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Report
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document:
**The
redistributive
effects of
special taxes**

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Credits

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1

Executive Summary

Virtually all consumer goods in developed countries are subject to value added tax, although some goods are levied with an additional tax burden in the form of so-called “excise duties”, which are justified by a regulatory norm because of the existence of *negative externalities* not explicitly incorporated into prices.

These goods in most countries are alcoholic beverages, tobacco products, hydrocarbons and other energy products, such as electricity. If their demand generates negative externalities that lead to social costs, the internalisation of these externalities to help pay for costs must be performed through the right mechanisms.

The general profile obtained from the effects of excise duties is regressive and their ability to redistribute income is barely noted over the period under review. These tax figures in Spain have been used as a permanent source of revenue streams (intensifying in moments of crisis) because of the limited response of consumers to price changes.

Under these circumstances, this report proposes a new question as to whether it is possible to focus more on alternative collection functions and thereby simultaneously contribute to income redistribution. The answer is yes, as becomes evident from several microsimulation exercises that propose changes to the excise duties on electricity and fuels.

Nonetheless, following the general rule of disrupting economic activity as little as possible, reforms are designed to allow much more effective redistribution through alternative financing decisions that reduce rates without altering the prices of other goods or by establishing compensation mechanisms for the most affected households.

In the case of electricity, its demand structure allows a tax reduction to finance the cost of renewable energies outside the energy sector to effect final prices that allow redistribution. In the case of fuels, their high capacity for revenue collection enables the design of compensation mechanisms that can have a redistributive capacity as well as discouraging consumption.

In short, it is possible to use excise duties to apply short-term reforms that can have a redistributive effect, with or even without compensation mechanisms, and help to tackle other serious problems facing the Spanish economy at the same time.

2 Introduction

As in other countries of the European Union (EU), practically all consumer goods in Spain are subject to value added tax (VAT), with some exceptions in health products, the rental of primary residences, financial services and insurance. Some goods are levied with an additional tax burden in the form of so-called “excise duties” (EDs), whose regulatory rule justifies them by the existence of negative externalities not explicitly incorporated into prices.

Excise duties are regulated by Law 38/1992 of 28 December 1992, the explanatory memorandum of which states: “[...] because the consumption of goods that are subject to these duties generates social costs that are not taken into account when setting their private prices and must be paid for by consumers by means of a specific tax that selectively levies this consumption”. These goods in most developed countries are alcoholic beverages, tobacco products, hydrocarbons and other energy products.

Taxation is not fully harmonised in the EU, despite the fact that all countries are obliged to place VAT rates within specific margins. Even indirect taxation allows for broad discretion in rates, in classifying taxable goods and in selecting exempt goods. This lack of common action specifically affects excise duties, in which discretion is high, except for the actual definition of goods and establishment of minimums (Directive 2008/118/EC of the Council of the European Union, of 16 December 2008).

As stated in the regulations for their justification and underlying theory, it is certainly true that the consumption of these products generates health, environmental and labour-related externalities, etc. And in some cases these may not be fully included in the tax system or poorly designed in others for the consumption structure, thereby leading to inefficiencies (for example, to finance specific public policies other than those related to the generated externalities) in such a way as to adversely affect redistribution.

The main aim of this study is to analyse the distributive impact of excise duties in Spain using data from its latest Household Budget Survey. It therefore aims to

answer the following question: How is the tax burden of excise duties distributed according to income level? The study also aims to ascertain its evolution over the past decade. In other words, it attempts to analyse how the tax changes that have been applied have affected the tax burden and income distribution. Finally, it also provides *ex ante* evidence of the effects of certain reform proposals through specific microsimulation exercises.

It seems appropriate in this context to compare the existing situation in the EU with that of Spain and discuss the implications of these differences, not only on collection but also basically on the use that is made of such collection for distributive purposes.

The study is structured in the following manner. Section 2 describes the general framework of the report and reviews the most important aggregate figures. Section 3 is devoted to presenting the situation in Spain and the EU, including aggregate and microeconomic data. It describes how excise duties are implemented, their degree of harmonisation and the main figures in relation to tax collection globally and by country. The results in distributive terms are presented and discussed in section 4, while section 5 contains several microsimulation analyses of certain reforms that could be feasibly introduced in Spain to achieve various goals, but with a focus on improving the redistributive capacity of excise duties. And finally, section 6 sets out the conclusions on the results of fiscal policy for the country's welfare.

3

General Framework: Rationale and Justification

The origins of excise duties date back to ancient Rome. The first known duties were applied to the production of what were considered luxury goods, such as wines and products imported from other areas. These duties have been maintained until today and come under the banner of indirect taxes. They are indirect because they are applied to the consumption of specific products and are in line with the amount consumed, in other words, separate from the income of a consumer. Excise duties fulfil two functions: *collection*, like all taxes, and *dissuasive*, seeking to avoid externalities.

Excise duties currently have Europe-wide coverage and are compulsory for tobacco and tobacco products, alcohol and alcohol products, and hydrocarbons, with different structures in all EU member states. Other goods and services, such as coal, electricity, fluorinated gases, insurance and gambling services, are also affected by this taxation in some countries.

Although excise duties are levied on the production or import of goods and service, their burden is shifted to end consumers, with rare exceptions usually corresponding to short-term decisions. The rationale for imposing them on these aforementioned products is that consumers barely react to price increases. Their revenue collection function therefore seems to prevail in their design, thereby greatly limiting their function as a deterrent.

There are many academic exercises that show the low sensitivity of consumers to changes in the prices of goods subject to excise duties at both national and international levels. For information purposes, and also due to the need to have these parameters available for the microsimulation exercises in section 5, some values of price elasticities (including their sources) are presented there to corroborate the results obtained from adjusting demand equations.

Beyond the importance of revenue in developed countries in order to provide public services, the Spanish tax system presents a unique level of tax burden and fiscal

structure in relation to other EU economies with relatively similar levels of economic development and provision of public services.

The progress of welfare states has been matched by an increase in revenue collection capacity. From the end of the 1960s until the end of the twentieth century, the *tax burden* – the ratio of tax revenue to gross domestic product (GDP) – has been increasing. The revenue collection capacity in the weighted average of the EU-15 in 2012, close to 40% of GDP, was 13 percentage points higher than that observed in 1965.

Although an upward trend has been observed in Spain until recent times, it began at the end of the 1970s, primarily from the fiscal reform of 1978. The gap between the tax burden in the EU-15 and Spain had remained slightly below 15 points of GDP until then, managing to reduce this difference to less than one third before the end of the 1980s.

In addition, during the years of the commonly dubbed “marvellous decade” (1995-2007), tax revenue collection increased substantially, thereby helping to reduce the differences to 4 points of GDP in relation to the EU-28 and just over 5 points with EU-15 countries, the Eurozone and the major four (Germany, France, Italy and the United Kingdom).

The recent crisis revealed that the increase in revenue was not founded upon permanent pillars, but rather upon factors associated with the financial/real estate boom. Consequently, there was a significant fall in tax revenues (by more than 6 points of GDP) and this distanced us from convergence with the EU, where tax bases are much more stable and there are no significant drops in collection given that fiscal pressure is also stable.

After the crisis, Spain has had relative levels of collection similar to those of the 1990s and, therefore, substantial differences in tax pressure from more developed countries of the EU (more than 7.5 points of GDP with respect to the average of Germany, France, Italy and the United Kingdom).

In excise duties in particular, collection in Spain in 2017 was 24% of total indirect tax receipts and almost 11% of total revenue of the National Tax Administration Agency (AEAT), including taxes and rates (Table A1.1). It is easy to see that the price of each of the goods levied with these taxes is greatly altered.

Nonetheless, general collection behaviour during the crisis is not applicable to excise duties. The main reason is that the loss of revenue in some tax figures has been offset by increases in excise duty rates, although a high degree of heterogeneity among member countries can be found. The ultimate goal has been to maintain a suitable level of revenue to handle the austerity measures that were imposed at a global level.

4

General Situation and Description of Data

The situation in the European Union

The term excise duty on specific consumption covers a set of taxes forming part of the duty levied on consumption, which complements that of VAT. This is an additional tax that is now included in the VAT base, a double taxation that, as stated in the explanatory memorandum of Law 38/1992, “is justified because the consumption of goods that are subject to these duties generates social costs that are not taken into account when setting their private prices and must be paid for by consumers by means of a specific tax that selectively levies this consumption”.

Products subject to excise duty may be levied by other indirect taxes for specific purposes, provided that these are not of a turnover tax nature and logically do not contravene any of the principles of the Single Market. Article 1 of Directive 2008/118/EC of the Council of the European Union, of 16 December 2008, concerning the general arrangements for excise duty, lists the products subject to excise duties that are in turn covered by the following Directives:

- / Energy products (including hydrocarbons) and electricity covered by Directive 2003/96/EC
- / Alcohol and alcoholic beverages covered by Directives 92/83/EEC and 92/84/EEC
- / Manufactured tobacco covered by Directives 95/59/EC, 92/79/EEC and 92/80/EEC

They are subject to excise duties if the goods have been produced or extracted within the EU, or if they have been imported. Certain exemptions from payment are permitted when the goods have specific destinations, such as use within the framework of diplomatic or consular relations, use by the armed forces of a NATO country in the EU and so on. The Directive also excludes specific geographical areas, such as the Canary Islands and the Channel Islands.

Energy products and electricity are governed by Directive 2003/96/EC, according to which they are subject to taxation when used as motor or heating fuels. The main products are mineral oils; solid fuels, including coal and coke; natural gas; electricity;

alcohols, when used as heating or motor fuels; and vegetable oils, when used as heating or motor fuels.

The legislation introduces several minimum levels for motor fuels, heating fuels and electricity that apply from 1 January 2004 (Table A.1.4). In addition, energy products used as raw materials or for the purposes of chemical reduction and electrolytic and metallurgical processes are not taxed.

There are also exemptions for specific products, such as energy products used to produce electricity and those supplied for use as fuel for air navigation. Other products that can benefit from tax reductions are those used for heating and agriculture and so-called B and C gas oils in Spain. Finally, there are tax differentiations for public transport, ambulances, etc.

Alcohol and alcoholic beverages are governed by Directive 92/83/EEC. In particular, it establishes the tax on beer, which is based on the number of hectolitres/degrees Plato (one degree Plato corresponds to 0.4% alcohol by volume). Beers with a maximum content of four degrees are divided into categories, with the same rate of excise duty per hectolitre applied to all beers in each category. The possibility also exists of applying reduced rates to small independent brewers. Taxes on still and sparkling wines, other fermented beverages and so-called intermediate products, such as port and sherry, are included in this Directive.

EU countries must apply the same rates of tax to each beverage category, with the possibility of applying reduced rates for wines with an alcoholic strength of less than 8.5%. Taxes on spirits are also included, with the possibility of a reduced rate for small distilleries. Directive 92/84/EEC lays down minimum rates for each category of alcoholic beverages, as well as reduced rates for specific Greek, Italian and Portuguese regions.

Although it is outside the sample period under review, it should be noted that the Commission proposed new regulations on excise duties for alcohol on 25 May 2018. These are contained in the proposal to amend Directive 92/83/EEC on the harmonisation of excise duty structures on these goods.

The provisions for tobacco products are contained in Directive 2011/64/EU. The legislation provides for the following categories of products: cigarettes, cigars, cigarillos, fine-cut tobacco for rolling and other smoking tobacco. The regulations apply minimums to cigarettes whether they are manufactured in the EU or imported and these minimum rates are harmonised, although member states can apply higher rates.

There is an *ad valorem* tax for cigarettes that is calculated on the maximum retail price and a specific excise duty per unit of product. The rate of the *ad valorem* tax and the amount of the specific excise duty must be the same for all cigarettes. EU countries may set an *ad valorem* tax, specific tax or combination of both for other tobacco products.

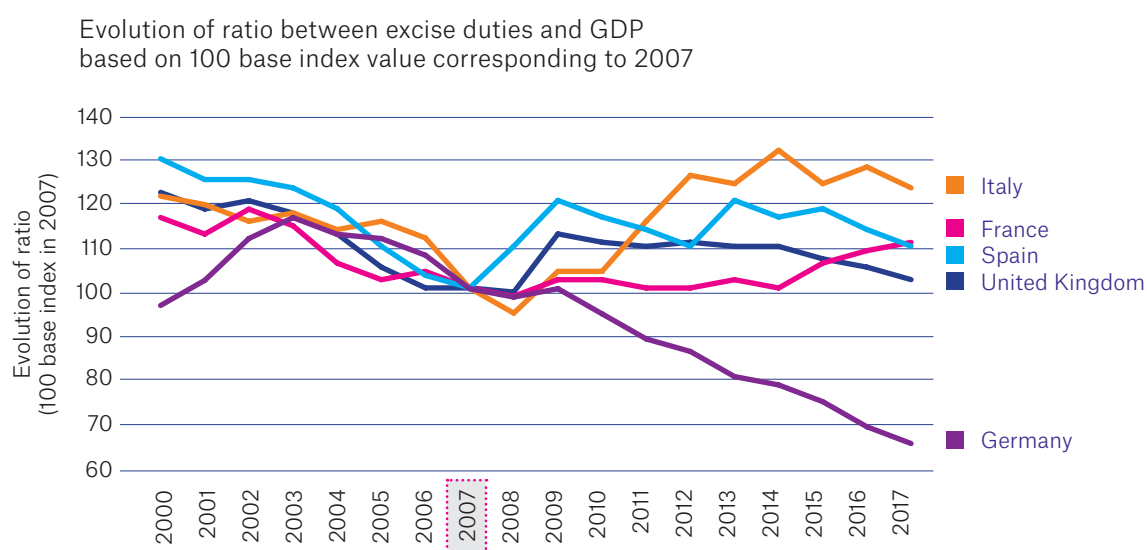
With regard to the collection of VAT and excise duties by EU member states, Table A.1.5 shows this collection in the pre-crisis period of 2007 and in the post-crisis period of 2010, 2014 and 2017. The distribution of the burden between VAT and excise duties is relatively stable.

There are huge differences among countries, given that the percentage of VAT collection ranges from a maximum of 33.2% in Croatia to a minimum of 14.1% in Italy. Excise duties represent 6% of the total collected during the period under review for all member states and, similarly, the differences are many. In this case, they range from a minimum in Luxembourg (0.4%) to a maximum in Bulgaria (17.5%). Spain is above the EU-28 average (6.4% compared to 5.7%) and is only surpassed by the United Kingdom (8.6% of GDP) when it comes to major countries.

Collection figures show that the profile of the crisis is very pronounced in Spain and the United Kingdom when it comes to VAT, while this profile in Germany does not coincide with the date of the crisis and there are no pronounced effects in France and Italy. In contrast, it is more difficult to observe the pattern of the evolution of excise duty revenues. There are many overlapping regulatory changes in the period 2000-2017 because of the economic situation in all countries. The greatest impact of the recession is seen in the collection figures of the United Kingdom.

If we take 2008 as the first year in which the effects of the crisis on collection can be observed, Figure 1 presents the changes in fiscal pressure in the five major countries with a base of 100 in 2007. The crisis had a minor effect in Spain, France and Italy in 2008, but since then collection has recovered strongly in all three countries. Germany is an exception, as both its regulation and the limited effect of the crisis on its GDP have led to a fall in the excise duty burden from 5.2% in 2007 to 3.3% in 2017.

Figure 1. How has the collection of excise duties evolved?



Spain represents a paradigm case in the European comparison. The proportion implied by excise duties in the period 2000-2007 as part of total collection coincides with the amount contributed by these very same taxes during the period 2008-2013. In the case of VAT, these contributions are 17.1% and 15.9% respectively, 35 billion euros less in 5 years of crisis, with figures that have not yet recovered despite two VAT reforms that place nominal rates above the EU-28 average.

The evolution observed in the collection of excise duties is the result of two factors. First, the legislative changes introduced, which have led to increased rates in most countries (once again the exception is Germany, where regulation has gone in the opposite direction). Second, the low sensitivity of these products to price changes. Given the need of public sectors to maintain expenditure levels or to keep these as low as possible in times of austerity, what this demonstrates is that excise duties are used almost exclusively for revenue raising purposes.

The situation in Spain

Everything described above with regard to justification and legislation also applies for this section, which will now focus on describing the changes that have taken place and the evolution of figures in Spain as studied from various perspectives. Although excise duties have been changed many times since their introduction, this section describes the reforms over the period 2006-2017.

Two changes were introduced to the excise duty on tobacco products in 2006, increasing the *ad valorem* tax rate for the different classes, as well as the unit tax rate for cigarettes (RDL 1/2006 and RDL 2/2006).

The tax rate on hydrocarbons applied to diesel was increased in 2007 (Law 42/2006 of the 2007 National Budget), while in 2008 there were no changes.

There was a further increase in the excise duty rates on hydrocarbons in 2009, which in this case affected both diesel and petrol, while the unit tax rates for cigarettes and rolling tobacco were increased, as was the *ad valorem* rate on cigars (RDL 8/2009).

Tax rates levied on tobacco were further increased in 2010 (RDL 13/2010), while those on cigarettes were changed in 2012, reducing the *ad valorem* rate and increasing the unit rate (RDL 12/2012 and RDL 20/2012).

A further similar change was introduced in 2013, while at the same time increasing the unit rate on rolling tobacco and the excise duty rate on alcohol and alcoholic beverages (RDL 7/2013). Natural gas consumed by households also began to be taxed (Law 15/2012).

