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WHO PAYS THE TAX?
Theoretical and Empirical Considerations of Tax Incidence

Cecil E. Bohanon and Brandon M. Pizzola

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Mercatus Center
George Mason University
3351 North Fairfax Drive, 4th Floor
Arlington, VA 22201-4433
(703) 993-4930
mercatus.org

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ABOUT THE AUTHOR

Cecil E. Bohanon is a professor of economics at Ball State University. He has published over 30 refereed professional articles, notes, and comments and over 100 popular articles, policy monographs, and newspaper editorials. His research interests include public choice, applied microeconomics, and economic education.

Brandon M. Pizzola is an MA Fellow at the Mercatus Center. He is a second-year MA student in the Department of Economics at George Mason University. He received his undergaduate degree from the College of William & Mary.

ABSTRACT

THE QUESTION OF who pays a tax has a discernible answer that need not be shrouded in technical mystery. This paper offers those who have little or no formal exposure to economics a tutorial in the economics of tax incidence. The analysis begins by considering a simple market for butter in a provincial town in France. A tax is placed on butter and its impact on both buyers and sellers is examined. A number of general principles of tax incidence are derived. The paper then examines three taxes used in the United States. Evidence as to the incidence of each tax is presented. The empirical analysis is broadly consistent with the theoretical predictions. The upshot is that a bit of basic economic analysis coupled with some common sense will take the untrained analyst a long way in making reliable predictions as to tax incidence.

JEL code: H2

I. INTRODUCTION

Of the 44 states that made budget predictions for fiscal year 2012, all anticipate budget shortfalls ranging from 2 percent in Indiana to over 45 percent in Nevada.[1] Moreover, the federal government is currently running a budget deficit estimated to be 8.7 percent of U.S. GDP.[2]

As a result of this fiscal crisis, legislators will likely consider tax increases in future sessions. Such proposals will inevitably be debated, and an important component of these debates will be who bears the burden of the tax increase. Unfortunately, which party ultimately bears the burden of a tax can be a source of much confusion and misstatement. The purpose of this paper is to outline the basic principles of what economists call tax incidence.

A simple way of thinking about tax incidence is to consider the following conceptual exercise. Suppose a $1 tax is imposed on the sale of butter at the retail level and it is the retail outlet's responsibility to remit the tax revenues to the government. If the price consumers pay for butter rises by a full dollar, then the burden—the incidence of the tax—is fully borne by consumers. In this case, although the retailer incurs the statutory incidence of the tax, it is able to shift forward the full economic incidence of the tax to consumers.

If, on the other hand, the price rises by less than $1, then someone other than the consumer must pay part of the tax. This tax revenue could come from retailers or from someone in the butter supply chain in the form of a reduction in their compensation. The retailer may shift backward part or all of the tax burden to the butter wholesaler, the butter manufacturer, the dairy farmer, or someone else in the production process.

The entity with the obligation to remit the tax revenues to the taxing authority may not be the entity who pays the tax. In other words, the statutory incidence is not necessarily the same as the economic incidence. This observation is important because the general public and policymakers often assume that the statutory incidence and the economic incidence are the same. What determines who pays the tax?

1. "State Tax Revenues Rebound," *Wall Street Journal*, May 24, 2011, http://s.wsj.net/public/resoures/documents/st_STATEBUDGET100414_20100414.html.
2. "Economic and Financial Indicators," *Economist*, February 18, 2012, 92.

The side of the market with participants least able to adjust to a price change bears most of the tax. This point is the central theme of this essay.

A recent political controversy in Minnesota illustrates the problem. In an attempt to balance the state budget, legislators proposed a package of tax increases that included a surtax on lender income from credit card balances.[3] The proposed legislation would have imposed a tax "at the rate of 30 percent on any income attributable to interest collected from the portion of an annual percentage rate that exceeds 15 percent on [credit card balances and] transactions."[4] The Minnesota Department of Revenue estimated the tax would yield $118.9 million in the first year.[5]

The bill imposes the statutory burden of the tax on those credit card lenders who charge an annual rate of interest in excess of 15 percent. As most credit card issuers are banks, it seems the bill's intent is to balance the state budget by delivering a blow to rich banks that gouge poor consumers. Given that the credit card tax is buried in a larger tax package and is accompanied by public pronouncements that it is a tax on banks, the average voter might believe the incidence would indeed fall on banks. But even a cursory appeal to economics reveals a different story.

