

Does the Laffer curve exist? A review of the theoretical and applied literature, with special focus on the US and Spain

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ABSTRACT

The Laffer Curve, which illustrates the relationship between tax rates and fiscal revenue, has been a central theme in economic theory and fiscal policy since its formulation. This article provides a comprehensive review of the literature on the Laffer Curve, with a particular focus on the elasticity of the tax base as a tool for its analysis. The elasticity of the tax base refers to the sensitivity of fiscal revenue to changes in tax rates and is crucial for understanding how variations in taxation impact economic behavior and, consequently, public revenue. The study compares empirical evidence from the United States and Spain to offer a detailed perspective on how these economies respond to changes in tax rates. Through a comparative analysis, it highlights similarities and differences in the response of the tax base and the efficiency of tax collection. This article provides an integrated view of the applicability and limitations of the Laffer Curve in different national contexts, offering practical implications for policymakers and contributing to the debate on optimizing tax revenue.

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1. Introduction

The tax systems of countries are based on the same three principles: efficiency, equity, and simplicity; all must be aimed at achieving adequate tax revenue to maintain social welfare state expenditures. The issue lies in the fact that these principles are often in conflict with each other, as increasing equity reduces efficiency (Torres-Remírez et al., 2024). For this reason, the theory of optimal taxation has been developed, which seeks to maximize the achievement of these three principles under the constraint of tax revenue.

However, it is often overlooked that redistribution can occur both through tax revenues and through spending, so maximizing tax revenue, while reducing redistribution through revenue, can increase it through spending.

Many studies have been conducted to try to demonstrate the predominance of certain principles over others. This is due to the ideology inherent in taxation (Einsenstein, 2023). For this reason, ideological bias will be removed, and the article will focus on maximizing tax revenue.

The Laffer curve has been evaluated in several countries and by various researchers. Most studies defend and validate its postulates, while few reject them. Furthermore, the methodologies used over the nearly fifty years of its academic existence since its first publication by Jude Wanniski (1978) have been very heterogeneous.

The focus of this paper is not to assess the literature on the curve as a whole or based on its methodology, but rather to focus on two countries with different tax trends: Spain and the United States. The European country is known for an increase in tax revenue due to higher tax pressure (Sánchez de la Cruz, 2021), while the United States is the paradigm of fiscal freedom for policymakers (Diamond & Saez, 2013).

The article is relevant and timely for several reasons. First, it addresses a key issue for analyzing a part of future fiscal policy, given the challenges that countries face. Second, the article not only gathers the most well-known papers but also introduces readers to other lesser-known or more marginal research. Third, the comparison between OECD member countries with such different fiscal policies will provide a more comprehensive perspective on the Laffer curve.

This study, unlike previous works, particularly that of Sanz Sanz (2017), starts from the belief in the existence of the Laffer curve and that studies provide us with information only about the efficiency or inefficiency of income taxation.

2. What is the Laffer Curve?

When we talk about optimal taxation, we refer to a term that has been present in economic literature for a long time. Even when the neoclassical economists outlined the four fundamental principles of taxation (efficiency, equity, simplicity, and revenue), they were thinking about the combination of these principles to achieve comprehensive taxation. Although they did not call it optimal, it was implicitly present in their formulation. It can be said that the first great economist to stop and reflect on the limitations of government administration in collecting according to its planning was Frank Ramsey. However, it was only with the arrival of James Mirrlees in the 1970s that the fiscal problem was generalized. This marked a reference for modern fiscal theory and a substantial advancement in the study of optimal taxation.

If we refer to the first time the idea of taxation that maximizes revenue explicitly appeared, we could date it to 1978 when Wanniski presented a simple idea about the relationship between tax revenue and tax rate (López García, 2012). Since then, these ideas have appeared intermittently over time, coinciding with periods of economic crisis.

The current economic crisis has been accompanied by an imbalance in the general budgets of most countries, both developed and developing. This scenario, with relentless declines in the collection of all forms of tax revenue and increased spending, has posed a challenge for governments and economists.

In this context, the issue of public deficits has been resolved, or attempts have been made to resolve it, through tax increases and reductions in the largest spending items. This has increased the tax burden on taxpayers. In some cases, the collection did not grow as expected.

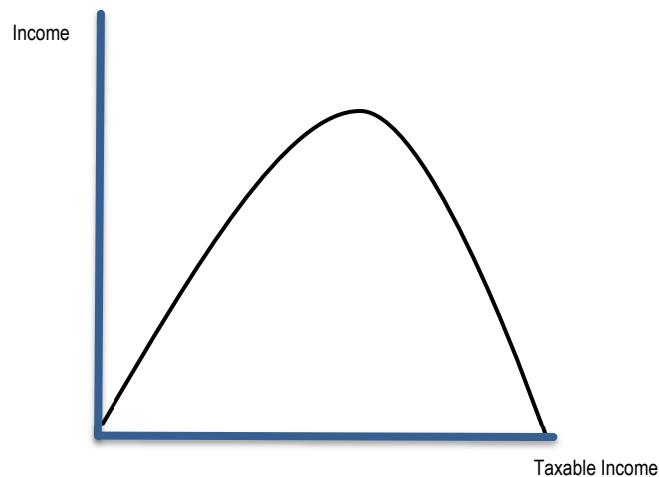
This situation forms the underlying idea of the famous Laffer curve. Perhaps it is, along with the optimal size of the state (Feldstein, 1996), one of the two most commented and debated theories of optimal taxation. At the same time, they are complementary theories. One shows the maximum productive spending of the state, and Laffer calculates the maximum collection. Both serve as constraints to each other. And both are the solutions given to the budget crisis.

The Laffer curve, the theoretical tool we will work with, is based on the idea that there is a relationship between tax revenue and the income tax rate. However, this relationship is not linear but parabolic, where there is a maximum revenue point.

