The Macroeconomic Effects of Lump-Sum Taxes*

François Geerolf
UCLA

Thomas Grjebine
CEPII†

November 2019

Abstract

This paper measures tax multipliers using the property tax, which is the closest real-world counterpart to a lump-sum tax. This allows us to test for Ricardian equivalence and to isolate the demand-side component of tax multipliers. For identification, we use more than 100 exogenous property tax changes in advanced economies isolated through the narrative record, as well as structural VAR approaches that include more than 1,000 tax changes. We find, using both types of methods—independently—that tax multipliers are between 2 and 3, in line with a growing consensus in the literature. This contradicts Ricardian equivalence, and questions models that predict large tax multipliers only for distortionary tax changes. The effects are persistent, which implies that aggregate demand shocks can have long-term effects.

Keywords: Tax Multipliers, Narrative Approach, Aggregate Demand.
JEL classification: E00, E20, E62, H20.

*We thank Emmanuel Farhi, Francesco Giavazzi, Richard Green, Mathias Hoffmann, Jean Imbs, Etienne Lehmann, Philippe Martin, Thierry Mayer, Valerie Ramey, José Scheinkman, Larry Summers, David Sraer, and seminar and conference participants at various institutions. François Geerolf thanks the UCLA Rosalinde and Arthur Gilbert Program in Real Estate, Finance and Urban Economics for generous funding. An online appendix is available **here**.

†E-mails: fgeerolf@econ.ucla.edu, thomas.grjebine@cepii.fr.

> "Ask an economist about which are the most efficient kinds of taxes, and property taxes will be high up on the list. They distort behaviour less, and are more growth friendly, than taxes on income, employment or even consumption." *(The Economist*, 2013)

A growing consensus in the empirical literature holds that tax multipliers are very large—between 2 and 3—and uniform across a number of countries.[1] However, there is still substantial controversy about the channels through which tax changes operate. Changes in taxes simultaneously impact not only agents' incentives to work, invest, and hire (supply), but also their disposable income (demand). On the theoretical side, neoclassical and New Keynesian models predict large tax multipliers only for distortionary tax changes: Disposable income effects are absent because of Ricardian equivalence. In the empirical literature, economists still debate whether tax cuts operate mainly through supply or demand. For example, Romer and Romer (2010), in their seminal study of tax multipliers in the US, write: "Our results are largely silent concerning whether the output effects operate through incentives and supply behavior or through disposable income and demand stimulus." This is an important question, since policy recommendations differ substantially if tax changes operate mainly through supply or demand. From a supply-side perspective, growth-friendly taxes are those that distort people's behavior less: A lump-sum tax, with everyone paying a fixed amount, is the most efficient. According to Ricardian equivalence, a lump-sum tax should have exactly zero effect on consumption and output.

This paper measures the demand-side component of tax multipliers using the property tax, which is the closest real-world counterpart to a lump-sum tax. We argue that the effects of the property tax can be interpreted in terms of aggregate demand effects that work through changes in disposable income, and not in terms of supply or incentives. Indeed, property taxes are usually considered to be the least distortive of all taxes. For this reason, increases in land taxes have been advocated by economists since at least Smith (1776), Ricardo (1817), and George (1879). For the same reason, increases in property taxes are often recommended by international organizations, in policy discussions, and in the financial press.[2] Raising more revenue through property taxes was also a key recommendation by the *Mirrlees Review* (Adam et al., 2011b), according to which property "can be taxed without significantly distorting people's behavior." In particular, property taxes do not affect the decision to supply labor, invest in human capital, or innovate; the tax base for the property tax is immovable and in-

[1] Ramey (2019) states that "on average, multipliers for tax changes involving tax rate changes are surprisingly large and surprisingly uniform across a number of countries. The bulk of the estimates vary between -2 and -3."

[2] We give several examples in Appendix E.

elastic. From a policy perspective, it is often an important component of stabilization programs undertaken by the IMF, and international organizations such as the OECD often call for property tax reform as a means to increase economic efficiency.

We argue that measuring tax multipliers using property taxes allows to test for Ricardian equivalence and for the hypothesis that fiscal policy affects output only through the supply side. We find in contrast to the supply-side view and Ricardian equivalence that property taxes have large and persistent effects on consumption and output. According to our preferred specification, property tax multipliers are between 2 and 3. This cannot be attributed to the supply effects of property taxes, which are confined to the housing sector, and in particular to residential investment. Of course, our results do not imply that supply-side effects are not important for other types of taxes.[3] However, our results suggest that demand effects can be large.[4] To our knowledge, our study is the first to isolate the demand-side component of tax multipliers.

We first use a narrative approach to identify more than 100 property tax shocks. We construct, from scratch, a new narrative dataset of property tax changes in the universe of 35 OECD countries, following the methodology of Romer and Romer (2010) for the United States and Cloyne (2013) for the United Kingdom. The considerable data requirements of the narrative approach render it challenging and time consuming to conduct. We are able to use the narrative methodology for a large number of countries, a task that is usually considered too cumbersome. We study the different property tax systems, how often property taxes are revised, and what the motivations are for these revisions, and identify more than 100 exogenous tax changes. Multiple sources were used to examine the motivation for tax changes. A large online appendix describes the shocks, and their motivations, and gives details on the various sources that were used for each country.[5] The advantage of the narrative approach is that it makes shocks observable, and allows us to discuss, case by case, whether their motivations are indeed exogenous to the macroeconomy.

We find that tax multipliers are between 2 and 3, in line with growing consensus in the literature using narrative methods (Ramey, 2019).[6] We go beyond the direct

[3]Mertens and Montiel Olea (2018) find that marginal tax changes have larger effects on output than average tax changes, which is suggestive of supply-side effects. At the same time, this is hard to reconcile with the microeconomic literature, which has consistently found that reported pretax income reacts only modestly to changes in marginal tax rates (Saez et al., 2012).

[4]Demand effects potentially include housing wealth effects (Berger et al., 2018). House prices effects are not significant in the short run, whereas both consumption and investment react immediately. Several quarters after the shock, we cannot exclude the possibility that movements in house prices magnify consumption effects; hence housing wealth effects could magnify multipliers in the long run. We discuss the link between multipliers and housing wealth effects in Section 5.4.

[5]The online appendix is available **here**.

[6]For instance, Romer and Romer (2010) find a tax multiplier equal to 3.1 in the United States, and Cloyne (2013) finds 2.5 in the United Kingdom. Guajardo et al. (2014) estimate that a tax-based consolidation shock of 1% of GDP reduces GDP by 3.1%.

effects on output and investigate the mechanism through which property taxes affect overall economic activity. We show in particular a strong effect on consumption, which is inconsistent with Ricardian equivalence.

At the same time, narrative methods are sometimes criticized for their lack of replicability. We use structural VAR approaches to confirm the results arising from the narrative approach. We arrive at the same multiplier, both when we rely on 100 property tax shocks identified through the narrative record and when we use structural estimations that include more than 1,000 tax changes. We can do this because property tax changes are largely exogenous, unlike other tax changes, which are contaminated by output movements.[7] This allows us to use property tax changes as accurate measures of shocks, without any need to use a cyclical adjustment.[8]

To the best of our knowledge, our study is the first to identify large tax multipliers coming solely out of a structural estimation, independent of narrative shocks. Blanchard and Perotti (2002) find that structural VAR approaches imply tax multipliers that are lower than 1.[9] Mertens and Ravn (2014) have reconciled large narrative multipliers with low structural VAR multipliers, using Romer and Romer's (2010) narrative shocks to estimate the elasticity of tax revenues to output. However, this reconciliation implicitly assumes that the narrative analysis has successfully identified exogenous shocks. We do not need this assumption, as the structural estimation in our case is independent of the narrative approach. This is a novelty of our study: We use narrative and structural approaches independently, and reconcile these two methods.

Finally, both the narrative and the structural approach lead to persistent effects. This is in line with the view that aggregate demand also determines output in the long run (Fatás and Summers, 2018), which may come from hysteresis effects (Blanchard and Summers, 1986; Delong and Summers, 2012) or secular stagnation (Summers, 2017; Blanchard and Summers, 2017). This result is consistent with the literature, such as Romer and Romer (2010) and Cloyne (2013), who also find persistent effects of tax changes on GDP. However, this is usually interpreted as evidence in favor of supply effects. Our study suggests instead that long-run effects can also be driven by demand.

The rest of the paper proceeds as follows. Section 1 reviews the literature. Section

[7] Property taxes are the exception in that respect. Indirect taxes, such as VAT or excise taxes, are directly affected by contemporaneous consumption. Income or social security taxes similarly directly depend on current income. So do various forms of capital gains taxes, corporate taxes, etc. Even in countries in which a reassessment of cadastral values is frequent, such as the U.S. (a rare case in our panel of countries), the base for property taxes is impacted by house prices—and therefore by macroeconomic developments—only with a lag.

[8] However, the rationale behind property tax changes might also be correlated with output—if, for example, property taxes are systematically increased during recessions. To address this endogeneity bias, we develop a second structural method using a Cholesky decomposition, which allows property taxes to be endogenous to output, even contemporaneously. Both structural methods lead to very similar results, qualitatively and quantitatively, and confirm those of the narrative approach.

[9] Caldara and Kamps (2017) show that this result is very sensitive to the choice of the elasticity of revenues to output.

2 presents the data. In Section 3, we compute multipliers using the narrative approach, and we confirm the results in Section 4 using two structural methods. Section 5 discusses our results. In Section 6, we perform a number of robustness checks and conclude.

1 Related Literature

Our paper is closely related to the literature on tax multipliers using empirical methods.[10] The empirical literature is broadly divided between cross-sectional studies based on regional, county, or even individual data, and time-series studies based on aggregate country-level data. Our study is based on aggregate data, mainly because we wish to arrive at model-free estimates of the aggregate multiplier. In contrast, cross-sectional studies have been used to estimate fiscal multipliers, but typically require a structural model to take into account general equilibrium effects (for example, Nakamura and Steinsson (2014)). This literature on cross-sectional fiscal multipliers is surveyed by Chodorow-Reich (2017). Individual-level data, which are often based on administrative records, also allow us to estimate the direct effects of tax cuts on households' consumption, using quasi-experimental methods—for example using the timing of tax cuts (e.g, Parker (1999), Johnson et al. (2006), Parker (2011), Parker et al. (2013), or Cloyne and Surico (2017)). These microeconomic studies arrive at much more precise estimates, but unfortunately they are almost by design silent on general equilibrium effects. Indeed, according to Keynesian theory, the "control" group in these studies may increase their consumption as well; for example, because higher aggregate demand may decrease the unemployment rate. This is true both of households who benefit from tax cuts and of those who do not.

The literature on tax multipliers using aggregate data is itself divided between narrative and structural methods. The narrative approach was first applied in monetary economics by Friedman and Schwartz (1963), Romer and Romer (1989), and Romer and Romer (2004). Romer and Romer (2010), Cloyne (2013), and Hayo and Uhl (2014) have also used this approach to characterize the effects of fiscal policy. The literature on fiscal multipliers has recently been surveyed by Ramey (2019). Event studies include Alesina et al. (1995), Alesina and Perotti (1997), and Alesina and Ardagna (1998). Other methods are more structural, in that they use theory-based restrictions to achieve identification from the data. For example, Blanchard and Perotti (2002) use an external elasticity of taxes to output. Mountford and Uhlig (2009) use sign restrictions based on

[10] Another approach has been to study the effect of distortionary taxes in DSGE models (McGrattan, 1994), but property taxes would have very limited effects in those models. This is not supported in our results. Therefore, our approach will be mostly atheoretical. For example, Chahrour et al. (2012) have examined Romer and Romer's (2010) results using such DSGE models, but assuming that tax shocks were distortionary. Ramey (2016) and Nakamura and Steinsson (2018) give an overview of the current state of identification in macroeconomics, with discussions of the interaction between theoretical and empirical methods.

theory and find much higher tax multipliers. Following the debate regarding austerity in the aftermath of the 2008 financial crisis, there has been renewed academic interest in these issues, such as Blanchard and Leigh (2013), Guajardo et al. (2014), Alesina et al. (2015b), and Jordà and Taylor (2016).