Finally, after two years without any changes, the unit tax rates on cigarettes and rolling tobacco and the rate on alcohol and alcoholic beverages were increased at the end of 2016 (RDL 3/2016).

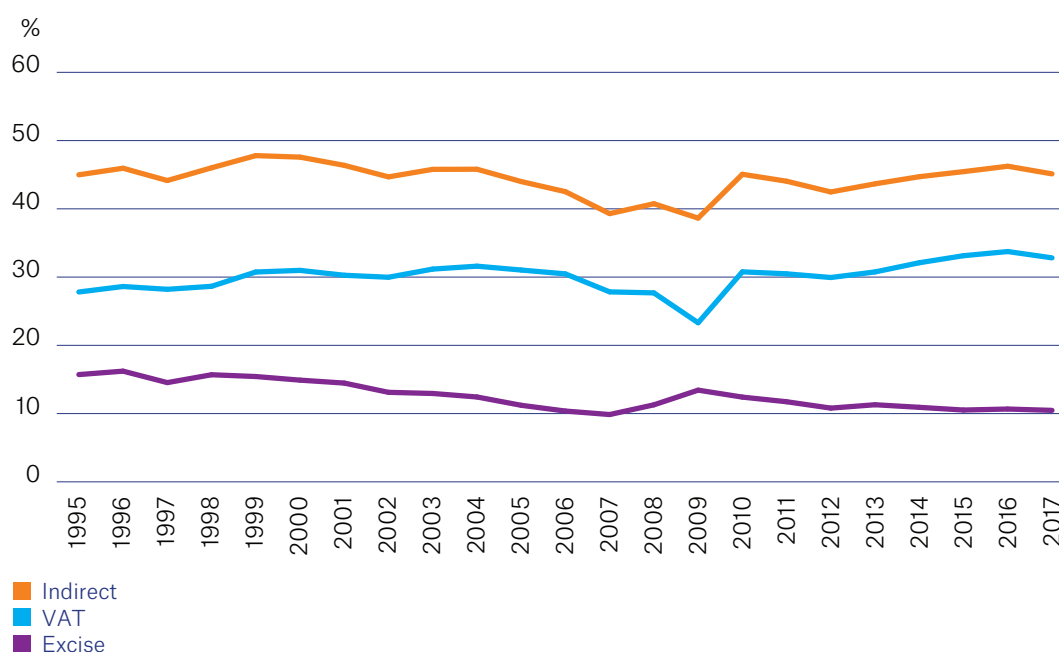
Furthermore, during the period under review, Spain's Autonomous Communities also introduced or modified the Autonomous Community rates of the tax on retail

sales of certain hydrocarbons (IVMDH), which since 2013 had been integrated into the tax on hydrocarbons, including the Autonomous Community rate in the national rate at the maximum level allowed for these regions since 2019.

Changes in the collection structure in Spain since 1995 is first presented. In this way, we have two complete cycles in which to observe structural trends. Figure 2 provides the percentages that total indirect taxes, VAT and excise duties represent over the total revenue obtained by the AEAT.

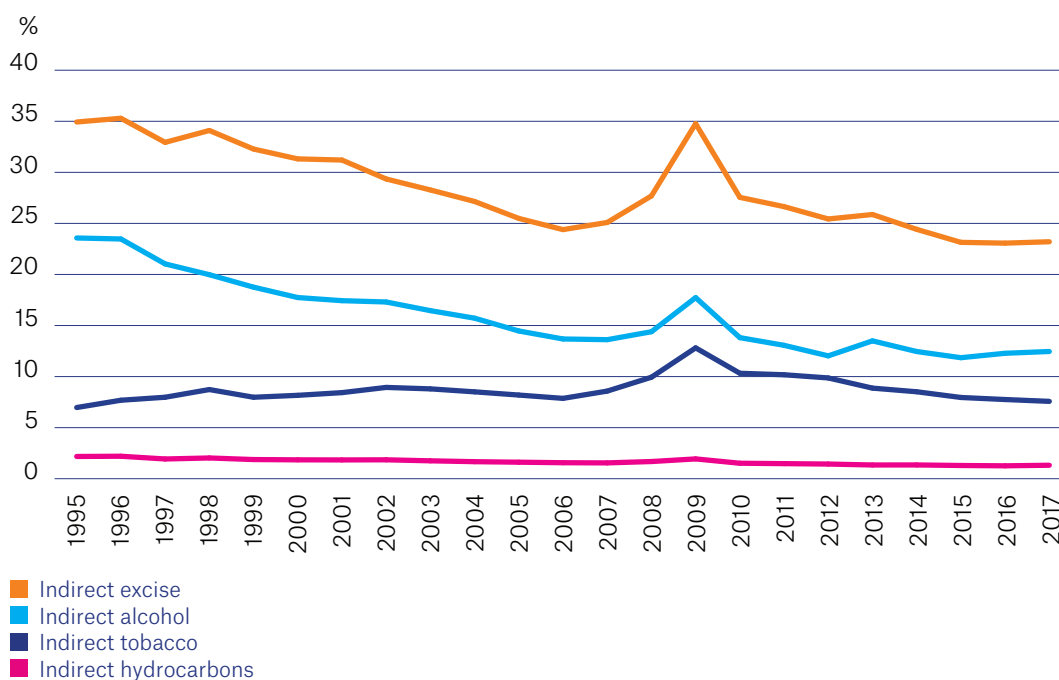
Although VAT displays a cyclical profile, the appearance of excise duties is counter-cyclical for the aforementioned reasons. Figure 3 shows the proportions of excise duties and their main components in the total of indirect taxes collected. Once again, the counter-cyclical aspect of these taxes can be observed, with the component corresponding to hydrocarbons being the most sensitive to the cycle.

Figure 2. Tax structure of consumption taxes



The most important element in the collection of excise duties is hydrocarbons, which on average represent more than 50% (53.69% in 2017). Tobacco products are in second place, with an average of over 30% (32.64% in 2017). Alcoholic beverages have always represented a residual part, given that Spain's negotiation with the EU helped to maintain products such as beer and wine outside any harmonisation, based on the argument of avoiding price distortions that would affect the sector's competitiveness. The excise duty on electricity, which currently accounts for more than 6% of revenue, has not been introduced into the Figure.

Figure 3. Excise duties in relation to indirect taxes



One might think that the enormous weight that both hydrocarbons and electricity have acquired in the structure of excise duty collection is due to the attempt to internalise the environmental problems caused by their consumption through pricing. But this is not a concern in the decision-making of the tax authorities. No tax proposals have so far been considered in Spain to fit in with the so-called green tax reforms, so neither the electricity tax nor the fuel tax have been designed with these objectives in mind.

Consideration of the aforementioned aspects would require profound changes. Both taxes share a very important component on the overall amount paid and not on the amount consumed of the pollutant, which means that they are not in line with the general principle of the *polluter pays*.

Clear evidence of a lack of interest in correcting these negative externalities is that the maximum collection of the excise duty on electricity occurred in 2012 (at the height of the crisis) and the highest collections (in relative terms) of the excise duty on hydrocarbons occurred in the late 1990s, and its evolution has been one of a constant fall in the total contribution to collection since its peak in 2008.

It should be obvious to tax authorities that this fall in revenue will be difficult to recover through the amount, given that the structure of the motor vehicle fleet is shifting towards the purchase and use of hybrid and electric vehicles. Although there appears to be some room for increased taxation, new designs should be considered if the current volume of collection is considered to be necessary for maintaining public expenditure levels.

In short, these three major tax figures display some clear facts. First, excise duties in Spain, unlike other taxes, are counter-cyclical, possibly due to an attempt to maintain

revenue at times when it has been lost due to the effects of economic developments (*regulatory effect*). Second, tobacco products and hydrocarbons account for more than 80% of total revenue over the period under review. Third, the weight that hydrocarbons have lost in the composition of the collection basket has been won by the tax on tobacco products.

Fuels are much more linked to the economic cycle because of their importance in the transport sector, and also because households use private transport vehicles for both commuting to work and taking their children to school, or for leisure purposes. The tax component differences of the Spanish price and arithmetic average of Germany, France, Italy and the United Kingdom are currently around 23%, 36% and 18% for non-commercial diesel (used mainly in agriculture), diesel A and petrol respectively, which gives an idea of the existing room for manoeuvre.

Nonetheless, the composition of the excise duty collection basket in its main components has changed significantly over time. Electricity has therefore been less sensitive to the crisis because the reforms have affected the amount of the final bill, mainly the fixed component, and not so much the price per kWh, while alcoholic beverages and tobacco products have been more sensitive.

5

Calculating Redistributive Effects

This section presents the distributive impacts of excise duties calculated by using data from the Household Budget Survey (HBS). The analysis has been conducted from various perspectives in order to provide solid results; in other words, the aim is to confirm their nature in terms of redistributive inequality and capacity through various measurement alternatives. Moreover, an attempt has been made to ensure the compatibility of the results of the different approaches and, finally, to compare the excise duties in Spain with those of the EU in terms of redistribution.

The four approaches have been dubbed: *the structural approach*, through which the distribution of the tax burden is analysed; *the concentration approach*, through which progressivity and redistribution are defined (in other words, by combining burden and income); *the microsimulation approach*, which aims to find out whether some of the reforms introduced have changed the characterisation of excise duties; and *the narrative approach*, which helps to calculate the effects of the tax reforms in terms of inequality and redistribution and to provide validity to the microsimulation analyses. The details of these four approaches can be found in Annex 2.

Results of different approaches

The structural approach

So named because it only incorporates the tax structure into the analysis. The tax burden or proportion that the excise duties paid by each household represent in the household income is calculated for this purpose, and its distribution by deciles for the period 2006-2017 is displayed in Figure 4. Income or duly corrected income can be used, although both have been used here and their reasons and differences are explained.

A relevant issue is that the calculation of averages has been corrected if required by raising factors, which measures the number of households in the population represented by each household in the sample. In this way, representative figures are obtained with regard to the Spanish population. It can be seen that the proportion

average decreases with equivalent income. But it increases with income up to the 6th and 7th deciles. However, analysis by year reveals a change in 2016 and 2017, given that the burden increases up to the 8th decile.

Figure 4. Tax burden on the equivalent income of excise duties by deciles (2006-2017)

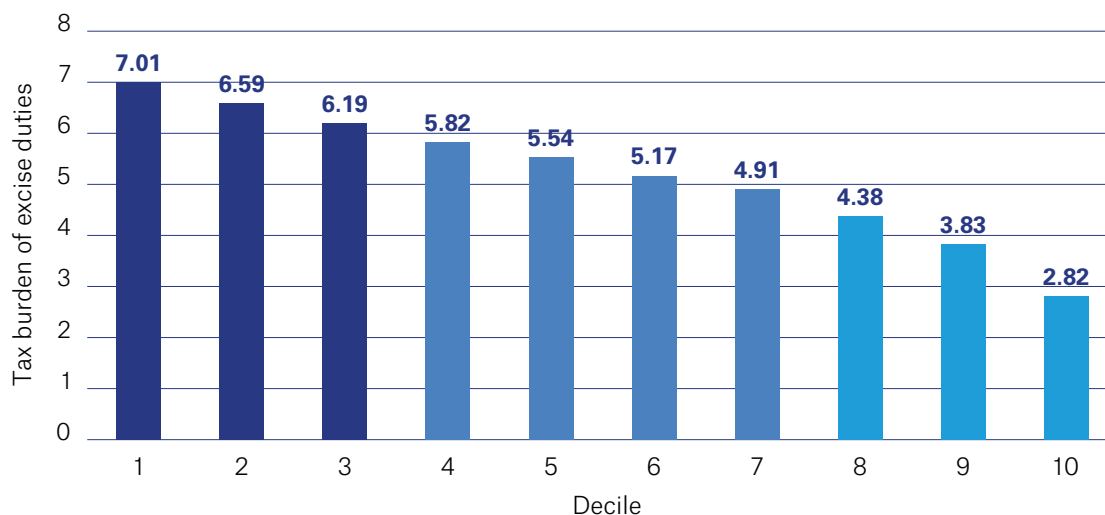


Figure 4 shows how the tax burden varies through the distribution of equivalent income. The distribution of the burden is obviously very uneven, as it varies inversely with equivalent income (as well as income) and clearly shows a situation of regressive excise duties.

Equivalent income is considered because it takes into account the size of the household in explaining the evolution of the inequality, progressivity or redistributive capacity of the taxes. It is structured by correcting income using a standard scale in which a value of 1 is assigned to the household's main breadwinner, 0.7 to the spouse and 0.5 to each of the dependent children, regardless of age.

This variation can also be calculated by the correlation between the two variables (Annex 2). The burden increases as income increases if the correlation is positive, which would thereby indicate that the structure of excise duties is *progressive*. The coefficient measuring this correlation throughout the period analysed is negative, clearly and constantly showing that these tax figures are, generally speaking, *regressive*.

It is true that variability can be found in this coefficient in the different years, but the main correlation is negative, both with income and, more clearly so, with equivalent income. Although the regressive profile appears to be linear, the pattern of the tax burden has also been analysed by using a quadratic profile, thereby confirming its regressivity.

In short, the tax burden of excise duties is an inverse function of income and family size, with the largest poor households bearing the greatest burden.

The concentration approach

The concentration approach presents the redistributive capacity of a tax by calculating a series of indicators. Income is added to the tax burden to incorporate the effects of inequality, proportionality (or lack thereof) and redistributive capacity of excise duties.

A simple methodology is used to draw intuitive conclusions from the analysis. It provides a measure of the inequality caused by excise duties (*indices of inequality*), which approximate how the taxes affect income distribution. It measures progressivity (*indices of progressivity*); in other words, the deviation from proportionality. And, finally, it calculates the *reordering effect* to complete the analysis of all factors affecting distribution; in other words, the capacity shown by tax changes to modify the position of individuals in income distribution.

The most common measure of inequality is the Gini index, which associates a real number to each income distribution that reflects the level of inequality in a summarised manner. In this way, how near or far a distribution is from one that is perfectly equal can be identified.

Constructing the index takes into account the absolute value differences of each income with respect to the weighted average (divided) by twice the average income. Therefore, the index varies between 0 and 1, with 0 as the minimum value indicating perfectly equal distribution (all individuals enjoying the same income, which in turn is the average income) and 1 as the distribution with maximum inequality (one individual owns all income).

If we compare the index in income distribution before and after a tax is applied, we obtain the contribution of this tax to the change in inequality (or *redistributive capacity*). This can be calculated on the basis of absolute values (Reynolds-Smolensky index), which quantifies twice the area between the pre- and post-tax Lorenz curves of income.

It can also be calculated on a relative measure structured as the quotient between the difference of the pre- and post-tax Gini and the pre-tax Gini (Pechman-Okner index).

The deviation from proportionality is measured by comparing the distribution of tax rates. In other words, a tax is more progressive than another alternative tax if the rates of the former are more unequally distributed than those of the latter. This is commonly measured by using the Kakwani index, which is calculated as the difference between the tax rate concentration index and the Gini index.

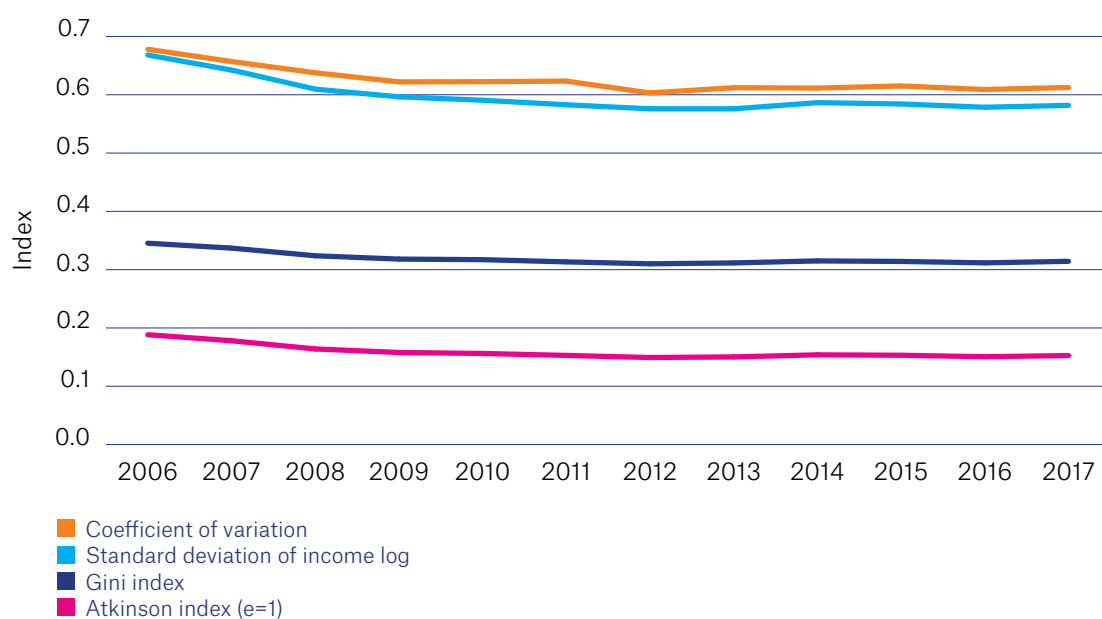
This is justified because the distributive effect depends on the size of the payment and the increase or decrease in the average rate throughout income distribution. It is true that the redistributive effect is also affected by the reordering of individuals in the distribution of income after payment of the tax (reordering effect). This is the third type of indicator presented.