Suppose the hypothetical XYZ bank charges Minnesotan John Doe a rate of 21 percent on his unpaid credit card balance. Doe has an average annual balance of $10,000, yielding the bank $2,100 in income. Under the bill, the bank pays the state $180 in taxes.[6] However, what prevents the bank from simply raising the rate it charges Doe to make up for the tax or from canceling Doe's credit card? XYZ has many alternatives to lending to Doe. The high interest rate Doe pays indicates he has few alternatives to borrowing from XYZ. Thus, consumers would bear the actual burden of the tax although banks would bear the statutory incidence.

And just who are these credit card consumers? St. Thomas University economist John Spry's examination of the proposed tax concludes that "Minnesota's proposed thirty percent surtax on consumer interest in excess of fifteen percent would create a highly regressive tax."[7] Specifically, "twenty percent of the new tax would be paid

3. Eric Ostermeier, "Pawlenty Delivers on Veto Pledge; Override Season Opens," *Smart Politics*, May 10, 2009, http://blog.lib.umn.edu/cspg/smartpolitics/2009/05/pawlenty_delivers_on_veto_pled.php.
4. "H.F. No. 885, Conference Committee Report - 86th Legislative Session (2009–2010)," Minnesota House of Representatives, May 8, 2009, https://www.revisor.mn.gov/bin/bldbill.php?bill=ccrhf0885B.html&session=ls86.
5. "Analysis of S.F. 507 (Ortman) As Proposed to be Amended (SCS0507A-3)," Minnesota Department of Revenue, http://taxes.state.mn.us/legal_policy/Documents/revenue_analysis_2009_2010_senate_files_sf0507_hf0716__2.pdf, accessed February 22, 2012.
6. Thirty percent of the amount over $1,500 is calculated as $600 x 0.3 = $180.
7. John A. Spry, "The Regressivity of a Tax on Consumer Interest Exceeding Fifteen Percent" (working paper, Faculty of Finance, University of St. Thomas, Minneapolis, 2010), http://ir.stthomas.edu/cgi/viewcontent.cgi?article=1000&context=ocbfincwp.

by Minnesota families with the lowest 10 percent of income. Thirty-seven percent of the tax would be paid by families with the lowest 20 percent of income."[8]

Minnesota did not adopt the tax. The plan was derailed after a sponsor of the bill stated, "I don't know what the consequences will be."[9] Although the poorly designed tax did not inflict damage on Minnesota, the experience offers a cautionary tale: The party who is assessed a tax and the party who actually pays a tax are not necessarily the same. But can it be known before a tax is enacted who will actually bear its incidence? Will the retailer always be able to shift a tax burden forward or backwards? Are there general and readily discernible principles of how tax incidence is apportioned, or are policymakers forced to rely on the esoteric modeling of economic experts?

The answer is that the economic incidence of any given tax is generally knowable. Although the detailed split of the tax may require statistical expertise beyond the scope of most policymakers, some very simple principles and a bit of common sense will take one far down the road in understanding how a tax is likely to play out.

To promote an understanding of these principles, this paper offers a simple example that explains the possible ways tax incidence can be apportioned between market participants and what forces determine the apportionment. We then turn our attention to three taxes that are or have been actually imposed in the United States with an eye to what statistical analysis suggests are the actual patterns of tax incidence. In general, the evidence confirms the principles of tax incidence as valid.

II. A SIMPLE EXAMPLE

To drill down to the basics of tax incidence, it is useful to consider a simplified model of exchange where producers and consumers interact directly with one another without the use of intermediaries. Imagine a market for butter in a provincial town in France. Local butter producers bring their wares to townsfolk on regular market days. Local gendarmes (policemen) patrol the market to ensure order, quell disputes, maintain records, and enforce justice.

Given ordinary market conditions, butter is packaged in kilo containers and is priced at 30 francs per kilo. Prices rise somewhat before holidays and feast days and prices fall when excess supplies emerge, but 30 francs remains the typical price. Although the quantity of butter sold varies, it averages around 2,000 kilos per week, as duly recorded by the statistical branch of the gendarmes' office.

Suppose the local authorities are looking for a revenue stream to support some public project that is at best only indirectly related to goods in the local market. After some consideration, a 6-franc tax per kilo of butter is imposed. The ordinance

8. Kim Crockett, "Dayton Claims He Will Tax the Rich. Economist John Spry Says Dayton Would Also Tax the Poor," Minnesota Free Market Institute, October 29, 2010, http://mnfmi.org/2010/10/29/dayton-claims-he-will-tax-the-rich-economist-john-spry-says-dayton-would-also-tax-the-poor/.
9. Spry, "Regressivity of a Tax," 1.

instructs the local gendarmes to collect the tax from butter sellers. Thus, the statutory incidence is imposed on the sellers.

