that can take two values; equal to 1 if individuals belong to the treatment group and equal to 0 if they do not belong to the treatment group. $T_t$ is a time dummy variable that can take two values: equal to 1 if the data occur after the treatment and equal to 0 if they occur after the treatment. This approach is known as the Two-Way Fixed Effects Estimator (TWFE). The measure effect is $\delta$ and we have identified the counterfactual for the treatment using the time differences in the untreated units.

The above would apply in the case where we have two periods. What happens when we have more time periods?

If we have several time periods we can test the hypothesis of parallel trends and we can also see the temporal effects after the implementation of the measure: for example, we can check if the effects are persistent, if they end, if it is an immediate effect or if it takes a long time to take effect, etc. This is known as event study.

The econometric specification would be as follows:

$$Y_{it} = \beta_i + \beta_0 + \beta_1 D_i + \beta_2 T_t + \sum_{t=1, t \neq t_0}^{T} \delta_t D_i \cdot T_t + \varepsilon_{it} \tag{2}$$

where $t_0$ is the period 0 in which the policy is implemented. In this case it is much simpler to test the policy and we can see the temporal causal effect of the policy implementation ($\delta_t$).

### 3.1 Model applied for the Spanish market

Following the methodology proposed in the DiD section and identifying the control and treatment groups, when the measure is applied we can apply the DiD and event study methodology for more periods to our case. Moreover, with evidence that the assumption of parallel trends is met in our case for Spain. The model would be as follows:

$$Y_{it} = \beta_i + \beta_0 + \beta_1 Treated_i + \beta_2 VAT_t + \delta Treated_i \cdot VAT_t + \varepsilon_{it} \tag{3}$$

Where $Y_{it}$ is the dependent variable, in our case it is the Harmonized Index of Consumer Prices (hereinafter, HICP) of the products, $\beta_0$ is the constant term, $Treated_i$ is a dummy variable that takes value 1 for the weighted products affected by the measure and 0 for those that are not, $\beta_1$ is the coefficient measuring the difference between the products affected and those not affected, $VAT_t$ is a time dummy variable indicating when the measure was implemented, specifically taking value 1 for values after January 2023, inclusive, and 0 for the rest. $\beta_2$ is the coefficient that measures the time difference before and after, $Treated_i \cdot VAT_t$ is a multiplicative dummy variable, which takes values equal to 1 when the products are affected and we are after the implementation of the measure, $\delta$ is the coef-

ficient of interest, the causal effect of VAT implementation, and $\varepsilon_{it}$ is the error term. Time fixed effects are included in the model as an explanatory variable.

For the event study, the model would be as follows:

$$Y_{it} = \beta_i + \beta_0 + \beta_1 Treated_i + \beta_2 VAT_t + \sum_{t=1, t\neq t_0}^{T} \delta_t Treated_i \cdot VAT_t + \varepsilon_{it} \tag{4}$$

where the rest of the variables are the same as in the previous model, $t_0$ is the period of implementation of the VAT measure, which is January 2023, and $\delta_t$ is the temporary causal effect of the VAT implementation on prices.

In order to carry out our model we must first establish an effective group of controls that follow a parallel trend to the groups of products affected. In the case of Spain, we identified subclasses of products that, despite being very similar to the treatment group, have not changed their VAT because they are not considered basic products in the shopping basket. Among these products, we find, for example, breakfast cereals, discarded due to their high level of sugars, or yogurts, which, unlike other dairy products, such as all types of milk and cheese, have not been affected. In this way, we can identify a robust group of controls that have very similar characteristics to the products with which they are to be compared. By constructing graphs comparing these products in pairs, we can corroborate that prices move in a similar way, maintaining parallel trends, which allows us to perform the DiD model, as explained above.

# 4 Empirical Data and Results

## 4.1 Spain as control group

The Spanish Government has reduced the VAT (Royal Decree-Law 20/2022, of December 27) on fresh or basic foods announced from January 1, 2023 to alleviate the rise in prices caused by the war in Ukraine. The foodstuffs that have seen their VAT reduced from 4% to 0% are common bread, flour, milk, cheese, eggs, fruits, vegetables, legumes, tubers and cereals that have the status of natural products in accordance with the Food Code and the provisions issued for its development. The foods that have undergone a VAT reduction from 10% to 5% are olive oil, seed oils and pasta. This measure was originally intended to remain in force until June 30, 2023, but has been extended until December 31, 2023.

First, the price data have been obtained from the 5-digit subclass category of the Eurostat CPI for Spain, with monthly frequency. In order to correctly identify the treatment group and the control group, it was necessary to select those products affected by the VAT reduction measure in the case of the treatment group, and those products not affected by the measure, which follow the same trend and have similar characteristics to the affected products, for the control group.

It is for this reason that we have the IHPC of the following products: olive oil; rice; cereals and bread; fresh or refrigerated fruit; flours and other cereals; eggs; fresh whole

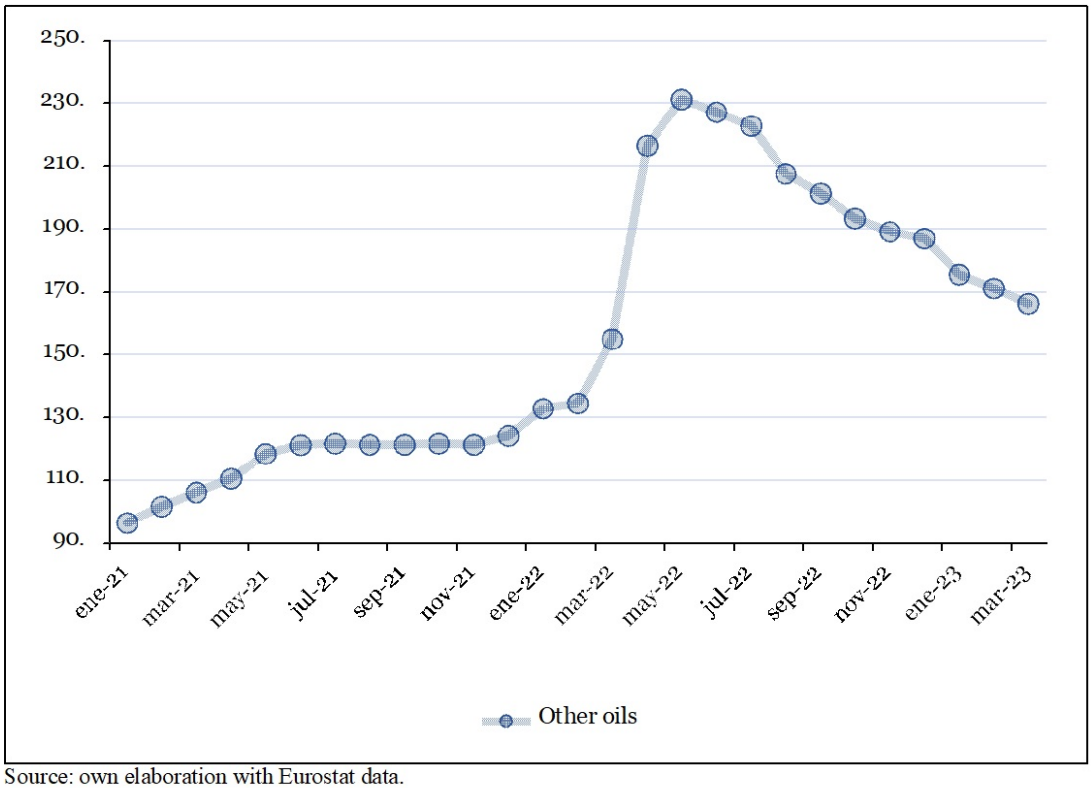
milk; fresh skimmed milk; bread; pasta and couscous; potatoes; cheese and curd; and frozen vegetables.

The control groups used for comparison should be groups that are not affected by the measure and have similar characteristics. Control groups that meet the parallel trends would be: poultry; breakfast cereals; canned fruit and fruit products; ice cream; butter; other cereal products; other baked goods; French fries; pizza and quiche; dried and other canned vegetables; and yogurt.

Among the products affected we find one exception (Figure 1), the subclass of Other oils. Within this group we find sunflower oil, whose price has registered an abnormally upward trend since the beginning of the Russia-Ukraine war. This exogenous event makes its evolution not comparable with any other product, which makes it impossible for us to include it in the model as we cannot use any valid control.

Thus, as described above, we can identify a robust group of controls that have very similar characteristics to the products with which they are to be compared. By constructing graphs (see Appendix A) comparing these products in pairs, we can corroborate that prices move in a similar way, maintaining the assumption of parallel trends, which allows us to perform the difference-in-differences (DiD) model, as explained above.

**Figure 1:** Evolution of the monthly price index of the Other oils group.




Source: own elaboration with Eurostat data.

As can be seen in Appendix A, in all the product groups analyzed we can observe a generalized upward trend, registering the highest values in terms of index at the end of

2022. This fact reaffirms the need to take measures in relation to prices, since all these products represent the basis of the diet of Spanish households, especially for those with lower incomes, who cannot afford to buy more expensive products, such as fish and meat. Since most of the products affected by the VAT reduction measure are agricultural, they can be highly affected by seasonality and climate, especially in times of high harvests or rainfall. For this reason, the data have been de-seasonalized by product following the STL decomposition (Seasonal-Trend decomposition using Loess).[5]

The STL decomposition is a seasonal adjustment method that decomposes series into seasonal series, trend series and the remainder using a filtering algorithm based on LOESS regressions introduced in Cleveland, Cleveland, McRae, and Terpenning (1990). STL has two main advantages over other seasonal adjustment methods. First, it works with any data frequency and can be computed on time series data with irregular patterns and missing values.

The STL method assumes an additive relationship between the seasonal, trend and residual components:

$$Y_t = S_t + T_t + R_t \tag{5}$$

where $Y_t$ is the dependent variable, $S_t$ is the seasonal component, $T_t$ is the trend and $R_t$ is the irregular component or the rest of the components of the variable. The calculation of each component involves a double recursive procedure.

Table 1 presents a detailed list of the products that are directly affected by the measure implemented by the government. In order to make informed decisions about the impact of this measure, we have matched each of these products with an appropriate control group. This choice is based on the observation of parallel trends, which allows us to compare precisely how the prices of the affected products develop relative to those that are not influenced by the measure.

It is important to note that the measure in question involves two key components. First, the change in the Value Added Tax (VAT) rate, which has a direct impact on the costs and prices of these products. Secondly, the change in price leads to a change in the expected theoretical price of the products.

In general terms, it is anticipated that the theoretical change in the prices of these products should reflect an average reduction of 3.95%. This percentage is calculated considering the direct effects of the variation in the VAT rate and how this affects the theoretical price. If, when analyzing the empirical data, we observe that the real decrease in prices does not exceed this value, it could be concluded that the measure implemented has not achieved a significant impact in reducing the prices of these basic foodstuffs.

To carry out this analysis, we have applied a specific formula, which we have taken from the research conducted by Almunia et al. (2023).

[5] Loess is a locally weighted regression technique.

$$\Delta P = \frac{1 + VAT_{after}}{1 + VAT_{before}} - 1 \tag{6}$$

where $VAT_{before}$ is the VAT tax rate before the implementation of the measure, while $VAT_{after}$ is the VAT rate after the implementation of the measure.

This formula is essential to accurately calculate the change in the theoretical price and, therefore, determine whether the measure has had a positive effect on the objective of reducing the costs of these essential products for consumers.