Finally, the property tax, as well as the land tax, has a special standing in the economics literature. Classical economists such as Smith (1776), Ricardo (1817), and George (1879), viewed the property tax as the least harmful tax, based on theoretical arguments. Similarly, the property tax is popular in policy discussions. Numerous international organizations, such as the IMF and the OECD, have called for increases in the role of the property tax. In Appendix E, we review these classical authors and related policy reports in more depth. Although the property tax is a relatively small tax relative to other taxes, it plays a large role in policy discussions and economic thinking.

2 Data

We have assembled a country-level unbalanced panel data set that contains information on national accounts, tax revenues, aggregate and sectoral employment, and other miscellaneous financial variables; these are available from various international organizations and national statistical agencies. Data on the property tax comes from *OECD Revenue Statistics,* and thus our sample includes the universe of 35 Organisation for Economic Co-operation and Development (OECD) member countries.[11] Importantly, we used all of the data that was available to us (in particular, we did not make any discretionary choices by selectively dropping countries, years, or quarters from our sample). Our data are from the OECD whenever possible, which we complement with other major institutional sources—such as the Bank of International Settlements (BIS)—when the corresponding data were not available in any OECD dataset. The source for each variable is provided in Appendix A, where we also provide the full sample of countries as well as the time coverage. The resulting panel includes 1,492 country-year, or 5,968 country-quarter, observations, with approximately 42 years or 171 quarters per country. It is unbalanced, with a maximum of 204 quarterly observations (for 21 countries) and a minimum of 84 observations.

Property tax series. A key component of our database is the property tax variable. We retrieve cross-country time series data on "recurrent taxes on immovable property" (item 4100) from the *OECD Revenue Statistics*. This subheading covers

[11]The comprehensive sample of countries of 35 OECD consists of Australia, Austria, Belgium, Canada, Chile, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Latvia, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Slovenia, South Korea, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States. Sample coverage is in Appendix A.

taxes levied regularly with respect to the use or ownership of immovable property. More details are given in Appendix F. An important component of our data-collection efforts is a database of more than 100 property tax shocks, identified using the historical record, which we constructed ourselves. We have cross-referenced sources from diverse academic sources, several OECD reports, official national sources (statistical agencies), and sometimes even newspaper articles. We will come back to this in Section 3.

Normalization. We wish to express the size of property tax shocks as a function of the overall size of the economy under consideration. *OECD Revenue Statistics* report property taxes in national currency, as a percentage of GDP, and as a percentage of total taxation. Although we would have preferred to use an existing variable rather than create a new one (to reduce data-snooping concerns), we are satisfied with none of these three variables.

As already stated, we cannot use property taxes in national currency, because we need a way to compare effects across countries of different sizes. Neither can we use property taxes as a percentage of GDP or as percentage of total taxation, because we worry that movements in this ratio might be spuriously contaminated by movements in GDP or in the overall level of taxation; also, this quantity covaries positively with GDP, because of automatic stabilizers. GDP movements would then spuriously lead to a negative correlation between property tax revenues as a percentage of GDP.

To the best of our knowledge, no normalization procedure can be considered "standard" in the literature. To minimize concerns due to the use of the HP filter, we wanted to avoid using an arbitrary filtering procedure, and in particular to avoid choosing a parameter for the HP filter. For this reason, we chose to approximate real GDP by a log linear trend for each country and measure property taxes against real GDP. We also experimented with other detrending procedures, such as fitting an HP filter with a high smoothing parameter through the log of nominal GDP, and using this filter as a denominator for property tax revenues. Our results were robust both qualitatively and quantitatively.

Institutional and historical work on the property tax. Finally, we strove to learn as much as possible about each country's property tax system. A summary of this research effort is provided in Appendix F. For example, we learned that the frequency with which fiscal values are revised to reflect the market price of housing varies widely from country to country. Moreover, depending on the country, reevaluations are made at either regular or irregular intervals; they sometimes follow the officially announced frequency and other times do not. Institutional details are particularly important not only for the narrative approach we employ in Section 3, but also because we seek to understand how property taxes work in general in different countries, what is the mo-

tivation for their changes, and whether they can reasonably be considered to be shocks from a macroeconomic standpoint.

Summary statistics. Summary statistics for property taxes are presented in Table 3 in the Appendix. We give the average and maximum amount of tax take by property taxes in our 35 OECD economies, both as a percentage of GDP and as a percentage of the total tax take. Property taxes are 10.9% of total taxation in the United States and 9.7% in the United Kingdom, while they are only 0.5% of total taxation in Luxembourg and Greece. There is thus considerable heterogeneity across countries regarding the importance of property taxes.

Straightforward correlations between tax revenues and output also confirm the appeal of property taxes for the study of tax multipliers (Table 4 in the Appendix). We show that all types of taxes have a strong positive association with output (more particularly, consumption and income taxes), while property taxes do not. As stated previously, this is because the base for property taxes is rarely revised, and thus property tax revenues are not contaminated by short-run movements in GDP.

3 Narrative approach

3.1 Methodology

Our preferred empirical strategy consists of identifying property tax shocks using a narrative approach following Friedman and Schwartz (1963) and Romer and Romer (1989). We would aim to identify property tax shocks, which are to a first-order exogenous to the state of the macroeconomy. We also examine the historical record and identify a number of stated motivations behind property tax changes. These motivations are listed in Section 3.2.

Quantitative measure of tax changes. We use the change in property tax receipts as a measure of tax changes that actually took place. This way of calculating the magnitude of tax changes differs from that of Romer and Romer (2010) and Cloyne (2013), who instead use projections of tax revenues as detailed in the budget. In contrast, we are able to reduce the burden of data collection substantially, since only the actual dates on which property tax changes are documented in the narrative record need to be investigated. We are able to use a narrative methodology for a panel of countries, which is usually considered too cumbersome.[12]

The reason we can use actual changes in property taxes is that these are mildly

[12]For example, Ilzetzki et al. (2013) write: "In this paper, we employ the SVAR approach as in Blanchard and Perotti (2002). In our case the choice is forced because the military buildup approach has so far been applied only to the US and is not practical for a large panel of countries."

affected by movements in GDP. This method could not be used by Romer and Romer (2010) or Cloyne (2013), as overall tax revenues are strongly correlated with GDP. One option might have been to use cyclically adjusted revenues instead. The goal would be to correct for mechanic fluctuations in tax revenues that come from changes in outputs. However, these measures have limits, as automatic stabilizers are multidimensional. For example, "a boom in the stock market both raises cyclically adjusted tax revenues by increasing capital gains realizations and is likely to reflect other developments that will raise output in the future" (Romer and Romer, 2010).

Model. We estimate the following reduced-form equation—an autoregressive distributed lag quarterly panel with country- and time-specific fixed effects—in which $D_{i,t}$ are the time series of dummy variables for property tax shocks in country i, collected through the narrative record:

$$\Delta Y_{i,t} = \alpha_i + \mu_t + \sum_{p=1}^{P} a_p \Delta Y_{i,t-p} + \sum_{q=1}^{Q} b_q D_{i,t} \Delta T_{i,t-q} + \epsilon_{it}, \tag{1}$$

where $\Delta Y_{i,t}$ is either the quarterly change in our endogenous variable or the quarterly change in the log of our endogenous variable (the log percentage change) in country i, and $\Delta T_{i,t}$ measures property tax changes as a percentage of trend GDP. We also allow for country- and time-specific fixed effects. Romer and Romer (2010) and Cloyne (2013) use $Q = 12$ lags for the tax variable, and we follow them. We use $P = 3$ for the endogenous variables, as recommended by the standard lag selection criterion. In Appendix C (Table 18), we show that our results are robust to this choice. We also correct for Nickell's (1981) bias using an iterative bootstrap procedure.

IRFs. We compute the impulse response functions as a nonlinear function of the estimated reduced-form parameters $\{a_p\}_{p=1}^{P}$ and $\{b_q\}_{q=1}^{Q}$. This corresponds to the moving average representation of the autoregressive lag model in equation (1).

3.2 Stated motivations for property tax changes

To analyze the macroeconomic effects of tax changes, we seek to identify exogenous shifts in property taxes. We pursue a methodology based on the narrative approach, introduced in the seminal work of Friedman and Schwartz (1963) and Romer and Romer (1989), to analyze the macroeconomic consequences of monetary policy shocks.

First, we note that unlike monetary policy, fiscal policy on average responds less systematically to macroeconomic developments, so that issues of endogenous policy response are less severe than in studies concerning monetary policy shocks. In contrast, monetary policy's primary objective in many countries is aggregate demand manage-

ment.

Second, we note that the endogeneity problem is probably much less severe for property tax changes than for other types of aggregate tax changes. Except for a few exceptions, such as South Korea—where property taxes have been used as a means to stabilize housing markets—governments around the world rarely consider using property taxes to achieve macroeconomic stabilization. The main reason is probably that local governments are in charge of setting property taxes, while macroeconomic stabilization is managed at a more centralized level. Our narrative analysis confirms this hypothesis.

We investigate the actual reasons given for each property tax change and verify that it does not appear to be related to other factors affecting output in the near future. Multiple sources were used to examine the motivation for tax changes. In particular, OECD tax reports, OECD Country Surveys, Central Bank Macroeconomic reports, Treasury and Economic Ministry reports were used for many countries. Several cross-country reports on property taxes were also useful, notably OECD (1983b), Bird and Slack (2002), and Bird and Slack (2014). Details on the various sources used for each country are given in the **online appendix**.

We next classify the main stated motivations for exogenous tax changes identified through the narrative approach. In doing so, we sought to stay as close as possible to previous literature and to avoid discretionary choices as much as possible. We follow Romer and Romer (2010) and Cloyne (2013) in classifying property tax changes based on whether they correspond to long-term economic reforms, ideological changes, external changes, or deficit consolidation. We could not avoid adding a fifth category, property tax reassessments, which accounts for more than 50% of our property tax changes. Reassessments are an essential feature of the property tax, as valuation is at the heart of estimation of the tax base, and may increase effective tax rates without any change to nominal tax rates. These reassessments are sometimes automatic, and thus do not have a specific motivation. However, some reassessments are discretionary, and may thus fall in one of the other four categories as well. The motivations for exogenous property tax changes are as follows:

1. **Long-run economic reforms (LR)**. We group under this label all property tax changes that do not occur for reasons related to macroeconomic management. For example, governments may decide to enact supply-side reforms as part of a long-term economic strategy. They might then choose to raise the property tax, which is often praised for its positive economic effects. Of course, such changes may or may not happen during a recession. Another example of a long-run economic reform is a move to more decentralization and more autonomy for local governments. A move to more autonomy is typically not motivated by economic reasons, but by political factors. In France, for instance, the 1983 laws granted

more autonomy to local collectivities, which were also allowed to set property tax rates. Our narrative analysis allows us to identify 40 shocks that fall into this category.

2. **Ideological changes (I).** These changes in taxes occur for political and philosophical reasons, but not explicitly to influence economic performance: According to Romer and Romer (2010), these are "tax cuts for philosophical reasons, such as to shrink the size of government or for fairness." The property tax is, in many countries, very unpopular with taxpayers (Cabral and Hoxby, 2012); it's the "tax everyone loves to hate" (Rosengard, 2012). It is criticized notably because it is perceived as unfair, as it is often unrelated to ability to pay or to benefits received. Because of this unpopularity, property tax caps or limitations have been implemented in several countries—for instance, the "tax revolt" against the property tax in the 1970s in the United States that led to the California's Proposition 13 (1978) and spread across the United States (O'Sullivan et al., 1995). Similar phenomena can be identified in a number of countries—not only in the United States but also, for instance, in Canada, Denmark, Ireland, and the United Kingdom. Sixteen property tax changes can be classified as ideological changes.

3. **External changes (E).** According to Cloyne (2013), external changes are those imposed on policymakers by external bodies, such as court judgments and the enforcement of European directives. In Spain, for example, two sentences of the Constitutional Court resulted in a decrease in property taxation in 1986 and 1987. We can also classify as external changes events that are planned in advance and occur at fixed and regular dates.[13] We identify 15 shocks that correspond to external changes.

4. **Deficit consolidation (D).** These decisions may reflect past shocks (for example, the effect of a previous recession) even if they are contemporaneously exogenous. Romer and Romer (2010) also argue that this type of tax changes is exogenous: "One particular motivation [...] that falls into the exogenous category are tax increases to deal with an inherited budget deficit. An inherited deficit reflects past economic conditions and budgetary decisions, not current conditions or spending changes. If policymakers raise taxes to reduce such a deficit, this is not a change motivated by a desire to return growth to normal or to prevent abnormal growth.