The tax could be split up in an endless number of ways. At one end of the spectrum, sellers may be able to pass all the tax on to buyers by simply raising the price of butter to 36 francs. At the other end of the spectrum, sellers may absorb all the tax, in which case the buyers still pay 30 francs while the sellers receive 24 francs. In between these two extremes are any number of combinations (35-franc buyer price, 29 francs to seller; 34-franc buyer price, 28 francs to seller; etc.) that all imply a *reduced income received by sellers* and an *increased price paid by buyers*. In any case, one can be sure that the tax will drive a wedge of exactly 6 francs between the price the buyer pays and the price the seller receives. In the absence of the extreme cases one can conclude that a tax will *reduce the price received by sellers and increase the price paid by buyers*.

Additional information about both the buyers and sellers is needed to analyze the economic incidence. First, consider buyers. Buyers reduce their use of butter as it becomes dearer and expand their use of butter as it becomes cheaper. How much will consumers substitute out of butter when its price rises? From the buyers' perspective, there are numerous substitutes for butter, such as olive oil or lard, and buyers implicitly weigh the various alternatives when making their butter buying decisions. The amount of substitution depends on both the number and quality of the aforementioned substitutes. As each consumer has a unique set of tastes and preferences, the magnitude of the substitution will vary. Nevertheless, for any price increase there will be some reduction in the quantity of butter purchased by consumers.

The degree to which consumers adjust the quantity purchased when faced with a price change is known in economics as the **price elasticity of demand** for the product. If demand is **elastic** then small increases in price generate large decreases in the quantity of butter consumers buy. Conversely, if demand is inelastic then large increases in price generate small decreases in the quantity of butter consumers buy.

Now, consider producers. As the price of butter declines, producers will reduce the quantity of butter they bring to market and vice versa. How much will butter production decline when its price falls? Sellers have other ways to use their milk and labor if the reward for producing butter declines. Milk can be redirected to cheese or yogurt production and labor can be directed away from butter churning to crafts. The ability and willingness of farm producers to pursue those substitute activities inevitably vary among producers. Nevertheless, for any price decrease there will be some reduction in butter production by farmers as a group.

This degree of responsiveness in producer output to a price change is known in economics as the **price elasticity of supply** for the product. If supply is **elastic,** then a small decrease in price generates large decreases in the quantity of butter produced. Conversely, if supply is **inelastic,** then a large decrease in price generates only a small decrease in the quantity of butter produced.

We now head back to the town market. The gendarmes assess the tax by noting

the amount each vendor sells each day. For every kilo of butter sold, the vendor is liable for 6 francs in tax, consistent with the statutory incidence of the tax being on the sellers. But can the butter sellers pass on this 6-franc cost increase to the buyers? As a starting point, assume that buyers and sellers are responsive to price changes to the same degree. In particular, say that the amount of butter consumers want to buy decreases by 200 kilos for each 3-franc increase in butter prices to buyers, as indicated in table 1a.

TABLE 1A. CONSUMERS' DEMAND FOR BUTTER

Price of butter to consumers per kilo	Kilos of butter consumers want to buy
30 francs	2,000
33 francs	1,800
36 francs	1,600
39 francs	1,400

Also say that the amount of butter sellers will bring to market decreases by 200 kilos for each 3-franc decrease in the price they receive, as table 1b shows:

TABLE 1B. SELLERS' SUPPLY OF BUTTER

Butter income to sellers per kilo	Kilos of butter sellers want to sell
30 francs	2,000
27 francs	1,800
24 francs	1,600
21 francs	1,400

Now consider two extreme cases that give insight as to how the tax will play out: the case where sellers try to pass on all 6 francs of tax to the buyers and the case where sellers make no attempt to pass on any of the 6-franc tax to the buyers.

The sellers want to shift all 6 francs of the tax forward.[10] If successful, the sellers are unaffected by the tax as they continue to net 30 francs per kilo and will offer 2,000 kilos of butter to the market. Let all the sellers raise the price of a kilo of butter from 30 francs to 36 francs. But at 36 francs, buyers want something less than 2,000 kilos of butter; indeed, they demand only 1,600 kilos of butter (see table 1a). Some butter sellers will not be able to sell all the butter they want to sell, so there will be a surplus of butter. If the market price is freely determined, such a surplus inevitably leads to downward pressure on butter prices. The 36-franc price is not sustainable.

