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TAX INCIDENCE, BEHAVIORAL ECONOMICS AND LABORATORY EXPERIMENTS: A REVIEW OF THE LITERATURE

Abstract: Tax incidence is one of the most fundamental issues in public economics. This paper addresses this issue from a specific angle, by looking at the contribution to this field of research of behavioral and experimental studies to the principle of tax incidence equivalence (i.e. Liability Side Equivalence Principle). Moving from the idea that subjects have problems in correctly evaluating their own marginal tax rate, key behavioral and experimental features are addressed in the paper. These including: tax perception, tax complexity, tax salience, tax incidence and the impact of market structure upon tax related behaviors. Key contributions are reviewed and future research lines are proposed.

Keywords: tax perception, tax complexity, tax salience, tax incidence, behavioral economics, experimental economics.

"In this world nothing can be said to be certain, except death and taxes".
Benjamin Franklin

1. Introduction

Tax incidence is one of the most fundamental issues in public economics. It concerns the economic burden of a tax. A basic prin-

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ciple in public finance is tax incidence equivalence (well known as Liability Side Equivalence Principle). This principle holds that the burden of a unit tax on buyers or sellers is independent of who actually pays the tax. Thus, the relative tax burden depends solely on the relative elasticities of supply and demand. Moreover, neoclassical economic theory assumes an individual behavior model in which subjects act *as if* they have to fully optimize with changes in tax policies by correctly processing information in their possession (Harberger, 1962). Another fundamental tenet of this classical model is that individual preferences are time consistent, and are influenced only by the payoff that one could earn. Basically, the external environment or the manner in which decisions are made will not affect subjects' behaviors.

However relevant, this theory has revealed a number of limitations over the years. Several scholars (e.g. Biswas et al., 1993, Krishna et al., 2002) argue, for instance, that differences in the price *framing* (i.e. how the offer price is communicated to the subject) might induce subjects to systematically deviate from the neoclassical economic theory's expected results, which would predict that subjects' response to equivalent price cuts should not depend on how the price cut is presented/framed. There is vast empirical evidence indicating that the price framing effect is a ubiquitous phenomenon documented in many fields of investigation, such as medical and clinical decisions, perceptual judgments, responses to social dilemmas, bargaining behaviors, auditing evaluations, etc. (Levin et al., 1998).

The idea that underlies price-framing theory translates well into tax incidence theory. For instance, tax-inclusive prices and tax-exclusive prices could be conceived as alternative *framing* which ultimately could lead to price misperception. In fact, individuals could not perceive the exact burden of a tax when it is not salient[1] (as it could be in the case of a tax-exclusive price).

Moving from these considerations, in this survey we first provide a general overview on tax incidence theory and tax shifting patterns. Then, we discuss some important behavioral features that have emerged in tax incidence empirical literature (e.g. tax salience, perception of marginal tax rates, tax complexity and

[1] Chetty et al. define the salience of a tax as "the simplicity of calculating the gross-of-tax price of a good" (2007: p. 1) in terms of the visibility of the tax-inclusive price.

institutional relevance). Finally, we present some concluding remarks showing new directions of empirical research.

2. A baseline model to understand tax incidence

Preliminarily, it is important to emphasize a peculiar characteristic stressed in neoclassical economic literature: the person who has to legally pay tax may not be the person who bears the real tax burden. Building on this idea, Fullerton and Metcalf (2002) distinguish between *economic incidence* and *statutory incidence*, thus suggesting that the economic incidence of a tax is independent of the statutory incidence.

This difference may be caused by changes in behavior that affect equilibrium prices. Generally speaking, the introduction of taxes or changes in the combination of taxes alters an economy's equilibrium. For example, changes in goods' prices or factors' costs can be altered by taxes and, thus, lead to a *tax shifting* phenomenon. There are many shifting patterns; however, to keep it simple we shall refer to forward and backward tax shifts. In the first case, the consumer bears the tax burden because of a rise in the commodity price by the amount of the tax. In the second case, if the commodity price remains unchanged, the producer's revenue would fall by the tax amount as it is passed backward onto him/herself.