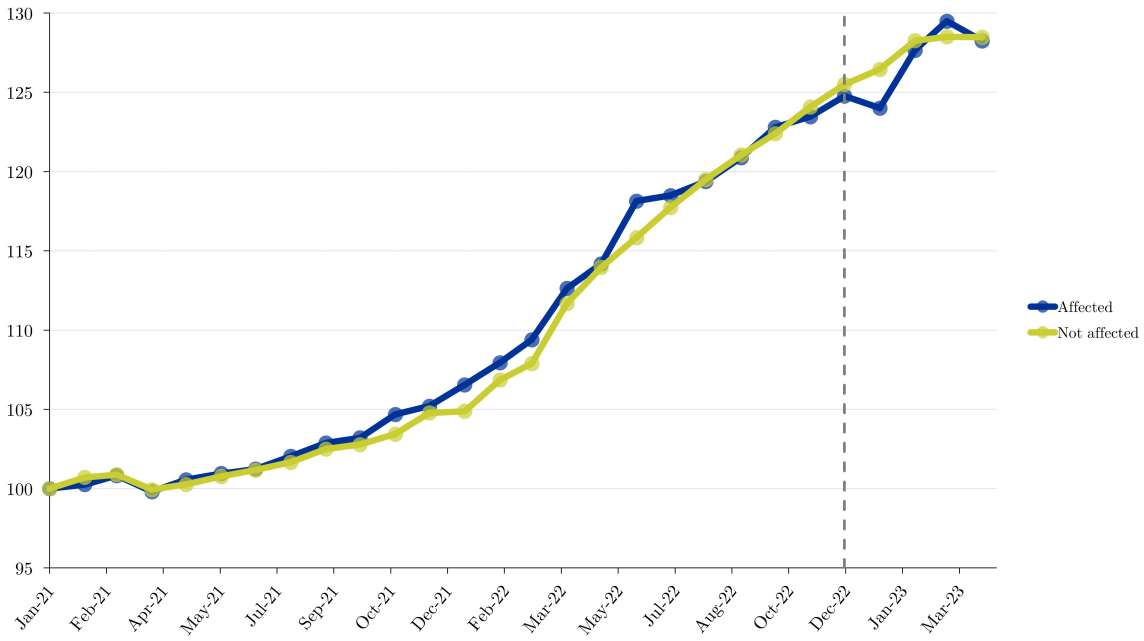
**Table 1:** Group of products affected and not affected by the measure according to VAT rate.

| GROUP OF PRODUCTS TREATED | VAT RATE 2022 | VAT RATE AS OF JANUARY 2023 | THEORETICAL PRICE CHANGE | CONTROL GROUP |
|---|---|---|---|---|
| Rice | 4% | 0% | -3.85% | Other cereal products |
| Cereals and bread | 4% | 0% | -3.85% | Breakfast cereals |
| Fresh fruit | 4% | 0% | -3.85% | Canned fruit |
| Flour and other cereals | 4% | 0% | -3.85% | Other baking products |
| Eggs | 4% | 0% | -3.85% | Poultry |
| Skimmed milk | 4% | 0% | -3.85% | Yogurt |
| Bread | 4% | 0% | -3.85% | Pizza and quiche |
| Potatoes | 4% | 0% | -3.85% | French fries |
| Cheese and curd | 4% | 0% | -3.85% | Ice cream |
| Frozen vegetables | 4% | 0% | -3.85% | Dried and canned vegetables |
| Fresh vegetables | 4% | 0% | -3.85% | Dried and canned vegetables |
| Olive oil | 10% | 5% | -4.55% | Butter |
| Pasta | 10% | 5% | -4.55% | Other baking products |

*Source*: own elaboration following Almunia et al. (2023).

Once we have the seasonally adjusted data and we have compared one by one which is the best control product for each treated product, the Eurostat weights of the affected and control products for the year 2021, 2022 and 2023 have been used to aggregate the index of the affected and control products, in order to carry out the DiD model. The sum of the weights of the treated group represents 11.26%, 10.62% and 8.83% for the year 2021, 2022 and 2023 respectively, over the total of the weights of the other products of the ECOICOP classification (European Classification of Individual Consumption by Purpose). For the control group, the sum of the weights represents 4.06%, 3.85% and 3.37% for the year 2021, 2022 and 2023, respectively, over the rest of the products in the ECOICOP classification. For example, bread represents 13.66% of that 11.26% for the year 2021. Thus, we have calculated a new weighted index for the treatment group and the control group based on January 2021, which can be seen in Figure 2.

**Figure 2:** Weighted index of the different groups before and after the measurement.

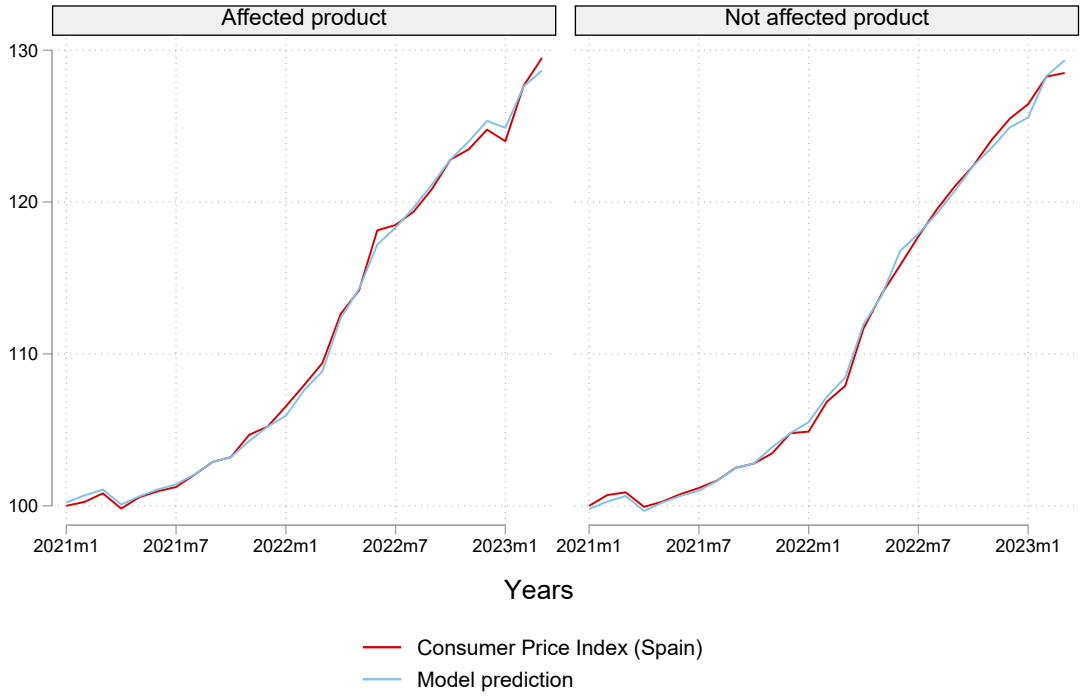



*Source:* prepared by the authors based on IHPC Eurostat data and weightings for each product.

Figure 2 shows the aggregation of affected and unaffected products following the aggregation of weights according to the CPI for Spain. The blue line would represent the price index for affected products while the yellow line shows the price index for products not affected by the measure. The vertical line represents the time at which the VAT reduction measure comes into force. It can be seen how, before the measure, the prices of the products affected and of the products not affected behaved in a markedly similar way, thus fulfilling the assumption of parallel trends. Specifically, if we analyze these results from January 2023 (year of implementation of the measure), we can see how clearly the prices of the products affected by the VAT reduction measure decrease at first, however, we can say that the effect is transitory. In the months of February, March and April, these prices return to the same growth path they followed before the measure, even placing them above those products that have not undergone changes in terms of taxation. This graph represents in a very visual way that the measure has not had the desired result, once the first impact after its entry into force is overcome. As will be seen in the results of the model below.

Applying the model explained in the previous section and generating a prediction of the realization including time fixed effects, we can conclude that, differentiating between affected and unaffected products in Spain, it is observed that the effective Consumer Price Index fits perfectly to the prediction made by our model, as shown in Figure 3. This is an important indicator of the goodness of fit reported by the methodology carried out, and because the parallel trends are fulfilled, the results obtained are significantly robust.

**Figure 3:** Model prediction compared to weighted IHPC data.




*Source:* prepared by the authors based on Eurostat data and the results of the model.

The results of the descriptive analysis are confirmed when we look at the results provided by the DiD model. After observing the results in Table 2 we see that the coefficient of interest of Treaties * VAT is not significant. Therefore, there is no difference between the prices of the products affected by the measure and the prices of the products not affected by the measure after implementing it. Therefore, comparing the treated products with the control products from Spain, we do not have enough evidence to affirm that prices have behaved differently, so, according to these results, the measure has not had the expected effect.

**Table 2:** DiD model results from linear regression

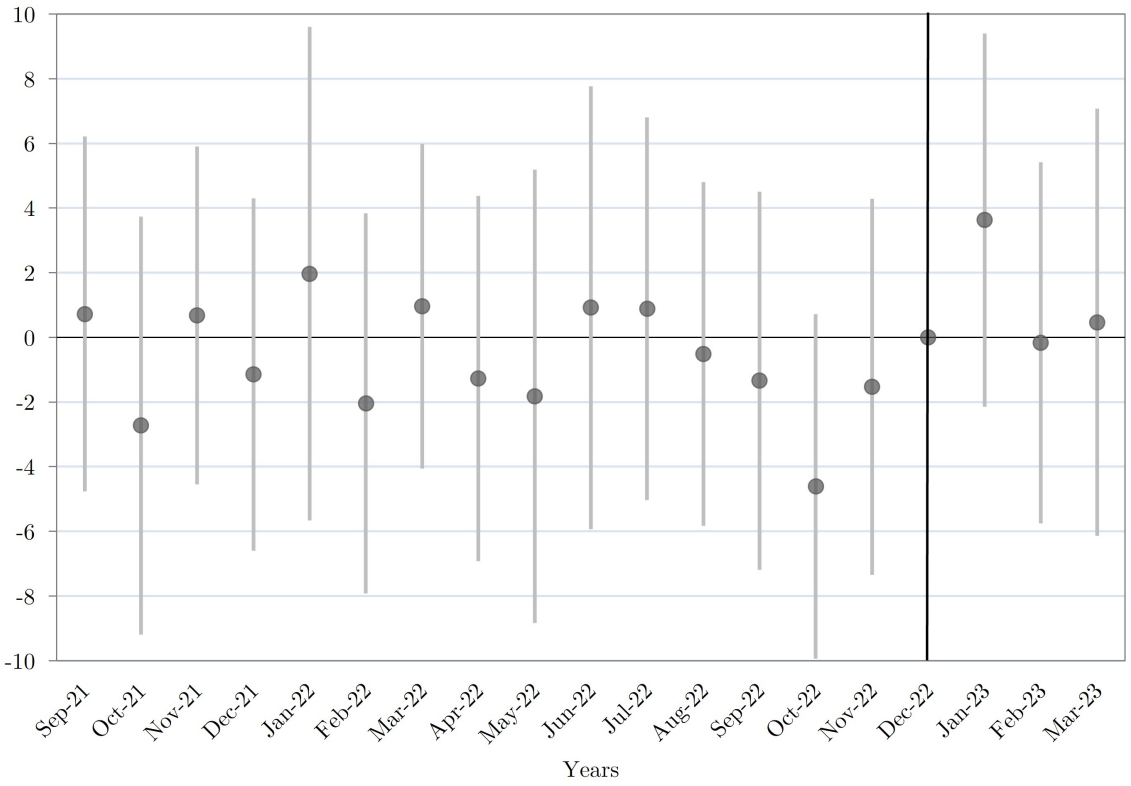
| **CPI** | **LINEAR REGRESSION** | **LINEAR REGRESSION** |
|---|---|---|
| Treated | 0.42 | 0.42** |
| | (2.5881) | (0.1530) |
| VAT | 18.98*** | Omitted |
| | (1.9163) | |
| Treated * VAT | -1.10 | -1.10 |
| | (2.9781) | (0.8544) |
| Constant | 108.76*** | 99.79*** |
| | (1.8359) | (0.2298) |
| Time fixed effects | No | Yes |

*Notes:* standard errors in parentheses. Inference: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Next, we proceed to apply the event study.

Figure 4 summarizes the results of the event study by month. The dark gray dot would be the effect of the coefficient, while the light gray line represents the confidence interval of the coefficient. The black line indicates the entry into force of the measure. It can be seen how before the measure the parallel trends, mentioned above, are fulfilled, as there are no differences of the treatment group with respect to the control group. After the measure comes into effect, there are no differences between the treatment group and the control group either, and the measure is ineffective in reducing prices.

**Figure 4:** Results of the event study.




*Notes:* own elaboration based on the results of the model.

If we pay attention to the coefficients resulting from the model in Table 3, we can conclude, as indicated in the previous graphs, that the measure has not been statistically significant in global terms, so that the fiscal efforts applied by the government have not been sufficient to reverse the upward trend in the prices of this set of staple products.