In contrast, if sellers are convinced they cannot pass any of the tax on to buyers, they will keep the buyers' price of butter at 30 francs. The sellers receive 24 francs per kilo of butter net of the tax. But under these conditions, sellers reduce

10. Another option would be to shift the tax backward, although in this example, the butter sellers are both the producers and the marketers, so it is not clear onto whom they would shift the tax. It will simply be assumed that no backward shifting is possible.

the amount of butter they want to sell to 1,600 kilos (see table 1b). Buyers still want 2,000 kilos of butter at the 30-franc price. The ensuing shortage generates upward pressure on the price charged to consumers. A 30-franc price is also not sustainable.

The price must settle somewhere above 30 francs and below 36. In this case, the response of buyers and sellers to a 3-franc change in the price of butter is equal. Buyers are willing to buy 1,800 kilos of butter at a price of 33 francs, while producers are willing to sell 1,800 kilos of butter when receiving 27 francs post-tax. This price structure, and this price structure alone, is consistent with buyers and sellers wanting to buy and sell an identical quantity of butter. The free interaction in the market driven by underlying elasticities of supply and demand splits the tax burden 50–50.

The popular idea that producers are able to shift forward the tax to consumers is simply not true. The tax is shared; it reduces the price received by sellers and increases the price paid by buyers.

Does economic analysis suggest that tax incidence is routinely split 50–50? The answer is no; this result is the byproduct of an instructive but extremely rare example where supply elasticity and demand elasticity are equal.

The relative elasticity of supply and demand determines how a tax is split between buyers and sellers.[11] (The details of this interaction will be explored in the next section.) The crucial policy implication that deserves constant repeating is that this split has nothing to do with either the statutory incidence of the tax or the intent of the authorities who impose the tax. The body that imposed the butter tax may have intended to burden only consumers, or only producers, but its desires on the matter are irrelevant to the actual incidence of the tax. Nor is the tax incidence the result of a negotiated process between buyers and sellers. Rather, the underlying responsiveness of buyers and sellers determines the split. Tax incidence is a market-driven phenomenon that defies politicization.

11. The analysis of this paper follows the general economic convention that actors accurately calculate price data; that is, they do not make mistakes in a systematic way. There is some evidence, both theoretical and empirical, that certain calculation errors may be systematic and persistent. See Raj Chetty, "The Simple Economics of Salience and Taxation" (NBER Working Paper no. 15246, Washington, DC, 2009), http://www.nber.org/papers/w15246. If actual reporting requirements lead to systematic errors by one or both sides of the market, tax incidence can certainly be affected. In a similar vein, the costs associated with the administration of any tax imply that statutory incidence "matters" in the sense that which side of the market is legally liable for the tax remission has implications for the total resource costs of the tax. See John Mikesell, "Administration and the Public Revenue System: A View of Tax Administration," *Public Administration Review* 34, no. 6 (1974): 615–624. Whether either of these two considerations overwhelms the economic implications of tax incidence is an empirical matter that must be discerned on a case-by-case basis.

III. RELATIVE SUPPLY AND DEMAND ELASTICITIES DETERMINE ECONOMIC INCIDENCE

The framework developed in the previous section calls for more analysis. What if elasticities of supply and demand are not equal? Change the assumptions and suppose that it is easy for farmers to switch from butter production to cheese production. Consequently, supply is much more elastic than in the previous example, but let demand elasticity be as before.

The new supply elasticity assumption implies that when butter prices fall by a small amount, there is a large reduction in the amount of butter sellers bring to market. As the amount of butter available declines, buyers who are less responsive to price increases than sellers are to price decreases absorb most of the tax as a price increase. It is buyers who pay most of the tax because sellers are more willing to exit the market than buyers.

Suppose, in contrast, that buyers of butter just aren't that attached to butter use: their demand for butter is quite elastic but let supply elasticity be as in the original case. When butter prices rise by a small amount, there is a large reduction in butter purchases. As the amount of butter bought declines, the sellers who are less responsive to price decreases than the buyers are to price increases absorb most of the tax as a price decrease. It is sellers who pay most of the tax because buyers are more willing to leave the market than sellers.

What if both butter buyers and butter sellers are quite responsive to price changes? How will the tax be split up? The answer, again, lies in the relative responsiveness. If demand is very elastic but supply is even *more* elastic, then buyers pay most of the tax. This insight leads to a number of special cases where one side of the market pays all the tax.

Consider the situation in which there is a threshold price necessary to induce sellers to bring any butter to market. All butter producers can and will switch from butter production to cheese production if the threshold price for butter is not met. Once the price is met, however, sellers will offer as much butter as buyers want at that price. In economic terms, butter supply is **infinitely elastic**.