Annual calculations have been made for the entire period 2006-2017 with data from the Household Budget Survey (HBS), designed in such a way so that each household remains in the sample for two years, thereby helping to replace 50 per cent of the households in each period. This procedure, called *rotation*, serves various aims, among which is that of not producing fatigue in those who collaborate or describing demand behaviour on repeated occasions.

Figure 5 shows the results of inequality. In it, it can be observed that the Gini index decreases until the economic crisis arrives, after which it stabilises and even displays minor increases at the end of the period. In this case, the evolution of the income indices is presented, but the profile of the evolution of the equivalent income indices is extremely similar, although magnitudes are different.

The coefficient of variation, the standard deviation of the income logarithm or the Atkinson index corroborates the profile shown by the Gini index with different orders of magnitude. The inequality aversion coefficient of the Atkinson index is 1; in other words, a certain degree of aversion is assumed in line with the exercise in question. If the coefficient is 0, there is no aversion to inequality in society (or among policymakers), while it is assumed that the valuation of social welfare would be made by the poorer individual if it is infinite.

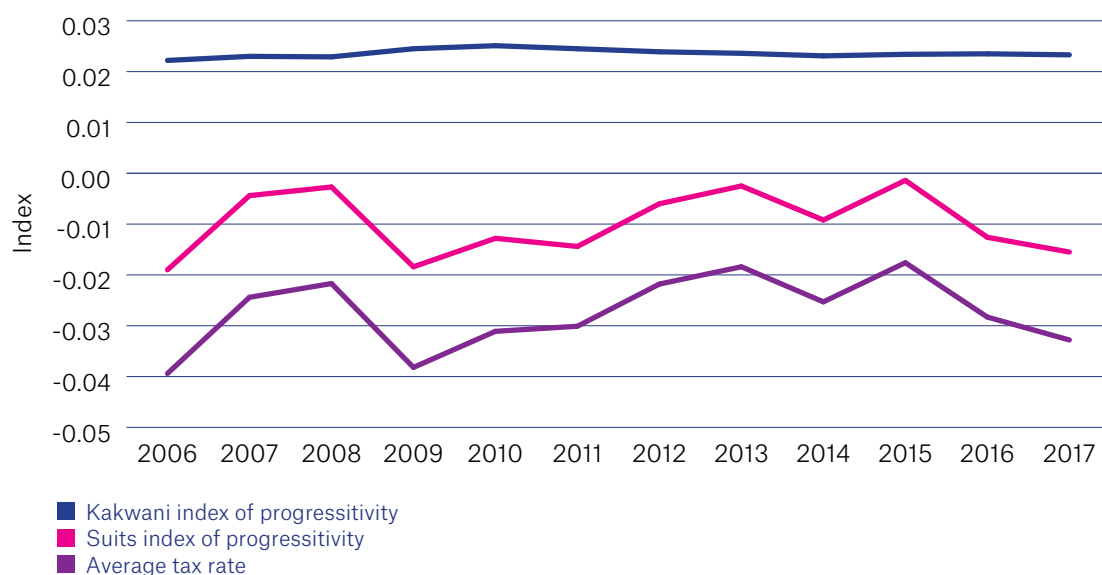
Figure 5. Evolution of inequality



The comparison of indicators for income and equivalent income underlines two major aspects. First, the stability of the measures over the period under review, with a slight tendency towards reduction at the beginning, but displaying a very similar profile and thus the same qualitative implications are maintained. Second, the introduction of the corrected household size leads to a slightly higher increase in inequality generated by excise duties. It may be that the return to the household of children with low income levels or who are unemployed because of the economic crisis may be the reason for this slight increase in inequality measured in these terms.

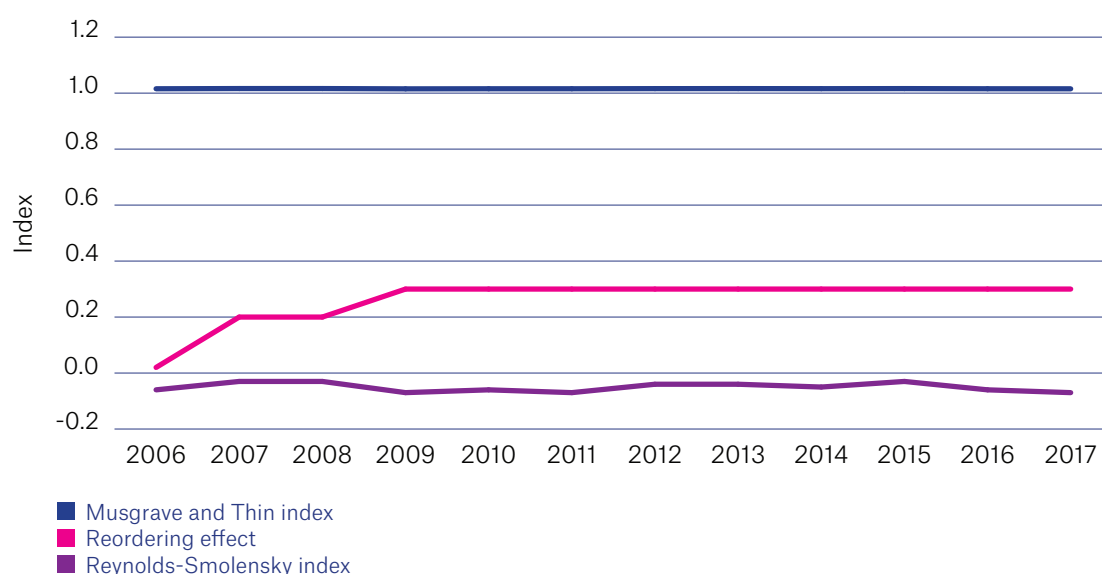
Progressivity measures inform the extent to which excise duties are moving away from proportionality. They have been calculated for each of the years in the period 2006-2017 and with the available panel. Figure 6 shows the evolution of some rates of progressivity (once again, equivalent income provide a very similar profile). In terms of income for the whole sample, the indicators give an almost proportional appearance of excise duties over time.

Figure 6. Evolution of progressivity



The Suits and Kakwani indices in particular show slightly regressive distributions, as demonstrated by the average tax rate, which has remained almost constant over the period under review. The average tax rate per decile of income, which is analysed later, decreases as income increases, thereby confirming the regressive nature of excise duties.

Figure 7. Evolution of redistributive capacity and reordering effect



With regard to redistributive capacity (Figure 7), the Musgrave and Thin index is not statistically different from 1 in any period, and the Reynolds-Smolensky index (which is shown multiplied by 100) is always less than one ten-thousandth, thereby indicating a tremendously limited redistributive capacity expected from indirect taxes, but which appears much more limited in the case of excise duties.

In the case of the Reynolds-Smolensky index, it can similarly be seen that the crisis has contributed to reducing its very limited previous redistributive capacity. As for a reordering effect, its minor contribution was completely halted by the arrival of the crisis.

Effect of the extensive margin

If there are negative externalities leading to social costs, these must be borne by those who contribute to them. It is clearly the buyers of these products who pay excise duties. Our aim in this sub-section is to determine whether differences exist between those who contribute (pay for the externalities they generate) and those who are not consumers of these goods, as well as in redistributive terms.

The study to identify whether or not the good subject to excise duty is consumed in the household involves dividing the sample into two groups. In the case of tobacco products, the so-called *smokers* group includes all households with positive expenditure in any of the three tobacco categories in the Household Budget Survey (HBS), and the *non-smokers* group, comprising households with no expenditure in any of the categories. The percentage of households with the presence of smokers has been falling over time (during the period covered by the HBS), and this percentage increases with the level of income.

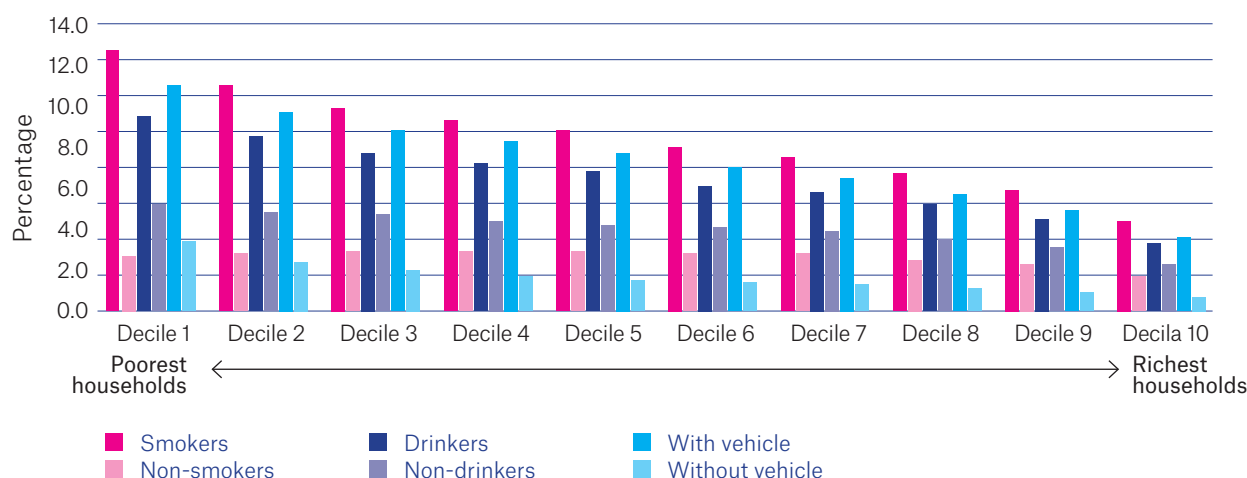
The tax charge for excise duties is on average almost three times higher in households with smokers than in non-smoking households (Figure 8). Almost one-third of excise tax revenue comes from tobacco. We can thereby deduce that the tax paid will be regressive based on these prevalence profiles and tax payments. Moreover, if the effective rate of indirect taxes in Spain is around 14%, excise duties on tobacco products represent more than 40% of the total for the middle and upper income deciles.

If we consider the average proportion of the tax burden of excise duties by income deciles in each year, we can deduce a significant difference in the distributive impact of these taxes on the two types of households under review. Therefore, while the weight in non-smoking households is almost proportional up to the 6th and 7th deciles, in households with smokers the weight decreases with income level and, therefore, these taxes have a very regressive impact.

The correlation between the tax burden and income is calculated for both groups of households in order to corroborate this. The basic difference is that taxes are highly regressive for households with smokers throughout all of the years of the survey (yearly and on average for the entire period), but are not as regressive in non-smoking households. The same qualitative results are obtained if equivalent income is used.

Figure 8: Which households pay excise duties?

Proportion that excise duties represent in the equivalent income of the household by type of consumption



The second division of the sample distinguishes households in which consumption of alcoholic beverages is observed from those that indicate zero consumption (considering the two categories of alcoholic beverages subject to excise duty contained in the Household Budget Survey). The percentage of households with *drinkers* generally increases with income level, although no significant differences can be noted between deciles when corrected for family size, mainly between lower income households.

The tax burden represented by excise duties in income level has a similar profile by deciles between consuming and non-consuming households, more notable among those that consume (Figure 8). Therefore, the average tax burden by deciles of equivalent income in each year and in the entire sample decreases with equivalent income in both types of households.

Similarly, the correlation between the tax burden and income is negative and significant (thereby indicating that excise duties are regressive for households with drinkers in all sample years). The same result is obtained with the panel data, results that are repeated when income is considered instead of equivalent income.

The third good analysed combines investment and consumption. Fuel is consumed if a vehicle is available for any purpose. Consequently, households will first have to make an investment decision. The Household Budget Survey (HBS) does not provide information on this, but if we observe a household that does not consume fuel for two years, we can infer that it does not own any vehicle, given the frequency of purchase and the way in which these expenses are collected during two consecutive weeks in the HBS.

The sample distinguishes between so-called *with vehicle* households, containing those with positive expenditure in the category of “Fuels and lubricants” according to the HBS (“Diesel and/or petrol” from 2016), and *without vehicle* households, those with no expenditure in any of the categories under review. The percentage of

households with a vehicle generally increases with income level, but the differences become less pronounced when the equivalent income level is considered, given that the probability of ownership increases according to the size of the household.

Figure 7 shows that the proportion of excise duties paid by the household of its income is on average more than three times greater for households with a vehicle than for households without a vehicle in most years and for the entire sample. When calculating the average tax burden by deciles of income from excise duties, we can see that it decreases with income and reconfirms its regressive nature for households both with and without a vehicle.

Finally, we have considered two sub-samples: on the one hand, smoking, drinking and vehicle households (SDV); in other words, those households with positive expenditure on the three products in question (tobacco, alcoholic beverages and petrol, according to the criteria defined in the previous sections), and, on the other hand, non-smoking, non-drinking and non-vehicle households (NSNDNV), without expenditure on any of the three products in question.

The percentage of SDV households increases with income level, while the percentage of NSNDNV households decreases with income level. Nonetheless, if we consider equivalent income, the percentage of SDV households generally increases with income level in the first deciles and decreases in the last deciles. There is no change between some households and others in distributive terms in view of the calculated indicators.

The microsimulation approach

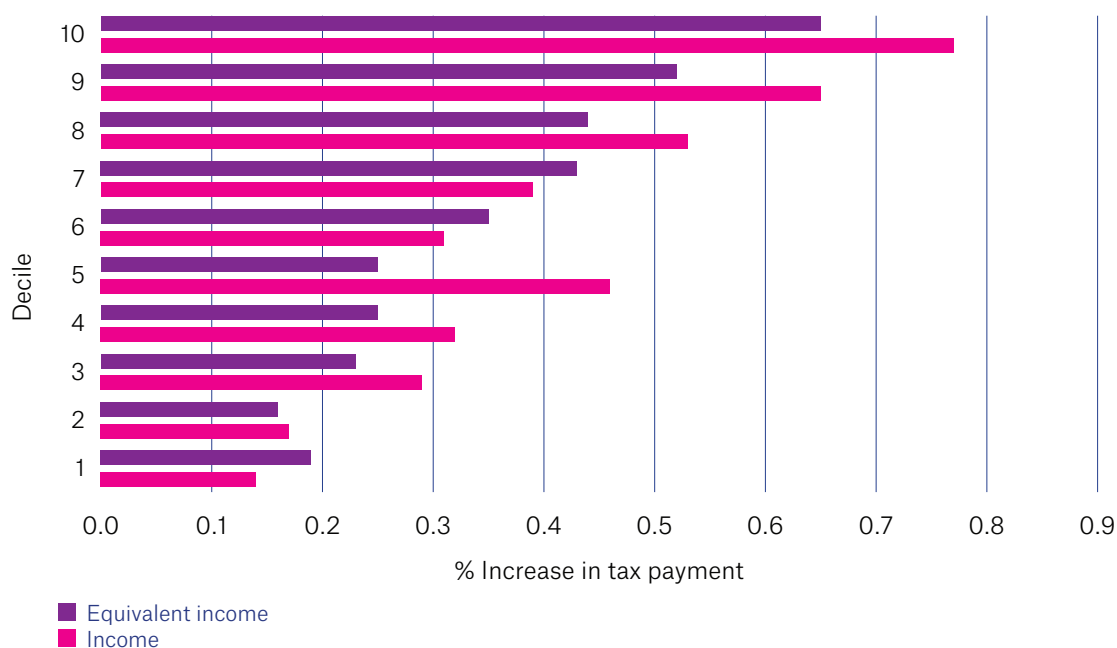
The third exercise is performed by microsimulation analysis, which studies the impact of the actual reforms on households. First, the reform that led to increasing the VAT tax rate from 18% to 21% (for goods subject to excise duties), which came into force on 1 September 2012, and also modified excise duties.

We can follow the reform as it was implemented because we have the week in which the household participated in the survey. In order to do this, we take the households in the sample in 2012 from the change of the tax rate and compare their tax burden with the burden they would have been subject to with 18% VAT.

It is assumed that the household consumption of goods subject to excise duties varies according to the following price elasticities: alcoholic beverages -0.80, tobacco products -0.20, electricity -0.13, petrol -0.29 and diesel -0.15, in line with the most recent values provided in the empirical literature for Spain.

It could be assumed that households do not react through behaviour; in other words, the deterrent function does not apply in any way. The response in terms of progressivity and redistribution would be known in advance and would coincide with the situation prior to the tax change. The reason is that the burden would increase while income would remain constant before any tax increases.

Figure 9. Percentage change in tax burden of excise duties by deciles



Pre- and post-reform comparisons reveal that the average share of household income from excise duties increased by 0.4% (the weight of the total tax burden considering VAT and EDs increased by 6.8%), with the percentages of variation being very similar in terms of equivalent income (0.4% and 6.6% respectively). Figure 9 shows that the general profile of these increases falls with income and equivalent income, in both cases displaying a strong regressive effect.

In a second exercise that follows the previous methodology, we analyse the impact on households of the increase in excise duties on petrol, diesel and tobacco products that was implemented in 2009 (Table 1), taking the households that participated in the Household Budget Survey (HBS) in this period from the tax change; in other words, the weeks in June 2009 when the reform came into force.