Laffer's idea is that if income is not taxed (a tax rate of 0%), the revenue obtained is zero monetary units. Similarly, if income is taxed at the maxi-

mum rate (a tax rate of 100%), the revenue must also be zero monetary units. This happens because there are no incentives to work if all the wages are taken by the state through taxation. Graphically, the theoretical shape of the curve can be observed in Figure 1.

Figure 1



This occurs because the state holds the monopoly on revenue collection, as it possesses fiscal sovereignty. In other words, it forcibly extracts the precise amount from the private economy through taxation (Fuentes Quintana, 1986). This collection without direct service is what motivates people not to work if the tax rate equals their entire salary.

The existence of a maximum at some point in the function is due to the relationship between an arithmetic effect (mechanical effect) and an economic effect (behavioral effect). The arithmetic effect states that the higher the tax rate, the greater the expected revenue (Laffer, 2004). The economic effect, in turn, is divided into two effects: the substitution effect and the income effect. The substitution effect refers to the opportunity cost between working and engaging in leisure. When the tax is small, the opportunity cost of leisure is the wage (minus the small tax) earned during that hour. However, when the tax is large, the opportunity cost is reduced. The income effect aims to maintain the same income as before the tax increase, which is why people work more. Both the substitution and income effects can be either negative or positive. The sum of these three effects (arithmetic, substitution, and income) is what causes the curved shape of the function.

The curve can be divided into two parts based on its slopes. The left part, with a positive slope, is where any increase in the tax rate increases revenue. The sum of the arithmetic, substitution, and income effects is positive.

The right part of the curve is known as the decreasing section. Any increase in the tax rate results in higher tax pressure and lower tax revenue. Taxpayers will stop working (earning wages), reducing the taxable base, and consequently, the revenue (López García, 2012). The sum of the arithmetic, substitution, and income effects becomes negative.

The behavioral effect of the Laffer curve depends on the elasticity of the taxable base. This term encompasses all the responses that taxpayers give in reaction to changes in the tax system. These reactions influence not only the labor supply but overall behavior, and are measured by the taxable base – i.e., the magnitude of the income that the taxpayer reports. The change, whether legal or not, in the taxable base is what measures the elasticity of taxable income (ETI). This concept will be studied and explained in more detail in the upcoming chapters.

Another idea captured by Laffer in his function is that for the same level of revenue, there are two tax rates that achieve it. One is found in the decreasing section, and the other in the increasing part of the curve. The preference for being in one or the other depends on the ease with which administrations can calculate the curve.

The main idea behind the function is the relationship between income tax and revenue. If we try to calculate the Laffer curve in taxes that do not tax labor and capital, the functional form indicates that at 100%, there is still positive revenue collected by the state (Torres Chacón, 2008).

Therefore, it is necessary to understand that an increase or decrease in taxes and their relationship with revenue does not only depend on that specific tax, but on many factors within the tax system (Laffer, 2004). These include the studied period, the mobility of productive factors, the effective tax pressure, legal loopholes, and, most importantly, the level of compliance with legal obligations.

Thus, the Laffer curve as initially formulated (the relationship between revenue and the income tax rate) is informative but of limited utility. Several authors have attempted to modify the curve to derive greater utility from it, such as a two-dimensional study correlating two taxes and their respective revenues (Torres Chacón, 2008). Even so, the marginal utility obtained remains minimal.

The tax structure and revenue collection capacity of Spain (and advanced countries) depend on many taxes. But if we focus on the central administration, we see that figures like personal income tax (PIT), social contributions,

and indirect consumption taxes represent more than 80% of revenue. The Spanish case will be explained in more detail in the following chapters. Therefore, a two-dimensional study would be insufficient as it could not relate all fiscal revenues.

On the other hand, transforming the tax rate into tax pressure would allow grouping the taxes we wish to study. One does not want to extract more monetary units from the economy than necessary, as this would be counterproductive for economic growth. Thus, a modification of the Laffer curve that relates tax pressure to revenue would be a useful and informative tool (Diamond & Saez, 2013).

The tool to be used in this work will be the Laffer curve of marginal rates. This modification allows, in a simple and intuitive way, the calculation of optimal tax pressure that leads to maximum revenue for the state.

The methodology of the curve is identical to that of the original Laffer curve. If no tax is imposed on the taxpayer (tax pressure of 0%), the administration will collect zero monetary units from them. However, if the tax pressure on the individual is 100%, no revenue will be collected. This is because there will be no incentives to work (no collection through income tax or social contributions), and the individual will not have income to consume (zero units collected through consumption taxes). It will also depend on the public spending received.

This function continues to present some of the issues raised by the original Laffer curve. However, being a study of a complete tax system, or at least the most relevant tax revenues, it is possible to draw more consistent fiscal policy conclusions. Problems remain, such as the time studied, tax avoidance and evasion, and the mobility of productive factors. But under certain assumptions that simplify the model and bring it closer to reality, it is a sufficiently precise tool for studying the tax system and tax pressure of any country.

3. How do we calculate the optimal tax rate?

As demonstrated in theory, the Laffer Curve represents the relationship between revenue and the tax rate. It has been shown that this relationship depends on the mechanical effect and the behavioral effect. Therefore, the question is: how do we calculate the rate that maximizes revenue?

To avoid raising tax rates to such high levels that they affect taxpayer behavior in ways that compromise their well-being and widen the gap between efficiency and equity, it is necessary to calculate the tax rate that maximizes reve-

nue. Any increase in the tax rate above the optimal rate would be detrimental to both the public and the revenue collection (Diamond and Saez, 2013).

To answer this question, let's assume that tax rates are increased for individuals with higher incomes. This leads to a response: there is a reduction in revenue that may result from the taxpayer's response to work less. As a result, the taxpayer will earn a lower wage, and this, due to the progressive nature of the main tax in the fiscal system (personal income tax), will lead to a reduction in tax revenue. It may also be due to tax avoidance or evasion. When playing with the rules of the tax system to have a lower obligation toward the state, it is considered tax avoidance. On the other hand, if earnings are not directly reported, this constitutes a crime: tax evasion (Diamond and Saez, 2013). All these responses are grouped under the concept of elasticity of the taxable base.