Suppose this threshold price is 30 francs per kilo. There is no butter market if the net price received by sellers is below 30 francs. Now impose a 6-franc tax. As long as buyers are willing to buy some positive quantity of butter at a 36-franc price, the 36-franc price will prevail. All the tax is passed on to the buyers.

In another specific case, producers will be able to shift none of the tax to consumers. Consider the situation, where independent of price, producers will always bring a fixed quantity of butter to market. In economic terms, butter supply is **perfectly inelastic**.

Before the tax, sellers bring 2,000 kilos to market and the price is 30 francs. The imposition of the 6-franc tax has no effect on the amount of butter sellers bring to market. Buyers, however, will only buy 2,000 kilos if the price remains at 30 francs. Sellers can only offer a 30-franc market price, implying that they accept a 24-franc

net price for their butter—which, of course, implies that sellers are absorbing all of the tax.[12]

The major points to take away from this example are as follows:

- The party who actually remits the tax revenue to the government has little to do with who actually bears the tax burden. In economic jargon, statutory incidence is not the same as economic incidence.
- The party who actually remits the tax revenue to the government cannot, as a matter of course, shift the tax burden forward or backward.
- The actual split of the tax burden is not determined by the will of the taxing authority or by some negotiated process between market participants, but by the market.
- The actual split of the tax burden in the market depends on the relative elasticities of supply and demand (the responsiveness to price by buyers and sellers).
- The side of the market that is less elastic bears more of the tax. The side of the market that is more elastic bears less of the tax.

IV. EXTENSIONS, REFINEMENTS, AND COMPLICATIONS

This core theory of economic incidence is quite standard. But is it all that can be said about the topic? No. The world is often more complicated than a simple economic model indicates. There are numerous qualifications to the major points outlined above. Fortunately, these qualifications are not that difficult to understand and identify. We shall outline two major qualifications.

The Long Run and the Short Run

Economists have long noted that the ability to substitute out of one activity and into another increases with time. A large increase in the price of butter may lead to very little substitution out of butter over a month, but the same price increase will lead to more substitution out of butter if the price increase persists for a year. As butter consumers have more time to seek out and experiment with substitutes for costly butter, they will discover acceptable substitutes. Thus, the demand for butter is more elastic in the long run than in the short run.

A similar proposition holds on the supply side of the market. Over a more extended timeframe, milk producers can successfully seek other markets as the

12. Correspondingly, if demand is infinitely elastic, buyers pay none of the tax; if demand is perfectly inelastic, buyers pay all of the tax. Infinitely elastic or perfectly inelastic demand are likely rarer than their supply-side counterparts.

reward for butter production declines. The supply of butter is thus more elastic in the long run than in the short run.

This simple insight leads to a commonsense proposition about who bears the burden of a tax: it can change over time. A butter tax that is split between producers and consumers in the first few months of its administration may be entirely passed on to consumers in a year's time. The "facts on the ground" of actual producer and consumer responsiveness will vary from industry to industry and will be contingent on the location of the market, its size, and a host of other factors.

General Equilibrium Effects

Most economic analysis focuses on individual markets. A tax on butter is analyzed by considering its impact on butter buyers and butter sellers. Clearly a tax on butter reduces both butter consumption and production, increases the price buyers pay, and reduces the price sellers obtain in most every case. If a tax on butter implies that dairy farmers direct fewer resources to the production of butter, they will likely redirect resources to the production of something else. Is it possible that this redirection of resources inherent in taxation has an impact on prices in other markets? The clear answer is yes.

In many cases when analyzing a tax, one may safely ignore the secondary effects to other markets. If the hundred or so butter producers in our region all redirect a fairly small portion of their resources to a variety of different markets, then the impact on any given market may be so small as to be irrelevant. When these effects are ignored, economists are said to be engaging in partial equilibrium analysis.

However, what if all the butter producers redirect their efforts toward the same market, for example, a particular type of specialty cheese produced only in the region? It may be important and interesting to consider the effect of the butter tax on the cheese market. If these secondary effects are significant, some of the burden of the butter tax will fall on the regional producers of specialty cheese. This more extensive analysis is known as general equilibrium analysis.

General equilibrium analysis is much more complicated than partial equilibrium analysis. Verifying the implications of a general equilibrium approach is nearly impossible. For example, although economists generally agree that the corporate income tax is divided between capital owners, labor, and consumers, they have yet to reach a uniform conclusion as to the detail of the division.[13] A tax on a single item is likely to be much more amenable to a partial equilibrium analysis than is a more complicated tax such as a corporate income tax.