Table 1. Changes in excise duties (reform of 13/06/2009)

Product	Tax rate before 13/06/2009	Tax rate after 13/06/2009
Petrol	0.39569 €/l	0.42469 €/l
Diesel	0.30200 €/l	0.33100 €/l
Tobacco Cigars and cigarillos Cigarettes Rolling tobacco	13.5% RRP 57% RRP + 8,2 €/1000 cigarettes 41.5% RRP	14.5% PVP 57% PVP + 10.2 €/1000 cigarettes 41.5% RRP + 6 €/kg

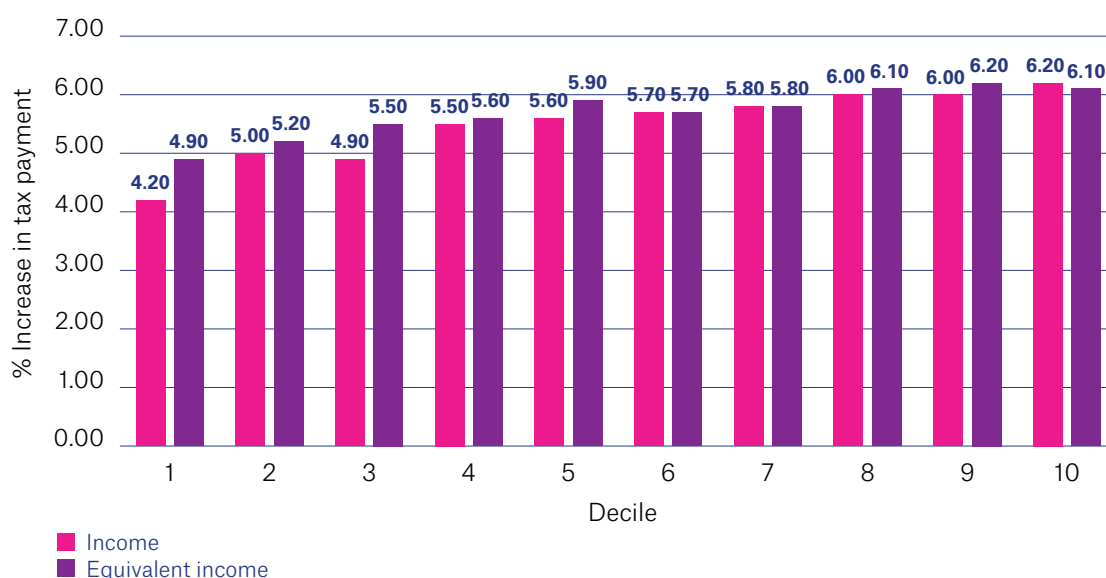
This reform implied an average increase in tax payments because of excise duties of 46.3 euros per household (52.2 euros per household if we also include VAT). The burden in terms of household income increased 5.6% as a result of the reform (the same percentage as for equivalent income). These increases are slightly higher

with both income and equivalent income levels, as well as for both the burden of excise duties (Figure 10) and the total tax burden of indirect taxes. The Reynolds-Smolensky index, which is not different from zero, confirms the proportionality of the reform.

The narrative approach

This final approach helps to establish the responses of households with regard to the goods analysed. In other words, tax reforms are usually reported through microsimulation analysis. This is an *ex-ante* assessment that helps to draw conclusions about the revenue that the reform will generate by adjusting or not consumer behaviour, as well as the effects it will have on the demand for goods and its implications for income distribution.

Figure 10. Percentage change in tax burden of excise duties by deciles



Responses to consumer demand are used to obtain new demand and income figures. These are used to calculate pre- and post-reform indicators and the effects on inequality, progressivity and redistribution.

A fundamental doubt of microsimulation is whether the results of hypothetical exercises are confirmed when real consumption data is available for subsequent periods once a reform is introduced. Several exercises have been carried out to resolve this doubt, although only the results relating to the effects of excise duties are presented for the most important reform in the sample, which corresponds to the 2012 VAT increase.

For this purpose, actual consumption data in the quarter following the reform is compared with simulated data for that quarter. A quarterly period is chosen because of the short-term nature of both the years and parameters used. The differences in terms of quantity, expenditure and expenditure ratio between actual and simulated data are presented in Table 2.

The differences in the amount adjustments are always lower than 2%, while the differences in expenditure and proportion of expenditure devoted to these goods are lower than 2.5% either individually or for all the expenditure dedicated to them. All these differences are compatible with any confidence level used. The differences between what actually occurred and what was simulated remain extremely minor if we present reforms that change prices by less than the 2012 reform.

Table 2. Differences between real and simulated results: tax reform 2012

	Quantity ^{3, 5}	Expenditure ^{4, 5}	Proportion ⁵
Spirits and liqueurs	1.85	0.52	0.76
Beer	1.90	0.52	0.87
Cigars and cigarillos	0.48	1.91	0.00
Cigarettes	0.46	1.92	1.85
Other tobacco¹	--	1.97	1.38
Electricity	0.29	2.07	2.02
Natural gas	0.45	2.04	2.05
LPG	0.43	1.95	2.11
Liquid fuels	0.04	2.44	2.30
Petrol²	0.41	1.94	1.91
All goods	--	1.95	1.94

Notes

1. The HBS does not provide consumption data for other tobaccos.
2. There is no disaggregated data on petrol and diesel consumption until 2016.
3. Quantities are litres for spirits and liqueurs, beer, liquid fuels and petrol, kilograms for LPG, kWh for electricity, m3 for natural gas, units for cigars and cigarillos, and number of packs of 20 for cigarettes.
4. Expenditure corresponds to euros and to the year 2011.
5. Percentage differences: difference 1 corresponds to amounts, difference 2 to expenditure and difference 3 to proportions of expenditure.

This exercise lends credibility to decision-making based on microsimulation analysis. In terms of redistribution, the results already presented in the previous section are confirmed. While in the case of taxes, it is not apparent that this reform or others that have been simulated over the period 2006-2017 have succeeded in redistributing income, as proportional results have been found to be the lesser evil in this respect.

Reconciling the results

The results obtained with regard to distributive effects unequivocally indicate that only the collection capacity of excise duties has been taken into account for their application in Spain. It is clear that charging excise duties is markedly regressive, given that this charge decreases when income increases (Figure 4).

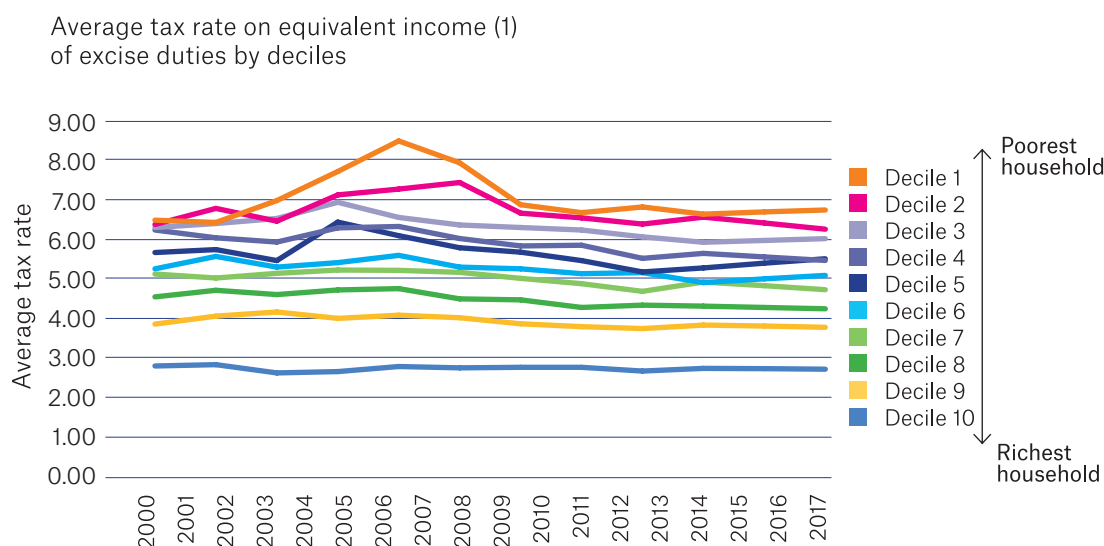
This sub-section calculates the average tax rate on income and equivalent income from excise duties for each year of the sample and by deciles. Figure 11 presents the evolution of these rates for the equivalent household income, because with it we also obtain the profile considering the size of the household. If we do not take into account the reordering effect, which has had very little effect, studying the distribution of the burden and rates serves to make the results compatible.

The endorsement of everything previously obtained comes from the detailed analysis in Figure 10. The crisis has contributed to an increase in average rates, especially those for the poorest. This may be due to an increase in excise duty rates, a fall in income or a combination of both factors, which is what has occurred in the Spanish economy.

Growth is relatively maintained over time depending on how great the fall in income has been, which, as is well known, was more pronounced in low income segments. An inverse relationship can be seen between average rates and equivalent income. In other words, depending on the fiscal pressure of excise duties, the highest average rates are borne by the poorest households with more members.

The maximum average rate of excise duties for the period was paid by the poorest households in 2010 and was equivalent to 8.45% of their income. In that same year, the richest households paid 2.73% of excise duties, in other words, 3.1 times less in relative terms than the poorest households. The ratio between the maximum and minimum average rates can be as high as 3.5 and these rates were respectively borne by the poorest and the richest.

Figure 11. How much do Spanish households pay in excise duties?



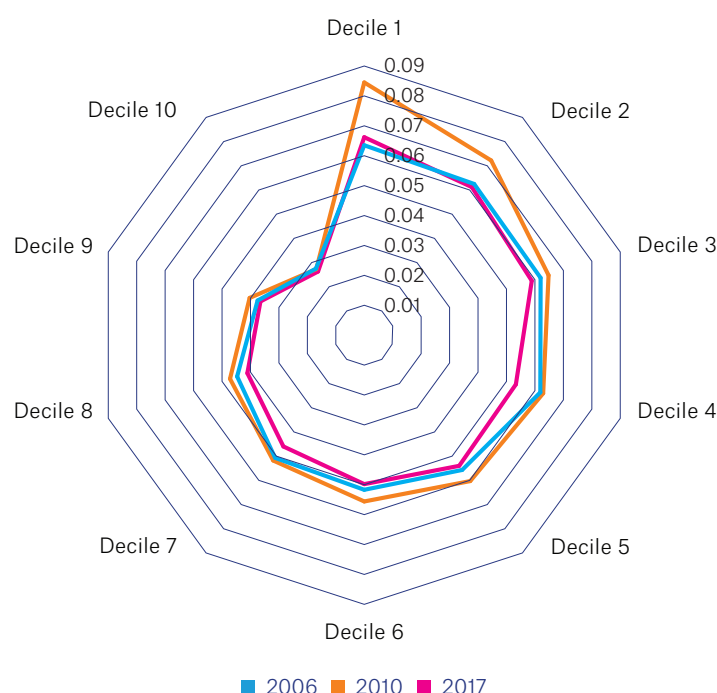
(1) Equivalent household income is obtained by dividing total household income by the number of consumption units (household members).

The richest households did not need to adapt their consumption (at least in the goods levied by excise duties) as a result of these adjustments.

As the country has overcome the crisis, slight increases in income and maintaining these measures have stabilised the evolution of rates throughout their entire distribution, although the poor continue to pay the highest rates and the rich the lowest rates.

This stabilisation can be clearly seen in the comparison before (2006), during (2010) and after the crisis (2017) in Figure 12. The average rates are similar before and after the crisis, with slightly higher contributions from the central distribution deciles. Rates during the crisis are higher for all deciles as a result of the factors listed. It is clear from the Figure that those most affected by the crisis were the poorest, while in contrast, no effect of the crisis can be observed in the richest deciles.

Figure 12. Comparison of average tax rate by deciles, 2006-2017



Spain – European Union comparison

There is a great deal of literature from the academic world, in addition to reports issued by international institutions and organisations, assessing the effects of changes in excise duties in the context of both comprehensive tax reforms (the most recent take into account green tax reforms) and isolated reforms.

There is also general consensus in favour of these taxes so that the prices of goods reflect the externalities generated. However, when it comes to redistribution, the studies available for many EU-15 countries show a similar situation to that described above. Excise duties have fulfilled their collection function much more so in times of crisis than during an economic boom.

It is true that the recent crisis has highlighted the need to think about tax schemes to combat local and global problems and it seems appropriate to consider fairer, more efficient tax designs that incorporate mechanisms to compensate certain households (rural households, for example, in the case of fuel, since they do not have

the possibility of using public transport, and poor households in the case of the tax on electricity).

The new member states of the European Union have not yet reached the welfare levels of the EU-15 and comparisons are complicated both in terms of collection and redistribution, given the fact that room for manoeuvre on the basis of public revenues is far from as wide as in most of the more developed countries of the European Union.

The excise duties that have been analysed most from the perspective of redistribution have been those levied on electricity and hydrocarbons. The reasons for this are obvious: in the former, because of their impact on poverty and, in the latter, because their collection represents more than 50% of excise duty totals in all the EU-15 countries.

The distributive studies have been conducted for different household variables, such as income, size or location and the results are not uniform. Excise duties are generally regressive and hydrocarbon taxes are greater for those with vehicles. Regressivity becomes more pronounced when equivalent income is taken into account, as in the case of Spain.

Location is not usually a suitable variable for defining compensation mechanisms, because in certain areas, such as rural areas in the United Kingdom, vehicle owners do not correspond to households with lower equivalent income. Rurality in Spain is a variable that can be used in specific locations, normally low-income Autonomous Communities.

In short, the harmonisation that the European Commission is trying to impose leads to regression, limited redistributive capacity and, most seriously, triggers an increase in inequality to a greater or lesser extent in all EU-zone countries.

6

Proposed Redistributive Nature Reforms of Excise Duties

The overall picture with regard to the question we are hoping to address unequivocally reveals that excise duties are regressive and have had no or very limited redistributive capacity. A new question therefore arises as to whether it is possible to reform these taxes to provide them with this capacity. Several exercises are presented in this section that once again use the microsimulation approach.

There is a need for deep reform of the tax system in Spain, including changes in a good number of taxes. This would lead to a multitude of simulations, even if the study were restricted to excise duties. But there are two changes that need to be addressed urgently because they share not only a domestic but also an international dimension. The first relates to energy poverty, a subject that has been widely discussed in the media and academic circles.

Energy poverty exists because poverty exists. Policies must therefore be general in nature; in other words, they must fight poverty even when they include energy-related measures. A first microsimulation exercise is proposed that considers changes in the excise duty on electricity.

The second urgent and highly relevant problem is climate change, although this problem is of a global nature. One sector whose emissions contribute to worsening the environment of our cities at a local level and the warming of the planet at a global level is transport. A further microsimulation exercise is outlined that introduces changes to excise duties on fuels.

The following procedure is used to calculate its distributive impact: first, its effect on the consumption of the good under review in each household is calculated by using the aforementioned price elasticities. The impact of the reform on income is determined with the new prices and consumption and the population raising factor is applied to this impact in order to obtain representative results at the level of population. Finally, the average effect by deciles of income is calculated and the distributive impact of the reforms is obtained.

The starting point is determining electricity and fuel consumption or their proportion in the household shopping basket. The most recent data from the Household Budget Survey for 2017 has been used. It can be seen that the share of electricity in total expenditure decreases as the level of income increases. Duties on electricity are those that have the most regressive impact.

In contrast, the share of diesel A in the shopping basket increases to the 8th decile (except for a slight reduction in the 6th decile) and decreases in the last two deciles, leading to progressivity in excise duties on this good. Finally, petrol has a lower weight in household expenditure, with the percentage of its expenditure increasing to the 6th decile and decreasing slightly in the last deciles.

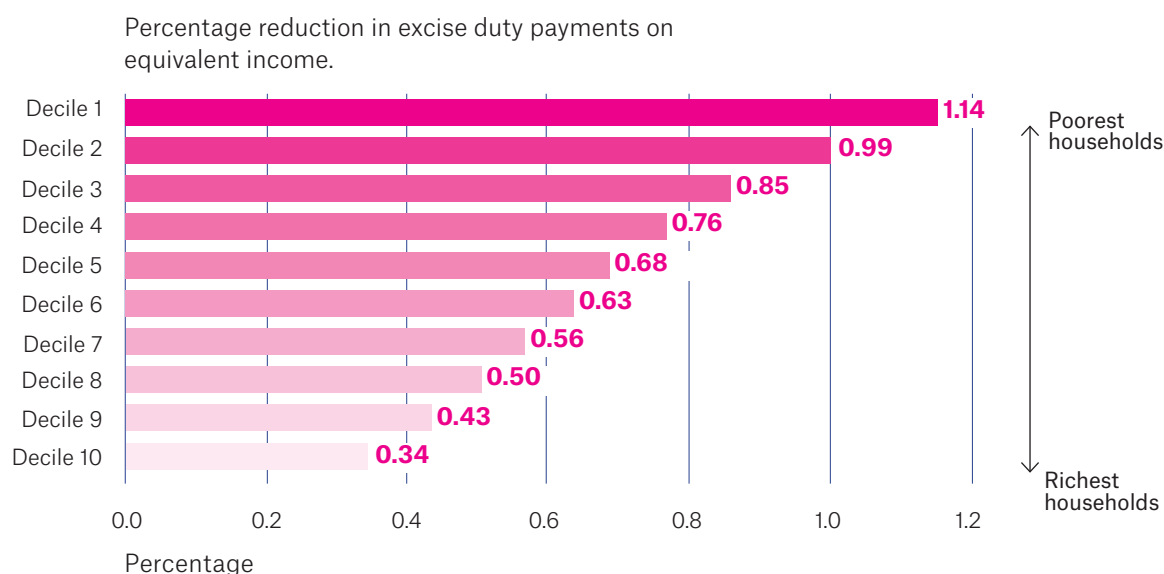
More than 21% of the final price of electricity paid by households corresponds to support costs for renewables, cogeneration and waste. The final price would be reduced by 27.3 if these costs were to be removed from the tariff, which would lead to an increase in demand of 5.5% and an increase in CO₂ emissions of 0.49%. The fall in price is greater than that resulting from the elimination of the aforementioned support costs, as the unit amount of VAT and electricity tax is reduced because they are *ad valorem* taxes.