**Table 3:** Results of the event study after the intervention.

| DATE | $\delta$ | CONFIDENCE INTERVAL |
|---|---|---|
| Jan-23 | 3.63 | [-2.15; 9.40] |
| | (2.80) | |
| Feb-23 | -0.17 | [-5.75; 5.41] |
| | (2.70) | |
| Mar-23 | 0.47 | [-6.14; 7.07] |
| | (3.20) | |

*Source*: own elaboration based on the results of the model. Product fixed effects have been included. Robust standard errors in parentheses. Inference: ***$p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

The reasons for this result may be diverse and can be explained from a microeconomic

or methodological point of view.

First, it can be explained through the prism of the market power that companies have and their resulting ability to set prices. Companies with significant market power can set prices higher than would be possible in a competitive market. This is because their dominant position allows them to control the supply and demand for specific products or services. When a tax cut occurs, these companies may choose to absorb some or all of the tax savings rather than pass them directly to consumers through lower prices. This allows them to maintain, or even increase, their profit margins, thus strengthening their market position.

On the other hand, the non-existence of the drop in prices of the products affected could also be explained by demand dynamics. The change in VAT, in addition to presumably implying a change in product prices, will also have an impact on consumer behavior. By changing the VAT on certain products while other similar products maintain a higher VAT, two main effects may arise: the substitution effect and the income effect.

On the one hand, the substitution effect occurs when consumers replace a product with a higher VAT with a similar product that has experienced a price reduction due to the lower VAT. In this case, by changing the VAT on fresh products, but not on processed products, such as canned goods or other substitute products. According to economic theory, consumers will tend to consume to a greater extent those products that have undergone a tax reduction, since their price will be comparatively lower. Even if prices are not effectively lowered, this change in consumer behavior may still occur, due to the expectations created through the information received. If this were to happen, we would be facing a possible demand shock, which would push the prices of the affected products upwards, giving rise to a result similar to the one we have obtained.

The income effect refers to changes in consumers' purchasing power as a result of a reduction in the price of certain products. When products experience a reduction in price due to lower VAT, consumers may have more disposable income, so they may increase consumption levels. This, coupled with the dynamics produced by the substitution effect, could explain the upward trend in prices. Also,the similar products of Spain have included the price of plastics, so that probably they are not a good control group given the idiosyncratic shocks of these products compared with the basic good that only depends on climate changes or productivity of land.

Finally, the specific factors of the methodology used must also be taken into account. Despite the robustness and explanatory capacity of the model developed, it was not possible to include the subclass of other oils within the group of affected products, since, as explained, these products followed very different price dynamics from the rest, caused by the war conflict between Russia and Ukraine. This limitation may have a slight impact on our results.

Having mentioned the possible explanations related to the model and its possible limitations, despite being the methodology proposed by the literature (Benedek et al., 2019), we will try to solve these problems, which can lead to insurmountable endogenous re-

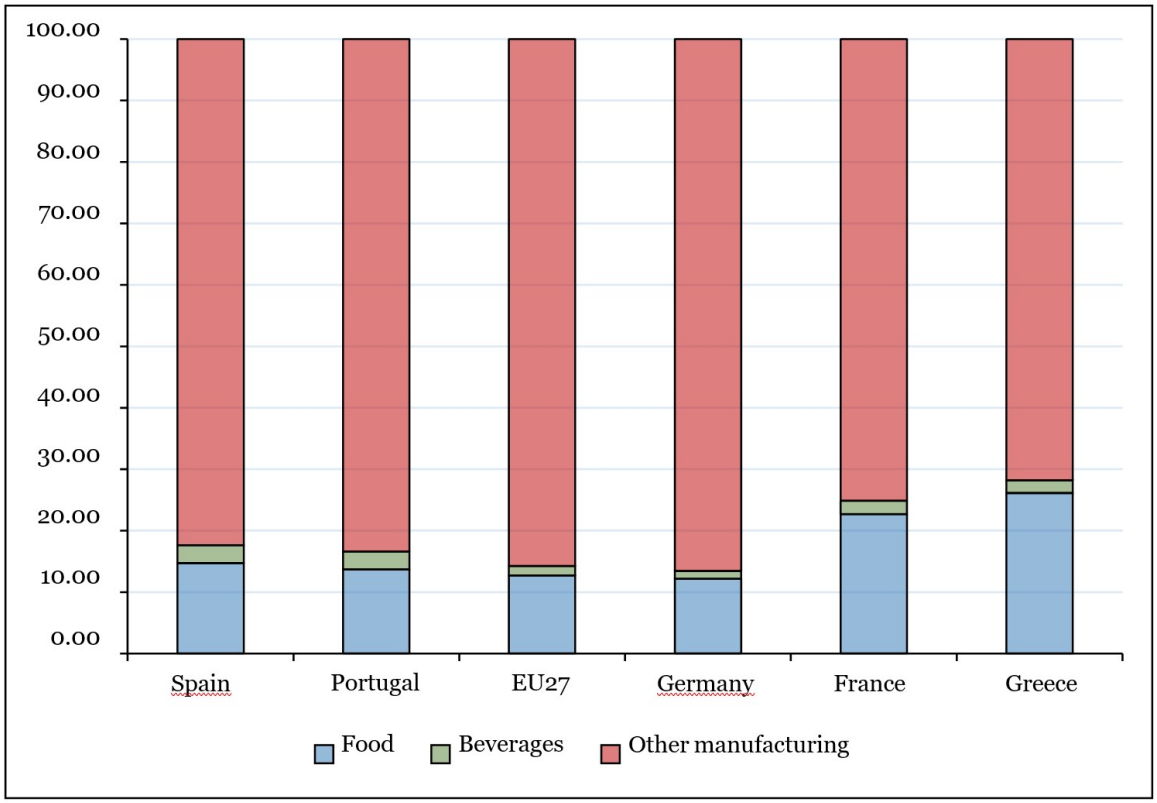
sults using products from the same market. To this end, the proposed solution will be to look for a control group that cannot be biased by changes in consumer behavior and, in addition, allows us to include all product subclasses, by fulfilling the inexorable assumption of parallel trends. In this sense, the most effective solution will be to compare the affected products with equivalents that have not undergone any change in VAT. That said, the market chosen to use as a control is the Portuguese market, since it presents similar characteristics to the Spanish market and is also subject to the same shocks, as could be the Iberian exception of energy market regulation.

### 4.2 Portugal as control group

In order to perform the DiD model using another country as a control, we need it to have a similar structure of the agri-food sector, as well as to share certain dynamics related to the advance of prices. In this way, we can ensure that the parallel trends are effectively fulfilled and do not respond to a spurious relationship.

In this sense, firstly, according to Eurostat data, we can observe that the agri-food sector has a similar importance in both countries. In Figure 5, we can see that the weight of the agri-food sector in both Spain and Portugal is above the EU average, presenting reasonably similar percentages in comparison with the rest of the European countries. This indicator shows the importance of the agri-food industry in both countries, positioning it as a strategic sector within the international market. In addition, both Spain and Portugal have high levels of tertiarization in their productive fabric, with a lower industrial presence than Central European countries.

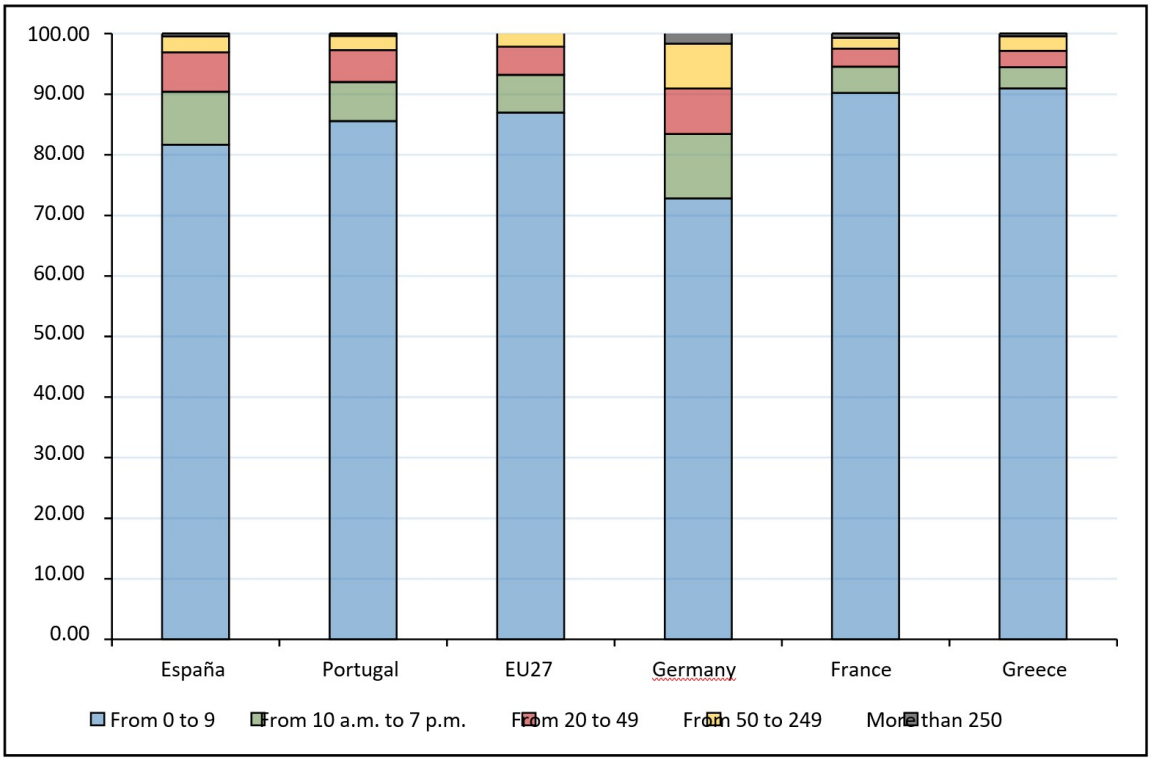
**Figure 5:** Weight of food and beverage manufactures over total manufactures (2021).




*Source:* own elaboration with Eurostat data.

Along the same lines, we also find similarities within the sector itself, which is also important when it comes to interpreting possible changes in the dynamics of supply and demand for the products we are concerned with here. In Figure 6 we can see how the business fabric of the sectors in both countries is very similar, presenting a very atomized distribution, with a large number of small companies and a very small percentage of large companies, which are the ones with the greatest market power. This is the case for both food and beverage manufacturing. Thus, we can corroborate that pricing according to market shares will be very similar in both territories.

**Figure 6:** Companies by number of workers within the beverage manufacturing sector (2021).




*Source:* own elaboration with Eurostat data.

Moreover, both countries share the implementation of the Iberian derogation on energy prices. With the approval of this measure by the European Union in March 2022, Spain and Portugal were able to limit the price of gas, which was soaring at the time due to economic tensions with Russia. The lack of interconnection with the rest of the European countries, and the energy independence of both countries, made it possible to control energy prices, one of the main causes of the acceleration of inflation in all industries, since it meant a significant increase in production costs, in addition to representing a major expense in households. Under these circumstances, it seems that both territories present common factors in price evolution, which makes them comparable, beyond the confluences analyzed within the agri-food sector itself.

Finally, referring more specifically to the study that concerns us here, the Spanish government's policy of lowering VAT was taken as an example by the Portuguese government in April 2023. Despite initial reluctance to implement the measure at the beginning of the year, the Portuguese government has positively evaluated the evolution of the policy, taking it as an example to make it its own four months later. This is evidence of the comparative suitability of the two territories, as the fiscal policy in terms of prices of one is a guide for the other. Moreover, in methodological terms, this situation offers the opportunity to enjoy a window of time in which we can observe the treatment of economic policy in Spain and, on the other hand, the control in Portugal, which results in a quasi-experiment suitable for applying a DiD model.

The appropriateness of using Portugal as a control is empirically justified when analyzing price trends of product subclasses in both countries.

In this case, the comparison is made in the same groups of products evaluated in both countries, so that there are no similar products to be found as control and treatment. As can be seen, the assumption of parallel trends is fulfilled in all cases, registering an almost identical price evolution in many of them. Unlike the case in which only Spanish products are used, in this analysis we can compare the same groups of products, which makes our assumption even more robust. In addition, as mentioned above, this allows us to include the "Other oils" group, given that, as shown in Appendix B, although its price behaves anomalously in the context of the same country, it evolves similarly in different markets. In this way, we can rigorously analyze all the sub-classes that have experienced changes in the value of VAT.