We shall now present a baseline partial-equilibrium model that, in spite of its simplicity, will allow us to start drawing some fundamental conclusions on tax incidence. Following Kotlikoff and Summers (1987), we shall consider an excise tax on a general commodity. As known, equilibrium is achieved at the intersection between demand and supply, so:

$$D(p) = S(p) \tag{1}$$

Considering the introduction of an excise tax τ collected from the buyer, the new equilibrium will be:

$$D(p' + \tau) = S(p') \tag{2}$$

and with tax collected from the seller:

$$D(p'') = S(p'' - \tau) \tag{3}$$

As reported by Kotlikoff and Summers, "the price paid by consumers and the net of tax receipts of producers does not depend on which side of the market the tax is levied, […]. This principle […] carries over to much more general contexts and underlies the general equilibrium tax equivalence results" (1987: p. 1046). Now, to verify the incidence of this type of tax, it is necessary to differentiate (2):

$$\frac{dp}{d\tau} = \frac{D\prime}{S' - D\prime} \tag{4}$$

that with simple calculations can be reduced to:

$$\frac{dp}{d\tau} = \frac{\eta_D}{\eta_S - \eta_D} \tag{5}$$

where indicates the elasticity of demand and indicates the elasticity of supply. Hence, the introduction of a small tax brings about changes in both producers' and consumers' surplus. The change in the consumers' surplus equals the change in the consumers' price multiplied by the initial quantity demanded, while the change in the producers' surplus equals the change in the producers' price multiplied by the initial quantity supplied:

$$\frac{dC_S}{d\tau} = -\frac{\eta_S D(p)}{\eta_S - \eta_D} \tag{6}$$

and

$$\frac{dP_S}{d\tau} = \frac{\eta_D S(p)}{\eta_S - \eta_D} \tag{7}$$

where C_S and P_S are respectively consumers' and producers' surpluses.

From these outcomes, we can infer another important principle of the tax incidence theory: inelastic supply and demand are intended to bear the whole burden of a tax. Hence, with a completely inelastic demand and elastic supply, consumers bear the entire burden. In contrast, with inelastic supply and elastic demand, the entire tax will be borne by suppliers. Hence, assuming, for instance, that the long run supply curve is horizontal, prices would increase by the exact amount of the tax. Conversely, if the

long run supply curve is upward sloped, prices would increase by less than the tax amount.

Along responsiveness to supply and demand, however, there are several alternative explanations to tax shifting patterns. Early studies in this field focused largely on the relevance of market structure (Seade, 1985; Stern, 1987 and Delipalla and Keen, 1992)[2]. Subsequently, behavioral and experimental economists focused on salience, perception, and complexity issues. In the following section we shall address all these issues, focusing on the most recent developments in the literature.

3. Tax incidence and behavioral issues

As discussed in section 2, traditionally tax incidence studies were based primarily on a model of consumers' behavior. The underlying hypothesis being that, in their daily choices, consumers act *as if* they have to maximize a utility function by processing information already collected, and in their possession. Moreover, neoclassical economic theory assumes that individual preferences are time consistent, and influenced only by the payoff that one could earn (DellaVigna, 2009). In essence, the external environment or the manner in which the decision is made will not affect consumer behavior. Several prominent scholars, however, have pointed out how this theory has a number of limitations, especially when tested against reality. In the laboratory, individuals are time inconsistent (Thaler, 1981), show a concern for the welfare of others (Charness and Rabin, 2002), and exhibit an attitude toward risk that depends on framing and reference points (Kahneman and Tversky, 1979). Moreover, individuals violate rational expectation by overestimating their own skills (Camerer and Lovallo, 1999) and are affected by transient emotions in their decisions (Loewenstein and Lerner, 2003). Therefore, the simple pursuit of utility maximization is an oversimplification of the consumption phenomenon, as it is assumed that consumers act in mechanical and perfectly predictable ways. Now, given that the traditional partial equilibrium analysis of perfect competition focuses on firms' behavior, consumers' behavior is characterized

[2] See also Besley (1989) and Kats and Rosen (1985).

by simply introducing a demand function. This approach is focused mainly on the study and analysis of market mechanisms that lead to the formation and the determination of prices. Consequently, a consumer-behavior analysis is crucial to demonstrate the validity and functioning of any market model based on perfect competition.