As a first reform, it is assumed that the cost of renewables is funded outside the energy sector, so that there are no price distortions in other energy products. Under these circumstances, and as a result of price changes, there is a decrease in expenditure on electricity that leads to a reduction in revenue of 1,016.1 million euros. This reduction is due to the fact that both excise duty and VAT are applied to the price of electricity, the major fall in which is not offset by an increase in consumption.

The above is a partial cost to which the cost of support for renewables must be added: 6,402.1 million euros. This must be financed by another source and the small increase in compensation outside the Iberian Peninsula (36.5 million euros) must be eliminated as a result of the increase in electricity consumption. The total cost would therefore amount to 7,381.9 million euros.

The reform has a redistributive effect under these circumstances. The impact of the reform will be progressive as household expenditure on electricity is reduced, thereby benefiting more the lower income deciles, as can be seen in Figure 13. The reduction in burden is 3.3 times greater for households in the poorest decile than in the richest decile.

Figure 13. Effect of reducing price of electricity



The second simulation is framed within the goods used for transport. A change is recommended if we take into account the important externalities associated with road transport and consider that its rates in Spain are below the European average. In addition to generating revenue that could be used for compensation on a redistributive basis, the measures should address the inefficiencies of existing taxes and be dissuasive in order to reduce pollution in the short and medium term.

One immediate measure could be equalisation of the tax rates on petrol and diesel, in line with frequent recommendations by international agencies. Diesel vehicles generally produce less CO₂ emissions per km than those powered by petrol, but fuel tax rates are levied on litres consumed rather than distance travelled, and diesel has higher levels of emissions per litre of both greenhouse gases (GHG) and local pollutants.

Furthermore, other externalities associated with road transport, such as local and global congestion, accidents, noise or infrastructure costs, are generally more related to the distance travelled than to the amount of fuel used.

Given that diesel vehicles are usually more efficient and therefore allow a greater distance to be covered per litre, the social cost per litre of fuel is likely to be higher for diesel than for petrol. But the excise duty rate for diesel is lower than for petrol, and this is intended to provide an incentive for consumers to buy diesel vehicles, as demonstrated by the evolution of the vehicle fleet in Spain.

The proposed exercise shows the short-term effects of increasing the rate of excise duty on hydrocarbons applied to diesel to the level of petrol (Table 3). Two significant results can be observed: a large revenue-generating capacity (more than 2.6 billion additional euros) and a reduction in associated CO₂ emissions.

The proposal unfortunately has unwanted redistributive effects because it is regressive. A simple way to correct or reverse these effects would be to design several

compensatory measures. Many designs can be introduced, either linked to income or other variables, or aimed at reducing inequality, or constituting lump-sum payments focusing, for example, on reducing the risk of poverty.

In order to simplify the analysis, a scheme is illustrated that affects all households in the first five deciles and households that own vehicles in these deciles. In the former, households with an equivalent income of less than 10,625 euros per year are compensated and, in the latter, households with an equivalent income of less than 13,828 euros per year are compensated.

Table 3. Effects of equalising the tax rates on petrol and diesel

	Final price (%)	Consumption (%)	CO ₂ emissions (%)	Additional revenue (millions of euros)		
				Hydrocarbon tax	VAT	Total
Petrol 95	-	-	-	-	-	-
Diesel A (non-commercial)	9.39%	-1.89%	-1.89%	1,510.60	272.72	1,783.32
Diesel A (commercial)	9.39%	-1.89%	-1.89%	861.20	-	861.20
Total	-	-1,56%	-1,59%	2,371.80	272.72	2,644.52

Figure 14. Equalisation of excise duties on diesel and petrol

A reform can be defined to make the tax progressive

Difference in excise duty payments resulting from the reform as a percentage of equivalent household income

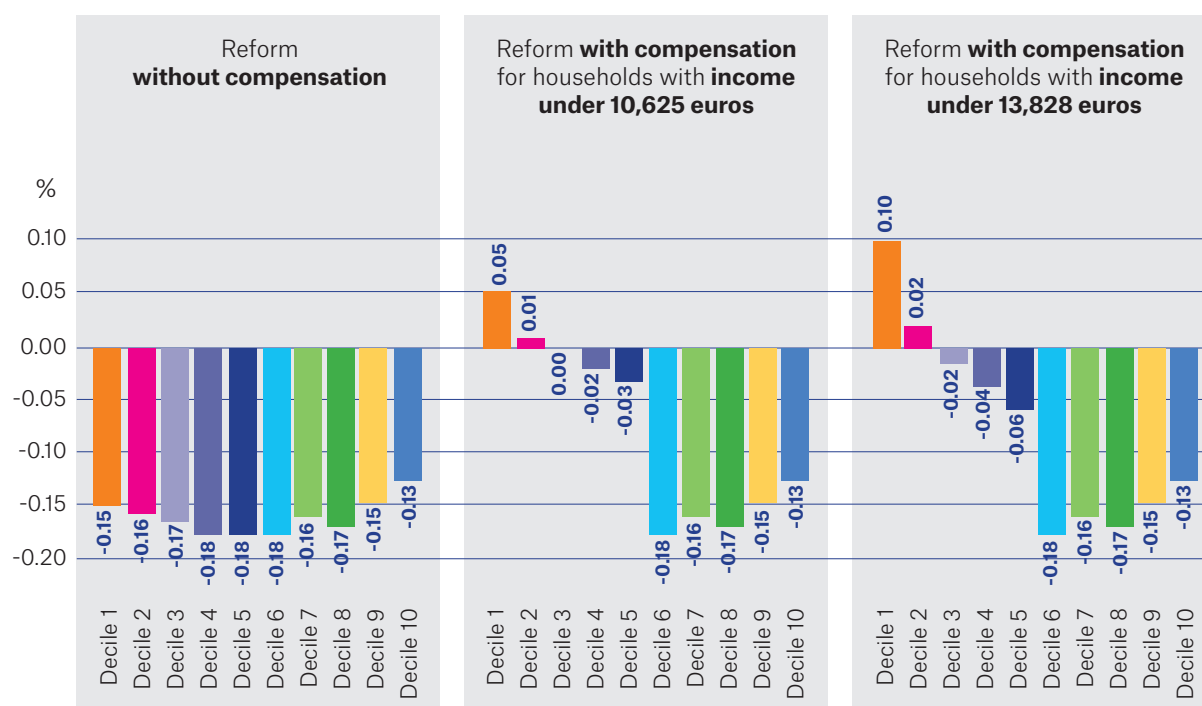


Figure 14 shows the effect by deciles of the reform without compensation and with the two aforementioned schemes. We can see that the two poorest deciles are benefited, although the following three do not lose very much. Moreover, the Reynolds-Smolensky index after the compensations becomes positive in both decile groups, showing that the reform with the introduced compensatory designs is progressive.

Finally, the additional collection generated amounts to 2,644.52 million euros, while returns to the poorest households have a cost of between 234 and 300 million euros; in other words, between 8.8% and 11.3% of this revenue collection. Margin therefore exists in the public budget to be dedicated to alternative uses and, in this way, the excise duties fulfil their functions of collection and dissuasion and have similarly been provided with a capacity for redistribution.

A second measure that would be desirable in the short to medium term could be a general increase in fuel taxation. Emissions from the transport sector accounted for 26% of Spanish GHG emissions in 2017. Over 92% of these emissions come from road transport and this leads to other already mentioned external costs that need to be addressed.

Taxes applied to the transport sector in the EU only cover around 60% of the costs associated with its externalities, a proportion that falls below 50% if infrastructure costs are included.

National tax rates on petrol and diesel have remained unchanged since 2010, although most Autonomous Communities have since introduced surcharges on the national rate, known locally as the *healthcare cent*. But the price of diesel has increased by 12.7% and that of petrol by 11.5%, which means that the weight of the tax in hydrocarbon prices has been reduced by 4.5% in diesel and 5.8% in petrol since 2010.

In addition to equalising the tax rates on petrol and diesel, if increasing these to the average rate of petrol in the main European countries (Germany, France, Italy and the United Kingdom) is also considered, the reform (Table 4) would help to increase tax revenues by almost 10 billion euros, while at the same time reducing fuel consumption and consequently CO₂ emissions by 6.1%.

Table 4. Effects of increasing and equalising petrol and diesel rates

	Final price (%)	Consumption (%)	CO ₂ emissions (%)	Additional revenue (millions of euros)		
				Hydrocarbon excise duty	VAT	Total
Petrol 95	20.41%	-5.16%	-5.16%	1,088.70	189.34	1278.04
Diesel A (non-commercial)	31.27%	-6.29%	-6.29%	4,786.21	856.91	5,643.12
Diesel A (commercial)	31.27%	-6.29%	-6.29%	2,728.66	-	2,728.66
Total	-	-6.09%	-6.11%	8,603.57	1,046.25	9,649.82

It should be noted that the tax on hydrocarbons uses unit rates (EUR per litre), which means that they are reduced in real terms if they are not adjusted periodically for inflation. The evolution of prices and rates from 2010 to 2018 (base in 2010) shows that they decreased by 4.7% and 2.3% respectively in real terms, although tax rates on petrol and diesel increased in nominal terms (5% and 7.6% respectively) because of regional surcharges.

In order to avoid this situation and at the same time gradually increase fuel taxation, a mechanism similar to the Fuel Price Escalator introduced in the UK in 1993, and in force until 2000, could be used, whereby annual tax increases were set above inflation in order to provide incentives for more sustainable mobility while increasing public revenues.

A similar system in Spain would allow gradual convergence towards European fuel tax levels, maintaining tax increases and thereby introducing incentives for fleet renewal (dissuasive effect). The additional revenue would help to design compensation mechanisms of a redistributive nature or in order not to distort sectorial competitiveness.

In short, previous years have shown that it is possible to use excise duties to implement short-term reforms that, with or even without compensation mechanisms, have a redistributive effect and help to tackle some of the problems faced by the Spanish economy. It would nonetheless be much more effective to consider a comprehensive tax reform that not only addresses existing problems but also seeks to address new challenges on the horizon.

7

Discussion and Implications of Fiscal Policy

This report has attempted to address a fundamental question concerning the distribution by income level of the tax burden of excise duties, as well as by taking into account family size. In order to this, data on Spanish households taken from the Household Budget Survey has been used. The answer is that these tax figures have focused on the effect of collection and not on the effect of dissuasion.

This means that the aim of internalising the costs generated in prices has been weakened, in accordance with a purely revenue stream purpose. This is due to the structure of demand for these goods and the response of consumers to changes in their prices, but also to the very design of the taxes they contain.

The studies carried out using various approaches show that excise duties are generally regressive and have not contributed to income redistribution over the period under review. These results are very solid in their different approaches, including different indicators or alternative variables (income, equivalent income or total expenditure).

Under these circumstances, the study has raised a new question as to whether it would be possible to provide more focus on other functions of excise duties and simultaneously contribute to income redistribution. Theoretical methods and arguments have been used to justify implementing the proposed reforms with collection or externality correction objectives. The result will be beneficial for not only individual but also social welfare by improving the environment, given that the collection potential is quite significant.

Several microsimulation exercises conducted provide an affirmative answer about the redistributive capacity of changes in the electricity tax. Whereas the design of the fuel tax has to be complemented with compensation mechanisms.

In the case of electricity, the structure of its demand means that a reduction in excise duty resulting from financing the cost of renewable energies outside the energy sector can have an effect on final prices that are redistributive. In the case of fuels,

their high collection capacity enables the design of compensation mechanisms that can also have a redistributive capacity.

In short, an attempt has been made to show that excise duties can be reformed to fulfil other functions, with or even without compensation mechanisms, so as to achieve redistributive effects and simultaneously help to tackle other problems faced by the Spanish economy.

References

- Atkinson, A. B. (1980). "Horizontal equity and the distribution of the tax burden". In A. J. Aaron and M. J. Boskin (eds.). *The Economics of Taxation*, 244-263. Brookings Institution, Washington, DC.
- Bartocci, A.; Pisani, M. (2013). "'Green' fuel tax on private transportation services and subsidies to electric energy. A model-based assessment for the main European countries". *Energy Economics*, 40.
- Böhringer, C.; García-Muros, X.; González-Eguino, M. (2019). "Greener and fairer: A progressive environmental tax reform for Spain". Oldenburg Discussion Papers in *Economics*, V-418-19. University of Oldenburg.
- Cansino, J. M.; Cardenete, M. A.; Ordóñez, M.; Román, R. (2016). "Taxing electricity consumption in Spain: evidence design the post-Kyoto world". *Carbon Management*, 7.
- Cantó, O. (2013). "La capacidad redistributiva del sistema español de prestaciones e impuestos". *Papeles de Economía Española*, 135.
- Comisión de Expertos de Transición Energética (CETE) (2018). "Análisis y propuestas para la descarbonización". http://www6.mityc.es/aplicaciones/transicionenergetica/informe_cexpertos_20180402_veditado.pdf.
- Freire-González, J.; Puig-Ventosa, I. (2019). "Reformulating taxes of an energy transition". *Energy Economics*, 78.
- Gago, A.; Labandeira, X.; López-Otero, X. (2013). "Impuestos energético-ambientales en España. Informe 2013". *Economics for Energy*.
- Gemechu, E. D.; Butnar, I.; Llop, M.; Castells, F. (2013). "Economics and environmental effects of CO₂ taxation: an input-output analysis for Spain". *Journal of Environmental Planning and Management*, 57.
- González-Eguino, M. (2011). "The importance of the design of market-based instruments for CO₂ mitigation: an AGE analysis for Spain". *Ecological Economics*, 70, 2292-2302.
- Hogg, D.; Elliot, T.; Elliot, L.; Ettlinger, S.; Chowdhury, T.; Bapasola, A.; Norstein, H.; Emery, L.; Andersen, M. S.; Brinck, P. ten; Withana, S.; Schweitzer, J. P.; Illes, A.; Paquel, K.; Mutafoğlu, K.; Woollard, J.; Puig, I.; Sastre, S.; Campos, L. (2016). "Study on assessing the environmental fiscal reform potential for the EU28". Final Report 07.0201/2015/709017/ENV.D.2. Eunomia, Institute for European Environmental Policy, Denkstatt, Aarhus University, ENT.

International Energy Agency (IEA) (2015). “Energy Policies of IEA Countries: Spain 2015 Review”.

<https://webstore.iea.org/energy-policies-of-iea-countries-spain-2015-review>.

Jones, A. M.; Labeaga, J. M. (2003). “Individual heterogeneity and censoring in panel data estimates of tobacco expenditure”. *Journal of Applied Econometrics*, 18.

Kakwani, N. C. (1977a). “Measurement of tax progressivity: An international comparison”. *The Economic Journal*, 87.

Kakwani, N. C. (1977b). “Measurement of tax progressivity: An international comparison”. *Econometrica*, 45.

Labeaga, J. M.; López, A. (1996). “Flexible demand system estimation and the revenue and welfare effects of the 1995 VAT reform”. *Revista Española de Economía*, 13.

Labeaga, J. M.; Mercader-Prats, M. (eds.) (2001). “Desigualdad, redistribución y bienestar: Una aproximación a partir de la microsimulación de reformas fiscales”. *Estudios de Hacienda Pública*. Instituto de Estudios Fiscales, Madrid.

Labandeira, X. (2011). “Nuevos entornos para la fiscalidad energética”. *Información Comercial Española. Revista de Economía*, 862.

Labandeira, X.; Labeaga, J. M. (2000). “Efectos de un impuesto sobre las emisiones de SO₂ en el sector eléctrico”. *Revista de Economía Aplicada*, 22.

Labandeira, X.; Labeaga, J. M. (1999). “Combining input-output analysis and micro-simulation to assess the effects of carbon taxation on Spanish households”. *Fiscal Studies*, 20, 305-320.

Labandeira, X.; Labeaga, J. M.; López-Otero, X. (2019). “New green tax reforms: An application to Spain”. *Sustainability*.

Labandeira, X.; Labeaga, J. M.; Rodríguez, M. (2004). “Green tax reforms in Spain”. *European Environment*, 14.

Labandeira, X.; Labeaga, J. M.; Rodríguez, M. (2007). “Microsimulation in the analysis of environmental tax reforms: an application for Spain”, in Spadaro, A. (ed.), *Microsimulation as a tool for the evaluation of public policies: methods and applications*. Fundación BBVA, Madrid.

Labandeira, X.; López-Nicolás, A. (2002). “La imposición de los carburantes de automoción en España: algunas observaciones teóricas y empíricas”. *Hacienda Pública Española. Revista de Economía Pública*, 160.

Labandeira, X.; Rodríguez, M.; Labeaga, J. M. (2005). “Análisis de eficiencia y equidad de una reforma fiscal verde en España”. *Cuadernos Económicos de ICE*, 70.

Musgrave, R. A.; Thin, T. (1948). "Income tax progression", 1929-1948. *Journal of Political Economy*, 56, 498-514.

Pechman, J. A.; Okner, B. (1974). "Who bears the tax burden?". Brookings Institution, Washington, DC.

Pestana, C.; Prieto-Rodriguez, J. (2008). "A revenue-neutral tax reform to increase demand for public transport services". *Transportation Research – Part A: Policy and Practice*, 42.

Plotnick, R. (1981). "A measure of horizontal inequity". *The Review of Economics and Statistics*, 63.