[13]This is the case for election cycles when legislation sets election dates, so that elections occur on a regular cycle. Property tax changes can be dependent on local electoral cycles. Although the electoral cycle theory was originally proposed to explain central government policies (Nordhaus (1975)), similar phenomena have been identified in a number of local government studies. Mouriuen (1989) shows, for example, that tax rates peak in midterm years, i.e. as far from elections as possible. Geys (2006) and Houlberg (2007) suggest that in an electoral year, local authorities avoid increasing local taxes, which leads to increased indebtedness. The reason may be that "on election day, the memory of recent events is probably more poignant than that of ancient ills" (Nordhaus (1975)).

So it is exogenous." More generally, we include in this category all decisions to correct past shocks, even if they are contemporaneously exogenous. This is the case, for example, for property caps that are the consequence of past large increases in property taxes or house prices. These property tax caps reflect past economic conditions and not current conditions. Our narrative study identifies 10 shocks motivated by deficit consolidation.

5. **Reassessments (R).** In principle, valuations should be updated annually to keep pace with changes in house price levels or with the level of rents. Annual reassessment is not common in practice, however, as revisions are costly. According to Almy (2014), among unitary states, only Iceland and the Netherlands currently maintain this frequency. Appendix F contains a more detailed description. Many of the reassessments are automatic, planned in advance, and often at a steady pace.[14] For instance, in Japan, a property tax reassessment takes place every 3 years. In the Netherlands, property taxes were reassessed every 5 years from 1975 to 1995. While many legislatures specify a revaluation schedule, they are sometimes ignored in practice. For instance, in France, following the last general review of 1970, values were supposed to be updated every 3 years, but these reassessments were not implemented. When reassessments are not automatic, we control for this by assigning them to one of the four other categories for exogenous tax changes.[15] In particular, reassessments may be classified as long-run economic reforms if they aim to correct a structural problem. More than 60 shocks correspond to property tax reassessments.

The **online appendix** provides more details on the motivations for property tax changes we were able to identify.

3.3 Elements of a narrative analysis of Spain

In this section, we illustrate our methodology for one country, Spain, in which we identify different categories of shocks. Additional details and references are also provided for Spain in the **online appendix**. The main sources we used for Spain are OECD (1983b) and Miranda (2004). We were able to identify an unusually large number of property shocks in Spain: To the best of our knowledge, there were seven shocks in 1981, 1982, 1983, 1986, 1987, 1992, and 1994. We provide more detail below, with the main motivation for each shock in italics.

[14] In some countries, legislation defines the maximum period between two revaluations, which is called the assessment cycle. For example, in the United States, assessment occurs at legally defined intervals in most of the country, with substantial variation between states in reassessment cycles.

[15] If most of the reassessments are planned in advance, one might worry that the assessment frequency was an endogenous policy response in the case of nonautomatic revisions. In Figure 13(f) in the Appendix, we show that the results of our narrative approach are robust to excluding nonautomatic revisions.

- **1981:** *Revision, Long-run, Deficit consolidation.* The first shock was the result of both a revision of cadastral values and the Royal Decree Law of 1979 taken in a context of decentralization reforms.[16] This Decree Law (11/1979) authorized gradual increases in property taxation. It introduced an extensive package of measures for the reorganization of local treasuries, ranging from doubling the base for some property taxes (the Urban Land Tax) to the subsequent revision of all cadastral values. To reinforce decentralization, property taxes were converted into local taxes (*Long-run*). They were also increased to deal with the structural deficits of local communities (*Deficit consolidation*). Social demands had increased since 1972 (the arrival of democracy) and were triggered by a central government deficit. The government responded to those demands by exporting the deficit to the local authorities. The package of measures provided by the Decree Law of 1979 thus addressed the "structural deficit of Local Corporations." The Decree Law of 1979 was supplemented by Decree Law 9/1980, which established that until such time as the revision established in Article 3 of Royal Decree Law 11/1979 was completed, the National Budget Law could update cadastral values of Urban Land.

- **1982:** *Revision.* The 1982 shock was the result of a revision of cadastral values. It was decided that the Urban Land Tax would be increased by 35%, through a reevaluation of cadastral values.

- **1983:** *Long run.* The shock was the result of a law that contained a package of measures designed to reinforce the capacity for local self-financing (Law 24/1983), to grant more political autonomy to local administrations. The law authorized local authorities to establish a surcharge on property taxation. The surcharge was effectively applied, amid fierce debate, by 528 local corporations that year. The law also granted local authorities the option to determine the Land Tax rate, in order to find a way around the difficulties that hindered desirable revision of cadastral values and to move forward in alignment with the principle of financial autonomy.

- **1986:** *External, revision.* The shock was the result of both a sentence of the Constitutional Court of 1985 and of a revision of cadastral values of the Rural Land Tax. The surcharge of Law 24/1983 was indeed overturned by the Constitutional Court on 19 December 1985. This resulted in a decrease in property

[16] Spain's 1978 Constitution assigns all taxation responsibilities to the central government. However, the Constitution also includes the possibility that such responsibilities can be transferred to the newly created Autonomous Communities (regional governments), so that they can regulate and/or administer their taxes within the limits established by the central parliament. The main motivation for decentralization during the design of the 1979 Constitution was to appease Catalan and Basque nationalists.

taxation. 1986 was also a pre-election period, which tends to be a period of fiscal moderation. Indeed, it was expected that a local election would take place in 1987.

- **1987:** *External.* The shock was both the result of a decision of the Constitutional Court and of the electoral cycle. The sentence of the Constitutional Court of 17 February 1987 overruled another part of the law of 1983 because it failed to respect the principle of legal reserve. 1987 was also a year for local elections, and as stated above, election years tend to be periods of fiscal moderation.

- **1992:** *Revision.* The shock was the result of a large revision of cadastral values in 1991 that were implemented in 1992. The revision is popularly known as "catastrazo," which became a synonym for a large increase in cadastral values. In effect, the cadastral revision of 2,447 locations went into effect. These locations represented cadastral registration of more than 22% of all urban units in the territories in the common system. The process ended with an update of rural cadastral values by 50%.

- **1994:** *Revision.* The shock was the result of a revision of cadastral values, effective on January 1, 1994.

Of course, property tax shocks sometimes co-occur with other economic reforms, changes in taxes, etc. However, we have not found any systematic pattern of simultaneous policy changes across our more than 100 policy changes.[17] In particular, we believe that it would be difficult to name a mechanism that could explain our results across our five categories of shocks, which are based on long-run economic reforms, ideological reforms, external changes, deficit consolidation, or revisions in property taxes.

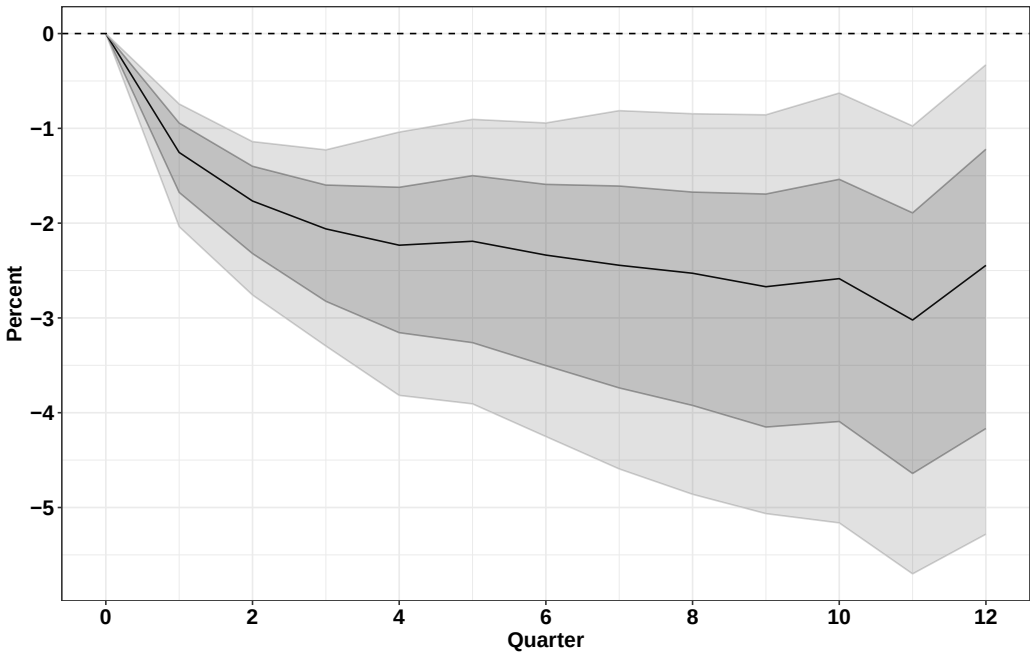
3.4 Results

Using more than 100 property tax shocks identified using the narrative approach allows us to calculate the causal impact of a property tax increase on output and other macroeconomic aggregates such as consumption, investment, imports and exports, and unemployment.

Output. Figure 1 shows that in our preferred specification, a 1-percentage-point of GDP increase in property taxes generates a large and persistent decrease in output,

[17] In Figure 8(a) in the Appendix, we examine the effect of tax shocks on government spending. In short, the spending response is small and statistically insignificant, which is consistent with Cloyne (2013) and Romer and Romer (2009). This is reassuring, since one might worry that tax changes motivated by contemporaneous changes in spending could be correlated with other developments that affect output. As a consequence, an increase in the property tax leads to a decrease in public debt (Figure 8(b)).

Figure 1: Estimated Impact of an Exogenous Tax Increase of 1% of GDP on GDP



Note: This figure shows the response to a 1-percentage-point of GDP increase in property taxes. Shaded areas correspond to 68% and 90% confidence intervals.

which peaks at 3.0% after 11 quarters. This result is remarkably close to that of Romer and Romer (2010), who find a fall in output of 3.1% after 10 quarters in the United States. It is also very close to the results of Cloyne (2013), who finds a fall in output of 2.5% after about 3 years for the United Kingdom.

The main difference with Romer and Romer (2010) and Cloyne (2013) is that we can interpret our results as resulting from disposable income effects, as we have focused on property taxes, which in theory have the least detrimental impact on output.

Consumption. Figure 2(a) illustrates the effects of property tax increases on household consumption. In our preferred specification, we estimate a maximum effect of -3.57% after 11 quarters, following a 1-percentage-point increase in taxes as a percentage of GDP. This is a large drop in consumption demand. This result is also very close to Cloyne (2013), who finds maximum impact of -2.9% in considering all tax changes in the United Kingdom. Tax shocks have a slightly greater effect on household consumption than on GDP (in percentage terms), although the dynamics and orders of magnitude are very similar.

One interpretation of the drop in consumption is that the tax increases reduce agents' disposable income. However, given that consumption is approximately 60% of

GDP, a -3.57% decrease in consumption is a lot more than the 1% of GDP additional tax take that landlords face. The consumption response is therefore suggestive of multiplier effects, whereby an initial drop in consumption leads to a drop in aggregate demand, which itself feeds back on consumption through reduced labor demand, leading to unemployment and hence lower consumption. A noteworthy feature of the consumption response is that it is very protracted, and that it builds up over time. This could be due to unemployed individuals' benefits exhaustion after a few years, which causes the multiplier effect to increase over time. We will return to this below when we discuss the rise in unemployment.

In any case, the strong decline in consumption is not consistent with Ricardian equivalence (Barro, 1974; Barro, 1989). According to this hypothesis, a lump-sum tax should have no effect on consumption, as agents anticipate future tax reductions coming from a fall in public debt: As noted above, we observe in Figure 8(a) in the Appendix that property tax shocks do not change government spending. This benchmark is central to "plain vanilla" DSGE models. In these models, only distortionary taxes can have an effect on output. This rejection of Ricardian equivalence is reminiscent of the results of Poterba and Summers (1987) and Summers et al. (1987) concerning the Reagan tax cuts. However, this episode has also been interpreted as resulting from supply-side effects. To the best of our knowledge, our study is the cleanest available test of Ricardian equivalence.