As discussed earlier, among competing theories countering this neoclassical approach, the theory of *price framing* (Biswas et al., 1993, Krishna et al., 2002) has always been at the core of marketing policies; the objective is to present prices in order to minimize the perceived burden of all expenses. It is based on the assumption that consumer behavior deviates systematically from what is preached by the standard theory of demand – responding, for instance, to equivalent price cuts, in ways that depend significantly on how the price cut is presented (e.g. in percentage or dollar terms). Moreover, there exists wide empirical evidence indicating that this is a ubiquitous phenomenon documented in many fields of investigation such as medical and clinical decisions, perceptual judgments, responses to social dilemmas, bargaining behaviors, auditing evaluations, etc...[3]. In a similar fashion, individuals cannot correctly perceive the effective tax burden, whereas neoclassical theoretical literature is mainly based on the assumption that the individual perceives the exact tax burden. As discussed below, recent studies have disproved this assumption, revealing in some cases large differences between personal estimates and the actual amount of the tax burden. We shall now define the 'perceived tax burden' as the tax burden that an individual estimates explicitly or implicitly when he/she is called upon to make an economic decision on, for example, labor supply or asset allocation, or when voting in elections. This definition will prove to be useful in what follows, where key behavioral features (associated with tax salience, tax perception, tax complexity and the market structure) that emerge in tax incidence empirical literature will be addressed.

3.1 Tax salience

Tax salience and the implications of tax perception was firstly acknowledged by John Stuart Mill (1848) who stated that:

[3] See Levin, Schneider and Gaeth (1998) for a useful review of these studies.

"Perhaps [...] the money which [the taxpayer] is required to pay directly out of his pocket is the only taxation which he is quite sure that he pays at all. [...] If all taxes were direct, taxation would be much more perceived than at present; and there would be a security which now there is not, for economy in the public expenditure".

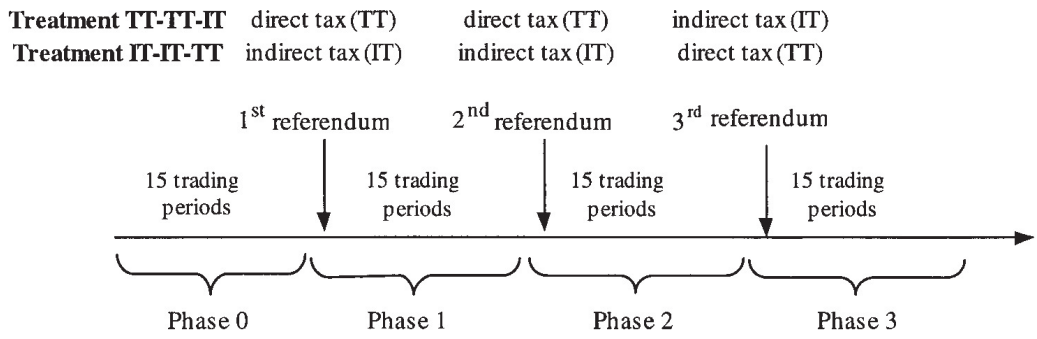
On the basis of Mill's intuition that stated the lower salience of an indirect tax, Chetty et al. (2009) showed how individuals in their purchasing activities are not aware of the tax burden imposed. They conduct a field experiment in a grocery store where they publish the tax-inclusive price for 750 products subject to sales tax. Normally, in this store, prices posted on the shelf exclude sales tax of 7.375%. If the good is subject to sales tax (cosmetics, hair care accessories and deodorants), it is added to the bill only at the checkout. After showing the tax-inclusive price below the original pre-tax price tag for a three-week period, the register data analysis revealed that this led to a reduction in demand for these products by 8% compared to control items and nearby control stores. They therefore conclude that, by showing prices with tax and without tax, the consumer is put in the position to properly assess the total price of the product (tax inclusive). This clearly indicates that indirect taxes, which are only applied at the checkout, are less salient.

In an earlier paper, Sausgruber and Tyran (2005) investigated whether the incorrect perception of the tax can translate into distorted fiscal choices by using a referendum mechanism. This tax misperception can be traced to the so-called phenomenon of *fiscal illusion*, which more generally suggests that, when government revenues are not completely transparent or are not fully perceived by taxpayers, the cost of government is seen to be less expensive than it actually is. Since some or all taxpayers benefit from government expenditures from these unobserved or hidden revenues, the public's appetite for government expenditures increases, thus providing politicians an incentive to expand the size of government. In this case, *fiscal illusion* arises when the relative invisibility of indirect taxes is compared to more visible direct taxes. Taxpayers may systematically underestimate the tax burden from indirect taxes compared to direct taxes, because indirect taxes are incorporated into the prices of goods. The experiment consists of two treatments in which subjects first participate in a competitive market as buyers, while sellers are computerized.