Reynolds, M.; Smolensky, E. (1977). *Public expenditure, taxes and the distribution of income. The United States 1950, 1961, 1970*. New York: Academic Press.

Robinson, D.; Linares, P.; López-Otero, X.; Rodrigues, R. (2019). "Fiscal policy for decarbonisation of energy in Europe, with a focus on urban transport: case study and proposal for Spain". In Villar-Ezcurra, M.; Milne, J.; Ashiabor, H.; Skou-Andersen (eds.), *Environmental fiscal challenges of cities and transport*. Cheltenham: Edward Elgar Publishers.

Romero, D.; Sanz, J. F. (2003). "El Impuesto sobre las ventas minoristas de determinados hidrocarburos. Una evaluación de sus efectos económicos". *Hacienda Pública Española / Revista de Economía Pública*, 164.

Romero, D.; Sanz, J. F.; Castañer, J. M (2013). "Sobre la regresividad de la imposición indirecta en España en tiempos de crisis: Un análisis con microdatos de hogares". *Papeles de Economía Española*, 135.

Smith, Z. (2000a). "Vehicle excise duty discounts in rural areas". Briefing Note. Institute for Fiscal Studies, London.

Smith, Z. (2000b). "The petrol tax debate". Briefing Note. Institute for Fiscal Studies, London.

Sterner, T. (2012). "Fuel Taxes and the Poor: The Distributional Consequences of Gasoline Taxation and their Implications for Climate Policy". Washington, DC: RFF Press.

Symons, L.; Speck, S.; Proops, J. (2002). "The distributional effects of European pollution and energy taxes: the cases of France, Spain, Italy, Germany and UK". *European Environment*, 12.

Vivid Economics (2012). "Carbon taxation and fiscal consolidation: the potential of carbon pricing to reduce Europe's fiscal deficits". European Climate Foundation and Green Budget Europe.

8

Annex 1: Spanish Data

Table A1.1. **Tax collection in Spain (selected periods)**

	2007	2010	2014	2017
Personal income tax	72,614	66,977	72,662	77,038
Corporate tax	44,823	16,198	18,713	23,143
Non-resident income tax	2,427	2,564	1,420	2,274
Environmental tax			1,625	1,807
Other revenue	114	88	195	193
Chapter 1: Direct taxation	119,979	85,827	94,614	104,454
Value added tax	55,851	49,086	56,174	63,647
Excise duties (1)	19,786	19,806	19,104	20,308
Alcohol and alcoholic beverages	935	810	761	840
Beer	286	279	293	314
Intermediate products	21	18	19	22
Hydrocarbons	10,715	9,913	9,724	10,881
Tobacco products	6,765	7,423	6,661	6,628
Coal			265	312
Electricity	1,065	1,363	1,383	1,306
Tax on fluorinated gases			31	120

External traffic	1,720	1,522	1,526	1,928
Insurance premiums	1,491	1,435	1,317	1,449
Gambling tax			76	53
Other revenue	13	44	7	13
Chapter 2: Indirect taxes	78,861	71,893	78,233	87,518

Rates	1,146	782	794	763
Other revenue	689	1,034	1,345	1,215
Chapter 3: Rates and other revenue	1,836	1,816	2,140	1,978

Total tax revenues	200,676	159,536	174,987	193,951
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Includes the tax on certain means of transport that has been transferred to the Autonomous Communities since 2002.

Source: AEAT annual tax collection reports.

Table A1.2. **Excise duties in the period 2006-2017**

	A. Hydrocarbons				
	Petrol	Diesel	Heating oil	Natural gas	LPG
	State portion	State portion	State portion		
	euros/l	euros/l	euros/l	euros/GJ	euros/ton
2006	0.39569	0.29386	0.08471	0	57.47
2007	0.39569	0.302	0.08471	0	57.47
2008	0.39569	0.302	0.08471	0	57.47
2009	0.39569	0.302	0.08471	0	57.47
2010	0.42469	0.331	0.08471	0	57.47
2011	0.42469	0.331	0.08471	0	57.47
2012	0.42469	0.331	0.08471	0	57.47
2013	0.42469	0.331	0.08471	0.65	57.47
2014	0.42469	0.331	0.08471	0.65	57.47
2015	0.42469	0.331	0.08471	0.65	57.47
2016	0.42469	0.331	0.08471	0.65	57.47
2017	0.42469	0.331	0.08471	0.65	57.47
2018	0.42469	0.331	0.08471	0.65	57.47

Notes:

1. State portion only. There are different regional portions of the tax on motor fuels sold at petrol stations (IVMDH).
2. Regulatory changes in red.

B. Electricity	
% Price w/o VAT	
2006	5.11269632%
2007	5.11269632%
2008	5.11269632%
2009	5.11269632%
2010	5.11269632%
2011	5.11269632%
2012	5.11269632%
2013	5.11269632%
2014	5.11269632%
2015	5.11269632%
2016	5.11269632%
2017	5.11269632%
2018	5.11269632%

C. Alcoholic beverages								
Alcohol and alcoholic beverages			Beer					Wine
			1.2-2.8 degrees	>2.8 degrees 11° Plato	>2.8 degrees 11°-15° Plato	>2.8 degrees 16°-19° Plato	>2.8 degrees >19° Plato	
	euros/l pure alcohol	euros/l	euros/l	euros/l	euros/l	euros/l	euros/l	
2006	8.3025	3.16285302	0.0275	0.0748	0.0996	0.1356	0.0091	0
2007	8.3025	3.16285302	0.0275	0.0748	0.0996	0.1356	0.0091	0
2008	8.3025	3.16285302	0.0275	0.0748	0.0996	0.1356	0.0091	0
2009	8.3025	3.16285302	0.0275	0.0748	0.0996	0.1356	0.0091	0
2010	8.3025	3.16285302	0.0275	0.0748	0.0996	0.1356	0.0091	0
2011	8.3025	3.16285302	0.0275	0.0748	0.0996	0.1356	0.0091	0
2012	8.3025	3.16285302	0.0275	0.0748	0.0996	0.1356	0.0091	0
2013	9.1328	3.47915737	0.0275	0.0748	0.0996	0.1356	0.0091	0
2014	9.1328	3.47915737	0.0275	0.0748	0.0996	0.1356	0.0091	0
2015	9.1328	3.47915737	0.0275	0.0748	0.0996	0.1356	0.0091	0
2016	9.1328	3.47915737	0.0275	0.0748	0.0996	0.1356	0.0091	0
2017	9.5894	3.6531	0.0275	0.0748	0.0996	0.1356	0.0091	0
2018	9.5894	3.6531	0.0275	0.0748	0.0996	0.1356	0.0091	0

	D. Tobacco				
	Cigars and cigarillos	Cigarettes		Rolling tobacco	
	% PVP	% PVP	€/1000 cigarettes	% RRP	euros/kg
2006	13.5%	57.00%	8.2	41.50%	0
2007	13.5%	57.00%	8.2	41.50%	0
2008	13.5%	57.00%	8.2	41.50%	0
2009	14.50%	57.00%	10.2	41.50%	6
2010	14.50%	57.00%	10.2	41.50%	6
2011	15.80%	57.00%	12.7	41.50%	8
2012	15.80%	53.10%	19.1	41.50%	8
2013	15.80%	51.00%	24.1	41.50%	22
2014	15.80%	51.00%	24.1	41.50%	22
2015	15.80%	51.00%	24.1	41.50%	22
2016	15.80%	51.00%	24.1	41.50%	22
2017	15.80%	51.00%	24.7	41.50%	23.5
2018	15.80%	51.00%	24.7	41.50%	23.5

Note:

1. Regulatory changes in bold.

Our redistribution study focused on the period 2006-2017 for various reasons. First, because it corresponds to the period for which a comparable household database is available. Second, because using that period can help us to analyse whether the profound crisis we have suffered has had consequences that affect the income distribution measures we are going to calculate. Third, because it enables comparison between periods of crisis and periods of recovery. But the aggregate data used covers a much longer period (1995-2017, including some data from 2018), although a greater analysis of its evolution is also made for the period in which it overlaps with the data from the Household Budget Survey.

A1.1 Aggregate data

Figures A1.1, A1.2 and A1.3 show the evolution of collection data in all chapters (Figure A1.1), a comparison of the two main collection instruments (personal income tax and VAT, Figure A1.2) and the comparative evolution of indirect taxes (VAT and excise duties, Figure A1.3).

Two key issues in Figure A1.1 are, first, the constant growth of the three fundamental pillars of AEAT collection and the stability of excise duties, and second, the crisis displayed all its severity in 2008 and 2009 but recovery in collection was not complete during the period under review.

Figure A1.2 also presents several crucial facts, among which the following should be highlighted: the constant growth of the collection of both tax figures until the onset of the economic crisis and also the fact that the crisis affected consumption much more than income. Several factors can explain these occurrences. First, the first people to become unemployed were individuals who were not obliged to pay the tax, and these individuals continue to consume although with obviously lower amounts. Second, there is evidence that VAT fraud increased substantially as a result of the economic crisis. Third, it is only from 2015 onwards that there is a return to the collection figures obtained in the periods before the crisis.

The comparative evolution of VAT and excise duties shown in Figure A1.3 differs from previous changes because the crisis does not seem to have affected the collection of excise duties. This can be explained by regulatory changes (mainly in the tax on hydrocarbons), but above all by the nature of these goods, whose price elasticity is generally very low. Finally, Figures A1.4 and A1.5 present the structure and evolution of excise duties.

Figure A1.1. Collection revenue from all chapters (1995-2017)

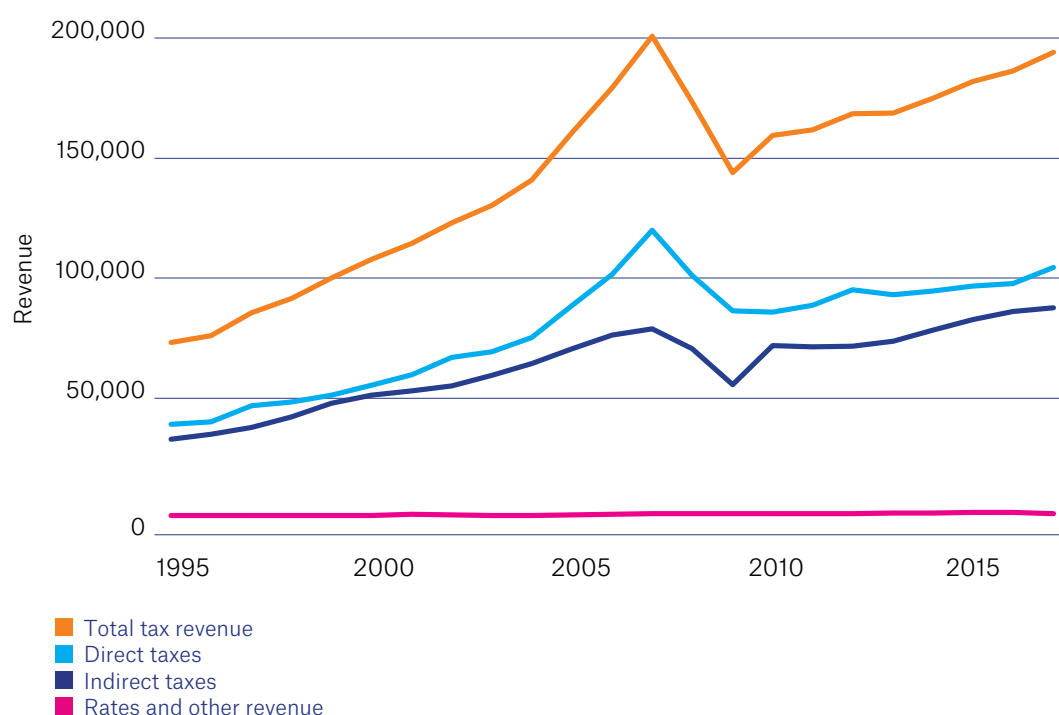


Figure A1.2. Revenue collection from personal income tax and VAT (1995-2017)

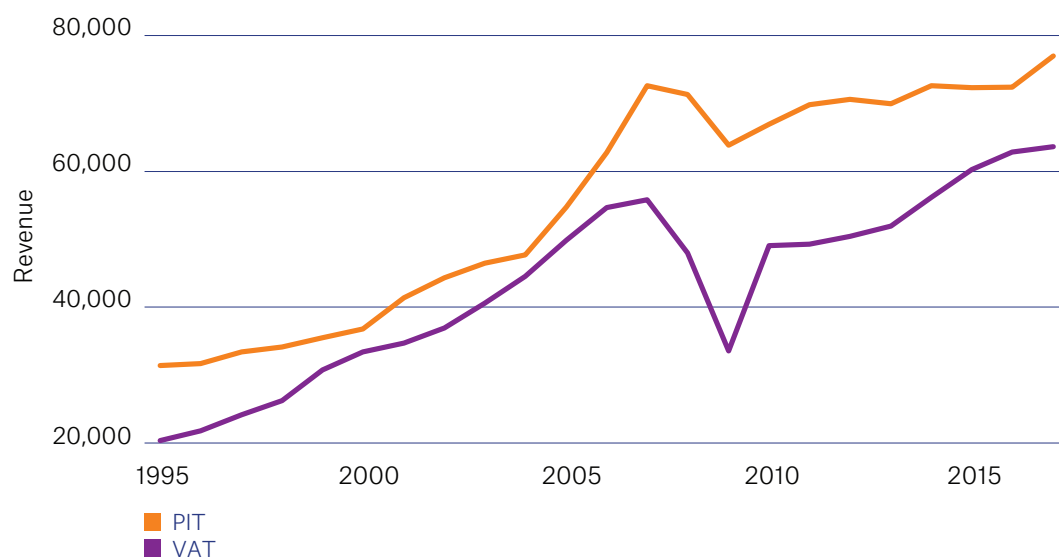


Figure A1.3. Revenue collection from VAT and excise duties (1995-2017)