To understand the formula for the tax rate, we need to follow a series of reasoning steps that influence taxpayer behavior. The equation we arrive at is as follows (Giertz et al., 2012):

$$r = \frac{1}{1+ae} \quad (1)$$

where a is the Pareto parameter (the relationship between the average income of the studied group and a threshold income), and eee represents the elasticity of the taxable base of the individuals under study.

This formula not only allows us to calculate the marginal rate that maximizes revenue for personal income tax (PIT), but it also serves to calculate the marginal rate that maximizes revenue for the overall tax system. In the United States, tests have been conducted to calculate the tax burden by summing the income tax, medical insurance, local and state income taxes, and consumption taxes. In Spain, while there are no local income taxes, the principle remains the same. It is possible to calculate the optimal tax burden by considering the PIT (both national and regional), social security contributions, and the Value Added Tax (VAT).

4. ETI (Elasticity of taxable income)

The elasticity of taxable income (ETI) is one of the two key terms required to calculate the marginal rate that maximizes tax revenue. It encompasses all the responses that taxpayers give in reaction to changes in the tax system. Decisions related to career choices, type of compensation, salary amount, legal compliance, the length of the working life, and other responses taxpayers may have towards taxes are measured by the elasticity of taxable income (ETI).

For years, economics focused on the elasticity of labor supply to measure changes in individual behavior following tax changes. The simplicity and utility of the elasticity of labor supply arise from the fact that, when modeling taxpayer behavior, they ultimately choose between two goods (leisure time and consumption goods). Consumption goods are translated into monetary units, i.e., the taxpayer's real wage. The relationship is that if the taxpayer decides to take an additional hour of leisure, they lose all the goods they could have bought with that real wage.

With some exceptions, historical evidence shows that the vast majority of professions had a labor supply elasticity close to zero. In other words, in response to changes in the marginal income tax rate, taxpayers changed their labor supply very little (Slemrod, 1998). The differences between countries tend to be very informative. However, researchers tend to differentiate groups based on their response at the intensive margin (hours worked) or extensive margin (whether or not they enter the labor market). Women with children and low-income workers tend to fall into the extensive margin, while the rest fall into the intensive margin (Mirrlees and Adam, 2011).

Although the evidence on the elasticity of labor supply was undeniable, researchers were making mistakes about where to locate the efficiency loss from tax increases. The income effect and the taxpayer behavior effect are not only observed in the labor supply but also in how individuals modify their taxable base.

a. Methodological review of elasticity of taxable income

The literature on elasticity of taxable income (ETI) not only provides a numerical result for use in research or fiscal policy, but each article has also contributed to a deeper understanding of the methodology used to minimize potential errors. Recent research is quite different from the article written by Feldstein in 1995, in which the number of observations was very small and there were no sensitivity tools.

Among the many details refined over the course of research are the study group, the differentiation between personal tax and corporate tax, and the study period, among other aspects.

A large number of articles and studies have found that if we really want to study the behavioral effect related to changes in marginal rates, it can only be precisely quantified in the higher income percentiles (Giertz et al., 2012). Results obtained from middle-income or lower-income individuals have not been significant for various reasons.

Regarding the differentiation between taxing the individual or a company or corporation, this is a topic that is included in debates on all tax reforms.

Most countries tax corporate and individual incomes differently, but all have a mechanism for transforming income from one category to another. Given this, it is easier to check the elasticity of the taxable base (Giertz et al., 2012).

Regulatory changes in taxes rarely happen without notice. A clear example is the policy with which President Clinton arrived at the White House in 1992. His program aimed to raise the marginal tax rate for higher incomes. This led to individuals attempting to earn as much as possible before the tax reform was implemented. The methodology currently used when modeling elasticity of taxable income is not designed for intertemporal issues. Therefore, it does not accurately measure expected changes in taxation. This is still an open challenge for researchers (Giertz et al., 2012).

The literature has also provided several ways to approach a nearly perfect counterfactual. The differences-in-differences method has contributed, like no other method, to expanding evidence and enriching this debate. Besides econometric tools that can be used, a good approximation for the counterfactual is undoubtedly represented by individual people. Tax reforms do not affect all taxpayers in the same way. Therefore, a good approach for a control group is to use taxpayers who are less (or not at all) influenced by the tax reform (Giertz et al., 2012). The search for a perfect control group has been of interest to major economists such as Looney, Singhal, and Emmanuel Saez. The U.S. tax code offers some possibilities, not without controversy and errors. These alternative avenues may offer a more homogeneous control group (counterfactual) compared to taxpayers who are not influenced. However, the lack of perfect information (due to individuals' lack of tax education) can lead to significant errors. Nevertheless, these new research pathways offer a vast field of study and, if refined, could provide a more homogeneous counterfactual compared to groups unaffected by reform.

Regarding data acquisition, there are some advantages of panel data analysis over cross-sectional data analysis that have emerged in research. The main utility lies in the fact that an individual's income in the base year is a good predictor of income after the reform. The only problem that may arise with this system is the mobility in individuals' income position. Therefore, eliminating extreme values can help mitigate this error. Additionally, the tax change aimed at affecting a group of taxpayers and not the entire group can be seen more clearly and with smaller standard errors through panel data. Therefore, these examples, along with other considerations listed in the literature, show that panel data involve fewer errors in estimating elasticity of taxable income compared to cross-sectional data (Giertz et al., 2012).

A problem that had not been addressed until recently in the calculation of elasticity of taxable income is capital gains. In most countries, capital income and labor income are taxed differently. The marginal tax rates on income earned from labor and those earned from capital rarely coincide. This difference in marginal rates, the transfer of income from labor to capital, and other capital-related issues cause overall elasticity to be unreliable. Usually, the elasticity of taxable income for labor income and capital income is studied separately. For some time now, researchers have been focusing on improving the calculation of overall elasticity. However, due to the lack of data, credibility issues with the data, and other capital-related problems, progress is difficult (Giertz et al., 2012).