Thus, in this market, participants can earn income from trade activities. In both treatments, subjects are given the opportunity to express a vote on a proposal to tax market transactions and then redistribute revenue among the participants. The tax regime chosen will be implemented only if it receives a positive vote and will be rejected otherwise. The two treatments differ in the sequence of tax regimes. In the Transparent Tax (TT) treatment, participants have the option of implementing a tax system with a direct tax, where the buyer is to be taxed. In the Intransparent Tax (IT) treatment, an indirect tax system is applied where the tax burden is placed on the sellers. The sequence of treatments is reported in Figure 1.

Each treatment consists of four phases and each phase consists of 15 trading periods. After the first phase without taxation, subjects have to vote on a proposal to tax market transactions and then redistribute the tax revenue among participants (public good) as mentioned above. If participants reject this proposal, no tax will be imposed and everything will work as in the first phase (without taxation). The experiment included different tax settings that prevent the direct tax being transferred to the sellers, whereas the indirect tax could be transferred completely to the buyers (unbeknownst to them). Then buyers would bear the entire tax burden so that both treatments are identical in economic terms. The acceptance of the proposal in all cases resulted in a reduction of participants' net income, as buyers and sellers participated in equal parts accessing the public funds provided (through redis-

Figure 1 - Sequence of voting and trading.



Source: Sausgruber, R. and J.R. Tyran (2005), p. 47.

tribution). As noted by the authors, it is clear that the vote cast for the tax introduction would be irrational, given that buyers' share of tax revenue is always lower than the tax that buyers have to bear. Particularly, in the treatment TT-TT-IT (treatment A) participants vote on a referendum to finance redistribution via a direct tax in phases 1 and 2, followed by an indirect tax in phase 3. In contrast, in the treatment IT-IT-TT (treatment B) the first and second referendum concerns the application of an indirect tax followed by a direct tax. The treatment sequence has been designed to shed light on several behavioral aspects, which are summarized hereafter.

- The comparison of the first phase across the two treatments has been used to detect the so-called *fiscal illusion*. In fact, if in the first referendum of treatment A, the first TT subjects reject the introduction of direct taxation in nine out of ten cases, then this does not happen in treatment B on the first IT where the subjects choose an indirect tax system in nine out of ten cases[4].
- The comparison between the first and the second phase within the same treatment allowed evaluating a possible learning effect: from the second referendum, the authors register a reduction over time in the number of participants who vote for the proposal with their expectations improving in general.
- The comparison between the first and the third phase between the various treatments allowed highlighting the transfer learning[5].

As a general conclusion of this study, it was shown that subjects who are experienced with one tax regime make better decisions in the other tax regime than subjects without such experience. Therefore the direct tax regime leads to correct tax perception. This discovery provides evidence in favor of the existence of the 'fiscal illusion'. Clearly a certain measure of misperception may persist even if it is intended to decrease. We can then infer an

[4] Later, through the use of a questionnaire, the authors note that 23% of respondents expect a benefit from direct implementation (55% in the case of indirect taxation arrangements), whereas 30% do not expect any tax shifting in the direct treatment.

[5] Transfer learning is the ability of subjects to take what has been learned in one economic environment and to generalize it to related environments (Cooper and Kagel, 2003).

important consideration: if individuals have the opportunity to learn, they can properly assess their tax burden.

Differently from the cases outlined above, Ruffle (2005) conducts an experiment in which participants are led to exchange a good in a *pit market*[6]. This analysis involves a tax implementation either on buyers or on sellers after some tax-free periods. Subsequently, there are two further treatments in which buyers and sellers obtain a subsidy. From a theoretical standpoint, the tax burden and the relief subsidy depend on the elasticity of supply and demand. Thus, the introduction of a tax or the granting of a subsidy leads to a new equilibrium. The authors note that there is a substantial difference between the price variance in subsidy treatment and the variance of the tax treatment. In particular the subsidy treatment has greater price heterogeneity. This reveals a lack of experience by subjects aided by subsidy compared to what happens to subjects in the tax treatment. However, it has been shown that, in general, the variance decreases over several periods proving the existence of a learning effect on individuals.

3.2 Perception of marginal tax rates

Along with tax salience, several scholars have investigated whether individuals include the marginal income tax rate in their decision-making processes[7]. Fochmann et al. (2010) conducted a comprehensive survey of the literature, pinpointing at some key results. Table 1 reports survey studies analyzed and classified according to the perception of individual marginal tax rates.