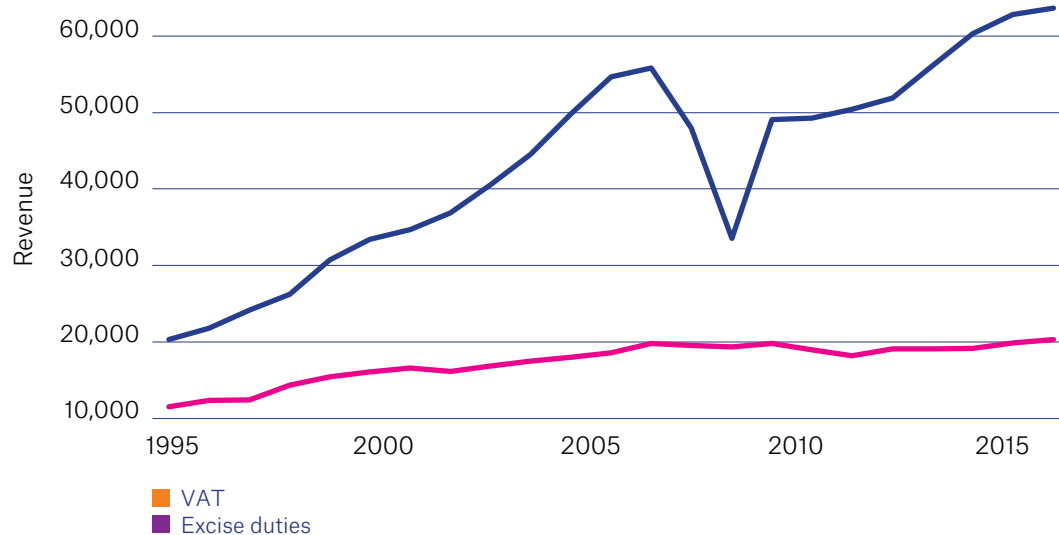


Figure A1.4. Tax structure of excise duties

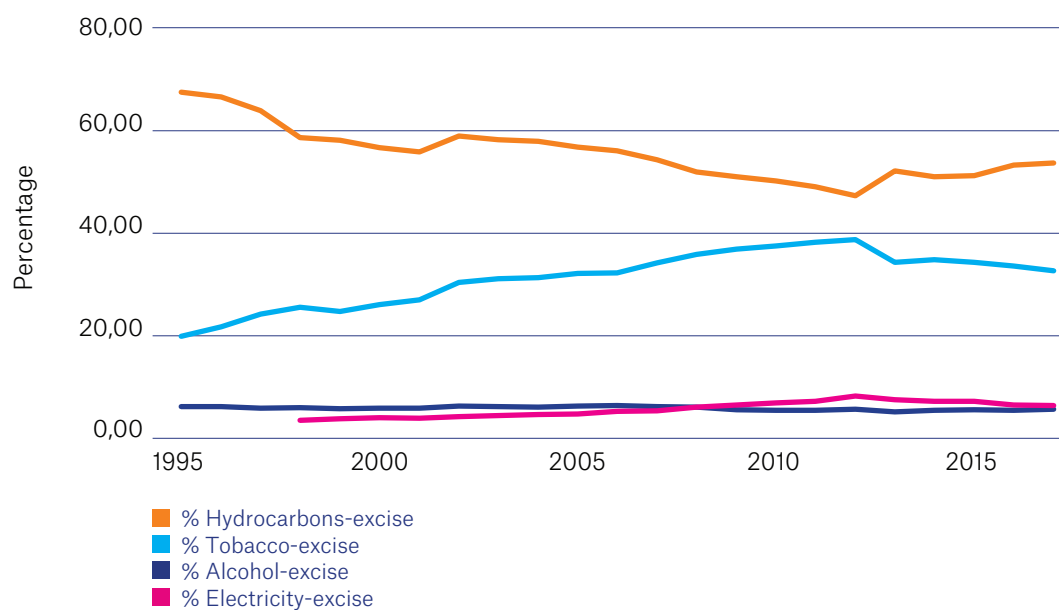
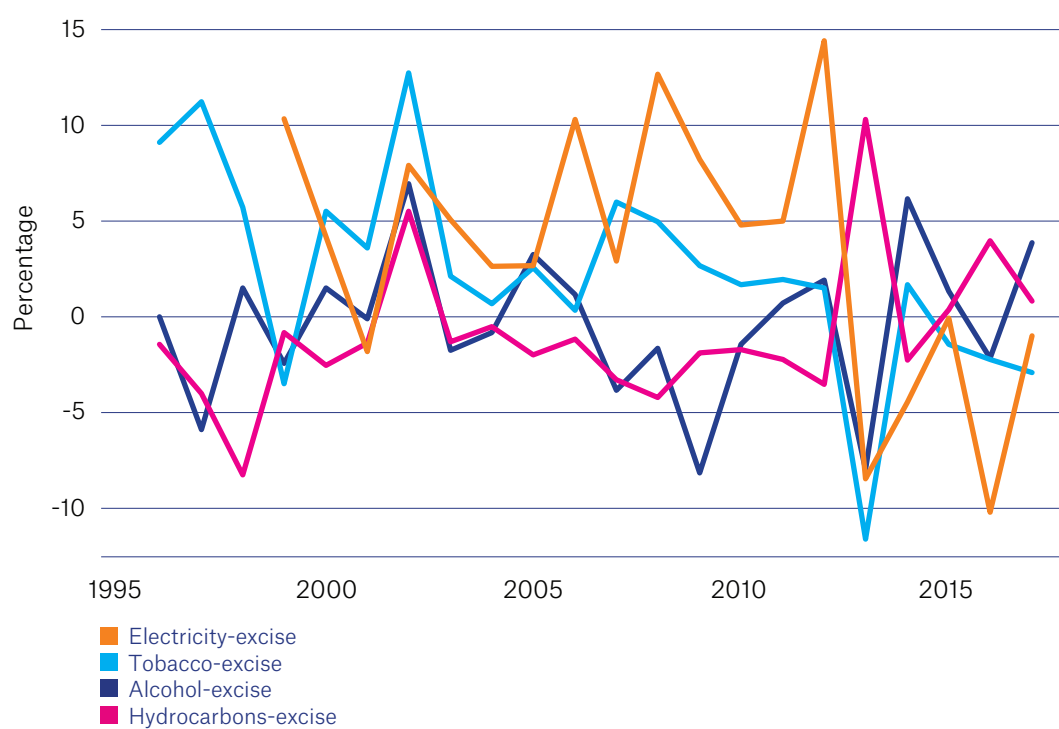


Figure A1.5. Changes in collection of excise duties



A.1.2 Individual data

In order to conduct the previous exercises individually, it is necessary to have household expenditure and income data (apart from sociodemographic variables). We fortunately have the Household Budget Survey (HBS) of Spain's National Statistics Institute (INE), whose current version commenced in 2006 and for which we have data until 2017.

For exercises following the narrative approach, it is necessary to have panel data. And the HBS offers us a panel with two observations per household (incomplete panel with a 50% turnover rate). In addition to having the HBS panel, we also have data on the weeks during which the household collaborated, which is extremely relevant for the narrative approach exercises.

We are aware that filtering the data is a crucial requirement in empirical exercises in which the adjustment of causal effects is sought and we have done so in the adjustment processes carried out to complete the third and fourth studies of this report. However, we provide information with the raw data available for this initial approach to the data.

Table A1.3 presents the basic descriptive statistics of the variables used in the various years, namely real-term consumption and income and their counterparts in real and equivalent terms. It is necessary to define expenditure and income in equivalent terms in the sense of using equivalence scales containing the composition of the household. The Household Budget Survey includes this composition in great detail, although the choice of scales requires a specific discussion and we have included this in Annex 2.

Nonetheless, the size of the household and the size adjusted according to the OECD scale have been used as a scale throughout the exercise, in which the spouse is assigned a value of 0.7 and the children are assigned 0.5 regardless of age. A total of 261,477 households are available distributed over 12 years, as indicated in the last column of the table.

Table A1.3. **Description of expenditure and equivalent income**

Variable / year	Average	Standard deviation	Minimum	Maximum	Observations
Expenditure					
2006	34350.55	22513.68	278.13	470548.30	19435
2007	35492.33	22562.95	748.59	287167.70	21542
2008	34457.19	21112.74	1884.23	348737.40	22077
2009	32947.04	19687.54	1139.10	316873.60	22346
2010	31876.25	19055.31	1101.12	243502.20	22203
2011	30424.04	18271.70	1556.38	418869.10	21680
2012	28788.70	16998.75	1476.77	217938.00	21808
2013	27458.39	16202.42	1147.24	209090.90	22057
2014	27364.06	16149.4	0	208874.5	22146
2015	27994.08	16907.07	843.19	229376.00	22130
2016	28520.01	16906.95	762.59	290747.60	22010
2017	28592.55	17109.85	499.65	203391.30	22043
Equivalent income					
2006	15921.54	9816.90	278.13	196061.80	19435
2007	16480.75	9989.79	748.59	274964.60	21542
2008	16149.41	9385.66	1454.22	182516.80	22077
2009	15747.33	9355.29	699.86	237552.60	22346
2010	15343.60	8896.55	915.52	418869.10	22203
2011	14782.49	8896.55	915.52	418869.10	21680
2012	14087.42	7993.69	476.38	127352.50	21808
2013	13588.95	7739.30	395.60	122189.00	22057
2014	13665.87	7954.72	0	136215.80	22146
2015	14056.35	7995.69	312.29	141498.50	22130
2016	14465.53	8187.50	762.59	124781.00	22010
2017	14632.51	8402.71	249.83	125420.00	22043

Figure A1.6 shows changes in consumption and equivalent consumption (corrected by the OECD scale) over the period 2006-2017, with average data for both variables taken from Table A1.1. In absolute terms, the crisis affected household consumption much more than equivalent consumption. Although the figures are similar in relative terms (Figure A1.5), despite several differences that are possibly related to demographic developments, especially the emigration of young people and a falling birth rate.

Although the profile of both variables is the same, total household expenditure was reduced by an average of 1.70 percentage points over the entire period under review, while the average reduction in equivalent expenditure was 0.70 percentage points. The correlation over time of both growth rates shows an increasing profile, as can be seen in the adjustment on annual dummies included in Figure A1.5.

A “W” profile of the crisis over the period 2007-2012 can be noted in both cases. Although the maximum increase is lower (in absolute value) than the maximum decrease, it dominates the growth profile when full distribution is taken into account.

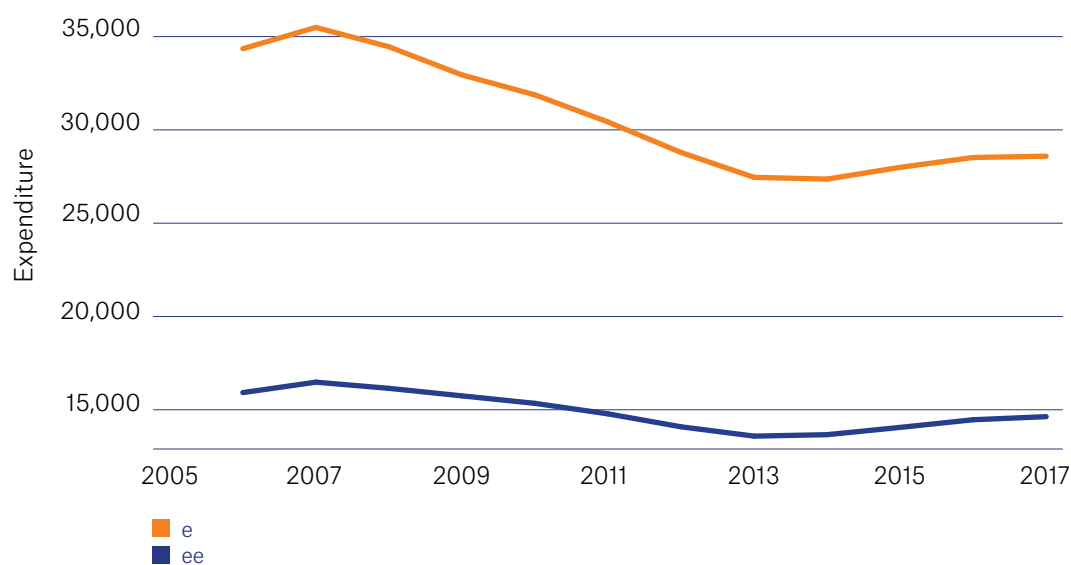
Figure A1.6 shows a comparison of changes in excise duty collection provided by the population raising factors in the Household Budget Survey with the AEAT data for the entire period under review.

Two issues to highlight are, first, the profile of both series is very similar and, second, there are differences that can be explained by at least three reasons. On the one hand, data on several goods subject to excise duties are erroneously provided in the surveys.

On the other hand, there are consumer groups that do not appear in the surveys: spending on these goods in hospitals, schools or prisons is not reflected. Finally, changes in aggregate consumption between the two sources are reflected when compared with the national accounts, which is also reflected in the collection.

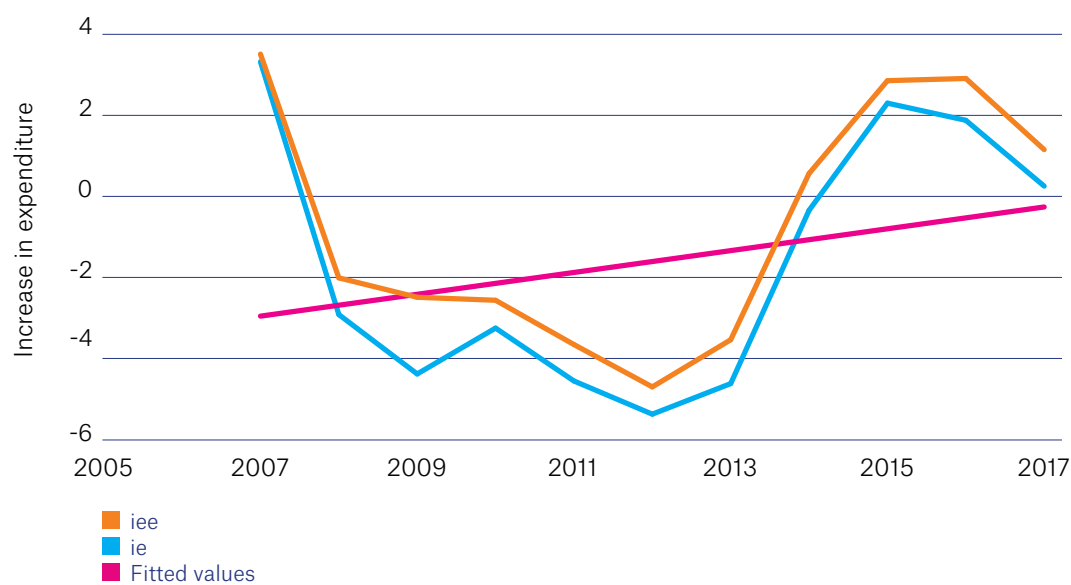
Given that the profile is very similar, we can expect that the inference we make with regard to the effects on distribution and inequality will be valid.

Figure A1.6. Evolution of consumption and equivalent consumption (2006-2017)



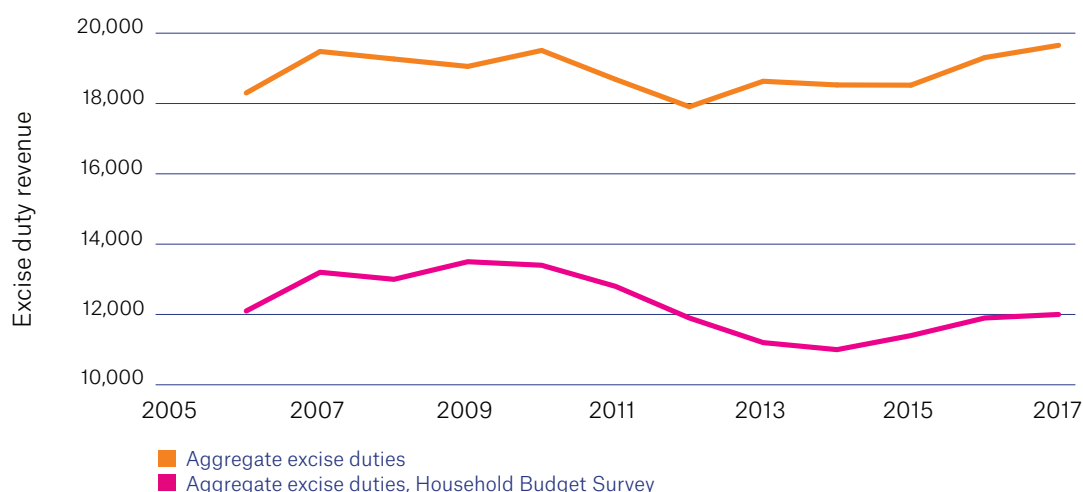
Source: Household Budget Survey and own preparation.

Figure A1.7. Evolution of consumption and equivalent consumption growth rates (2006-2017)



Source: Household Budget Survey and own preparation.

Figure A1.8. Evolution of consumption and equivalent consumption (2006-2017)



Source: Household Budget Survey and own preparation.

European Union

The data for the EU has been taken from Eurostat <https://ec.europa.eu/eurostat/>, the definitions of which can be found at <https://ec.europa.eu/eurostat/cache/metadata/>. We do not have as much detail in this database as in the case of AEAT data, so that the following tables and figures are provided by country, groups of countries and year, with a breakdown of tax figures corresponding to VAT and excise duties.

Table A.1.4: Minimum rates for products with excise duties in the EU

A. Minimum rates for motor fuels		
Product	Unit	Rate
Leaded petrol	Euros per 1,000 litres	421
Unleaded petrol	Euros per 1,000 litres	359
Diesel	Euros per 1,000 litres	330
Kerosene	Euros per 1,000 litres	330
Liquid petroleum gases	Euros per 1,000 litres	125
Natural gas	Euros per gigajoule	2.6

B. Minimum rates for motor fuels used for commercial and industrial purposes		
Product	Unit	Rate
Diesel	Euros per 1,000 litres	21
Kerosene	Euros per 1,000 litres	21
Liquid petroleum gases	Euros per 1,000 litres	41
Natural gas	Euros per gigajoule	0.3

C. Minimum fuel rates for heating fuels and electricity			
Product	Unit	Corporate rates	Other rates
Diesel	Euros per 1,000 litres	21	21
Fuel	Euros per 1,000 litres	15	15
Kerosene	Euros per 1,000 litres	0	0
Liquid petroleum gases	Euros per 1,000 litres	0	0
Natural gas	Euros per gigajoule	0.15	0.3
Coke	Euros per gigajoule	0.15	0.3
Electricity	Euros per MWh	0.5	1.0

D. Minimum rates for beer, wine and spirits		
Product	Unit of measurement	Minimum rate
Beer	Hectolitre per degree Plato	0.748 euros
	Hectolitre per degree alcohol	1.87 euros
Wine (including sparkling)	Hectolitre per volume	0 euros
Intermediate products (port, sherry)	Hectolitre per volume	45 euros
Spirits	Hectolitre of pure alcohol	550 euros

E. Minimum rates for other tobacco products, except cigarettes	
Product	Minimum rate
Rolling tobacco	48% of retail price, weighted average (50% in 2020)
	60 euros per kilo
Cigars and cigarillos	5% of retail price
	12 euros per kilo
Other tobacco	20% of retail price
	22 euros per kilo

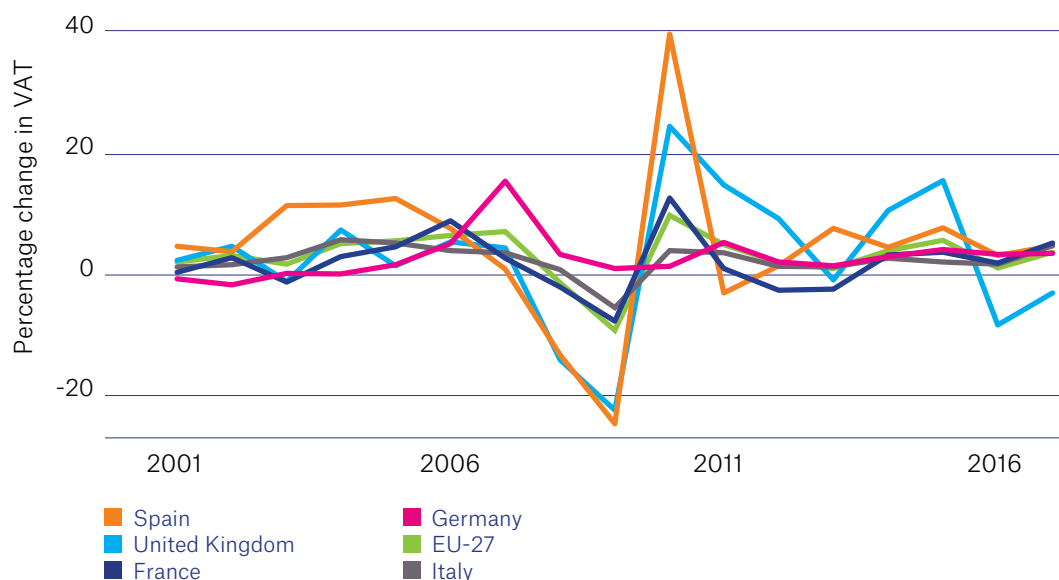
Table A.1.5. Tax collection in the EU (selected periods)