Elasticity of taxable income is a parameter that has been calculated relatively recently. Therefore, there are many improvements that can and must be made in its calculation. However, over these twenty years, much has been learned. It is used, among other objectives, as evidence of income tax inefficiencies—inefficiencies that affect taxpayer behavior. Feldstein was not the researcher who perfected the technique the most, but he was the one who brought attention to this problem and promoted research with his articles, which would later be led by Professor Saez. The main appeal of the concept of elasticity of taxable income is that it is an analysis of well-being. Therefore, since most individuals respond significantly to tax changes, it is important to know the dimensions of these responses to make decisions and calculate the various possible well-being responses. To expand the evidence, we will add in Annex I a review of elasticity of taxable income evidence in countries other than Spain and the United States.

b. United State

The first work that can be considered in the economic literature on taxable income elasticity, as we know it today, is Feldstein's 1995 study. Feldstein sought to investigate the response of high-income taxpayers following the modification of personal income tax introduced by the TRA 86 (Tax Reform Act). The study covered the years from 1979 to 1988. The results showed elasticities ranging from 1 to 3. However, due to the methodology used, the lack of control for mean reversion¹, and the small number of observations (4,000), this result is considered unreliable (Slemrod, 1998).

Subsequently, in 1998, researchers Auten and Carroll used a larger number of observations to quantify the effect of the 1986 reform already studied by Feldstein. However, the years considered were from 1985 to 1989. The study was also conducted for high-income taxpayers. Unlike Feldstein, the

¹ This statistical phenomenon has been studied very little in the research on the Laffer Curve. The simplest explanation was provided in the article by Lorenzo (2017).

researchers included an econometric methodology for the calculation. They used the logarithm of income in the base year as a control for mean reversion. The resulting elasticity was around 0.6 (Slemrod, 1998).

In the same year, Carroll conducted another study, this time on the fiscal reforms that took place in the United States in 1990 and 1993. The resulting elasticity was 0.4, significantly lower than the previous results. He used the same methodology as in his first article, but this time, the control variable for mean reversion was average income (Slemrod, 1998).

The next study also focused on the 1993 reform. Here, researcher Goolsbee differentiated between short-term and long-term elasticities. The long-term result was 1.4, while the short-term result was almost zero, at 0.1. This difference compared to Carroll's results could be due to the treatment of the data, as the mean reversion control, average income, is the same one used by Carroll (Sanmartín, 2007).

Attention once again shifted to the 1986 reform when Professors Mofitt and Wilhelm published their study on elasticity of taxable income in 2000. The novelty of this study was the absence of tax microdata; they obtained results using panel data from 1983 to 1986 provided by the Federal Reserve. They included the logarithm of income in the base year as a control for mean reversion. The elasticity was found to be between 0.35 and 0.97. While not as high as Feldstein's, it was close to the results published by Auten and Carroll (Díaz Caro and Onrubia, 2015). This work not only provided additional empirical evidence but also pushed subsequent studies to control for factors that could cause variations in the incomes of different groups, as there are numerous non-tax factors that can benefit a certain income group in a specific period (Sanmartín, 2007).

The reforms of the 1980s were also studied by Gruber and Saez in 2002. The data were obtained from the U.S. income tax microdata panel from the Internal Revenue Service. The years considered were from 1979 to 1990. They worked with a dataset of about 46,000 declarations. They defined minimum income thresholds in the base year, used three-year periods, and applied the Auten and Carroll model with modifications and a new control variable for mean reversion. The resulting elasticity was 0.4 (Díaz Caro and Onrubia, 2015).

The same two reforms were studied in 2005 by Kopczuk. The differences compared to the research conducted by Gruber and Saez are that the control variable for mean reversion used by Kopczuk was alternately the logarithm of income from the previous period and the income deciles. The second difference is the source of the data, as the researcher obtained them from the

University of Michigan. The sampled years are the same, from 1979 to 1990. The elasticity ranged between 0.1 and 1.1 (Díaz Caro and Onrubia, 2015).

c. Spain

Badenes Plá (2001) was the first study conducted in Spain on the elasticity of the tax base. The work aimed to measure the impact of changes in the treatment of income aggregation in personal income tax (IRPF) during the period 1989-1992 on secondary income earners. In Spain, the so-called “problem of the working woman” was present. The income received by secondary earners (mostly women) was aggregated with the income of the primary earner. This, combined with a progressive tax system, resulted in very high marginal rates. During the studied period, this system was eliminated, leading to a change in the behavior of secondary earners.

To obtain the most comprehensive measure possible, Badenes Plá used three different methodologies. The first followed the method proposed by Feldstein, which quantified the elasticity of the tax base of secondary income earners in relation to changes in the net percentage of income.

The second methodology, still following Feldstein, studied the response of both the primary and secondary income earners to changes in the net percentage of income. In summary, it measured the elasticity of the family. Considering decisions as a unit, it was important to observe the overall change. The last methodology used was a traditional method, which focused only on changes in the behavior of secondary income earners.

The work compared the elasticity of agents in 1988 with the following years (1989-1992) to verify whether the non-obligation of joint filing had incentivized income acquisition. The results using the first methodology ranged from 1.53 to 4.90, very high values, with a more pronounced response in the lower-income brackets. These results were expected, as, after the modification of the IRPF, secondary income earners were incentivized to obtain higher incomes.

The second methodology showed even higher elasticities, reaching values over 9 in some cases. Focusing solely on the overall response of taxpayers, the elasticities ranged from 0.4 to 3.40.

The third methodology, defined as traditional, gave lower responses, with a negative sign expected, as lower marginal rates aimed at obtaining higher tax bases. When studying taxpayers in general, elasticities ranged from -0.62 to -2.45.

After the first study on the elasticity of the tax base in Spain, Díaz (2004) sought to fill a gap considered essential: providing empirical evidence on the elasticity of the tax base for the Spanish case. The lack of results for Spain led

Díaz to gather the three existing methodologies up to that point and evaluate the reform already studied by Badenes Plá.