Investment. We next turn to the effect of property tax increases on investment. Figure 2(b) shows that nonresidential investment also falls considerably. The peak impact on nonresidential investment occurs after 11 quarters, with a 10.8% cumulative decline. This result is again strikingly close to that of Romer and Romer (2010), who find a fall in gross private domestic investment of 11.2%. This strong investment response is puzzling from a neoclassical point of view, given that property taxes are supposed to be the least distortive of all taxes. There is also no reason to believe that property taxes affect the cost of capital directly. In a neoclassical model, tax increases reduce the level of public debt, which lowers interest rates, therefore boosting investment demand (the reverse of crowding-out).[18] A Keynesian interpretation of our results is that investment demand depends on overall economic conditions, and in particular on aggregate demand (according to an accelerator model of investment). This more than offsets the negative impact of the cost of capital for investment.[19] In this interpretation, investment is determined by aggregate demand, both components of which

[18]In Figures 8(b) and 9(a) in the Appendix, we show that both public debt and long-term interest rates decline following property tax shocks.

[19]The low correlation between the cost of capital and investment is a pervasive puzzle from the point of view of neoclassical theory. For example, Cochrane (2011) writes: "Recessions are centrally about why consumer's desire to save more does not translate into greater investment. 'The' interest rate on government bonds fell sharply, both real and nominal. Why did investment not rise?"

are subject to multiplier effects. Overall, the strong negative relationship between tax changes and nonresidential investment helps to explain the size of our estimated overall effect of property tax increases on output.

Figure 2(c) shows that residential investment also falls following property tax increases. The order of magnitude is similar to that of nonresidential investment, which is also Mertens and Ravn's (2013) result following a change in both average personal income tax rates and average corporate income tax rates. Therefore, residential investment does not appear to be disproportionately affected by changes in property taxes, compared to other types of taxes. We discuss residential investment further in Section 5.1.

Unemployment. Lastly, Figure 2(d) shows the effect of property tax increases on unemployment. Exogenous tax increases are followed by a substantial rise in the unemployment rate, by about 2%. The intuition for this is similar to what happens for nonresidential investment, which is intuitive: Investment and hiring go hand in hand.[20] For example, in a theoretical search and matching model, hiring effort—i.e., vacancy posting—is a costly investment made by firms, which allows them to make profits in the future. In a Keynesian interpretation, unemployment is increased because aggregate demand falls, which increases slack in the labor market. Once again, our results are consistent with evidence presented by Romer and Romer (2010), who also show that a tax increase is followed by a large rise in the unemployment rate. If agents are not fully insured against job losses, the rise in unemployment may also work to reduce agents' consumption. Note that the design of unemployment insurance could also explain the protracted response of output and consumption, if consumption is further reduced at benefits exhaustion; this is strongly suggested by microeconomic data in Ganong and Noel (2017).

Imports and exports. Figure 3 illustrates the effect of a property tax increase on imports and exports. We find a stronger and more immediate effect on imports than on exports, as some of the reduction in aggregate demand leads to a reduction in external demand. The maximum impact on imports is -10.6%—a result again remarkably close to Romer and Romer (2010), who find a fall in imports of 10.1%. This result is not surprising. A tax increase does not reduce only internal, but also external, demand. Some of the consumption and investment responses fall on traded goods, some of which are produced abroad.

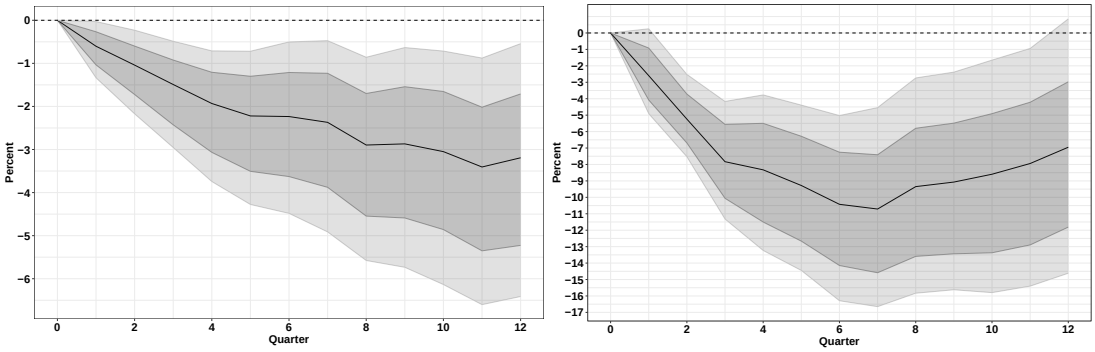
The positive effect on exports after 12 quarters can also be understood if the reduc-

[20]We could expect that tax increases lead to a higher cost of labor if employees increase their wage demands, which could explain higher unemployment. We observe instead, in Figure 9(b) in the Appendix, a decline in nominal wages following a a property tax increase.

Figure 2: Response of Private Consumption, Non-Residential Investment, Residential Investment, Unemployment

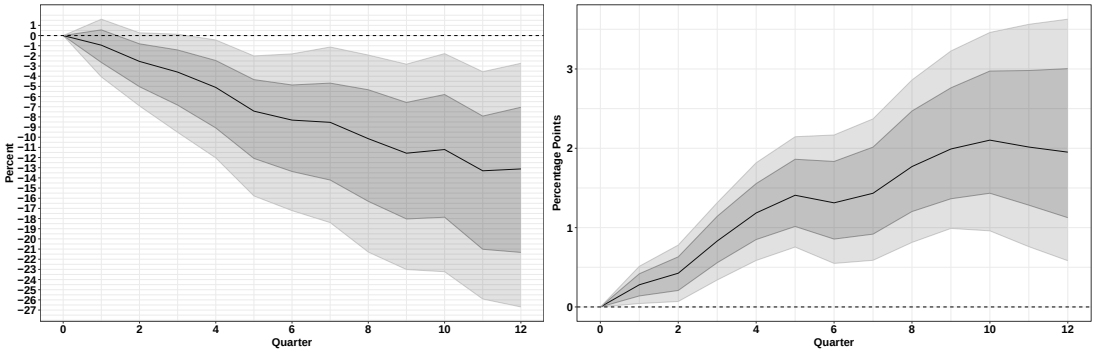
(a) Private Consumption

(b) Non-residential Investment



(c) Residential Investment

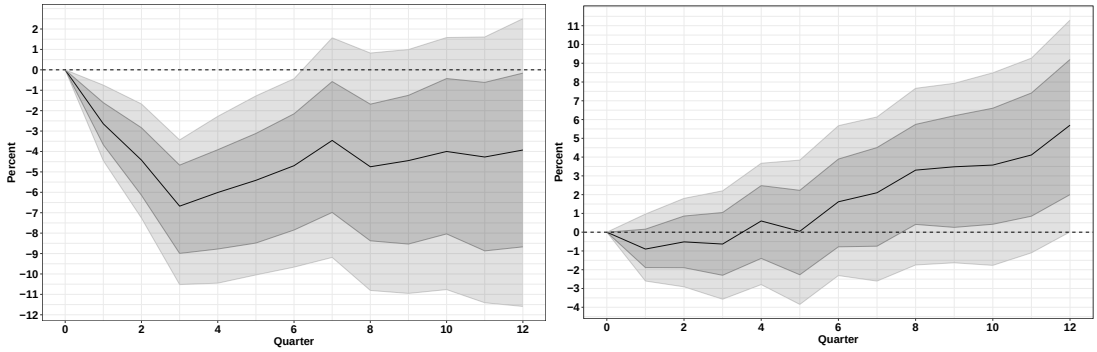
(d) Unemployment



Note: This figure shows the response to a 1-percentage-point of GDP increase in property taxes. Shaded areas correspond to 68% and 90% confidence intervals.

Figure 3: Response of Imports and Exports

(a) Imports (b) Exports



Note: This figure shows the response to a 1-percentage-point of GDP increase in property taxes. Shaded areas correspond to 68% and 90% confidence intervals.

tion in aggregate demand leads to a fall in nominal wages and a rise in competitiveness, which is confirmed by the results in Figure 9(b) in the Appendix. In addition, if monetary policy is loosened to offset the negative effects of fiscal policy on output, then the exchange rate depreciates and competitiveness improves. As emphasized by Romer and Romer (2010), "the fact that the effect is much stronger for imports suggests that the fall in income may be more important than the interest rate/exchange rate linkage," at least in the short run. Overall, both effects work toward an increase in net exports (exports - imports). Therefore, tax increases improve the country's external balance.

Testing for exogeneity. The narrative record is in theory sufficient to establish the exogeneity of the property tax shocks. However, one may wish to test the exogeneity of our narrative tax series econometrically. We follow Romer and Romer (2010) and Cloyne (2013) in showing that property tax changes are not predictable, using past values of GDP growth.[21] We have thus performed Granger causality tests to determine how predictable our property tax variable is on the basis of movements in output. It is not predictable at the 10% significance level (the p-value is 0.608). Property tax changes are not caused by past GDP growth.

[21] One could indeed worry that low GDP growth would lead governments to systematically raise more property tax revenues to meet revenue shortfalls. If GDP growth were positively autocorrelated, then past low GDP growth would predict current low GDP growth, while at the same time reducing tax revenues. This would lead to a spurious relation between GDP growth on the one hand and property taxes on the other.

4 Structural approaches

According to Nakamura and Steinsson (2018), one weakness of narrative methods is the "inherent opacity of the process by which the narrative shocks are selected."[22] Compared to previous narrative studies that attempt to measure tax multipliers, the burden of replicating our results is considerably reduced by the fact that we have only selected a subset of dates for property tax shocks, rather than how much these shocks were projected to raise in terms of revenues. Indeed, we are able to use the measure of tax changes that actually took place as a measure of the actual shock, because automatic stabilizers are absent. In other words, we have only collected a set of dummy variables, which reduces data collection efforts considerably and increases the ease of replication. Although we have made our best effort to use the least possible discretion in selecting property tax shocks, the costs of replicating our narrative approach are still higher than for more statistical research. This might raise some concerns.

In this section, we take this criticism to heart and turn to different methodologies. Instead of using a narrative approach to look for property tax changes and their motivations, we use only the time series of property tax revenues across countries. Also, we use all of these changes, as if they all corresponded to actual property tax shocks. In both cases, we find similar results. We argue that this points to the robustness of our estimates. The narrative approach is still our preferred methodology, because it allows us to flesh out the motivations for the shocks. However, we hope that the results in this section will alleviate the concerns of skeptical readers. We first estimate an autoregressive distributed lag model (Section 4.1) and then turn to a structural VAR model (Section 4.2).

4.1 Autoregressive distributed lag model

A first possibility is to keep as close as possible to the narrative approach. In this section, we estimate the same equation as in Section 3, except that we use all property tax changes as exogenous shocks and estimate an autoregressive distributed lag model. Assuming that all shocks are exogenous is a strong assumption, which is relaxed in Section 4.2.

Model. As we have previously explained, property tax changes are largely exogenous—unlike other tax changes, which are contaminated by output movements. We may thus estimate a dynamic panel with a distributed lag of property tax changes. Denoting by p the number of lags for the endogenous variable and by q the number of lags of the

[22] They further argue that "this raises the concern that data are (perhaps unconsciously) reverse-engineered to generate favored conclusions. Clearly, this concern applies to all research. But it applies with particular force to narrative analysis because of the high costs associated with attempting to replicate such analysis."

exogenous variables, we estimate an autoregressive distributed lag model denoted by $ADL(P,Q)$ for each outcome variable. Such an approach is used by Arezki et al. (2017) to investigate the impact of giant oil discoveries. More precisely, we estimate the impact of past property tax shocks on current economic outcomes, running the following ordinary least squares (OLS):

$$\Delta Y_{i,t} = \alpha_i + \mu_t + \sum_{p=1}^{P} a_p \Delta Y_{i,t-p} + \sum_{q=1}^{Q} b_q \Delta T_{i,t-q} + \epsilon_{it}. \tag{2}$$

Again, we take $Q = 12$ lags for the tax variable and $P = 3$ lags for the endogenous variable. We identify the effects of property tax shocks while allowing for country- and time-specific fixed effects. To take advantage of the large panel dimension of the data (T quarters and N countries), we assume that macroeconomic elasticities of aggregates to tax changes are homogeneous across countries.