Año	2007				2010				2014				2017			
	VAT	EDs	% EDs		VAT	EDs	% EDs		IVA	EDs	% EDs		VAT	EDs	% EDs	
EU-28	878,922.0	302,013.2	25.6		866,021.2	300,993.4	25.8		976,849.4	333,200.6	25.4		1,084,778.1	349,470.6	24.4	
Germany	170,067.0	51,095.0	23.1		180,213.0	48,149.0	21.1		203,081.0	46,008.0	18.5		226,582.0	43,838.0	16.2	
Austria	20,922.2	6,720.2	24.3		22,682.3	6,889.9	23.3		25,385.5	7,528.7	22.9		28,304.2	8,223.1	22.5	
Belgium	23,864.2	6,597.4	21.7		25,261.7	6,918.6	21.5		27,517.8	7,148.6	20.6		29,748.3	8,638.2	22.5	
Bulgaria	3,190.2	1,750.0	35.4		3,299.1	1,813.3	35.5		3,809.8	2,055.4	35.0		4,663.7	2,576.1	35.6	
Czechia	8,365.9	3,839.2	31.5		10,419.9	3,845.0	26.9		11,602.4	3,540.3	23.4		14,720.7	3,795.4	20.5	
Cyprus	1,627.8	486.4	23.0		1,597.4	542.7	25.4		1,512.0	620.0	29.1		1,851.4	638.3	25.6	
Croatia	5,207.0	1,668.4	24.3		5,161.5	1,669.0	24.4		5,455.2	1,741.8	24.2		6,485.0	2,179.5	25.2	
Denmark	23,439.6	7,836.4	25.1		23,039.6	8,095.0	26.0		24,949.6	8,548.0	25.5		27,931.1	8,237.0	22.8	
Slovakia	3,699.0	1,930.5	34.3		4,182.1	1,930.8	31.6		5,021.1	2,015.0	28.6		5,916.6	2,250.9	27.6	
Slovenia	2,923.0	1,123.6	27.8		2,926.0	1,499.4	33.9		3,154.8	1,569.9	33.2		3,478.6	1,671.0	32.5	
Spain	63,943.0	23,397.0	26.8		58,458.0	23,656.0	28.8		64,909.0	24,388.0	27.3		75,738.0	25,871.0	25.5	
Estonia	1,423.2		0.0		1,257.2		0.0		1,711.1		0.0		2,148.3		0.0	
Finland	15,207.0	6,016.0	28.4		15,533.0	6,289.0	28.8		18,948.0	7,434.0	28.2		20,404.0	8,004.0	28.2	
France	136,542.0	40,362.0	22.8		135,578.0	41,982.0	23.6		148,454.0	48,277.0	24.5		161,986.0	57,773.0	26.3	
Greece	16,511.0	5,729.0	25.8		15,958.0	7,316.0	31.4		12,676.0	6,756.0	34.8		14,642.0	6,529.0	30.9	
Netherlands	41,952.0	7,219.0	14.7		41,840.0	6,458.0	13.4		42,951.0	7,339.0	14.6		49,900.0	7,687.0	13.4	
Hungary	8,009.8	3,373.1	29.6		8,442.0	3,194.6	27.4		9,754.0	3,224.8	24.9		11,724.5	3,601.6	23.5	
Ireland	14,355.0	1,364.0	8.7		10,067.0	1,083.0	9.7		11,521.0	836.0	6.8		13,278.0	963.0	6.8	
Italy	95,622.0	34,441.0	26.5		97,586.0	35,778.0	26.8		97,071.0	47,993.0	33.1		108,143.0	45,754.0	29.7	
Latvia	1,733.2	604.1	25.9		1,192.2	634.7	34.7		1,787.3	750.7	29.6		2,163.7	913.3	29.7	
Lithuania	2,330.4	820.2	26.0		2,180.5	874.4	28.6		2,764.4	1,037.4	27.3		3,309.6	1,324.4	28.6	
Luxembourg	2,271.1	59.0	2.5		2,609.9	74.3	2.8		3,762.0	76.6	2.0		3,468.7	77.3	2.2	
Malta	420.0	183.6	30.4		477.1	185.6	28.0		642.2	243.5	27.5		810.2	288.3	26.2	
Poland	25,860.4	12,091.9	31.9		27,465.6	14,753.3	34.9		29,317.0	14,379.9	32.9		36,329.8	17,327.7	32.3	
Portugal	14,333.4	4,116.1	22.3		13,527.1	3,756.2	21.7		14,681.6	3,423.3	18.9		16,809.2	4,454.6	20.9	
UK	134,472.6	66,180.6	33.0		111,751.6	60,141.8	35.0		154,085.0	71,565.0	31.7		158,475.8	71,113.4	31.0	
Romania	10,078.7	3,711.1	26.9		9,493.9	3,775.6	28.5		11,496.3	4,892.2	29.9		11,650.5	5,297.3	31.3	
Sweden	30,549.4	9,298.5	23.3		33,825.4	9,688.3	22.3		38,845.9	9,808.2	20.2		44,115.1	10,444.1	19.1	
Arithmetic mean			24.2				24.9				24.2				23.5	
Maximum			35.4				35.5				35.0				35.6	
Units	Millions of euros															

Source: Eurostat. https://ec.europa.eu/eurostat/web/products-datasets/-/gov_10a_taxag

The following figures complement the information on collection in the EU and in different countries. By focusing on the five large EU-28 countries (strictly speaking, it is the EU-27 because for much of the period Croatia was not part of it), Figures A.1.9 and A.1.10 show the changes in VAT and excise duty collection respectively. They analyse the period 2001-2017 in order to determine what occurred before, during and after the economic crisis.

Figure A1.9: Change in VAT revenue in the EU-27 and five major countries



It can be seen that the profile of the crisis is very marked in Spain and the United Kingdom in the changes of VAT collection, while in Germany the decline does not correspond to the date of the crisis and no pronounced effects can be observed in France and Italy. The pattern of the changes in excise duty collection is much less clear. Many regulatory changes overlap with economic effects in all countries during this period. The greatest impact of the recession is seen in the collection figures of the United Kingdom.

As discussed in this report, the changes observed in the figures for excise duties are the result of two factors: (1) the legislative changes introduced and (2) the low sensitivity of these products to price changes.

Figure A1.10. Change in excise duty revenue in the EU-27 and five major countries

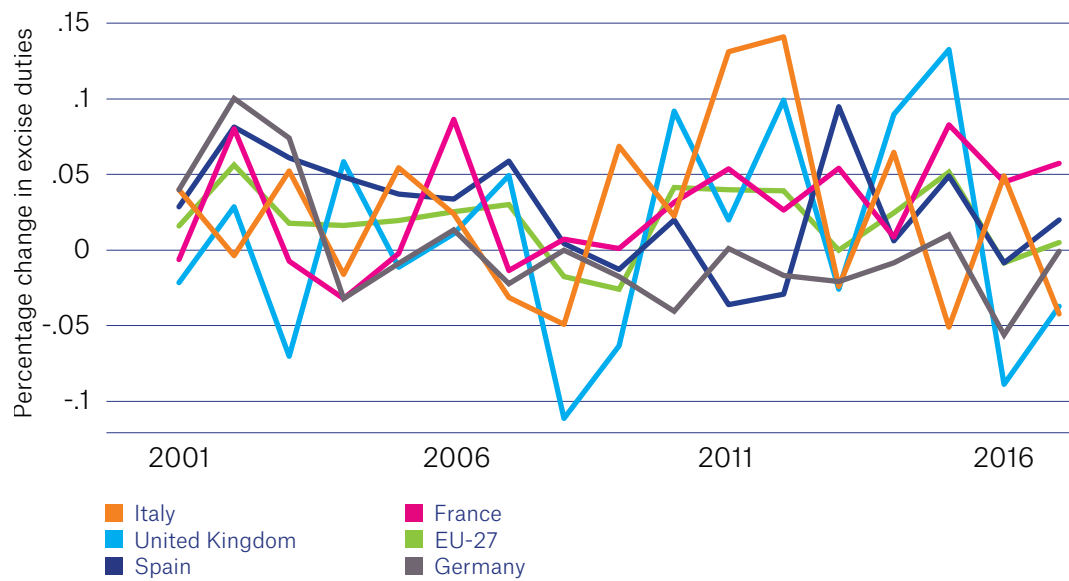
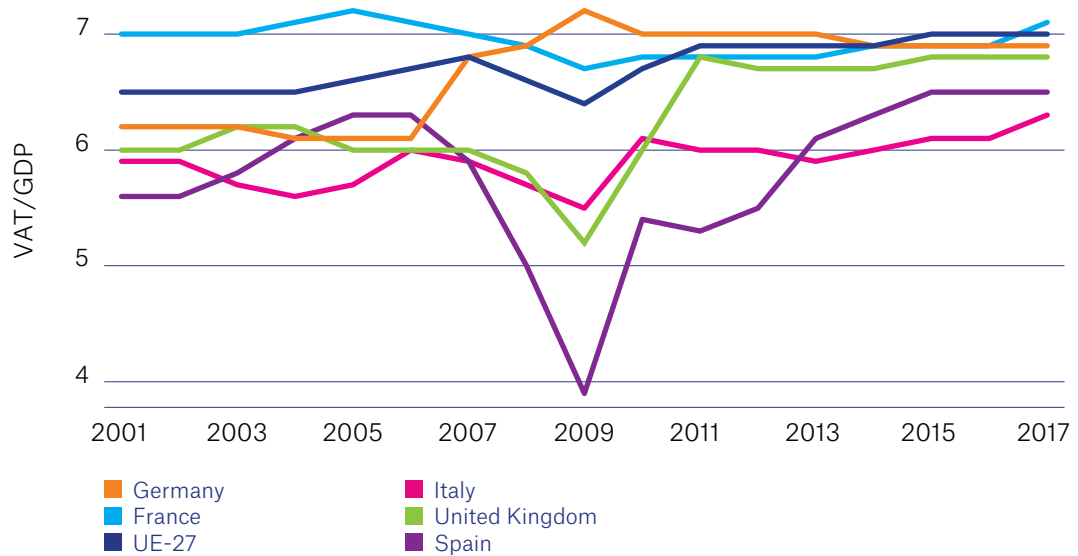


Figure A1.11. Evolution of the VAT/GDP ratio in the EU-27 and five major countries



Notes

1. As a proportion of GDP (arithmetic average for EU-27).
2. Base 100 in 2010.

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Annex 2. Methodology

This study uses the four approaches described below in order to answer the questions posed in this exercise.

The structural approach

The first *approach*, which we could call *structural*, is based on calculating the variation of the income tax burden. In other words, if we define the following quotient:

$$(A3.1) \quad m_t^h = \frac{T_t^h}{Y_t^h}$$

in which T_t^h and Y_t^h is the volume of excise duties paid (tax burden corresponding to these duties) and household income h at the time t respectively, m_t^h measures the percentage of income that the household has to bear in excise duties at the time. An analysis of the distribution of m_t^h by deciles will indicate how tax payments for these concepts are distributed throughout income distribution. We can summarise this distribution in a simple indicator by deriving (1) with respect to income

$$(A3.2) \quad \frac{\partial m_t^h}{\partial Y_t^h} = \frac{\partial \left(\frac{T_t^h}{Y_t^h} \right)}{\partial Y_t^h}$$

So the excise duty structure is progressive if (A3.2) is greater than zero; it is proportional if it is equal to zero, and it is regressive if it is less than zero.

The calculation can also assume that the household income and percentage that the tax payments represent in said income are related as:

(A3.3)

$$m_t^h = a + bY_t^h$$

in which the sign of the coefficient b gives us information on the progressivity, proportionality or regressivity of the taxes under review.

If we consider a quadratic instead of a linear relationship between household income and the weight of excise duty payments:

(A3.4)

$$m_t^h = a + bY_t^h + c(Y_t^h)^2$$

in which $\frac{\partial m_t^h}{\partial Y_t^h} = b + 2cY_t^h$

is now the combination of these two coefficients and the distribution of income that determines the nature of the good in question in terms of progressivity or regressivity. Given that it depends on income distribution, different effects may occur in different income deciles.

The concentration approach

We use the so-called *concentration approach* for our second proposed exercise, whereby, in addition to considering tax structure, it also takes into account the distribution of income in our case of excise duties. Using the distributions of tax payments and pre-tax income, it is possible to calculate both measures of inequality (coefficients of variation, standard deviations of logarithms, Gini indices, etc.) and measures of progressivity (comparisons of pre- and post-tax Gini index, Kakwani and Reynolds-Smolensky progressivity indices or average tax rates by population group and for different tax payments). Both in their limited way provide indications about the contribution of these taxes to inequality over time, as well as the redistributive capacity of these taxes.

In order to be slightly more precise about the objectives and the way to achieve them, we intend to provide some minimal explanations about these indices, even though we are aware that they are familiar to readers of this report.

As traditionally conceived, progressivity is a measure of deviation from proportionality. If we have a single rate in the case of direct taxes, then the tax payment is proportional to income. In the case of indirect taxes (or excise duties), what can detract from this proportionality is the heterogeneity of the consumption baskets of the individuals making up the population. In this sense, according to these indices, a tax is more progressive than another alternative tax the more unequally

its tax rates are distributed (Kakwani, 1977). If we therefore analyse income distribution before the tax and distribution after it, we can calculate an index (based on inequality and therefore on the Gini index) that tells us about the progressivity of the tax.

On the other hand, the redistributive power of a tax can be analysed using the Reynolds-Smolensky index (1977), which quantifies twice the area that exists between the pre- and post-tax Lorenz curves of income. Thus, the closer the index is to zero, the lower the redistributive power of the tax.

Therefore, progressivity and redistributive capacity (and also inequality) are closely related concepts, in such a way that the Reynolds-Smolensky index can be broken down into three factors: revenue capacity, progressivity and reordering effect. Progressivity has already been defined. The collection capacity corresponds to the average effective rate, calculated as a percentage of tax rates and gross household income.¹ Finally, the reordering effect occurs because individuals may have a different position in income distribution before and after paying the excise duty.

The microsimulation approach

Our proposed third exercise has been conducted by using a *microsimulation approach*. The idea is to commence from a moment in time with a given tax structure and assume a hypothetical tax reform. The variables of interest are considered (and the derived indices are calculated) in the initial situation (before the reform) and in the post-reform situation. The values of the variables (and their distributions) and the values of the indices in both situations are compared and the redistributive capacity of excise duties is studied. The variables of interest for this exercise may be tax payments or their distribution by income deciles, tax collection and its distribution throughout the income distribution, distribution of those benefiting and those not benefiting by income deciles, etc. The indicators may be those mentioned above or other alternatives. This exercise can be carried out under two alternative assumptions: (i) calculation of the *morning after effects*; in other words, assuming that the structure of expenditure on these goods remains unchanged after the tax reform, and (ii) calculation after *adjustment*; in other words, households are allowed to adjust their demand according to the values of the elasticities previously calculated or taken from specific consensus work.

Of course, this type of exercise can be carried out separately for each good that is subject to an excise duty or for all goods subject to these tax figures. If this second option is chosen, the case of adjustment by households has to take into account the fact that the elasticities are different for each of the goods under review.

1 There are many other measures in existing literature that can complement these global distribution measures. For example, Musgrave and Thin (1948) proposed tax elasticity, defined as the change in taxes on a change in income weighted by the inverse of the proportion that taxes represent on income; in other words, the ratio of the statutory rate to the average effective tax rate.

The narrative approach

Finally, we propose an exercise that we conduct from the so-called *narrative approach*, according to which we calculate what would have happened in the non-behavioural scenario for all the reforms throughout the period under consideration by using the microsimulation approach and comparing what the model predicts with what has actually happened according to an *ex-post* evaluation exercise. We have treatment and control groups in almost all cases, as these are goods consumed by a percentage of consumers and not consumed by another percentage (except in the case of electricity, where the treatment group – those who do not consume – must be constructed alternatively, such as between those who change the source of heating in the household from one period to another or do not have electricity for heating in any of the periods observed). The variables of interest will once again be tax payments, after-tax income or any other income.

Microsimulation methodology

The impact on consumption of the reforms under review has been made using the price elasticities already discussed and set out in Table A.2.1.

Table A.2.1. Price elasticities considered

Producto	Elasticidad
Alcoholic beverages	-0.800
Tobacco products	-0.200
Electricity	-0.126
Petrol	-0.293
Diesel	-0.153
Source: Labandeira et al. (2016) for petrol and diesel. Labandeira et al. (2010) for electricity, values for Spain. Labeaga and López (1994) for alcoholic beverages and Jones and Labeaga (2004) for tobacco products.	

The microdata of 2017 from the Household Budget Survey of Spain's National Institute of Statistics have been used to analyse distributional effects. Observations are available for 20,801 households, representative of all Spanish households. To determine the distributive impact of the proposed reforms, the new petrol and diesel prices resulting from the reform have been used to calculate the new consumption arising from the previous elasticities and the expenditure on each good before the reform, thereby helping to determine the impact of the reform on household income. The population raising factor has subsequently been applied and the average effect has been calculated by income deciles.

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