The first approach used the econometric mechanism of differences-in-differences. The second followed the methodology proposed by Auten and Carroll, while the study concluded with the method of calculating the elasticity of the tax base by Gruber and Saez.

The study period ranged from 1987 to 1994. The data, provided by the Institute of Fiscal Studies, were homogenized by eliminating incomes lower than 840,000 pesetas in the initial year and 1,200,000 pesetas in the final year. To avoid effects on results from retirees, taxpayers over 65 were excluded.

The first method, differences-in-differences, assumed that during the sample period, the studied group and the counterfactual would have followed the same evolution if it hadn't been for the tax change. The effect of the reform was seen in the change of the marginal rate each individual would have had under the tax in the first period. The results varied between an elasticity of 0.10 and 2.2.

The second approach, regression with instrumental variables, followed the methodology of Auten and Carroll and sought to explain the tax base through four factors: an unobservable heterogeneity, observable characteristics of the first period that changed over time, the marginal rate, and the time effect. Through mathematical modifications, elasticity was calculated, with a result close to 0.7.

Finally, the method of Gruber and Saez, estimated with greater rigor and for all years of the sample, gave an elasticity of about 0.35, a much lower value compared to the previous two cases and close to international evidence.

Sanmartín (2007) also explores the modification of the IRPF law carried out at the end of the 1980s and the early 1990s, seeking to measure the responses to changes in taxpayer behavior.

Sanmartín's study replicates the model proposed by Auten and Carroll. The dependent variable is the change in the logarithm of the tax base between 1987 and 1990. To avoid calculation errors, the 1990 tax base is expressed in constant 1987 pesetas. However, unlike previous studies, the tax base in the two periods is calculated according to the definition applied in the general rate at the beginning of the period.

The database used is the IRPF Declarants Panel prepared by the Institute of Fiscal Studies. The sample selected is a simple random extraction of 2% of the total annual declarants. Every year, the selected taxpayers are located, and their declaration history is examined during the studied period.

As in Díaz (2004), all declarations from 1988 under 840,000 pesetas were excluded, as the IRPF modification exempted these individuals from filing. Their inclusion could have introduced a regression to the mean bias.

Sanmartín's (2007) criteria are slightly modified compared to those of Díaz (2004), and the sample period goes from 1987 to 1990, different from the other studies.

The result of the study is an elasticity of 0.21, which changes to 0.11 when controlling for the initial tax base. This result differs significantly from that of Badenes (2001) and Díaz (2004). The small differences in the data, period, and calculation system can explain this large difference.

Sanmartín (2007) includes a control for regression to the mean and changes in the income distribution, which Badenes (2001) did not consider, and Díaz (2004) only included a piecewise function of the logarithm of the initial year's income. Therefore, it is safer to compare Sanmartín's (2007) result with Díaz's (2004) rather than with Badenes' (2001).

The subsequent national approach to the elasticity of the tax base was by Arrazola et al. (2014) for Wellington University. This study aims to evaluate the change in taxpayer behavior following the 2006-2007 reform, which transformed the IRPF into a dual system, with a general rate for income and a special rate for savings income. Moreover, the brackets went from five to four in the general rate. These changes could have influenced taxpayer behavior.

The goal of the work was not so much to provide further empirical evidence to the limited literature, but to demonstrate the usefulness of the elasticity of the tax base in designing efficient and optimal fiscal policy.

The methodology used is that proposed by Gruber and Saez, with the modifications suggested by Bakos, Benczur, and Benedek. They also follow control of variables, including demographic variables, family characteristics, and other variables considered essential by Auten and Carroll.

As in previous studies, a control is carried out to avoid regression to the mean, including an additional regressor to prevent biases that could invalidate the final result.

The data are provided by the Institute of Fiscal Studies, with a panel of microdata from taxpayers for 2006 and 2007. These two years were selected because the law change occurred in the last year of the sample.

For the entire Spanish taxpayer population, the research provides an elasticity of 1.541. However, it is observed that depending on the income decile and family characteristics, the elasticity can vary significantly. The first income quartile has an elasticity of 0.664, while the highest income quartile shows an elasticity

of 2.717. There is also a regional difference: the wealthier Autonomous Communities are more responsive to marginal rates than the poorer ones.

The authors of the survey believe the most significant result is the utility for evaluating the IRPF law reform carried out in 2012.

The last national study on the elasticity of the tax base was conducted by Díaz Caro and Onrubia (2015). This research focuses more specifically on the 2007 IRPF reform, with the primary goal of demonstrating the utility of the elasticity of the tax base. Through the result, they seek to calculate the efficiency costs generated by the reform and the optimal marginal rates that would maximize collection.

The theoretical framework and methodology followed are those established by Gruber and Saez. It includes a set of control variables to avoid errors in econometric specification. These variables do not change over time but influence the net income variable. To address potential endogeneity issues, the two-stage instrumental variable method is used. In the second phase, ordinary least squares (OLS) estimation is incorporated, and the elasticity of the tax base is calculated.

The data used for calculations come from the IRPF Declarants Panel provided by the Institute of Fiscal Studies. The study was conducted on data from 494,591 declarations for the years 2006 and 2007. Such a large sample was chosen to represent the more than 17 million taxpayers in Spain.

The results obtained differ significantly from those provided by Arrazola et al. (2014). The elasticity of the tax base for the entire taxpayer population is 0.43, close to values found in international literature in recent years. Subsequently, a study was conducted on the five income brackets of the IRPF before its modification. For the first bracket, the elasticity is 0.36, and 0.44 for the second. The third bracket shows a higher elasticity of 0.81. Finally, the two highest-income brackets show elasticities of 1.21 and 1.43.

Unlike Arrazola et al. (2014), no study with a spatial perspective was conducted, but it is emphasized that elasticities by income do not vary in their evolution (elasticity grows with income) but only in their magnitude.