13. See Alan Auerbach, "Who Bears the Corporate Tax? A Review of What We Know," *Tax Policy and the Economy* 20 (2006): 1–40.

V. EVIDENCE FROM EMPIRICAL STUDIES

Economic theory certainly gives insight into real world phenomena. However, theory can and should be compared with actual experience. Do the data show that taxes get split up in a way broadly consistent with economic theory? Generally, yes. This section will present several cases where the evidence convincingly reinforces the conclusions drawn in the previous section.

Federal and State Gasoline Taxes

Gasoline taxes are familiar to motorists, as they are often prominently displayed at the point of sale. Both the federal government and the various state governments impose taxes on gasoline. Most of these taxes are specific amounts per gallon, though a few states impose an additional percentage tax.

Intuition and numerous economic studies suggest that consumer demand for gasoline is quite inelastic, which predicts that most of the burden of a gasoline tax falls on consumers. However, intuition also indicates that the ability of a gasoline wholesaler to avoid a tax depends upon which level of government imposes the tax. If, for example, a small state geographically close to other densely populated states adds to its gasoline tax, gasoline wholesalers are likely to divert much of their product to lower-tax markets. The elasticity of supply is high, and theory suggests most of the tax will be passed on to consumers. Conversely, if the national government were to impose an equivalent tax, gasoline wholesalers have fewer options for diverting their product to lower-tax markets, implying they are likely to bear more of the tax burden than in the case of a state tax.

In a 2004 study, economists Hayley Chouinard and Jeffrey Perloff examined monthly data on inflation-adjusted retail and wholesale gasoline prices for the 48 states and the District of Columbia from March 1989 through June 1997.[14] During that time, both state and federal taxes varied. Using techniques of statistical analysis that control for other factors relevant in determining gasoline prices, the study's conclusions are remarkably consistent with economic theory.

At a federal level, the data suggest "consumers and wholesalers each pay roughly half of the federal specific tax," whereas for a state-imposed tax, typically "consumers bear the full burden." Interestingly, this second result is tempered by the size of the state. It is estimated that a 1-cent increase in the gas tax raises retail prices by 0.75 cents in California but by 0.97 cents in Vermont. This third conclusion comports exactly with what economic intuition would suggest: in a large market such as California, the supply of gasoline is expected to be less elastic than in a small market such as Vermont.

14. Hayley Chouinard and Jeffrey M. Perloff, "Incidence of Federal and State Gasoline Taxes," *Economics Letters* 83 (2004): 55–60.

Payroll Taxes

Another tax quite familiar to most Americans is the Social Security payroll tax. Under current law, a 7.65 percent tax is assessed on employee earnings.[15] A worker who earns $1,000 in a pay period will note on her pay stub that $76.50 is taken out of her gross pay and remitted to the Social Security Administration (SSA). She may be vaguely aware that an additional $76.50 is paid by her employer to the SSA. It is quite common for uninformed observers to believe that this 50–50 apportionment of the accounting of the 15.3 percent payroll tax implies that employees pay half while employers pay half. Does this accounting convention have implications for the economic incidence of the payroll tax?

Consider a case where the demand for butter is elastic compared to supply so that the seller bears most of the tax. The original price of butter is 30 francs per kilo. Let the 6-franc tax lead the buyer to pay 31 francs and the seller to receive 25 francs. Now suppose that sellers customarily issue a receipt upon the sale of butter. Table 2, column A shows what the receipt looks like with the 6-franc tax. The price of butter is 25 francs and the 6-franc tax is added on so that the full price the consumer pays is 31 francs.

Suppose a new law requires that the seller indicate on the receipt that only 3 francs of the 6-franc tax are attributed to the buyer; the other 3 francs must be paid by the seller. Table 2, column B shows how the law would impact the sales receipt for a kilo of butter. The price of butter is listed at 28 francs, and 3 francs are added on as the consumer's tax so that the full price is 31 francs. Sellers are in full compliance with the law and can say with a straight face that they are only passing on 3 francs of the tax to the buyer and paying their share out of the 28 francs they charge. The bottom-line price that buyers pay and sellers receive is unchanged by this reporting requirement, however. The reporting requirement is irrelevant!