On the other hand, when we look at the evolution of prices since 2021, we also find an upward trend in Portugal for all products. As for the prevalence of one trend over another, we do not find a common factor for all groups. While for some subclasses inflation has been higher for Spain, when we look at others, the opposite is true, so there is no unique pattern in terms of price evolution since the inflationary crisis began.

As in the case of Spain, in Table 4 we can see the different products affected by the measure we have used with their respective control group, based on compliance with the parallel trends, as well as the lowering of the VAT rate and the theoretical price change assigned. On average, the theoretical change should decrease the price of these products by 3.94%. If the empirical model's decrease is not greater than this observed decrease, we could say that the measure has had no effect in reducing the prices of these basic foodstuffs. To calculate the change in the theoretical price we have used the following formula, extracted from Almunia et al. (2023):

$$\Delta P = \frac{1 + VAT_{after}}{1 + VAT_{before}} - 1 \tag{7}$$

where $VAT_{before}$ is the VAT tax rate before the implementation of the measure, while $VAT_{after}$ is the VAT rate after the implementation of the measure. It can be commented that we have used as a control the equivalent products from Portugal not affected by the VAT measure.

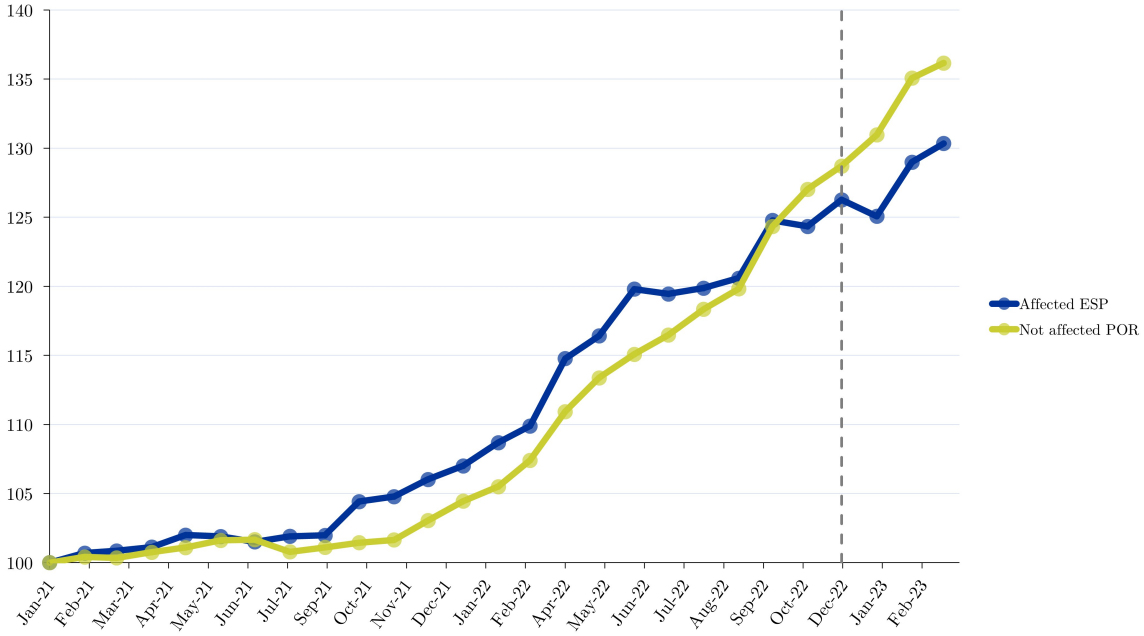
**Table 4:** Group of products affected and not affected by the measure according to VAT rate.

| GROUP OF PRODUCTS TREATED (SPAIN) | VAT RATE 2022 | VAT RATE AS OF JANUARY 2023 | THEORETICAL PRICE CHANGE | CONTROL GROUP (PORTUGAL) |
|---|---|---|---|---|
| Rice | 4% | 0% | -3.85% | Rice |
| Cereals and bread | 4% | 0% | -3.85% | Cereals and bread |
| Fresh fruit | 4% | 0% | -3.85% | Fresh fruit |
| Flour | 4% | 0% | -3.85% | Flour |
| Eggs | 4% | 0% | -3.85% | Eggs |
| Skimmed milk | 4% | 0% | -3.85% | Skimmed milk |
| Whole milk | 4% | 0% | -3.85% | Whole milk |
| Other oils | 4% | 0% | -3.85% | Other oils |
| Bread | 4% | 0% | -3.85% | Bread |
| Potatoes | 4% | 0% | -3.85% | Potatoes |
| Cheese and curd | 4% | 0% | -3.85% | Cheese and curd |
| Frozen vegetables | 4% | 0% | -3.85% | Frozen vegetables |
| Fresh vegetables | 4% | 0% | -3.85% | Fresh vegetables |
| Olive oil | 10% | 5% | -4.55% | Olive oil |
| Pasta and couscous | 10% | 5% | -4.55% | Pasta and couscous |

*Source*: own elaboration following Almunia et al. (2023).

As was done with the Spanish products, we de-seasonalized the data, as they present a high seasonality. Once we have the seasonally adjusted data and we have compared one by one which is the best control product for each treated product, we aggregate the indices of the treatment and control groups in the same way as in the previous section. The sum of the weights of the group of treated Spanish products represents 11.34%, 10.71% and 8.94% for the year 2021, 2022 and 2023 respectively, over the total weights of the rest of the products in the ECOICOP classification. For Portugal the sum of the weights represents 11.95%, 11.75% and 11.55% for the year 2021, 2022 and 2023 respectively, over the rest of the products in the ECOICOP classification. Thus, we have assumed that this is the basis for calculating the transformed weights for each product in both the control and treatment groups. For example, bread represents 13.66% of that 11.34% for the year 2021 for Spain. Thus, we have calculated a new weighted index for the treatment group and the control group based on January 2021. This can be seen in Figure 7

**Figure 7:** Weighted index of the different groups in Spain and Portugal before and after the measure.



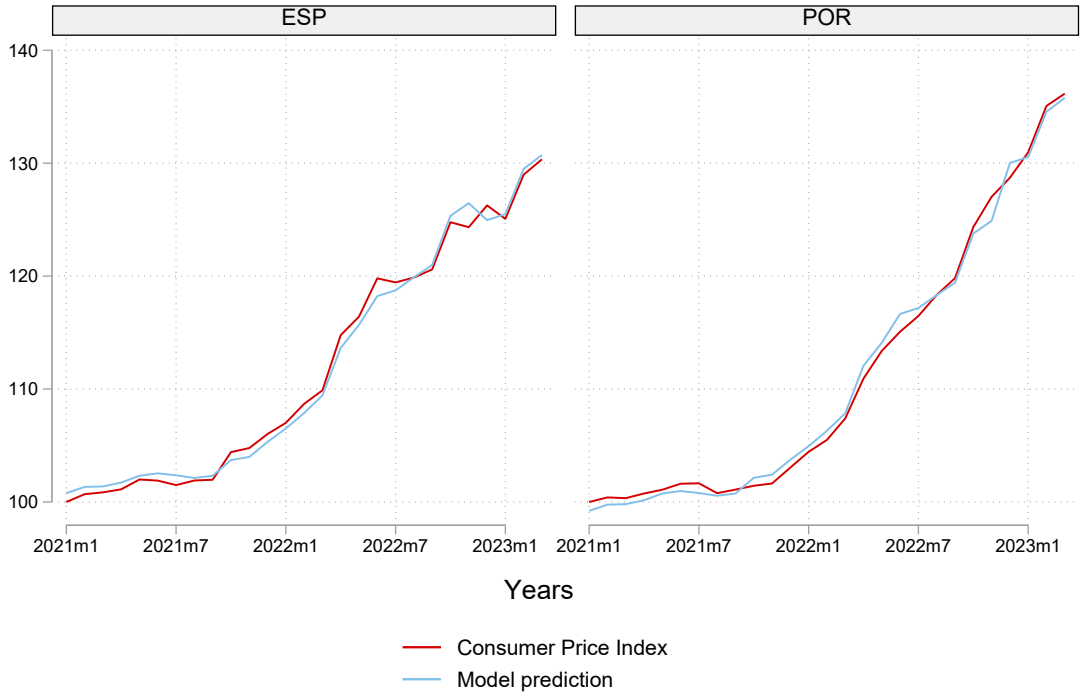

*Source:* prepared by the authors based on IHPC Eurostat data and weightings for each product.

In Figure 7 we see the aggregation of the affected Spanish products and the same unaffected Portuguese products following the aggregation of the weights according to the IHPC for Spain. The blue line would represent the price index for the affected Spanish products, while the yellow line would represent the price index for the Portuguese products not affected by the measure. The vertical line would represent when the VAT reduction measure comes into force. It can be seen how, before the measure, the prices of the products affected and of the products not affected behaved in a markedly similar way, thus fulfilling the assumption of parallel trends. Specifically, if we analyze these results from January 2023 (year of implementation of the measure), we can see how clearly the prices of the products affected by the VAT reduction measure decreased, although in the following month they grew at a higher rate, remaining below the trend of the unaffected prices. In the months of February and March, these prices seem to be below the growth path they followed before the measure. This chart represents in a very visual way that the measure has had the desired result, being effective in reducing the prices of the affected products, Portugal being a more suitable control group due to the exclusion of external factors that may be interfering in the price of the Spanish control products not affected by the measure. This will be observed in the model results below.

Applying the model of the previous section and generating a prediction of the model realization including time fixed effects, which can be seen in Figure 8, we can conclude that, differentiating between affected products in Spain and not affected in Portugal, it is observed that the effective Consumer Price Index fits perfectly to the prediction made by our model. This is an important indicator of the goodness of fit reported by the methodology carried out, and because the parallel trends are fulfilled, the results obtained are

significantly robust.

**Figure 8:** Model prediction compared to weighted IHPC data.




*Source:* prepared by the authors based on Eurostat data and the results of the model.

This is confirmed when we focus on the results provided by the DiD model.

Looking at the results in Table 5, we see that the coefficient of interest of $Treated * VAT$ is significant and robust. Therefore, there are differences between the prices of the products affected by the measure and the prices of the products not affected by the measure after implementing it. Thus, comparing the treated products with the Spanish control products, we have evidence to conclude that the measure has been effective in reducing prices. Specifically, the prices of basic foodstuffs have been reduced by 6.63% compared to unaffected products in Portugal. This price reduction is greater than the theoretical price reduction calculated in Table 4, with the 100% VAT reduction being passed on to final prices.