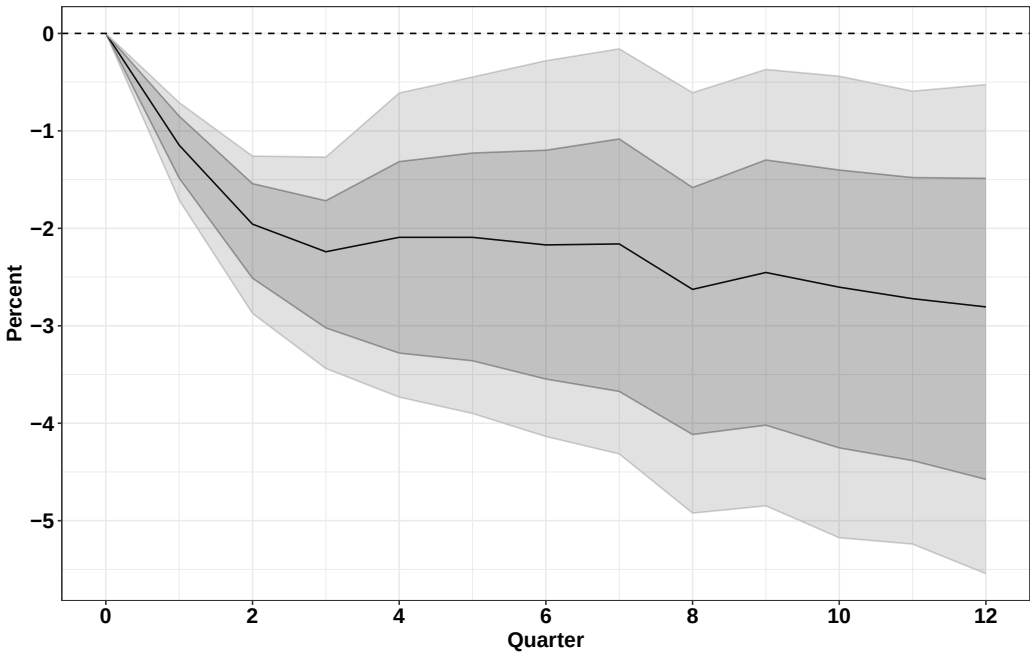
The impulse response function that represents the impact of a property tax increase is given by the moving average equivalents of these reduced-form estimates.

Results. Figure 4 illustrates the effect of the tax increase on GDP using the autoregressive distributed lag model. A 1-percentage-point increase in taxes as a percentage of GDP generates a large and persistent decrease in output (-2.8% after 12 quarters). This result is very close to the one found using the narrative approach: -3.05% after 11 quarters.

Testing for exogeneity. The autoregressive distributed lag model in this section implicitly assumes that all property tax changes are shocks, in the sense that they are not correlated with other macroeconomic factors. This implies that policymakers do not change property taxes in response to macroeconomic conditions. This is a testable proposition, at least with the macroeconomic data available to us. We have performed Granger causality tests to confirm that the autoregressive lag specification is not biased, and that our estimates are structural.[23] Even if our property tax series are not predictable on the basis of available macroeconomic aggregates, we next look at the results obtained through an even more agnostic identification procedure—a structural VAR approach—following Sims (1980).

[23] In particular, we performed Granger causality tests to determine how predictable property tax variations are on the basis of movements in output, which they were not at the 10% significance level (the p-value was 0.593).

Figure 4: Response of GDP—Autoregressive Distributed Lag Model



Note: This figure shows the response to a 1-percentage-point of GDP increase in property taxes. Shaded areas correspond to 68% and 90% confidence intervals.

4.2 Structural VAR model

An alternative approach is to assume that property tax shocks may also be endogenous. However, to the extent that macroeconomic aggregates do not contemporaneously respond to property taxes, we can follow Sims (1980) and use a Cholesky decomposition to measure the causal effect of property tax changes on macroeconomic aggregates.

Model. The base for property taxes is not contemporaneously affected by GDP, unlike most tax revenues. As a consequence, there is no need to assume a log-linear relationship between tax revenues and output. In this specification, we can thus consider all variations of the property tax:

$$\Delta Y_{i,t} = \sum_{p=1}^{P} \alpha_p \Delta Y_{it-p} + \sum_{p=1}^{P} \beta_p \Delta T_{i,t-p} + \epsilon_{it}$$
$$\Delta T_{i,t} = \sum_{p=1}^{P} \gamma_p \Delta T_{i,t-p} + \sum_{p=1}^{P} \delta_p \Delta Y_{i,t-p} + \nu_{it},$$

where ϵ_{it} and ν_{it} are the reduced-form residuals in a structural VAR involving the growth rate of GDP and the growth rate of property taxes $(\Delta y_{it}, \Delta T_{it})$. Using a matrix

representation,

$$Y_t = A(L)Y_{t-1} + U_t$$

where $Y_t = [\Delta y_{it}, \Delta T_{it}]'$ is a two-dimensional vector with GDP growth and property tax changes as a percentage of GDP. $U_t = [\epsilon_{it}, \nu_{it}]'$ is the vector of reduced-form residuals, and $A(L)$ is a distributed lag polynomial of order P, in matrix form with coefficients $(\alpha_p)_{p=1..P}$, $(\beta_p)_{p=1..P}$, $(\gamma_p)_{p=1..P}$, and $(\delta_p)_{p=1..P}$. Using the notations of Blanchard and Perotti (2002), the reduced-form residuals can be written as a function of the mutually uncorrelated structural shocks as follows:

$$\epsilon_{it} = a_1 \nu_{it} + e^y_{it}$$
$$\nu_{it} = b_1 \epsilon_{it} + e^t_{it},$$

where a_1 and b_1 are coefficients. Because property taxes are not mechanically affected by GDP—or at least not contemporaneously—we can set $b_1 = 0$. This means that $\nu_{it} = e^t_{it}$, or that the reduced-form shock in the tax equation ν_{it} is a structural shock.

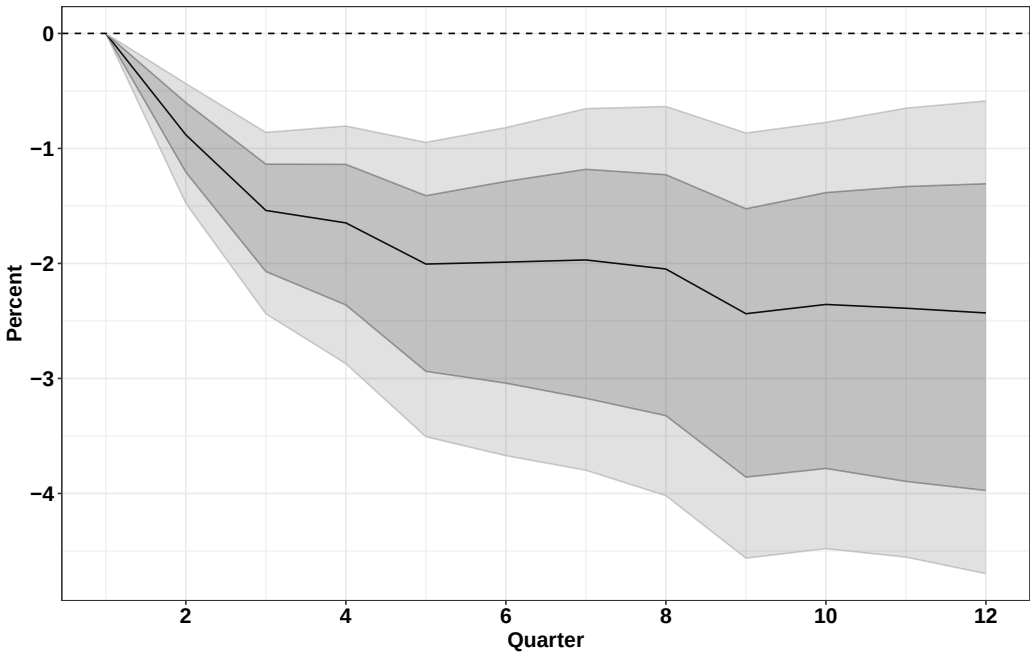
We are effectively using a Cholesky decomposition of the VAR, in which taxes are ordered before macroeconomic aggregates. We can thus directly trace the response of y_{it} to a structural shock in the tax equation ν_{it}. The above structural VAR has a moving average representation in terms of those structural shocks whose coefficients are the impulse response function coefficients.

Results. Figure 5 illustrates the effect of the tax increase on GDP using the structural VAR approach. A 1-percentage-point increase in taxes as a percentage of GDP generates a large and persistent decrease in output (-2.4% after 12 quarters). This result is very close to the one found using the narrative approach, -3.05% after 11 quarters. Again, this points to the robustness of our results.

To the best of our knowledge, our study is the first to identify large tax multipliers using only a structural estimation, independent of narrative shocks. In contrast, Blanchard and Perotti (2002) find small multipliers. To arrive at this result, they make assumptions about how tax revenues mechanically vary with output.[24] However, Caldara and Kamps (2017) show how sensitive results are to the choice of this elasticity.

[24] As a baseline, they assume that the elasticity of tax revenues with GDP is equal to $b_1 = 2.08$. They use a unique elasticity for the period ranging from the first quarter of 1947 to the fourth quarter of 1997 (p 1335). However, they note that "it increases steadily from 1.58 in 1947:1 to 1.63 in 1960:1 to 2.92 in 1997:4", which "suggests time variation in the dynamic responses of spending and taxes to activity and thus time variation of the VAR." In footnote 7, they also write: "One implicit assumption in our construction of $[b_1]$, is that the relation between the various tax bases and GDP is invariant to the type of shock affecting output. For broad-based taxes, such as income taxes, this is probably fine. It is more questionable, say, for corporate profit taxes: the relation of corporate profits to GDP may well vary depending on the type of shock affecting GDP."

Figure 5: Response of GDP—Structural VAR approach



Note: This figure shows the response to a 1-percentage-point of GDP increase in property taxes. Shaded areas correspond to 68% and 90% confidence intervals.

Mertens and Ravn (2014) have reconciled large narrative multipliers with low structural VAR multipliers, using Romer and Romer's (2010) narrative shocks to estimate the elasticity of tax revenues to output (b_1). However, this estimation of b_1 then hinges of having correctly identified narrative shocks. Our methodology allows us to circumvent that difficulty, since we do not need to estimate b_1: The fact that property tax revenues do not require a cyclical adjustment, especially in countries that revise the fiscal base infrequently, explains why the multipliers found using a structural approach are similar to those found using a narrative approach.

5 Discussion

In this section, we discuss the interpretation of multipliers and in particular, the potential supply effects of property taxes (5.1). We then discuss the persistence of our estimated effects (5.2). Finally, we discuss external validity, and in particular the question of the marginal propensity to consume (5.3) and the role of housing wealth effects (5.4).

5.1 Interpretation of multipliers: Supply or demand?

The distinguishing feature of our study is that we measure the tax multipliers that arise from aggregate demand effects. Our key identification assumption is that the property tax is the closest real-world counterpart to a lump-sum tax—which has no, or very limited, supply effects. In this section, we discuss this hypothesis in more depth.

The property tax and supply effects. There has been a large consensus among economists since at least Smith (1776), Ricardo (1817), and George (1879) that the property tax is the least distortive of all taxes. In Section E in the Appendix, we illustrate this strong view of the nondistortionary effects of the property tax held by economists, international organizations, and the financial press: The property tax does not affect the decision to supply labor, invest in human capital, or innovate. Broadening the scope for the property tax is also a key recommendation from the *Mirrlees Review* (Adam et al., 2011b): Property "can be taxed without significantly distorting people's behavior." According to the OECD (2010f), "the reviewed evidence and the empirical work suggests a 'tax and growth ranking' with recurrent taxes on immovable property being the least distortive tax instrument in terms of reducing long-run GDP per capita."[25] This explains why the property tax is often an important component of stabilization programs undertaken by the IMF, and why international organizations such as the OECD often call for property tax reform as a means to increase economic efficiency.