TABLE 2. CONSUMER'S BUTTER RECEIPT

A. 6-franc tax on one kilo of butter	B. 6-franc tax on one kilo of butter with reporting requirement that only 3 francs be attributed to the buyer
Price of butter: 25 francs Butter tax: 6 francs Total price: 31 francs	Price of butter: 28 francs Consumer butter Tax: 3 francs Total price: 31 francs

What if the law so confused sellers that they changed the bottom line tax-inclusive price buyers paid? What if they continued to list the pre-tax price as 25 francs and added 3 francs in tax so that the final price to consumers became 28 francs? Such a circumstance could not be sustained. The reduction in the buyer's price

15. As of this writing, the Social Security payroll tax rate has been temporarily reduced to 4.2 percent for employees through the end of 2012 while remaining at 6.2 percent for employers. The Medicare tax rate is 1.45 percent each for employees and employers. The maximum earnings subject to Social Security taxes are $110,100. There is no limitation on taxable earnings for the Medicare tax. See U.S. Social Security Administration, "2012 Social Security Tax Rate and Maximum Taxable Earnings," http://ssa-custhelp.ssa.gov/app/answers/detail/a_id/240/~/2012-social-security-tax-rate-and-maximum-taxable-earnings.

generates an increase in the quantity of butter buyers demand, and the reduction in seller income generates a decrease in the quantity sellers wish to bring to market. The resulting imbalance (shortage) between quantity supplied and quantity demanded leads to price increases until buyers pay 31 francs and sellers receive 26 francs. Again, it is the underlying economic responses that determine the tax split, not accounting conventions.

Apply this principle to the incidence of the payroll tax of 15.3 percent, which is to be split 50–50 between the employee and the employer so that each pays 7.65 percent. A hypothetical worker earns a gross pay of $1,000 which results in take-home pay of $923.50 after the $76.50, tax while the employer pays $1,076.50 to obtain the worker's services. Assume, for simplicity, that this $153.00 tax is the only tax on workers' earnings. Now abolish the 50–50 reporting convention and replace it with a requirement that all $153.00 must be paid by the employer and may not be taken out of the employee's check.

An employer can easily restore the status quo ante by reducing the gross pay from $1,000, to $923.50. Both the worker and the employer are in exactly the same after-tax position as before the new mandated accounting convention; she takes home $923.50 and the employer pays $1,076.50 for her services.[16]

What if the law somehow so confused employers that they increased the amount they paid the workers after taxes? In such a case, workers are getting a better deal for their work effort and the quantity of workers seeking similar employment will rise, while employers will note that the costs of employees are higher and will reduce the number of workers they wish to hire. The ensuing surplus of labor will drive wage compensation down, and market forces will restore equilibrium. Again, the market, not accounting convention, determines how the payroll tax is split between employers and employees.

As noted earlier, a 50–50 split in tax incidence only happens in an extremely rare case where supply elasticity and demand elasticity are equal. Even a superficial examination suggests that this split is not the case for the payroll tax. Consider both the supply and demand for labor. Intuition tells us that the demand for labor is fairly elastic. Labor is in many cases replaceable by capital. For example, if labor is very inexpensive, then a sandwich shop owner can hire multiple workers to make sandwiches. Conversely, if labor is very expensive, then the sandwich shop owner can hire a single worker and buy a sandwich-making machine for the worker to operate.

Consider the supply of labor. Intuition and a host of empirical studies inform us that it is relatively inelastic.[17] Specifically, labor is not generally fungible; workers in an economy are differentiated by the skills and qualifications they possess as well as

16. An astute reader will notice that 15.3 percent of $923.50 is only $141.30. To do an apples-to-apples comparison using a percentage tax is problematic, so the $153.00 tax will be assumed.
17. See Michael P. Keane, "Labor Supply and Taxes: A Survey," *Journal of Economic Literature* 49, no. 4 (2012): 961–1075. Although Keane states that empirical studies indicate the elasticity of labor supply is typically higher than zero, it is still inelastic.

by their spatial distribution. For example, if there were a sudden change in the economy that resulted in a permanent increase in the demand for doctors, then employers would offer doctors higher wages in the hope of attracting doctors from other employment. This change would draw some doctors out of retirement and result in some doctors working longer hours, but the number of doctors and number of hours worked by doctors cannot change much in a short period of time. It takes time for a new set of individuals to gain the skills and qualifications to become doctors.

What do academic studies indicate about the incidence of a payroll tax? The empirical results are strikingly conclusive: "Virtually all applied incidence studies assume that both the employee share and the employer share are borne by the employee (through a fall in the net wage by the full amount of payroll tax). This assumption has been tested and confirmed repeatedly."[18] John Brittain's 1971 article, "The Incidence of Social Security Payroll Taxes," provides the classic example of such a study.[19] In order to isolate the effect of the payroll tax on wages, Brittain employs a cross section of data from 1958 on labor input, value added, and wage rate in 13 industries across 64 countries. After using a number of statistical models, Brittain finds, in accordance with the economic theory presented here, that "the presence of a payroll tax on employers tends to reduce the wage in dollars by roughly the amount of the tax."