**Table 5:** DiD model results from linear regression

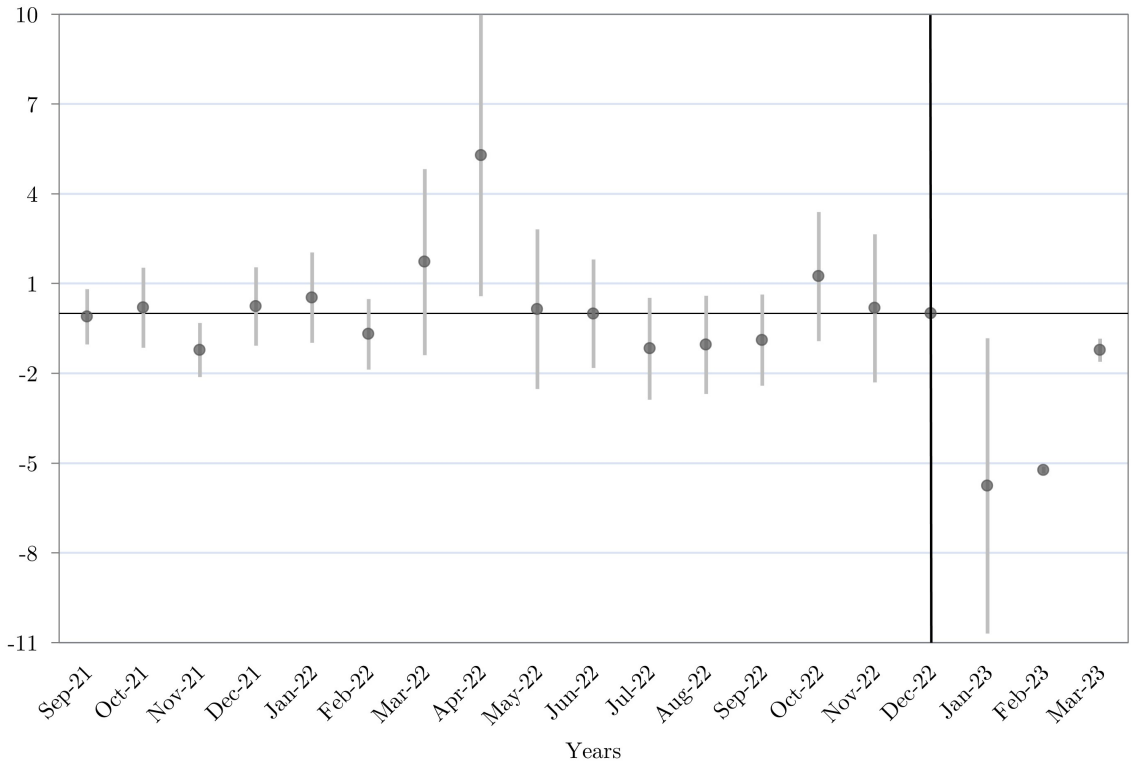
| **CPI** | **LINEAR REGRESSION** | **LINEAR REGRESSION** |
|---|---|---|
| Control | -1.57 | -157*** |
| | (2.5785) | (0.3573) |
| VAT | 25.05*** | Omitted |
| | (2.4025) | |
| Treated *VAT | -6.63*** | -6.63*** |
| | (3.2093) | (0.8634) |
| Constant | 109.25*** | 100.79*** |
| | (1.8274) | (0.8353) |
| Time fixed effects | No | Yes |

*Notes*: Standard errors in parentheses. Inference: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Next, we proceed to apply the event study.

Figure 9 summarizes the results of the event study by month. The dark gray dot would be the effect of the coefficient, while the light gray line represents the confidence interval of the coefficient. The black line indicates the entry into force of the measure. It can be seen how before the measure the parallel trends, mentioned above, are fulfilled, as there are no differences of the treatment group with respect to the control group. After the measure comes into effect, there are differences between the treatment group and the control group, and the measure is effective in reducing prices.

**Figure 9:** Results of the event study.




*Source:* own elaboration based on the results of the model.

The graph above summarizes the results of the DiD model by month. The dark gray dot would be the effect of the coefficient, while the light gray line would be the confidence interval of the coefficient. The black line indicates the entry into force of the measure. It can be seen that before the measure the parallel trends are fulfilled as there are no significant differences of the treatment group with respect to the control group. After the entry into force, significant differences are observed between the treatment group and the control group, with the measure being effective in reducing prices. Although it is observed as in March 2023, the differences become smaller.

**Table 6:** Results of the event study after the intervention.

| DATE | $\delta$ | CONFIDENCE INTERVAL |
|---|---|---|
| Jan-23 | -5.76*** | [-10.70; -0.82] |
| | (2.41) | |
| Feb-23 | -5.23*** | [-5.35; -5.23] |
| | (0.06) | |
| Mar-23 | -1.22*** | [-1.62; -0.83] |
| | (0.19) | |

*Source*: own elaboration based on the results of the model. Product fixed effects have been included. Robust standard errors in parentheses. Inference: ***$p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

As can be seen, the effect of the measure in January 2023 is a decrease of -5.76% and February 2023 is a decrease of -5.23 percentage points in Portugal's harmonized price index. These two decreases are statistically significant. Meanwhile, in March 2023 the effect of the measure on the index is -1.22 points. This indicates that the effect of the measure is temporary.

In order to evaluate the effect of the measure on price reduction, it is essential that the actual price reduction exceeds the theoretical reduction that we have calculated in Table 4. This is a necessary condition for the theoretical savings to be fully translated into lower prices for consumers, i.e. to achieve 100% pass-through.

It is interesting to note that the measure has an immediate impact. In the first month of its implementation, the coefficient manages to significantly reduce prices by 5.76%. Meanwhile, in the second month, we also observed a drop of 5.23%, somewhat less than in the previous month, therefore both represent a complete transfer of the theoretical savings to final prices. However, in the month of March, the decrease in prices is lower, only 1.22%. This implies that only approximately 30.96% of the theoretical savings have been passed on to consumers. This pattern suggests that while the measure appears to have had a positive effect in the first two months, it also indicates a tendency for prices to rise again. This suggests that the effect of the measure is temporary and may require continued review to maintain its long-term impact on price reduction. These results are in line with the empirical evidence presented in Section 2. Especially with the research by Fuest et al. (2021) and Benedek et al. (2019), regarding the transitory nature of the effects on prices. In turn, this result is also supported by the work of Crossley et al. (2009) on the temporary reduction of VAT in England. In order to compare the results with the same studies on VAT, we find similar effects to Almunia et al. (2023) and de Amores-Hernández et al. (2023), which obtained a pass-through of 90% and 93%, respectively. However, in our study we obtain a slightly higher result, with a pass-through in the first months of implementation of 100%. This may be due to using the same products from Portugal without the control

group being contaminated by plastic prices of similar Spanish products not affected by the measure, including the price index that takes into account retail prices.

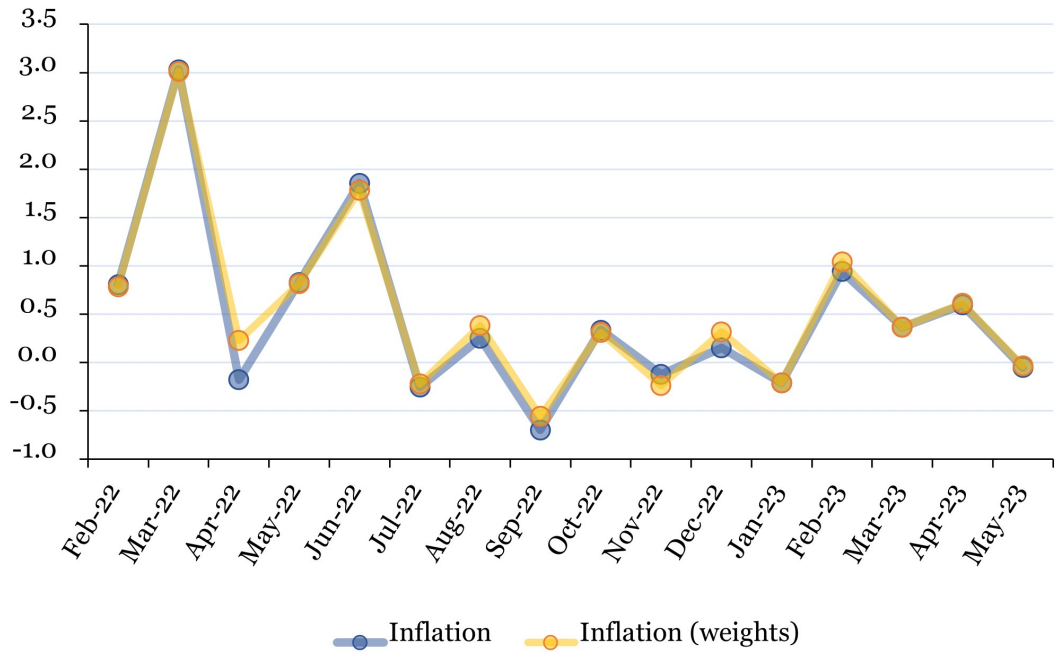
# 5 Counterfactual inflation without VAT measure

In this section we will calculate monthly and annual inflation, according to Spanish Statistical Office's weights for each of the products (obtained from the Expenditure Household Survey) if the measure of the VAT reduction on agricultural commodities had not existed. The objective is to measure the contribution of these products to headline inflation. Using the results of the DiD model, we already know the effects of this policy on our treatment group. Therefore, we will focus on calculating this effect on the counterfactual of inflation, i.e., what would have happened if the VAT reduction had not been implemented.

In the following figure, we show the evolution of monthly inflation and the construction of monthly inflation using the weights provided by Spanish Statistical Office. These weights reflect the relative importance of different product categories in the calculation of headline inflation.

What we want to show with the following figure is to evaluate if there are significant differences between monthly inflation and monthly inflation constructed with the weights, which could indicate changes in the Spanish Statistical Office weights or in the composition of products in the market. However, we can see that the inflation provided by the Spanish Statistical Office is exactly the same as the one constructed with the inflation of each product by its weighting. This gives robustness to the calculation of our effect multiplied by the total weighting of the affected product group, which represents 6.32% of the total products.

**Figure 10:** Evolution of effective monthly inflation and the construction of monthly inflation through Spanish Statistical Office weightings.

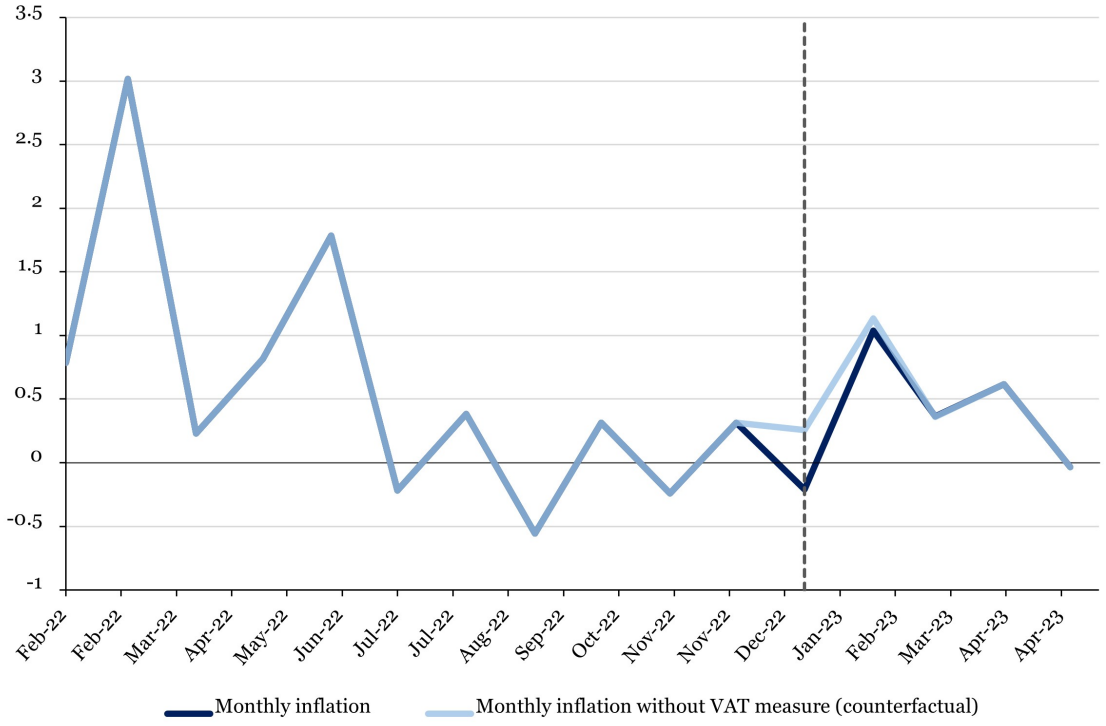



*Source:* own elaboration with Spanish Statistical Office data.

Figure 11 shows the monthly inflation provided by Spanish Statistical Office with the calculation of the same if there had been no VAT reduction. The dark blue line represents the actual monthly inflation and the light blue line represents the monthly inflation if there had been no VAT reduction on commodities, calculated with the weights provided by Spanish Statistical Office each year multiplied by the effect of the DiD in each month. The vertical line marks the period in which the measure was implemented.

We can see that, in the first month of the application of the measure, which is January 2023, monthly inflation without the measure presents a difference of 0.46 percentage points more if there had been no VAT reduction. However, in the following two months, it shows a much smaller difference. Specifically, in the month of February 2023, the difference with the estimated inflation would be 0.09 percentage points more, while in the month of March 2023, the difference is 0.01 percentage points. Therefore, it could be said that the effect of the decrease in monthly inflation is a temporary impulse effect that returns to its initial value after the implementation of the measure. Thus, the measure has a temporary effect as we have been discussing in the model results.