Excluding residential investment. The land value tax advocated by Ricardo (1817) and George (1879) was supposed to tax an inelastic factor, and therefore had no distortionary effect: The supply effect of a land value tax is zero.[26] Even though property taxes are considered to be the least distortive tax, property tax bases also include the value of housing. As a consequence, one might worry that property taxes also affect the incentive to consume more housing relative to other consumption goods. Yet the property tax mainly affects the existing stock of housing, and potential supply effects

[25] The OECD (2010f) also asserts: "The explanation for these findings relates to the efficiency characteristics of the different taxes. Taxes that have a smaller negative impact on economic decisions of individuals and firms are less negative for economic growth. [...] A growth-oriented tax reform would therefore shift part of the tax burden from income to consumption and/or residential property." For other references, see in particular Blöchliger (2015): "The tax on immovable property is usually seen as one of the most efficient and least detrimental taxes to economic growth. The tax base is immovable and inelastic, i.e. households usually react little to changes in tax policy. [...] Since property taxation largely maintains households' decisions to save and invest, it should be less of a drag on economic growth. OECD analysis suggests that immovable property taxes are the least harmful to economic growth." Norregaard (2013) emphasizes that property taxes do not affect the decision to supply labor, invest in human capital, produce, invest, or innovate as much as other taxes.

[26] According to Samuelson (1962), "George was not original in attacking incomes that come from land; as Foxwell said long ago, nationalizers of land we have always with us. This is understandable from the Hume-Ricardo recognition of rent as a price-determined (rather than price-determining) surplus to a factor in inelastic supply."

apply only to new construction and expansions. We therefore test the potential supply effects linked to residential investment.

Figure 6 illustrates the effect of the tax increase on GDP excluding residential investment from GDP. Multipliers are not significantly lowered, with a peak effect of -2,1% after 11 quarters.

However, excluding residential investment surely overestimates the supply effects. Increases in property taxes reduce consumption, especially of durable goods such as cars, of which housing is another example. To put it simply, a fall in purchasing power leads to less consumption of housing. Therefore, the change in residential investment results from both supply and demand effects.

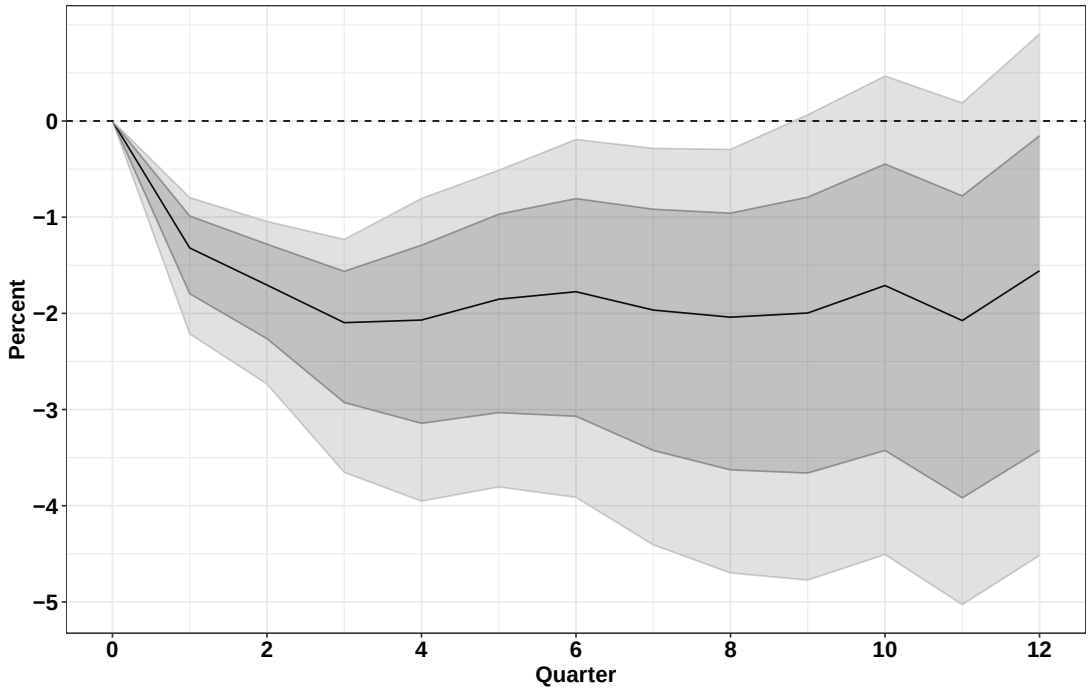
Although we cannot distinguish precisely between the two, we compare our estimates with Romer and Romer's (2004) monetary shocks to assess the effect on residential investment of pure demand shocks.[27] Using these shocks, we find a large effect of aggregate demand shocks on residential investment—nine times higher than the effect on GDP (Figure 10(d) in the Appendix)—which is much higher than the ratio of 4.5 using our property tax shocks. This suggests that demand effects alone can explain the full response of residential investment.

In addition, the response of residential investment is not specific to property tax increases. Even though Romer and Romer (2010) do not consider housing-related taxes, they also find substantial effects of tax shocks on residential investment. We replicate their analysis and find, using their shocks, a peak reduction in residential investment of 9% (which can be compared with an effect on GDP of 2.5%; see Figure 10 in the Appendix). This could be due to the demand component of Romer and Romer's (2010) fiscal shocks.

These various elements suggest that the supply effects linked to residential investment are small or negligible.

[27] As Romer and Romer (1989) argue: "The central motive for interest in the effects of monetary disturbances is the desire to gain insight into the question of whether aggregate demand shocks have real effects."

Figure 6: Response of GDP—without Residential investment



Note: This figure shows the response to a 1-percentage-point of GDP increase in property taxes. Shaded areas correspond to 68% and 90% confidence intervals.

5.2 Persistent Effects

We find that property tax shocks have persistent effects on output. This is consistent with the literature on tax multipliers, which also finds persistent effects of tax changes on GDP. In Romer and Romer (2010), following a cut in tax liabilities corresponding to 1% of GDP, GDP rises by around 3% over 3 years. Similarly, Cloyne (2013) finds that tax cuts generate large and persistent increases in output. The effect rises to nearly 2.5% after about 3 years.

The novelty of our paper is to isolate the demand-side component of tax multipliers and show that these fiscal demand shocks can have persistent effects. However, the key difference with Romer and Romer (2010) and Cloyne (2013) is that the tax changes in these studies are also distortive, which prevents them from disentangling between supply and demand. These persistent effects are not completely surprising either, since this has been found before in the monetary empirical literature. For example, Bernanke and Mihov (1998a) find a persistent effect of expansionary monetary shocks on GDP after 4 years. As emphasized by Romer and Romer (2010), "monetary policy, which

necessarily works through demand, also has highly persistent output effects." To the best of our knowledge, we are the first to isolate persistent demand effects for fiscal shocks.

More generally, the persistent effects on output are in line with the view that aggregate demand also determines output in the long run (Fatás and Summers, 2018), which may come from hysteresis effects (Blanchard and Summers (1986); Delong and Summers (2012)) or secular stagnation (Summers (2017); Blanchard and Summers (2017)).

A remark on persistent shocks. Persistent effects could be due to the fact that the shocks under consideration are themselves persistent (Figure 11 in the Appendix). Changes in taxes are not reversed immediately, which would be the case if shocks were purely transitory. The size of the estimates can also be explained by the persistence of shocks, as the marginal propensity to consume out of persistent shocks (MPC^P) is larger than the marginal propensity to consume out of a one-time transitory shock (MPC^T). Hence, using the traditional formula for the multiplier, $\frac{MPC}{1-MPC}$, implies that the multiplier for permanent shocks is larger than for transitory shocks ($\frac{MPC^P}{1-MPC^P} > \frac{MPC^T}{1-MPC^T}$). This formula also implies large multipliers, as in theory MPC^P should be equal to 1—see Straub (2019) for a discussion of this hypothesis, both theoretically and empirically. Again, our study is not different from Romer and Romer (2010) and Cloyne (2013), whose fiscal shocks are highly persistent (Figure 12 in the Appendix).

5.3 External validity: Marginal propensity to consume

Property tax multipliers may not correspond to general tax multipliers. Mertens and Ravn (2013) show that different types of taxes affect aggregate economic activity with varying intensities. There are good reasons to believe that demand effects are relatively large for property taxes. Indeed, when tax changes work through disposable income effects, as in our case, these effects might be maximized when they fall on consumers who have a relatively higher marginal propensity to consume. There is substantial evidence that propensity to consume depends negatively on income at both the micro and macro level, and hence on the type of taxes. At the microeconomic level, there is evidence both for transitory shocks (Jappelli and Pistaferri, 2014) and persistent shocks (Straub, 2019). At the macroeconomic level, Zidar (2019) shows the heterogeneous effects of income tax changes with an average multiplier of 3.5, which is largely driven by tax cuts for lower-income groups (around 7 for the bottom 90%) and roughly zero for the top 10%.[28] Property taxes fall on homeowners, which implies that the share of the population that is affected by the property tax is close to 50%, and thus are agents with a relatively high marginal propensity to consume. This could explain the large

[28]Note in the case of Zidar (2019) that different multipliers can also come from differential incentive effects across groups.

effects we find, and in particular on consumption.[29]

5.4 External validity: Housing wealth effects

A large literature estimates "housing wealth effects," or the increase in aggregate consumption brought about by changes in house prices (Mian et al., 2013; Guerrieri and Uhlig, 2016; Berger et al., 2018). Figure 7(a) shows that a 1% of GDP increase in property taxes leads to a reduction in real house prices of approximately 17% after 12 quarters using the narrative approach, whereas we find a smaller effect of 5.9% after 12 quarters using the structural VAR approach (Figure 7(b)). Therefore, we cannot rule out that some fraction of the consumption response is due to wealth effects, as property taxes may reduce the expected discounted value of investing in housing (Oates, 1969).

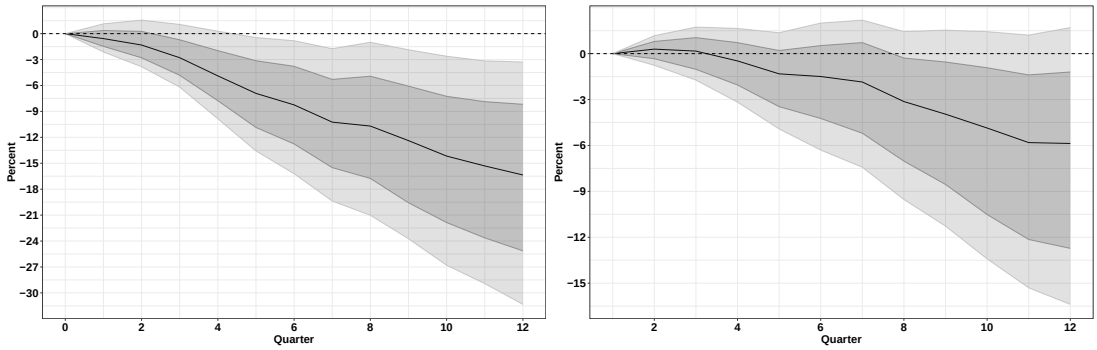
We note, however, that the response of house prices is typical of aggregate demand shocks. For example, we compare our results with Romer and Romer's (2004) monetary policy shocks, which are usually considered to be "pure" demand shocks. The point estimates are not directly comparable, since the impulses in Romer and Romer are calculated with respect to interest rate shocks (in basis points). However, we can estimate the reduced-form elasticity of GDP to house prices in the two cases. It is defined as $\frac{d\ \mathrm{GDP}}{d\mathrm{HP}} = \frac{\partial \mathrm{GDP}/\partial r}{\partial \mathrm{HP}/\partial r}$ in the monetary policy shock case—where $\partial \mathrm{GDP}/\partial r$ is the partial response of GDP to a monetary policy shock—and $\frac{d\ \mathrm{GDP}}{d\mathrm{HP}} = \frac{\partial \mathrm{GDP}/\partial T}{\partial \mathrm{HP}/\partial T}$ in the property tax shock case, where $\partial \mathrm{GDP}/\partial T$ is the partial response of GDP to a property tax shock. In the former case, we compute an elasticity of $(-1.25)/(-7.25) \approx 0.17$, and in the latter an elasticity of $(-3)/(-17) \approx 0.17$ (Figure 10(f) in the Appendix). The two elasticities are thus similar. In like fashion, Romer and Romer's (2010) fiscal shocks lead to a large fall in house prices, equal to -7,5% after 12 quarters (Figure 10(e) in the Appendix). Therefore, the change in house prices is not particularly high for property tax shocks.