The empirical evidence provided by the studies on the elasticity of the tax base in Spain is comparatively higher than international evidence. Part of this difference can be explained by the high levels of fraud and tax evasion in Spain compared to the countries in the ETI studies. However, the results obtained are very high for the factor of non-compliance with tax obligations to explain the high elasticity level. Other research could provide results more in line with expectations or explain the reason for the extremely high elasticities.

5. Revision of the Laffer Curve

The Laffer Curve is a simple tool but with great explanatory power, which has allowed it to be a recurring theme in fiscal economic literature. The treatment of this tool has always been either from a historical perspective, aiming to demonstrate the veracity of the curve with data, or from an analytical perspective, attempting to calculate the tax rate that maximizes income tax revenues.

The historical argument is generally used when, over a short period of time, a tax reduction results in an increase in revenues; thus, the most loyal authors consider that this occurs because taxpayers were on the prohibitive side of the curve. On the other hand, numerous calculations of the optimal tax rate have shown that it is not a static point.

The interdependence of the results with other dynamic variables and the ease of interpretation, along with the availability of data that few fields have, have facilitated its popularity among researchers. The paragraph is structured into two sections. The first shows the historical evidence, while the second lists some examples of optimal tax rate calculations. Additionally, the historical section is divided into two parts. The first is based on authors (Wanniski and Laffer) who argue that if there is an increase in revenues following a tax cut, it is because countries were beyond the optimal tax rate. The second part is a review of reasons that might explain such an increase in revenues without taxpayers being on the prohibitive side of the curve.

a. Historical Evidence

The first historical reference providing evidence for the existence of the famous curve is the fiscal policy of U.S. President W. G. Harding, who, after World War I, reduced tax rates to levels prior to the war. After this reduction in the marginal tax rate, a significant increase in state revenues was observed in the following years (Wanniski, 1978). The subsequent historical example studied in the literature is the tax reduction promoted by the Kennedy administration, implemented in 1964. This was the first major reduction in marginal tax rates after World War II, carried out in the United States. The maximum rate was 91%, and the tax reform reduced it to 70%. Direct tax revenues were \$72.1 billion in 1964 and \$80 billion in 1965 (Laffer, 2004). The average annual increase in tax revenues during the four years preceding the reform was 3.3%, reduced to 2.1% when adjusted for inflation. Meanwhile, the growth rate in the four years following the fiscal decision was 11.8% (8.6% adjusted for inflation).

The next major tax cut supporting Laffer's hypothesis occurred during President Reagan's terms. The reform initially provided for a 25% reduction

in the maximum marginal rate over a three-year period. In 1981, the marginal rate was 70%, while by 1989, the year Reagan left office, it had decreased to 28%. In the four years prior to the tax cut, direct tax revenues, adjusted for inflation, grew on average by -2.8% per year. In contrast, in the four years following the tax cut, they grew by 2.7% per year (Laffer, 2004). During this period, the country's economy went from a real growth rate of 0.9% (1978-1982) to 4.8% (1983-1986).

The European example used to defend the Laffer Curve hypothesis is the economic policy implemented by German Finance Minister Ludwig Erhard (1949-1963). He reduced tax rates and achieved an increase in tax revenues. His tenure as Finance Minister is known as the German economic miracle. His policy is considered more important for the reconstruction of a Germany devastated by World War II than the Marshall Plan itself (Wanniski, 1978).

b. Empirical Evidence

It is important to emphasize that the changes in personal taxation discussed were made not only by administrations that believed in a policy of low marginal rates but also through public announcements communicating them. The idea was that lower income taxation would change taxpayer behavior. Currently, we live in a period where tax increases, which face significant opposition, occur without the affected individuals being informed. According to a Google survey, 63.7% of Americans were unaware of how taxes had evolved in the past year, and only 20% knew that taxes had increased in 2014 (Baker, 2014). This can impact the calculation of the maximum tax rate. This issue has been defined as "The tax burden that taxpayers are willing to bear for the services received" (Wanniski, p. 5, 1978). If taxpayers themselves do not know the tax burden they bear, the result may be an unreliable marginal rate.

Setting aside this problem, calculations of the maximum rate of the Laffer curve are common in economic literature. However, it is important to note that maximizing tax revenue is not the same as maximizing the welfare of the country. A tax increase leads to a loss of efficiency and income redistribution through taxes and public spending. This redistribution reflects the weight that citizens attribute to the welfare of the entire country. If taxpayers do not value redistribution, its value would be null, meaning that the maximum welfare of society would occur exactly where revenue is maximized. On the other hand, if they value redistribution, even if only slightly, the maximum welfare would not be achieved where revenue is maximized, but at another point on the Laffer curve (Trabandt et al., 2011). The greater the concentration of income in a few hands, the greater the importance that all taxpayers place on the redistribution

of that income. Just as the optimal rate is a variable over time, the valuation of income redistribution changes over time as well.

One of the latest works on this topic is that of Trabandt and Uhlig (2013). This study covers the entire European Union and the United States, attempting to calculate the additional income that could be obtained, as a percentage of Gross Domestic Product (GDP), if the rate that would maximize societal welfare were adopted (Trabandt and Uhlig, 2013). The authors refined the model used in recent years to make it as faithful as possible to the wealth of families and society as a whole. It does not focus solely on the revenue collection decision for the government or the Time-Work debate of families but interrelates them, placing each at the service of the other to achieve the highest possible welfare for society.

The model maximizes the utility of a family over its lifecycle with budget constraints and capital flows (Trabandt and Uhlig, 2011). To do this, the authors followed the methodology used in previous articles (Trabandt and Uhlig, 2011). The model is a neoclassical growth model with variable tax rates and CFE preferences (Constant Frisch Elasticity). All of this, in turn, increases the welfare of society, represented here by families.

The importance of this result lies not so much in the increase in revenue that administrations could achieve but in the methodology used. It maximizes revenue while considering the maximum possible welfare. It does not only study the incentives caused by taxes but, within a general equilibrium structure, links classical time and work variables from each study and expands them to introduce government transfers. The authors consider an important part of taxpayer welfare to be what they receive from the state.