Again, a bit of common sense and a basic understanding of elementary economic principles serves one well. Unfortunately, common sense is not so common. A decade or so ago Indiana was looking for ways to replace revenue lost from property tax reforms. The Senate Finance Committee proposed a 1.3 percent tax on the value of business payrolls. The authors of the bill not only ignored common sense and academic research on the incidence of a payroll tax, the language pretended it could revoke economic principles! As if tax incidence could be mandated by legislative fiat, the bill explicitly stated,

> The incidence of the tax shall be solely upon the employer subject to the tax and shall not be transferred directly or indirectly to the employee in any circumstances.[20]

This proposal must rank with the infamous legislation passed by the Indiana House in 1897 mandating that the value of the mathematical term pi be equal to 3.2.[21]

18. Don Fullerton and Gilbert E. Metcalf, "Tax Incidence," in *Handbook of Public Economics*, eds. A. J. Auerbach and M. Feldstein (Amsterdam: Elsevier, 2002), 1787–1872.
19. John A. Brittain, "The Incidence of Social Security Payroll Taxes," *American Economics Review* 61 (1971): 110–123.
20. Indiana Senate Finance Committee Report on House Bill 1004, February 21, 2002, 88, lines 3–5.
21. Neither the pi proposal nor the payroll tax became law. On the 1897 pi bill see Larry DeBoer, "The Indiana Pi Bill, 1897," March 2010, http://www.agecon.purdue.edu/crd/localgov/Topics/Essays/Pi_Bill_Indiana_1897.htm.

The Yacht Tax of 1990

Perhaps the most infamous failure of federal tax policy in modern America was a luxury excise tax passed in 1990 that included a provision for a 10 percent tax on yachts selling for more than $100,000 (the "yacht tax"). While the policy rationale was to raise revenue by taxing the rich, a basic consideration of tax incidence theory would have stopped this legislation in its tracks. As this paper has repeatedly emphasized, the burden of a tax falls on the group least capable of altering its behavior. It is substantially easier for the prospective buyer of a yacht to substitute to any other recreational good or service or to buy a yacht outside the United States than it is for workers who specialize in yacht construction to retool for other lines of employment.

This elastic demand and relatively inelastic supply of luxury yachts resulted in a disastrous divergence of policy rationale and economic principles. Although we are aware of no scholarly study of the yacht tax, there is much anecdotal evidence that the tax led to massive layoffs in the luxury segment of the yacht-building industry. This evidence is corroborated by reports indicating that luxury boat sales collapsed after the enactment of the tax and revived after its repeal.[22] Realizing they had missed the boat, Congress repealed the yacht tax in 1993.

VI. CONCLUSIONS

Popular political and journalistic rhetoric about tax incidence is often inaccurate and misleading. It is all too common to assume that the party that remits the tax payment to the fiscal authority is also the party that bears the tax burden. Economic theory teaches that the forces that determine tax incidence are independent of the whims, desires, and rhetoric of policymakers.

So what does determine tax incidence? Both in theory and as confirmed by a number of empirical studies, the answer lies in the ability of various market participants to adjust to price changes. The side of the market that is least able to adjust to a price change (least elastic) will bear the lion's share of the tax burden. Neither wishes nor good intentions can offset this economic reality.

In a nutshell, when considering how a tax burden is likely to be distributed, an examination of the basic supply and demand theory of price determination combined with an understanding of elasticity and some common-sense intuition will take one far.

22. See Agis Salpukas, "Falling Tax Would Lift All Yachts," *New York Times*, February 7, 1992, http://www.nytimes.com/1992/02/07/business/falling-tax-would-lift-all-yachts.html?src=pm; Penny Singer, "New Luxury Tax Trimming Boat Sales," *New York Times*, July 21, 1991, http://www.nytimes.com/1991/07/21/nyregion/new-luxury-tax-trimming-boat-sales.html?pagewanted=all&src=pm; Bill West, "Congress Should Scuttle Tax on Luxury Boats," *Seattle Times*, January 15, 1992, http://community.seattletimes.nwsource.com/archive/?date=19920115&slug=1470467; and Kwame Holman, "Effects of Repeal of the Federal Luxury Tax on Boats," January 1, 1996, http://www.pbs.org/newshour/bb/government_programs/jan-june96/budget_01-01.html.