The research question that is common to all these studies is: "if you earn an additional amount of money, how much do you

[6] A "pit market" can be defined as a market in which trade activities among participants are not conducted anonymously. That is to say that every person is free to choose his/her business partner who does not remain anonymous during the negotiation.

[7] This is the amount of tax paid on an additional dollar of income. The marginal tax rate for an individual will increase as income rises. This method of taxation aims to fairly tax individuals based upon their earnings, with low-income earners being taxed at a lower rate than higher income earners. Under a marginal tax rate, taxpayers are most often divided into tax brackets or ranges, which determine which rate taxable income is taxed at. As income increases, what is earned will be taxed at a higher rate than your first dollar earned. While many believe this is the most equitable method of taxation, many others believe this discourages business investment by removing the incentive to work harder.

Tab. 1 - Perception of individual marginal tax rate (surveys studies).

Authors	Country	Results
Gensemer et al. (1965)	USA	under- and overvaluation of marginal tax rate
Morgan et al. (1977)		
Lewis (1978)	UK	undervaluation of marginal tax rate
Fujii and Hawley (1988)	USA	
Rupert and Fischer (1995)		overvaluation of marginal tax rate
Hundsdoerfer and Sichtmann (2007)	Germany	

Source: Adapted from Fochmann et al. (2010).

think you would have to pay in income taxes on that additional income?" The most significant finding that emerged from these papers is the presence of a possible misperception in the evaluation of the marginal tax rate. As shown by Fochmann et al. (2010), there are contexts in which the marginal tax rate is undervalued and situations in which it is overvalued. The determinants of these misperceptions are different. The authors argue, for example, that the level and type of education undoubtedly contributes to a misperception of tax rates. Moving along this line of reasoning, the contribution of Konig et al. (1995) is useful when they show that school education has considerable impact on perception. Fochmann et al. (2010) argued that also the type of educational path (and especially the acquisition of economic knowledge) might reflect in a better understanding of the exact marginal tax rates although, as they acknowledge, there is no literature supporting this conjecture[8].

As already mentioned for tax salience, it is easy to assume that, in the course of their own experiences, subjects acquire new knowledge and learn new patterns and concepts designed to influence future evaluation. In this regard, a learning effect was observed in an early study by Lewis (1978) and subsequently by Rupert and Fischer (1995). The earlier investigation noted how

[8] In this regard, Hundsdoerfer and Sichtmann (2007) showed that even physicians are not comfortable with the concept of marginal tax rates.

older subjects are savvier in their choices, while the latter study gave evidence of a correct perception of the tax burden when subjects have acquired some sort of financial experience.

However, if we pay attention to the misperception, results are inconsistent, showing an overestimation in some cases and an underestimation in others. Fochmann et al. (2010) attributed the misperceptions to a different complexity of fiscal policies, sometimes framed in a manner that is not easily understood. However, the authors point out that the framing effect is not the only plausible explanation, as it also happens that the same tax regime may lead to perceptual errors. It is also necessary to consider that in almost all analyses it is not possible to obtain objective tax data on, for example, taxable income. Its assessment is often entrusted to empirical estimates, which always leave some margin for error. However, these estimates are necessary to make a direct comparison between the estimated marginal tax rate and the actual marginal tax rate calculated on the taxable income to fulfill the purpose of the investigation.

Indeed, assumptions at the basis of the investigative models can influence the results. For example, Fuji and Hawley (1988) propose a test on the accuracy of marginal tax-rate perceptions in which they compare responses to a direct inquiry with the computed marginal tax rates. Since the authors did not have data on federal income tax returns, the effective rates were calculated assuming standard deductions. However, these assumptions are ill suited to represent situations in which individuals pursue fraudulent behaviors by declaring higher deductions. The comparison between the actual and marginal tax rates leads to an underestimation of the latter. Another misleading assumption can be the amount of additional income considered in the experiment. In the studies cited, this amount is different and varies from 1 to 1000 currency units. Variations in the amount of additional income can induce a framing effect even in the absence of a large perceptual difference.

Following the categorization proposed by Fochmann et al. (2010), Table 2 reports some econometrics studies that analyze individuals' perceptions of the marginal tax rates[9].

[9] Note that these studies differ from those reported in Table 1, as they address a different research question, i.e. "Do individuals base their decision on how many hours to work on a correctly perceived marginal tax rate?"