According to this research, the European Union is closer to the maximum revenue indicated by the Laffer curve compared to the United States. The United States could increase its income tax revenue by up to an additional 9% of its GDP, while in the European Union, this percentage would represent only 4.3%. In the case of capital taxes (Corporate Tax and Capital Tax), the European Union would collect an additional 1.2% of its GDP, while the United States would collect 2.6% (Trabandt and Uhlig, 2013).

For capital tax revenues, a similar trend occurs. However, because this base is more mobile, the additional gains that could be obtained are smaller compared to labor income tax.

Another result derived from the Laffer hypothesis leads us to consider the underground economy. Several authors, generally supporters of the Laffer curve, have considered that if illegal activities exist, it is because the country is in the prohibitive part of the curve. Therefore, by lowering taxes, it would

move to the optimal point or the increasing side of the Laffer curve, encouraging activities to return to the legal sphere, thus increasing revenue (Heijman and Van Ophem, 2005).

Heijman and Van Ophem (2005) created a model where, considering labor productivity and the unemployment rate, they calculate the marginal rate that maximizes revenue. They assume that taxes influence activities, incentivizing them to move to the underground economy. The results for the marginal rates are lower than those indicated by the literature up until then. However, the optimal rate is still higher than the effective rate (Heijman and Van Ophem, 2005). For the case of Spain, calculations were made using data for the period 1988-1996. In 1995, the effective rate was 37%; it could have been 54% if the goal was to maximize revenue.

All the countries studied could have increased their taxes, except Sweden, to obtain additional revenue. For this period, and taking the underground economy into account, the Swedish government could have collected more if the marginal rates, set at 65%, had been set at 58% (Heijman and Van Ophem, 2005). The relevance of these data and the importance of this model show that the existence of the underground economy is not due to the country being in the prohibitive part of the Laffer curve, but to other characteristics. The information provided by the Laffer curve is limited to revenue and tax rates. Going beyond this, without a study like Heijman and Van Ophem's, could lead to highly inaccurate conclusions.

These results support other calculations made to study the Spanish tax system. Pre-crisis calculations indicated that the income tax rate that maximized revenue was between 40% and 60%. The effective rate was 34%, leaving room to increase the tax rate and boost revenue. The same applied to capital income and consumption taxes (Torres Chacón, 2008). Therefore, before the crisis, the Spanish tax system was in the increasing phase of the curve when analyzed tax by tax.

Focusing on the more recent evidence from Spain, we must understand that the Spanish tax system is not simple. The income tax is calculated by brackets, meaning it does not have a fixed tax rate. Furthermore, since it is an intergovernmental tax, this means that the Central Administration has the power to modify certain aspects of the tax, while others are under the competence of various Autonomous Community governments. It is a dual tax system, meaning general income is taxed in one way and capital income in another. This tax system has been in place since the 2007 reform. Initially, capital income was taxed at a fixed rate, but with the crisis, the Central Administration added brackets. This modification was used to calculate the elas-

ticity of taxable income for Spanish taxpayers. However, it had little relevance in calculating the optimal rate.

Sanz Sanz (2014) aims to determine how taxpayer rationality and behavior are influenced not only when the administration modifies taxation but also that there is differentiated behavior for income brackets due to the progressivity of the income tax. Thus, the researcher assumes an ETI of 0.6, in line with international evidence. He then formulates the hypothesis of how the optimal rate would change if the mechanical effect were greater or smaller than the behavioral effect. In the first case, it is observed that the tax rates derived from the Laffer curve methodology are lower than the actual tax rates. In the second case, the opposite occurs: the actual rates are lower than those indicated by the model. This underscores the key role that taxpayer behavior elasticities play in calculating the optimal rate that would maximize revenue for income brackets.

Regarding the differences between Autonomous Communities, the starting hypothesis of López García's (2012) research is based on the idea that the wealth of the country is distributed differently, and therefore, the taxpayer will behave differently depending on where they live. The latest work done to estimate the curve with a spatial perspective included evaluating the effect that agglomeration economies may have on the result of the Laffer curve. It is not an innovative model, as other authors have used it for the same purpose. Specifically, it is the model Hsing proposed in 1996. The equation is estimated in both logarithmic and semi-logarithmic terms. However, it had never been applied to the Spanish case. The data, so they could be disaggregated by Autonomous Communities, were extracted from the "Panel of Income Tax Filers 1999-2009" developed by the Institute of Fiscal Studies and the Tax Studies and Statistics Service of AEAT (López García, 2012). The results, disaggregated by Autonomous Communities, which can be studied in Table 4, show that the three wealthiest communities (Madrid, Catalonia, and the Balearic Islands) have the highest tax rate. Autonomous Communities with Special Status were not included in this study.

In turn, the results for cities provide a result quite consistent with the principle of agglomeration economies. The greater the agglomeration, the greater the wealth. Therefore, a larger population corresponds to a higher tax rate according to Hsing's model.

Díaz Caro and Onrubia (2015) published the calculation of the optimal tax rate using a methodology similar to the one proposed in this work. By studying the "taxable income-marginal rate" elasticity, they find the rate that maximizes revenue for each income level.

Through the five income brackets that existed in the personal income tax (IRPF) before the 2007 reform, elasticities were estimated. Subsequently, rounding to the nearest higher and lower decimal, average values in percentages of the optimal marginal rates are provided. The calculation of the compensated “taxable income-net marginal rate” elasticity allows for determining the marginal rates that minimize the excess burden generated by the tax. The methodology provided by Gruber and Saez is used to reach the maximum potential revenue. Since the personal income tax is a tax with a rate that includes various marginal rates, the equation provided by Gruber and Saez is modified. The tax rate that would reach the maximum revenue, considering the elasticities of each income bracket, is contrary to the idea of progressivity that accompanies the IRPF. This can be understood from the ease with which each income bracket can modify their income and transform it into other sources of income. In the lower brackets, the only way is through the extensive margin of labor supply. In the middle-income brackets, the response occurs through the intensive margin. And for higher incomes, beyond the tools mentioned, they can also decide how they receive their income (labor income or capital income).