The importance of housing wealth effects probably depends on the time horizon. In the short run, there is no significant change in house prices; in contrast both consumption and investment react immediately. Therefore, housing wealth effects are unlikely to explain the short-run response. Using the narrative approach, Figure 7(a) shows that the effect on house prices is not significant at the 90% level before 5 quarters. Using the structural VAR approach of Section 4.2 (Figure 7(b)) or the autoregressive distributed

[29] Another argument to explain the large size of our multipliers is that the property tax is a particularly salient tax. The importance of salience for the impacts of taxation has been documented in the context of sales taxes by Chetty et al. (2009). Anecdotal evidence suggests that salience could also play a role in the context of property taxation as well. For example, Cabral and Hoxby (2012) write: "Because of the manner in which it is normally paid, the property tax is almost certainly the most salient major tax in the U.S. The property tax is also the least popular tax and the only major tax whose revenues have declined as a share of income" and "people hate the property tax more than other taxes. There are fairly regular 'tax revolts' against the property tax, many of which are based on local or statewide referenda."

Figure 7: Response of House Prices

(a) Narrative approach (b) Structural VAR



Note: This figure shows the response to a 1-percentage-point of GDP increase in property taxes. Shaded areas correspond to 68% and 90% confidence intervals.

lag model described in Section 4.1, the effect on house prices is never significant at the 90% level, and becomes significant at the 68% level only after 2 years. In the medium to long-run, we cannot exclude that multipliers can be magnified by housing wealth effects. It could be that lower household demand leads to lower house prices, which in turn lowers household demand further through housing wealth effects. However, again, this is also the case for multipliers that have been estimated elsewhere in the literature. This could be another explanation for why multipliers are large, slow to build up, and persistent.

In any case, wealth effects also work through a change in demand (Mian and Sufi, 2018). Therefore, the presence or absence of wealth effects does not alter our main contribution that property tax multipliers are about demand and not supply.

6 Additional Results and Robustness Checks

In this section, we provide a number of additional results. We first investigate the macroeconomic effect of different types of shocks, depending on their stated motivation. We then ask whether property tax shocks have differential effects during expansions and recessions. Finally, we decompose output into its components (consumption, investment, etc.) for the ADL and the SVAR approaches (Section 4).

We then perform a number of robustness checks. We first relax the hypothesis that output and macroeconomic aggregates are integrated of order one, by looking at a specification in which endogenous variables are assumed to have a deterministic instead of a stochastic trend. We also change the number of lags used in the main regression equations—for endogenous variables as well as for exogenous property tax changes—and investigate the robustness of our estimates to these changes. Overall, we confirm

the robustness of our findings in Section 3.

Macroeconomic effects of property taxes, depending on their stated motivation. In Section 3.2, we classified our narrative shocks into five categories depending on their stated motivation. Given that we have subcategories for the exogenous group of tax changes, we are able to investigate whether long-run, revision, or deficit consolidation tax changes have heterogeneous effects on macroeconomic activity. The first panel of Figure 13 in the Appendix displays the effect of a tax change based only on revisions of cadastral values. While the overall effect is larger, the overall shape and magnitudes are broadly consistent with the aggregate series. This is interesting, because many of these revisions are expected, so that according to permanent income theory they should have a lower effect on consumption, or output overall: There should exist some anticipation effect. This result is consistent with microeconomic studies showing that consumers do respond to predictable changes in income (Parker (1999); Mankiw (2000)). If most reassessments are planned in advance, one might worry that the assessment frequency might be an endogenous policy response in the case of nonautomatic revisions. In Figure 13(f) in the Appendix, we show that the results of our narrative approach are robust to excluding nonautomatic revisions.

Figure 13 also shows the effect of property tax changes carried out to improve long-run economic performance, as well as those implemented for ideological reasons—for example, because governments believe that property taxes are good for incentive reasons and are the least distortive tax. We choose to group these two similar categories as in Romer and Romer (2010). Again, the shape of the response is close to the baseline estimate, even if the effect is a bit smaller.

One might worry that property tax increases for deficit consolidation are endogenous, although as already stated, this problem is largely taken care of by controlling for lags in GDP. We thus also estimate the baseline VAR, excluding narrative shocks that correspond to deficit consolidation measures (Figure 13(e)). Once again, we find that our results are robust.

Comparing multipliers during expansions and recessions. Figure 14 in the Appendix compares the effect of a tax shock during expansions and recessions. To define expansions and recessions, we apply the algorithm of Harding and Pagan (2002) to identify local maxima (peaks) and minima (troughs) in the log-levels of real GDP in each country in our panel. The parameters of the algorithm are fixed such that a full cycle and each of its phases must last at least 6 quarters and 2 quarters, respectively. We define a recession as the 2-year period after a peak. All other quarters are defined as expansions.

Figure 14 shows that the effect of a property tax shock is larger during recessions

than expansions. More precisely, the point estimate for the fall in output is 4.5% after 11 quarters when the property tax increase occurs during a recession, whereas the peak effect is a fall in output of 2.1% after 4 quarters when the property tax increase occurs during an expansion. These results are in line with the results on government purchases in Auerbach and Gorodnichenko (2013), who show that multipliers of government purchases are larger in a recession (however, Ramey and Zubairy (2017) find higher multipliers only with the zero lower bound).

These results can again be rationalized in a model in which output is sometimes determined by aggregate demand. In a recession, aggregate demand is low and there are underutilized resources (e.g., idle factories and a slack labor market), so that tax cuts have a large effect on output that is largely demand determined. In contrast, during an expansion, aggregate demand is higher, so that tax cuts are more likely to face a constraint on supply. Therefore, output effects are more muted, although it should be noted that they are still significant.

Results for components of GDP (ADL and SVAR). Figures 15 and 16 show results of the autoregressive distributed lag model (ADL) and SVAR approaches for consumption, investment, imports, and exports. Concerning household consumption, the peak effect is a fall of 3.3% with the ADL approach (Figure 15(a)) and 3.2% with the SVAR approach (Figure 16(a)). This is remarkably close to the result found with the narrative approach (-3.5%). Concerning total investment, we observe a fall of 13% with the ADL approach (Figure 15(b)), and of 12.5% with the SVAR approach (Figure 16(b)). The fall was smaller with the narrative approach (-11%). Concerning imports, the peak effect is a fall of 8% with the ADL approach (Figure 15(c)) and 7% with the SVAR approach (Figure 16(c)). With the narrative approach, the fall was smaller (-6.6%). Finally, concerning exports, we observe an increase of exports of 5% with the ADL approach (Figure 15(d)), and 4% with the SVAR approach (Figure 16(d)). With the narrative approach, the impact on exports is barely significant.

Deterministic or stochastic trends. The results in Section 3 work under an assumption of stochastic trends: It is assumed that shocks to output and other macroeconomic aggregates are best thought of as permanent, so that the time series are integrated of order 1. An alternative assumption, which is not favored by a Dickey-Fuller test, is that the trend in output is deterministic. Figure 17 shows the resulting impulse response function to a property tax shock, allowing for 4 lags of the endogenous variable in the main specification. The main result of Section 3 is notably robust using this specification.

Robustness to the number of lags (narrative approach). Figure 18 shows

results of the narrative approach using different lags of the endogenous variable. In Figure 18(a), we directly calculate the impact of property tax shocks on output without even controlling for lags of the endogenous variable. This is the first specification in Romer and Romer (2010). Doing so leads to an even larger effect than our baseline specification: The peak effect is a fall in output of 3.6% after 11 quarters. We then show the results with 1, 2, 3, and 4 lags of the endogenous variable. Results are similar and show a large and persistent decline in output. The peak effect is a fall in output of 3.5% with 1 lag (Figure 18(b)), 3.2% with 2 lags (Figure 18(c)), 3.05% with 3 lags (Figure 18(d)), and 2.8% with 4 lags (Figure 18(e)) after 11 quarters.

Robustness to the number of lags (structural VAR approach). Figure 19 shows results of the SVAR approach with 4, 8, 12, and 16 lags. The four specifications show a large and persistent decline in output. Orders of magnitude vary between a fall in output of 2.1% with 8 lags (Figure 19(b)) and a fall of more than 3% with 16 lags (Figure 19(d)).

Finally, we experimented with a number of other specifications. For example, in the **online appendix**, we show that the narrative approach is robust to excluding the United States or federal countries (Section 4 of the online appendix). For the other specifications, point estimates as well as significance levels vary—for example, more lags usually lead to more noisy estimates, as more parameters must be estimated. However, only under extreme specifications have we found tax multipliers lower than 2.

Conclusion

In this paper, we measured the demand-side component of tax multipliers using the property tax, the closest counterpart to a lump-sum tax. For identification, we used more than 100 exogenous property tax changes isolated through the narrative record, as well as structural VAR approaches that include more than 1,000 tax changes. We find, using both types of methods—independently—that tax multipliers are between 2 and 3, in line with the growing consensus in the literature. Not only are demand-driven tax multipliers large, but our evidence suggests that aggregate demand can determine output with long-run effects. To the best of our knowledge, our study is the first to isolate the demand-side component of tax multipliers and to reject Ricardian equivalence.

Aggregate demand effects can explain why macroeconomic elasticities of income to taxes are so much larger than corresponding microeconomic elasticities: The microeconomic literature has consistently found that reported pretax incomes react only modestly to changes in marginal tax rates (Saez et al., 2012). Microeconomic studies

allow us to measure incentive effects, but they are silent on aggregate demand effects.

Of course, our study does not imply that supply-side effects are not important for other types of taxes. However, our results suggest that tax changes can have sizeable effects if they affect agents with high propensity to consume. This raises questions about the prevailing typology of taxes based on incentive effects. For example, according to the *Mirrlees Review* (Adam et al., 2011b), consumption tax changes should be preferred to labor or capital taxes. However, less distortive taxes are usually more regressive, and thus have more detrimental effects on consumption demand. Further investigation of this issue is needed.

Bibliography

Adam, Stuart, Timothy Besley, and Richard Blundell, *Tax By Design: The Mirrlees Review*, OUP Oxford, September 2011. Google-Books-ID: POh3f73miJMC.

Alesina, Alberto and Roberto Perotti, "Fiscal Adjustments in OECD Countries: Composition and Macroeconomic Effects," *Staff Papers*, June 1997, *44* (2), 210–248.

Alesina, Alberto and Silvia Ardagna, "Tales of fiscal adjustment," *Economic Policy*, October 1998, *13* (27), 488–545.

Alesina, Alberto, Omar Barbiero, Carlo Favero, Francesco Giavazzi, and Matteo Paradisi, "Austerity in 2009–13," *Economic Policy*, July 2015, *30* (83), 383–437.

Alesina, Alberto, Roberto Perotti, Francesco Giavazzi, and Tryphon Kollintzas, "Fiscal Expansions and Adjustments in OECD Countries," *Economic Policy*, 1995, *10* (21), 207–248.

Almy, Richard, "Valuation and Assessment of Immovable Property," OECD Working Papers on Fiscal Federalism 19 April 2014.

Arezki, Rabah, Valerie A. Ramey, and Liugang Sheng, "News Shocks in Open Economies: Evidence from Giant Oil Discoveries," *The Quarterly Journal of Economics*, February 2017, *132* (1), 103–155.

Auerbach, Alan J. and Yuriy Gorodnichenko, "Fiscal Multipliers in Recession and Expansion," *NBER*, 2013, pp. 63–98.

Barro, Robert J., "Are Government Bonds Net Wealth?," *Journal of Political Economy*, 1974, *82* (6), 1095–1117.

Barro, Robert J., "The Ricardian Approach to Budget Deficits," *Journal of Economic Perspectives*, June 1989, *3* (2), 37–54.

Berger, David, Veronica Guerrieri, Guido Lorenzoni, and Joseph Vavra, "House Prices and Consumer Spending," *The Review of Economic Studies*, July 2018, *85* (3), 1502–1542.

Bernanke, Ben S. and Ilian Mihov, "Measuring Monetary Policy," *The Quarterly Journal of Economics*, August 1998, *113* (3), 869–902.

Bird, Richard and Enid Slack, "Land and Property Taxation: A Review," Technical Report, World Bank 2002.

Bird, Richard M and Enid Slack, "The Political Economy of Property Tax Reform," OECD Working Papers on Fiscal Federalism 18 April 2014.

Blanchard, Olivier and Lawrence H. Summers, "Hysteresis and the European Unemployment Problem," *NBER Macroeconomics Annual 1986, Volume 1*, January 1986, pp. 15–90.