Tab. 2 - Perception of individual marginal tax rate (econometric studies).

Authors	Country	Results
Rosen (1976a)	USA (only women)	**correct valuation of marginal tax rate** individuals react rationally to tax rate modification (i.e. labor supply decision are based on net wages)
Rosen (1976b)		
Brannas and Karlsson (1996)	Sweden (only men)	
Konig et al. (1995)	Germany (only women)	**undervaluation of marginal tax rate** labor supply decisions not based on accurate knowledge of individuals' marginal tax rate
Arrazola et al. (2000)	Spain (only men)	**overvaluation of marginal tax rate** labor supply decisions not based on accurate knowledge of individuals' marginal tax rate

Source: Adapted from Fochmann et al. (2010).

Rosen's (1976b) study sets the benchmark for econometric analysis of marginal tax rates for all subsequent investigations[10]. The purpose of this analysis was to provide a labor supply model based on the assumption that the wage was related to the number of worked hours[11]. Specifically, the addressed research question was "Do individuals base their decision on how many hours to work on a correctly perceived marginal tax rate?" In this model, hours of work were the dependent variable, while gross wage and marginal tax rates defined the independent variables. This made it possible to develop a testable model that allowed statistical estimation of a "coefficient of tax perception". In fact, with the help of

[10] Although each survey uses a different method of multivariate statistical analysis, such as OLS, NLLS or ML-estimation.

[11] Unlike previous models of labor supply, it considers the possibility that the wage amount may depend on the number of hours worked. Contrary to much of the literature, the results of Rosen's paper strongly suggest that marginal tax rates do have an important impact on labor force behavior.

cross-sectional data of a sample of white married women, Rosen showed how the marginal tax rate exerts a strong influence on labor market decisions[12].

Along the same lines, Peak and Wilcox (1984) studied the relationship between changes in tax rates and changes in returns. Through the estimation of a fiscal illusion parameter[13], they discovered that adjustments to changes in tax rates are complete, i.e., the pre-tax interest rate rises sufficiently to preserve after-tax returns. In this case, investment decisions are made based on a correct perception of the marginal tax rates. Interestingly, this finding is inconsistent with earlier works by Rosen (1976b), which showed a tax misperception.

Fochmann et al. (2010) pointed out that this inconsistency may be due to multiple factors. On the one hand, complex framing of tax regimes or a lack of transparency in taxation laws can cause misperception. On the other hand, it is plausible that divergent results stem from differences in legislation among countries or reforms that increase tax system complexity over time[14]. The issue of tax complexity is indeed a relevant one. We shall now turn our attention to this very issue.

3.3. Tax system complexity

In section 3.2 we saw how often individuals incur a misperception when asked to evaluate the marginal tax rate. However, the misperception is even more likely to occur when subjects face complex tax frameworks influencing their decision making process. In general there is some vulnerability in the public's understanding of tax systems due to their extreme complexity, which can lead to incorrect judgments and evaluations. In many cases, individuals adopt a heuristic approach in which they choose to focus on salient objects but ignore the most relevant information. This contrasts against the neoclassical economic theory assump-

[12] However, Rosen shows that the cross-sectional correlation between marginal tax rate versus hours worked and wage rates versus work hours is similar, indicating a limited "tax illusion".

[13] The "fiscal illusion" parameter was equal to 1 if the net tax variables are relevant to behavior or 0 if agents disregard taxes altogether.

[14] Also the econometric specification and the independent variables choice criterion to the base of the models may have greatly affected the interpretation of the misperception parameter.

tion of full rationality. In this respect the seminal contribution of Herbert Simon (1955) on "bounded rationality" has shown how individuals deviate, often systematically, from rationality repeatedly showing inconsistent behaviors. The author proposed a model in which individuals face a cost of processing information; hence, they rationally use simplified heuristics to solve complex problems. As reported by Simon, assuming the psychological limits in computational and predictive ability, "the actual human rationality can at best be an extremely crude and simplified approximation to the kind of global rationality that is implied, for example, by game-theoretical models" (Simon, 1955: p. 9). In this way, it is possible that people make predictable mistakes when estimating tax burden or when assessing the impact of public finance measures; areas of considerable complexity[15].