The latest empirical evidence produced by Spanish academics focuses exclusively on incomes above €100,000 (Torres-Remírez et al., 2024). The methodology used is the same as that proposed by Giertz et al. (2012). The added value of this contribution lies in the spatial comparison, as it is made across different regions and over a very long period (2010-2019), concluding that in each of the regions, if the marginal rates had been reduced, tax revenue would have increased. Additionally, it is observed that the wealthier regions are the ones that come closest to optimal taxation.

6. Conclusions

It can be concluded that historical and analytical evidence demonstrates a broad field of study and debate. Tax collection does not depend solely on the tax rate, but also on many other variables that influence the economy and the expectations of taxpayers. It is therefore crucial to consider these variables in order to conduct a comprehensive study of the Laffer Curve. The Spanish literature reviewed in this work shows a weakness in this regard; except for the work of Díaz Caro and Onrubia, the rest of the research mainly focuses on the optimal marginal rate without examining the broader interrelationships. In contrast, international literature shows a growing interest in the impact of fam-

ily and socio-economic variables on tax collection, as well as the incidence of such collection on these variables.

It is important to emphasize that taxpayer behavior is rational and that taxes are a well-known variable. The responses of individuals to tax authorities represent a crucial variable, as a miscalculation of these responses can lead to a poor forecast of the maximum potential collection. In this context, the increasing complexity of fiscal models and the integration of behavioral and socio-economic variables are essential for improving the accuracy of tax forecasts.

Economic literature suggests that, in addition to the marginal rate, the progressivity of the tax system, the elasticity of the tax base, and the structure of public transfers are determining factors in calculating the optimal taxation. More recent studies indicate that the maximization of tax collection may not coincide with the maximum social welfare if taxpayer preferences for redistribution and public services are not considered.

Furthermore, the literature highlights the importance of considering the effects of globalization and capital mobility, which can influence tax collection and taxpayer responses. Fiscal policies must therefore be adapted to global economic dynamics and local specific conditions to be effective.

In summary, future research should integrate more complex models that consider not only direct fiscal variables but also indirect effects on social welfare and economic efficiency. Only through a more nuanced and comprehensive analysis can fiscal policy be optimized and overall societal welfare be improved.

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Appendix 1: International Evidence

Economists working in public finance often pointed out in the first decade of the century that, while there was a fairly extensive literature on the United States, there was little research on tax base elasticity for the rest of the countries, especially those members of the OECD. For this reason, studies on this topic proliferated during that period, contributing to a faster spread of the term and improvements in calculation methodologies.

One of the first pieces of evidence outside the United States was the research conducted by Professors Sillamaa and Veall in Canada in 2001. They examined the personal income tax reform introduced in 1988. Following the work of Auten and Carroll, they included a control for mean reversion, using the logarithm of income in the initial year. The result obtained was practically null (0.1), which gave greater credibility to Goolsbee’s results in the United States (Sanmartín, 2007).

In Europe, the first significant research arrived in 2001, with studies conducted in both Norway and Spain (the latter will be discussed further below). Aarbu and Thoresen studied the tax reform implemented by the Norwegian government in 1992, investigating how taxpayer behavior had changed. Unlike the Spanish research, they included controls for mean reversion and variations in the income distribution. They applied different econometric methodologies, with results ranging from an elasticity close to 0 to just above 0.2 (Sanmartín, 2007).

In 2002, Professor Selen published empirical evidence from the study of the Swedish tax system reform. Like other researchers, he used various econometric tools, obtaining an elasticity range between 0.2 and 0.4 (Sanmartín, 2007).

The research department of the Bank of Israel also focused on tax base elasticity, and many of their publications calculate it. One of the early studies indicated that Israeli taxpayers’ behavior changed significantly following a tax reform, with an elasticity ranging between 1 and 1.5 (Romanov, 2004).

More recent works have adopted the methodology of Gruber and Saez with some modifications to adapt it to the research needs of their respective countries. This is the case of the 2008 study by Bakos et al., which examined the Hungarian tax reform of 2005. The sample size was very large, with about 215,000 declarations, allowing for comparisons not only of the country as a whole but also specific groups of people. The results showed elasticities ranging from 0.06 to 0.45 (Díaz Caro and Onrubia, 2015).

Finland has a dual tax system, similar to the one currently in place in Spain, where capital income is taxed differently from labor income. In 2011, researchers Pirttilä and Selin studied how the introduction of this system in 1993 may have modified the behavior of Finnish taxpayers. The study was conducted with various definitions of the tax base and distinguished between employees and self-employed individuals. The results showed variations between 0.04 and 0.2 (Díaz Caro and Onrubia, 2015).

For New Zealand, in 2012, Professor Claus and others conducted a study differentiating taxpayers based on their income level. The period studied was one of economic growth (2002-2008), which could affect the elasticity of certain groups, with values ranging from 0.0 to 1.7 (Díaz Caro and Onrubia, 2015).

Recent empirical evidence provided by Kleven and Schultz has produced atypical results compared to the average. In Denmark, the elasticity of labor income ranged from 0.05 to 0.1, indicating that Danish taxpayers are not greatly influenced by changes in the tax system. For capital income, the elasticity ranged from 0.08 to 0.14 (Díaz Caro and Onrubia, 2015).

In Germany, researchers have also devoted attention to studying tax base elasticity in recent years. The literature following the methodology of Gruber and Saez estimates results close to 0.6, while studies conducted using the Kopczuk model show elasticities between 0.32 and 0.47. However, the article analyzing the most recent change in the German tax system estimates an overall elasticity of 0.36 for all taxpayers. When distinguishing between married and unmarried taxpayers, singles show a lower elasticity (0.17), while married individuals have an elasticity of 0.44 (Werdt, 2015).