**Figure 11:** Evolution of the monthly growth rate of inflation and the counterfactual of inflation without the VAT reduction measure.




*Source:* prepared by the authors with data from Spanish Statistical Office.

Figure 12 shows the annual inflation provided by the Spanish Statistical Office with the calculation of the same if the VAT reduction had not existed. This time, we have created the index after multiplying the weights of each product by the effect of the affected products and the inflation of the rest of the products, with the following formula (using 100 as the first period):

$$I_t = I_{t-4} \cdot \left(1 + \frac{g}{100}\right) \tag{8}$$

Where, $I_{t-4}$ equal to 100 for the first period; $g$ is the monthly inflation calculated with the weights.

Once we have calculated the index, we calculate the year-on-year growth rate of the index, which would be referred to as annual inflation. The dashed gray line represents when the measure was implemented.

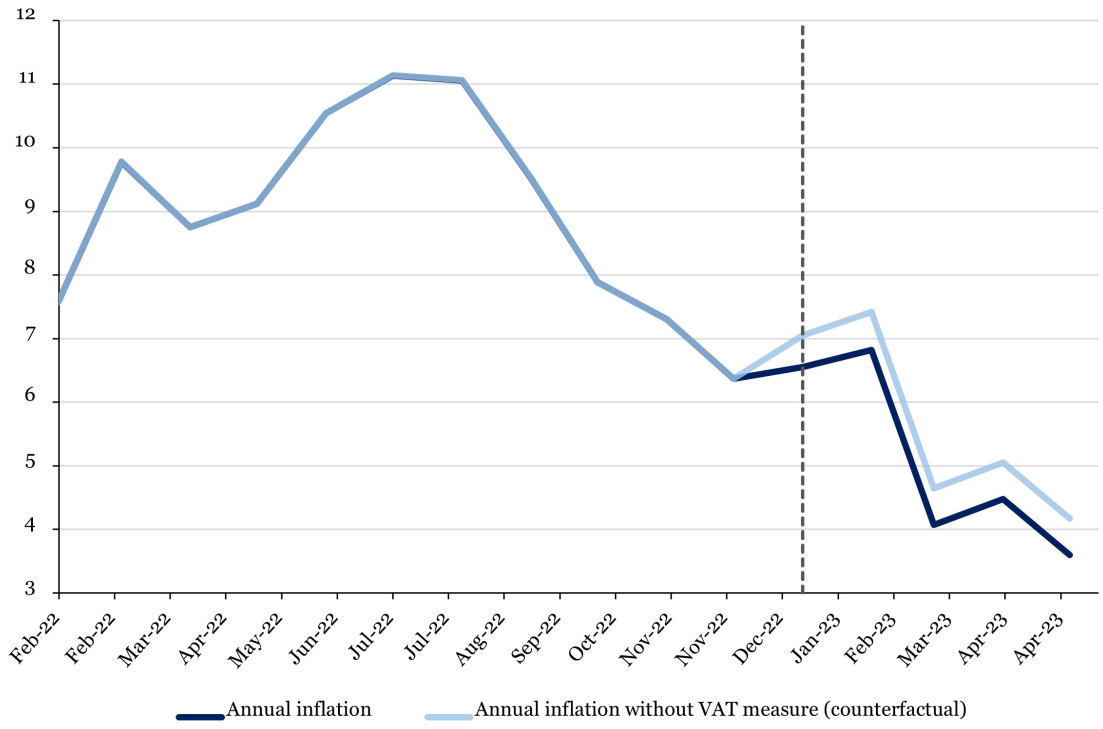
In the analysis of the effects of the measure, we observe that, during the first month of its implementation, in January 2023, monthly inflation without the measure shows a difference of 0.50 additional percentage points compared to actual inflation, suggesting that the VAT reduction has had a limited impact at that time.

However, in the following two months, this difference widens significantly. Specifically, in February 2023, the difference with actual inflation indicates that, without the measure, inflation would be 0.60 percentage points higher, while, in March 2023, the difference

is 0.57 percentage points. As reflected in the graph, the effect of the VAT reduction on annual inflation is presented as a step that lasts over time. We can conclude that this effect of the measure on annual inflation behaves as a staggered impulse that maintains a constant difference over time after its implementation.

Specifically, this effect stabilizes at an additional 0.57 percentage points of inflation if the measure had not been applied. While this effect is not particularly significant in terms of reducing inflation, it has played a role in controlling and stabilizing prices.

**Figure 12:** Evolution of the yearly growth rate of inflation and the counterfactual of inflation without the VAT reduction measure.




*Source:* prepared by the authors with data from Spanish Statistical Office.

## 6 Impact of VAT reduction measure on households

The Value Added Tax (VAT) is a very important topic of political debate, given its regressive nature from the point of view of income distribution. VAT is an indirect tax levied on goods and services without discrimination based on income. In other words, it is a tax rate that applies in the same way to all households, regardless of the expenditure they make or the money they earn. Thus, the tax burden borne by the lowest income deciles will be higher in relative terms. This is especially relevant for those products that are considered basic in the development of individuals. In macroeconomic terms, consumption is defined on the basis of a distinction into two categories. On the one hand, there is exogenous consumption, i.e., consumption that remains constant and is independent of the propensity to consume and disposable income. Within this category, we find staple goods, those whose

consumption is practically obligatory within a household. In this classification would be the foods that constitute the basis of a healthy diet, which are those that concern us in this study. On the other hand, there would be endogenous consumption, which will depend on the spending capacity of households and which can be considered dispensable within certain parameters. This type of consumption could be exemplified by leisure activities.

With the increase in prices and, therefore, the decrease in real wages, households have less purchasing power, therefore, less consumption capacity. This becomes a serious problem when households are not even able to cover basic consumption, constituting a very relevant problem of categorical inequality.

In these terms, the government's measure seeks to reduce the impact of the inflationary crisis by establishing an exemption for a group of food products that are part of the basic consumption basket. This policy, as will be shown, despite not including income discrimination, has a redistributive character, given the nature of the goods covered. To contextualize this reasoning, we must first analyze the level of spending on this set of foods by income deciles.

Using the microdata provided by Spanish Statistical Office from the Expenditure Household Survey (in Spanish Encuesta de Presupuestos Familiares - then, EPF hereafter), we managed to obtain data from a sample of approximately 24,000 households on their annual spending on various groups of products according to the ECOICOP classification and their income (we observed the survey for the years 2021 and 2022). In this way, we will be able to evaluate whether the measure presents a redistributive effect or not when considering those income deciles. Since the effect depends on the expenditure made by households, as well as on the composition of the different consumption baskets. Households residing in the Canary Islands, Ceuta and Melilla have been excluded because they do not pay VAT as they have their own taxes. We use the variable IMPEXAC, which is the monthly income reported for the last month to calculate the deciles, according to the EPF definition: "The set of monetary income regularly received by the household and its individual income earners, whatever its origin, after deducting Social Security contributions and other assimilated payments (Social Security Entity, Compulsory Mutual Benefit Societies and Passive Rights), as well as the amounts paid as taxes. Household members are considered to receive income when they are working or have a job for which they receive remuneration, or receive a pension, subsidies, capital income or transfers. Monthly income refers to the regular income received in the last calendar month, taking into account prorations for extraordinary income and other income received periodically, although not monthly."

Although we do not have administrative records of household income, it seems more correct to use the income reported by the household (with the drawbacks that it entails, such as, for example, that it is not the correct income that the household obtains), because normally those households with the highest proportion of expenditure on commodities are those with the lowest income. Then, decile 1 may be contaminated with high incomes, since the total expenditure of that household is not a good proxy variable for income.

Based on monthly income, ten groups of households (deciles) are constructed by ordering Spanish households according to their income, from the 10% of households with the lowest income (decile 1) to the 10% of households with the highest income (decile 10).

The annual income deciles for the years 2021 and 2022 are presented below.

**Table 7:** Intervals of annual income deciles of Spanish households in 2021.

| DECILES | LOWER LIMIT | UPPER LIMIT |
|---|---|---|
| 0-10 | 0.00 | 9,936.00 |
| 10-20 | 9,936.00 | 14,604.00 |
| 20-30 | 14,604.00 | 18,000.00 |
| 30-40 | 18,000.00 | 21,000.00 |
| 40-50 | 21,000.00 | 26,172.00 |
| 50-60 | 26,172.00 | 29,520.00 |
| 60-70 | 29,520.00 | 32,832.00 |
| 70-80 | 32,832.00 | 38,736.00 |
| 80-90 | 38,748.00 | 47,832.00 |
| 90-100 | 47,844.00 | 224,808.00 |

*Source*: prepared by the authors with data from EPF data.

**Table 8:** Intervals of annual income deciles of Spanish households in 2022.

| DECILES | LOWER LIMIT | UPPER LIMIT |
|---|---|---|
| 0-10 | 0.00 | 10,236.00 |
| 10-20 | 10,236.00 | 14,880.00 |
| 20-30 | 14,880.00 | 18,864.00 |
| 30-40 | 18,864.00 | 21,396.00 |
| 40-50 | 21,396.00 | 26,520.00 |
| 50-60 | 26,520.00 | 30,384.00 |
| 60-70 | 30,396.00 | 33,024.00 |
| 70-80 | 33,024.00 | 39,960.00 |
| 80-90 | 39,960.00 | 48,960.00 |
| 90-100 | 48,996.00 | 204,000.00 |

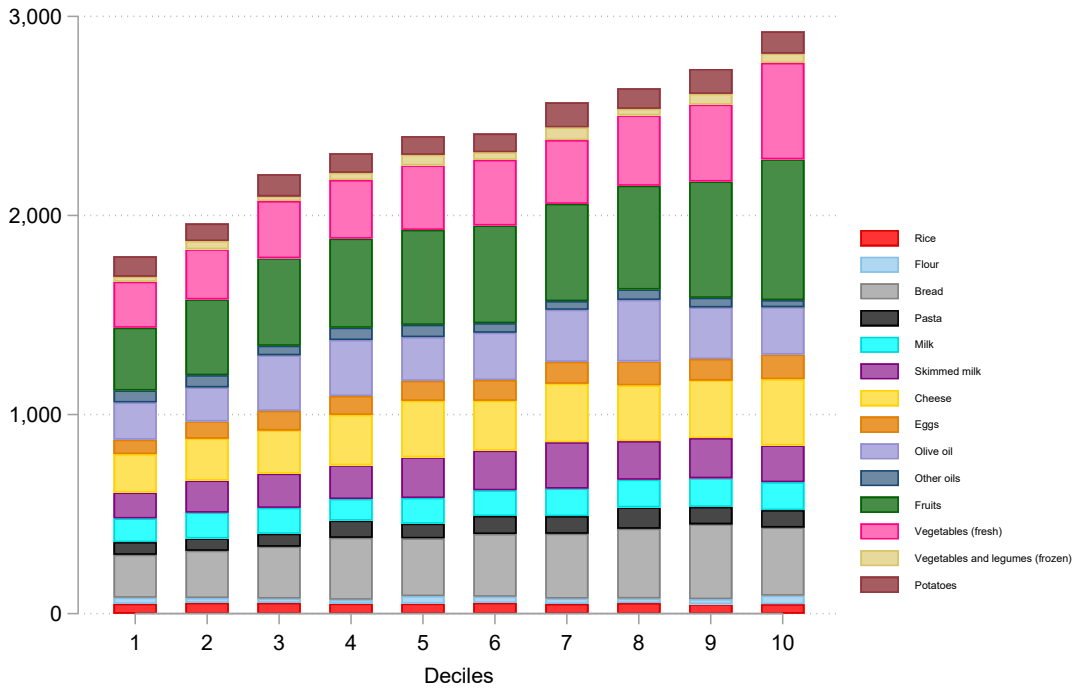
*Source*: prepared by the authors from EPF data.

As can be seen in Table 7 and Table 8, household income has shifted to the right in the distribution, since the lower limit of the lowest deciles has increased with respect to the upper limit of the highest deciles. This behavior could be considered as one of the explanations for the evolution of the income distribution in these years and a possible

explanation of whether household spending has grown.