As noted by Fochmann (2010), the vast majority of studies on tax systems reach similar findings, suggesting that the greater the complexity of the tax system (or tax), the lower the quality of subjects' judgments and accuracy of decision. Moreover, taking a broader perspective, it is easy to assume that tax complexity also affects welfare policies. As we know, these are directed to increase revenue more equitably and efficiently through some well-defined rules on the basis of optimal taxation theory (Auerbach, 1985). However, as discussed above, these rules may be perceived differently and the welfare objectives depend on how individuals respond to taxes. This means that the market's efficiency will be influenced by tax systems' complexity and transparency. This clearly emerges in the experiment by Boylan and Frischmann (2006) where they conclude that tax law complexity can have a negative impact on investors' profits. The experiment consisted of two treatments: the first had a simple tax regime while the second constituted a more complex system. Participants in both treatments produced profits thanks to some trade activities. Then the income would be invested and taxed according to two different regimes. The former used a flat rate of 40%, independent of the respective gain level, whereas the latter used a flat rate of 15% plus a negative or positive tax payment, which depended on the pretax gain. Clearly the treatments were equivalent because they had the same tax burden with an effective rate of 40%. However, the different settings

[15] For a comprehensive literature review on this topic see Fochmann (2010).

in the second, more complex, treatment caused market inefficiencies with prices and quantities above market equilibrium. Also, in this case, a learning effect was observed given that the differences between the two treatments faded away over time.

De Bartolome (1995) investigated the type of rate used by individuals in marginal economic decisions. The interesting finding is that many individuals use the average rate as if it were the marginal tax rate. Through a laboratory experiment, the author shows that many MBA students confuse the average rate with the marginal rate when they have to invest 1$ in a taxable or non-taxable project. The experimental design involves a change in the tax scales: in the first form the tax burden is expressed in absolute terms (with no rate), while in the second form the tax regime is declared verbally with explicit indication of the rate. Logically, it is the same progressive tax scale appropriately modified for the analysis' purpose. In the second form, the tax scale leads individuals to use the average tax rate rather than the marginal rate. This is due solely to the tax scale presentation. In fact, almost all individuals resort to using the marginal rate when it is explicitly mentioned in the tax table. In a similar way, Rupert and Wright (1998) use four different configurations of the tax scale to produce the framing effect. Here the greater or lesser visibility of marginal tax rates significantly influences investment decisions.

In a subsequent paper, Rupert et al. (2003) reproduced the tax system's complexity through a unique combination of rules on the limitation of possible tax deductions. In essence, more limitations on deductions involve greater complexity of the fiscal system while always maintaining the equivalence of the marginal rate (identical in all treatments). As it was shown, complex systems lead individuals towards a greater misperception and to formulate an incorrect estimate of effective marginal tax rates. Indeed, in more complex treatments, the number of individuals who chose the optimal investment drastically decreased, because the subjects did not adjust their estimates (taking into account the limitations) and underestimated the true marginal tax rates.

Blaufus and Ortlieb (2009) considered employees' decisions concerning company pension plans. In this case the complexity measure is given by the adaptation costs that individuals have to bear in order to understand the tax regime. The authors implemented a structure with constantly changing length of tax in-

structions, number of technical terms, arithmetic operations, etc. Although it has been shown that many people ignore after-tax returns in the presence of a simple tax regime (where it is possible to rely on accredited assessments of rating agencies or similar organizations), Blaufus and Ortlieb's study showed that, with high tax complexity, only a small fraction of subjects based their decisions on after-tax returns.

3.4. Institutions' relevance to tax incidence analysis

We saw in section 2 that incidence is independent of which side of the market it is levied. Therefore assigning legal liability to pay tax should not affect tax incidence in the long run. However, existing literature has not paid due attention to the potential influence the type of market institution has on tax incidence. Effectively, there are many different types of markets, each of which has different properties and mechanisms for determining the price and the quantity traded between sellers and buyers. It is plausible that different market configurations or arbitrary combinations of their properties lead to different incidence results.