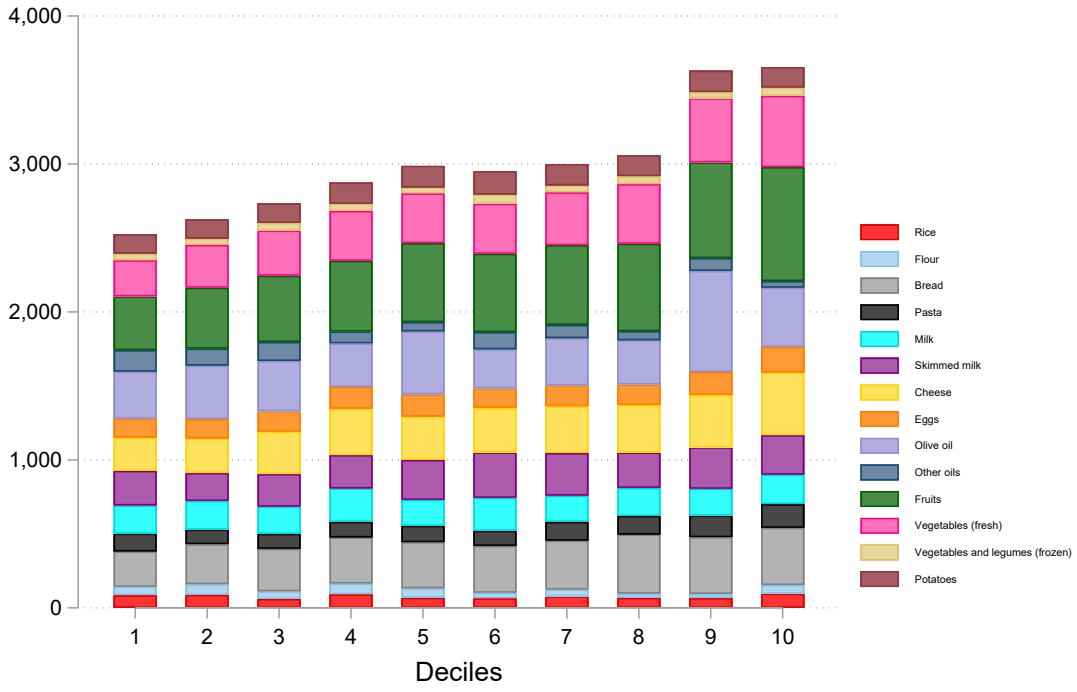
One of the assumptions we will make when analyzing the distributional effect is that household spending on the affected products, both in absolute value and as a % of their income, will be the same as in 2022. Another assumption we make is that we take a 100% pass-through to prices in all products throughout the year.

**Figure 13:** Composition of household spending (euros) in 2021.




*Source:* prepared by the authors from EPF data.

**Figure 14:** Composition of household spending (euros) in 2022.




*Source:* prepared by the authors from EPF data.

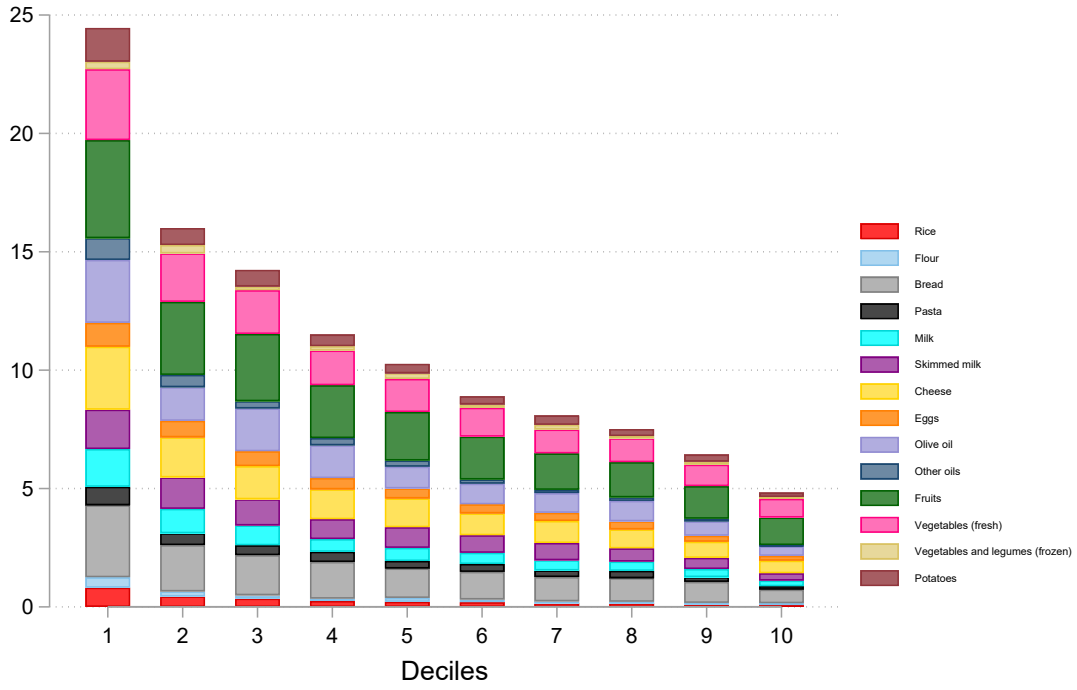
The Figure 13 and Figure 14 show the composition of the average annual expenditure in € and the average total expenditure on annual income on the foods included in the measure according to the income decile in which the household is located, based on the EPF data for 2021 and 2022. First, it can be seen in both graphs that the level of expenditure on these foods is increasing as a function of income level, in absolute terms. This was somewhat to be expected, given that households with greater spending capacity will invest in higher quality products within these categories and will not pay as much attention to saving. However, when this expenditure is relativized in terms of income, it can be seen that the distribution is quite the opposite. Basic foods will account for a high percentage of income for the lowest income households, while for the highest deciles it will be below 10% of annual income. This is exemplified by comparing income decile 1 with decile 10. Figure 15 shows that, for the first decile, the consumption of these foods constitutes more than 20% of their annual income, while for the last decile it is around 5%. This comparison justifies the redistributive nature of the policy, something that will be verified when analyzing its effect.

We can also observe that most of the average expenditure of Spanish households is concentrated in bread, olive oil, cheese, fresh fruit, fresh vegetables and frozen vegetables and legumes. We observe disparate consumption among the 10 deciles.

On the other hand, a comparison of the composition of average spending in both years shows the effect of prices on consumption. As mentioned above, this increase in prices has a special impact on households with fewer resources. If we look at the first income decile,

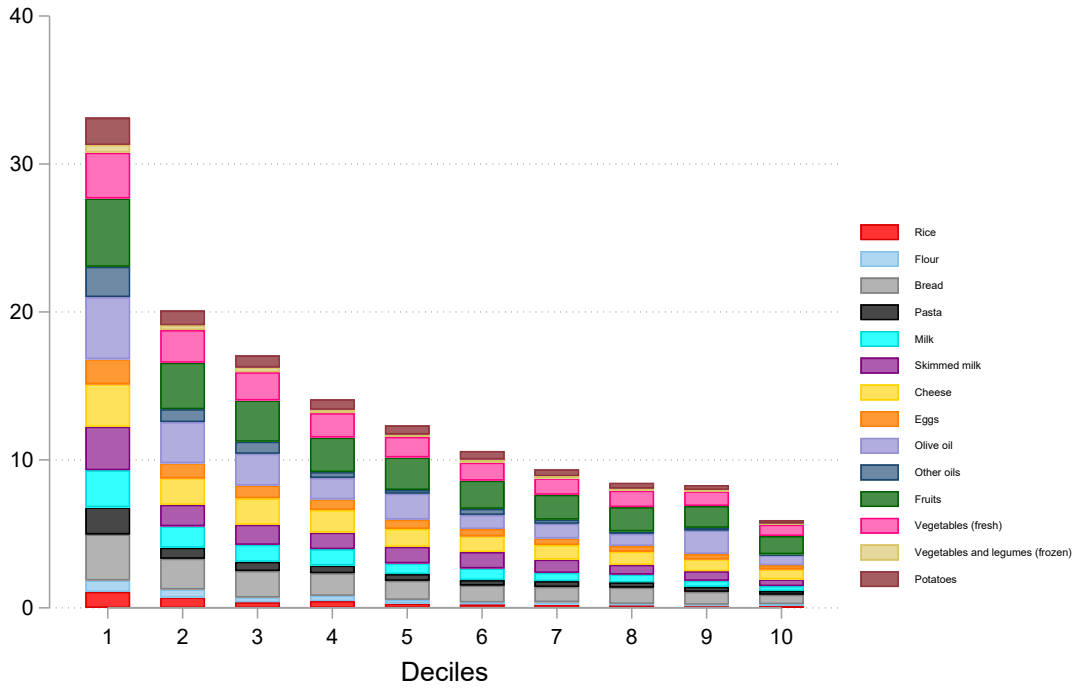
spending on this food basket has gone from approximately 1,800 euros to 2,500, which translates into going from consuming less than 25% of their income to more than 30%, just taking into account these products. The fact of consuming a third of their income in basic dietary products means that these households have a much lower spending capacity. In fact, this result implies that these households will have problems in reaching the level of consumption that is considered basic for development in an economy such as the Spanish one. This fact justifies the VAT exemption policy for these basic products, since many of these households could be at risk of exclusion or poverty, even if they have a monthly income from work.

**Figure 15:** CComposition of household spending (% annual income) in 2021.




*Source:* prepared by the authors from EPF data.

**Figure 16:** Composition of household spending (% annual income) in 2022.




*Source:* prepared by the authors from EPF data.

We have applied the DiD model for each good. When we look at the size of the effect by product in Table 9, we see that the measure has had disparate effects within this basket of staple foods. On the one hand, we observe that some products such as eggs, potatoes and pasta have suffered a significant decrease in their prices, while others such as cheese, oils and frozen vegetables do not even register significant effects. This disparity in results, together with the different consumption weights of each group of products, make up the variations in expenditure, which, as can be seen, are not composed in an equitable manner. It is worth noting that for some products there is a price pass-through of over 100%, while for others it is not complete. In this paper, as mentioned above, we will assume that the empirical effect we observe per product is the one that is passed through.

**Table 9:** Effect of DiD by product.

| PRODUCT | DiD EFFECT |
|---|---|
| Rice | -16.03*** |
| Flour | -15.87* |
| Bread | -5.18** |
| Pasta | -18.33*** |
| Milk | -13.16** |
| Skimmed milk | -13.92** |
| Cheese | -4.74 |
| Eggs | -19.81*** |
| Olive oil | -4.82 |
| Another oils | -5.11 |
| Fruits | -10.12*** |
| Vegetables (fresh) | -15.15*** |
| Vegetables and legumes (frozen) | -1.07 |
| Potatoes | -21.09*** |

*Source*: prepared by the authors based on the results of the model by product.

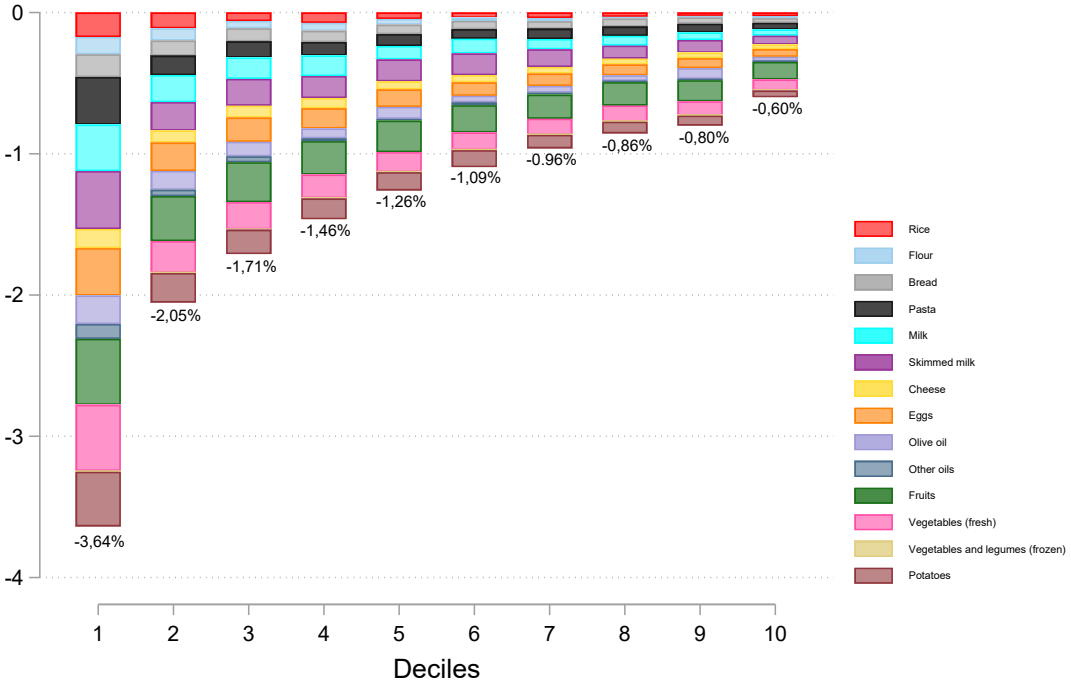
Therefore, to obtain the average expenditure savings per decile, what we do is to multiply this product reduction by the average expenditure of the decile on that product and then we add it. Since prices fall in that proportion, the value of the expenditure will be the previous result multiplied by the effect of the price reduction.

Finally, after analyzing the composition of spending on this food basket by income deciles, Figure 17 shows the average expenditure savings as a percentage of income and therefore the effect of the measure according to the purchasing power of households. As anticipated, the choice of these basic consumption products makes this policy redistributive in nature, which is verified by observing the percentage savings by income decile, being progressive. Taking into account the effect of our DiD model for each of the products affected, we see that, for the first decile, the measure results in average expenditure savings of 3.64% of their income and 8.86% for the first 4 deciles (40% of lower incomes). Meanwhile, as we move up the distribution, the savings are relatively smaller, showing that this tax policy represents a significant relief for those households with few resources. For example, in the top decile (decile 10) we observe savings of 0.6% of their income and 3.22% of income for the 40% of households with the highest incomes, which is less than half of what it has meant for the first 4 deciles. For the medium-sized households, those in decile 5, it represents a saving in average expenditure of 1.26% of their income.

Despite the positive effect of the measure, it must be taken into account that households do not recover the purchasing power they had before the inflationary crisis, so this type of policy must be reinforced via wages, which will bring labor income into line with the increase in prices. Since the measure will be applied throughout the year, if we assume that

households continue to have the same consumption as in 2022 and that prices are passed on at 100% (an assumption that would fail since in the empirical model we observe that in the month of March product prices fell less, and were passed on 31% in prices), this would be the expected savings in average household spending in this simulation.

**Figure 17:** Effect of the VAT reduction on average expenditure savings as a % of income




*Source:* prepared by the authors from EPF data.

By way of conclusion, under all assumptions it could be said that the measure has been successful in reducing the prices of the affected products by 100% at least in the first months, despite the fact that in March they will begin to rise. In addition, this VAT reduction effect has contributed to reduce annual inflation by 0.5 percentage points, which, added to other measures, reflects the success of fiscal policies in lowering inflation, making Spain the European Union leader in the lowest inflation at present (at 2.4% yearly growth rate of the Harmonized Index of Consumer Prices in August) after Denmark and together with Belgium. Finally, the measure could be considered to have had a redistributive and progressive effect on average household spending, favoring Spanish households with lower incomes and alleviating the consumption of basic products.

# 7 Conclusion

Taking as a starting point the VAT reduction on some products of the agro-industrial sector in Spain (Royal Decree-Law 20/2022, of December 27), this chapter aimed at estimating the effects of the VAT reduction on the prices of the goods affected by it and its effects on

households' spending. For this purpose, a quasi-experimental DiD methodology and an event study design has been used, which allow us estimating the effect of the tax reduction policy on certain goods in perspective compared to a control group, composed of goods not affected by such measure. In our case, we take as a reference a group of products not affected by the VAT measure in Spain and, secondly, the products affected by the Spanish policy, albeit in Portugal. This comparison with Portugal allows us to avoid the possible dynamics of the Spanish market that act as a response to the measure and prevent the effect from being observed in isolation. In this way, we obtain a quasi-experiment that allows us to draw conclusions on the effects of the VAT reduction on the prices of these goods in Spain.

In theory, the effect of a VAT fluctuation is not unequivocal; it depends on the market structure, the VAT rate, the type of product, the macroeconomic context and the temporality of the measure. In conclusion, the study of the effect of a VAT change on prices is essentially empirical. Using the aforementioned methodology, it is concluded that there is a significant effect of the VAT reduction on the price of the affected goods. Specifically, a strong difference is found in January (-5.76%) and February (-5.23%), which dissipates in March (-1.22%). In other words, the measure is effective, but temporary, since it loses effectiveness as time goes by. This may lead to the total lack of collection being absorbed by sellers and prices returning to their initial trend.

On the other hand, we also study the impact of this measure in terms of savings on households according to their disposable income. This analysis shows that, despite the fact that lowering indirect taxes is not a recommended measure for reducing inequality, by focusing on a basic food basket, this policy has a redistributive effect as Gaarder (2019) finds. Households with lower incomes are those that save the most in relative terms in relation to their income (-3.64%), while, for the richest households, the effect is very small (-0.6%). This finding is very relevant, given that it supports the fact that the measure fulfills the objective of helping the most disadvantaged households to be able to consume the necessary products, something that seemed very difficult in view of the continuous rise in prices. On the other hand, the measure has also been useful in containing total inflation, causing this indicator to be 0.5% lower than if this policy had not been approved.

It is estimated that this VAT reduction will have a budgetary cost of 645 million euros (García-Miralles, 2023). We can say that more than 100% of the income that has ceased to enter the public coffers has meant savings for households in the four lower deciles of the distribution. This is different from Almunia et al. (2023) because they did not include the rest of the 60% of the total share of the market. They do not have retail prices. We compare with the prices of products from Portugal which are also affected by the Iberian exception and we also compare with prices of the same products. In their control group they compare with similar but unaffected products that are made of plastics that have risen sharply in price due to energy shocks. Therefore, their effect is biased downward.

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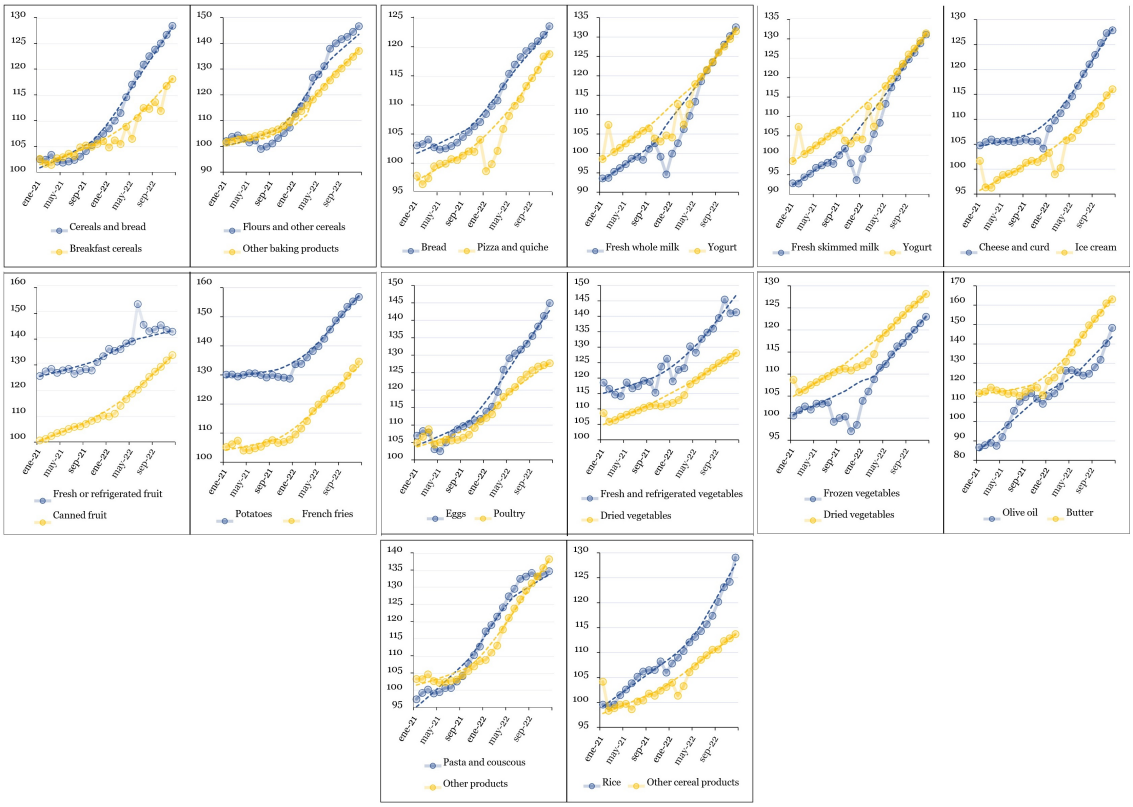
# Appendix A Parallel trends (Spanish products).

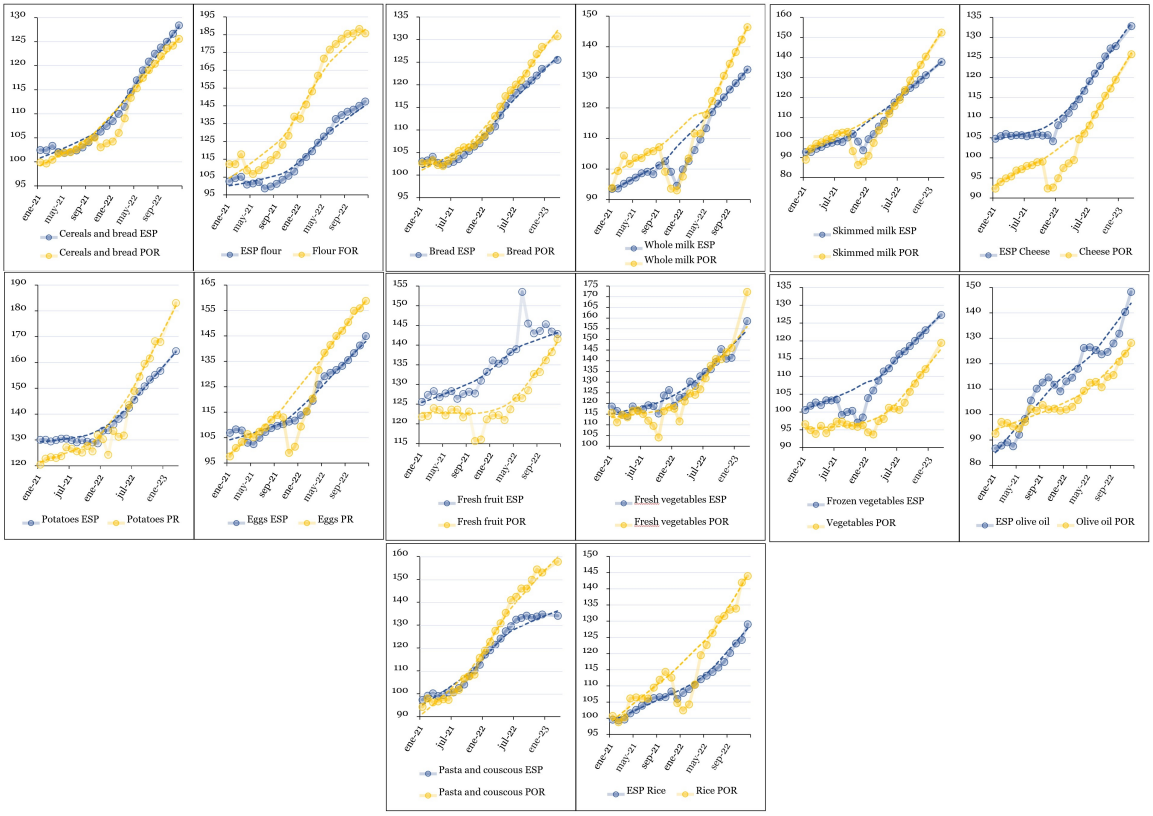
**Figure 18:** Parallel trends between treatment group and control group (Spanish products).




*Source:* own elaboration with Eurostat data

# Appendix B Parallel trends (Portugal products).

**Figure 19:** Parallel trends between treatment group and control group (Spanish and Portuguese products).




*Source:* own elaboration with Eurostat data