This insight is the basis of the work conducted by Cox et al. (2012). Their research questions are essentially two: (1) Is tax incidence independent of the assignment of the liability to pay tax in experimental markets? (2) Is tax incidence independent of the market institution in experimental markets? In a laboratory experiment the authors compare two different market institutions: a double-auction market (DA) and a posted-offer market (PO). These markets seem particularly suitable for the investigation's purpose. On the one hand, the DA markets represent a widespread reality mainly through stock exchanges like the New York Stock Exchange and other futures markets. Many experiments give evidence of their rapid convergence to competitive equilibrium reaching Pareto efficiency in resource allocation. In experimental DA markets, buyers and sellers are free to declare a price quote for one unit of the fictitious commodity within certain time constraints. Each exchange covers a single unit of commodity and happens when one of the parties accepts the price quote proposed by the other party. On the other hand, the PO markets represent the most important market institution worldwide especially in the retail sector. Think of a supermarket or, more generally, any point

of sale. The seller publishes the prices of goods possibly limiting the amount for sale and the buyer decides to buy this good on the basis of a comparison between the prices published by different sellers. However, it has been shown that these markets converge more slowly to competitive equilibrium and produce less efficient allocations than DA markets. The experimental design was specifically aimed to test whether the above-mentioned change of market institution or the assignment of the liability to pay tax may have different results in terms of incidence. The first hypothesis tested is the technical prediction regarding the influence of market institution on tax incidence. For this reason, the authors propose changing the market institution from DA to PO, maintaining the same condition of liability to pay tax. Subsequently, they change the assignment of liability to pay tax from the seller to the buyer, keeping the market institution unchanged.

To test the two hypotheses underlying the research question, the authors resort to a Kolmogorov-Smirnov test performed on two independent samples with pairwise comparisons of the average buyer prices from the four treatments. Experimental investigation showed how both the assignment of the liability to pay tax and the change in market institution have a significant impact on tax incidence, thus confirming their research hypothesis.

Morone and Nemore (2015) conducted a laboratory experiment to test (i) tax salience, and (ii) the independence of the assignment of the liability to pay tax principal, with a between-subjects design in which subjects trade one unit of a fictitious good in a double-auction market as pioneered by Smith (1962). The experimental design consists of nine treatments divided into two groups – ST (salient treatment) and NST (non-salient treatment) – each composed of treatments where the statutory incidence was on the buyers (i.e. tax-on-buyers treatments) and treatments where the statutory incidence was on the sellers (i.e. tax-on-sellers treatments). Particularly, in ST treatments it is assumed that showing a reserve price or a cost value incorporating the excise tax makes it more perceptible and therefore more salient. However, NST values do not include tax and consumers face a cognitive cost of computing the actual reserve price or cost in the presence of a lower tax salience. The definition of two different amounts of the excise tax allows determining whether a higher tax leads to different effects on traders' behaviors, *ceteris paribus*. Contrary

to theoretical predictions, the authors reported evidence of stark differences in average trading prices. In particular, they observe that prices are systematically higher in tax-on-sellers' treatments, thus revealing a plausible tax shifting phenomenon both in ST and NST. Moreover, as in Cox (2012), results seem to confirm that the assignment of liability to pay taxes in competitive markets can produce a statistically significant effect in terms of tax incidence: taxes can be easily shifted on buyers when the assignment of liability to pay is on the seller.

4. Conclusions

In this paper we addressed tax incidence, showing how this fundamental area of enquiry of public economic theory has gained momentum over time attracting the attention of behavioral economists as much as experimentalists. Key behavioral features addressed in the literature investigated the following aspects: tax perception, tax complexity, tax salience, tax incidence and the impact of market structure upon tax related behaviors.

The starting point is the observation that subjects have problems in correctly evaluating their own marginal tax rate. We reviewed interesting laboratory results where individuals are asked to display their computational capacity in valuating marginal tax rates. We identified tax overestimation in some studies and underestimation in others. In any case the computational difficulties seem to be determined by different factors including level and type of education, age and presence of an economic background. Within a broader perspective, experimental literature showed that if tax complexity rises, this has a negative effect on subjects' behavior causing a loss of efficiency. The adoption of heuristics in evaluating and comparing tax structures necessarily means less accurate decisions. On the one hand, concerning tax salience, survey studies reported a certain degree of "fiscal illusion". This means that individuals incur a perceptual bias when facing an indirect tax implementation due to its relatively invisibility compared with direct taxes. On the other hand, experimental studies showed how tax saliences do not affect significantly subjects' behavior. Contrary to theoretical predictions, a stark difference (statistically and economically) in average trading prices was found

if the burden of tax was shifted from buyers onto sellers, thus revealing a plausible tax-shifting phenomenon. Finally, a change in the market institution was shown to have a greater impact on tax incidence than on a change in the assignment of the liability to pay tax.

As a concluding remark, we shall point at how in real life, these are groups, rather than individuals, that take most of this type of decisions. Hence, as a suggestion for future research, it would be useful to study how groups make choices in different tax environments.

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