Blanchard, Olivier and Lawrence H. Summers, "Rethinking Stabilization Policy: Evolution or Revolution?," Working Paper 24179, National Bureau of Economic Research December 2017.

Blanchard, Olivier and Roberto Perotti, "An Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes on Output," *The Quarterly Journal of Economics*, 2002, *117* (4), 1329–1368.

Blanchard, Olivier J. and Daniel Leigh, "Growth Forecast Errors and Fiscal Multipliers," *American Economic Review*, May 2013, *103* (3), 117–120.

Blöchliger, Hansjörg, "Reforming the Tax on Immovable Property," OECD Economics Department Working Papers 1205 April 2015.

Brys, Bert, Laura Vartia, Chistopher Heady, Jens Arnold, and Åsa Johansson, "Taxation and Economic Growth," OECD Economics Department Working Papers 620 July 2008.

Cabral, Marika and Caroline Hoxby, "The Hated Property Tax: Salience, Tax Rates, and Tax Revolts," Working Paper 18514, National Bureau of Economic Research November 2012.

Caldara, Dario and Christophe Kamps, "The Analytics of SVARs: A Unified Framework to Measure Fiscal Multipliers," *The Review of Economic Studies*, July 2017, *84* (3), 1015–1040.

Chahrour, Ryan, Stephanie Schmitt-Grohé, and Martín Uribe, "A Model-Based Evaluation of the Debate on the Size of the Tax Multiplier," *American Economic Journal: Economic Policy*, May 2012, *4* (2), 28–45.

Chetty, Raj, Adam Looney, and Kory Kroft, "Salience and Taxation: Theory and Evidence," *American Economic Review*, September 2009, *99* (4), 1145–1177.

Chodorow-Reich, Gabriel, "Geographic Cross-Sectional Fiscal Spending Multipliers: What Have We Learned?," Working Paper 23577, National Bureau of Economic Research July 2017.

Churchill, Winston, "Land Price as a Cause of Poverty," May 1909.

Cloyne, James, "Discretionary Tax Changes and the Macroeconomy: New Narrative Evidence from the United Kingdom," *American Economic Review*, June 2013, *103* (4), 1507–1528.

Cloyne, James and Paolo Surico, "Household Debt and the Dynamic Effects of Income Tax Changes," *The Review of Economic Studies*, January 2017, *84* (1), 45–81.

Cochrane, John H., "Presidential Address: Discount Rates," *The Journal of Finance*, August 2011, *66* (4), 1047–1108.

Commission, European, "Possible reforms of real estate taxation : criteria for successful policies," Technical Report, Publications Office of the European Union. Directorate-General for Economic and Financial Affairs., Luxembourg : 2012.

Commission, European, "Taxation trends in the European Union - Taxation and customs union," Technical Report 2017.

Delong, J. Bradford and Lawrence H. Summers, "Fiscal Policy in a Depressed Economy," *Brookings Papers on Economic Activity*, 2012, *2012* (1), 233–297.

Economist, The, "Levying the land," *The Economist*, June 2013.

Economist, The, "An unexploited resource," *The Economist*, June 2013.

Fatás, Antonio and Lawrence H. Summers, "The permanent effects of fiscal consolidations," *Journal of International Economics*, May 2018, *112*, 238–250.

Friedman, Milton, "Milton Friedman, Land value tax," 1999.

Friedman, Milton and Anna J. Schwartz, *A Monetary History of the United States, 1867-1960*, Princeton University Press, 1963.

Ganong, Peter and Pascal Noel, "Consumer spending during unemployment: Positive and normative implications," April 2017.

George, Henry, *Progress and Poverty: An Inquiry Into the Cause of Industrial Depressions, and of Increase of Want with Increase of Wealth, the Remedy*, W. Reeves, 1879. Google-Books-ID: FuyvpmtWyRAC.

Geys, Benny, "Government weakness and electoral cycles in local public debt: evidence from Flemish municipalities.," Technical Report SP II 2006-06, Social Science Research Center Berlin (WZB) 2006.

Guajardo, Jaime, Daniel Leigh, and Andrea Pescatori, "Expansionary Austerity? International Evidence," *Journal of the European Economic Association*, August 2014, *12* (4), 949–968.

Guerrieri, Veronica and Harald Uhlig, "Chapter 17 - Housing and Credit Markets: Booms and Busts," in John B. Taylor and Harald Uhlig, eds., *Handbook of Macroeconomics*, Vol. 2, Elsevier, January 2016, pp. 1427–1496.

Harding, Don and Adrian Pagan, "Dissecting the cycle: a methodological investigation," *Journal of Monetary Economics*, 2002, *49* (2), 365–381.

Hayo, Bernd and Matthias Uhl, "The macroeconomic effects of legislated tax changes in Germany," *Oxford Economic Papers*, April 2014, *66* (2), 397–418.

Houlberg, Kurt, "The Fine Art of Creating Local Political Business Cycles: The case of Danish Municipalities 1989–2005," in "paper on XVI Nordic Conference for Local Government Research, Goeteborg" 2007, pp. 25–27.

Ilzetzki, Ethan, Enrique G. Mendoza, and Carlos A. Végh, "How big (small?) are fiscal multipliers?," *Journal of Monetary Economics*, March 2013, *60* (2), 239–254.

IMF, "IMF Fiscal Monitor (FM) – Taxing Times," Technical Report, International Monetary Fund October 2013.

IMF, "Greece : Fifth Review Under the Extended Arrangement Under the Extended Fund Facility," Country Report 14/151, International Monetary Fund June 2014.

Jappelli, Tullio and Luigi Pistaferri, "Fiscal Policy and MPC Heterogeneity," *American Economic Journal: Macroeconomics*, October 2014, *6* (4), 107–136.

Johnson, David S., Jonathan A. Parker, and Nicholas S. Souleles, "Household Expenditure and the Income Tax Rebates of 2001," *American Economic Review*, December 2006, *96* (5), 1589–1610.

Jordà, Òscar and Alan M. Taylor, "The Time for Austerity: Estimating the Average Treatment Effect of Fiscal Policy," *The Economic Journal*, February 2016, *126* (590), 219–255.

Mankiw, N. Gregory, "The Savers-Spenders Theory of Fiscal Policy," *American Economic Review*, May 2000, *90* (2), 120–125.

McGrattan, Ellen R., "The macroeconomic effects of distortionary taxation," *Journal of Monetary Economics*, June 1994, *33* (3), 573–601.

Mertens, Karel and José Luis Montiel Olea, "Marginal Tax Rates and Income: New Time Series Evidence," *The Quarterly Journal of Economics*, November 2018, *133* (4), 1803–1884.

Mertens, Karel and Morten O. Ravn, "The Dynamic Effects of Personal and Corporate Income Tax Changes in the United States," *American Economic Review*, June 2013, *103* (4), 1212–1247.

Mertens, Karel and Morten O. Ravn, "A reconciliation of SVAR and narrative estimates of tax multipliers," *Journal of Monetary Economics*, December 2014, *68*, S1–S19.

Mian, Atif and Amir Sufi, "Finance and Business Cycles: The Credit-Driven Household Demand Channel," *Journal of Economic Perspectives*, August 2018, *32* (3), 31–58.

Mian, Atif, Kamalesh Rao, and Amir Sufi, "Household Balance Sheets, Consumption, and the Economic Slump," *The Quarterly Journal of Economics*, November 2013, *128* (4), 1687–1726.

Mill, John Stuart, *Principles of Political Economy with some of their Applications to Social Philosophy* 1848.

Miranda, Jesus Hita, "The Cadastre and Real Estate Tax," *Catastro*, 2004, p. 26.

Mountford, Andrew and Harald Uhlig, "What Are the Effects of Fiscal Policy Shocks?," *Journal of Applied Econometrics*, 2009, *24* (6), 960–992.

Mouriuen, Poul Erik, "The Local Political Business Cycle," *Scandinavian Political Studies*, March 1989, *12* (1), 37–55.

Nakamura, Emi and Jón Steinsson, "Fiscal Stimulus in a Monetary Union: Evidence from US Regions," *American Economic Review*, March 2014, *104* (3), 753–792.

Nakamura, Emi and Jón Steinsson, "Identification in Macroeconomics," *Journal of Economic Perspectives*, August 2018, *32* (3), 59–86.

Nickell, Stephen, "Biases in Dynamic Models with Fixed Effects," *Econometrica*, 1981, *49* (6), 1417–1426.

Nordhaus, William D., "The Political Business Cycle," *Review of Economic Studies*, 1975, *42* (2), 169–190.

Norregaard, Mr John, *Taxing Immovable Property Revenue Potential and Implementation Challenges* number 13-129, International Monetary Fund, 2013.

Oates, Wallace E., "The Effects of Property Taxes and Local Public Spending on Property Values: An Empirical Study of Tax Capitalization and the Tiebout Hypothesis," *Journal of Political Economy*, November 1969, *77* (6), 957–971.

OECD, *Taxes on immovable property*, Paris: Organisation for Economic Co-operation and Development, 1983.

OECD, *Tax Policy Reform and Economic Growth* OECD Tax Policy Studies, OECD Publishing, November 2010.

OECD, *OECD Economic Surveys: Belgium 2015*, Vol. 2015 of *OECD Economic Surveys: Belgium*, OECD Publishing, February 2015.

OECD, *OECD Economic Surveys: Hungary 2016*, Vol. 2016 of *OECD Economic Surveys: Hungary*, OECD Publishing, May 2016.

Ormaechea, Santiago Acosta and Jiae Yoo, "Tax Composition and Growth; A Broad Cross-Country Perspective," Technical Report 12/257, International Monetary Fund October 2012.

O'Sullivan, Arthur, Terri A Sexton, and Steven M Sheffrin, *Property taxes and tax revolts: The legacy of Proposition 13*, Cambridge University Press, 1995.

Parker, Jonathan A., "The Reaction of Household Consumption to Predictable Changes in Social Security Taxes," *The American Economic Review*, 1999, *89* (4), 959–973.

Parker, Jonathan A., "On Measuring the Effects of Fiscal Policy in Recessions," *Journal of Economic Literature*, September 2011, *49* (3), 703–718.

Parker, Jonathan A., Nicholas S. Souleles, David S. Johnson, and Robert McClelland, "Consumer Spending and the Economic Stimulus Payments of 2008," *American Economic Review*, October 2013, *103* (6), 2530–2553.

Poterba, James M. and Lawrence H. Summers, "Finite lifetimes and the effects of budget deficits on national saving," *Journal of Monetary Economics*, September 1987, *20* (2), 369–391.

Ramey, Valerie A., "Macroeconomic Shocks and Their Propagation," *Handbook of Macroeconomics*, January 2016, *2*, 71–162.

Ramey, Valerie A., "Ten Years after the Financial Crisis: What Have We Learned from the Renaissance in Fiscal Research?," *Journal of Economic Perspectives*, May 2019, *33* (2), 89–114.

Ramey, Valerie A. and Sarah Zubairy, "Government Spending Multipliers in Good Times and in Bad: Evidence from US Historical Data," *Journal of Political Economy*, December 2017, *126* (2), 850–901.

Ricardo, David, "Principles of Political Economy and Taxation," 1817.

Romer, Christina D. and David H. Romer, "Does Monetary Policy Matter? A New Test in the Spirit of Friedman and Schwartz," *NBER Macroeconomics Annual 1989, Volume 4*, January 1989, pp. 121–184.

Romer, Christina D. and David H. Romer, "A New Measure of Monetary Shocks: Derivation and Implications," *American Economic Review*, 2004, *94* (4), 1055–1084.

Romer, Christina D. and David H. Romer, "Do Tax Cuts Starve the Beast? The Effect of Tax Changes on Government Spending," *Brookings Papers on Economic Activity*, 2009, *2009*, 139–200.

Romer, Christina D. and David H. Romer, "The Macroeconomic Effects of Tax Changes: Estimates Based on a New Measure of Fiscal Shocks," *American Economic Review*, June 2010, *100* (3), 763–801.

Rosengard, Jay K., "The Tax Everyone Loves to Hate," in William J. McCluskey, Gary C. Cornia, and Lawrence C. Walters, eds., *A Primer on Property Tax*, Blackwell Publishing Ltd, 2012, pp. 173–186.

Saez, Emmanuel, Joel Slemrod, and Seth H. Giertz, "The Elasticity of Taxable Income with Respect to Marginal Tax Rates: A Critical Review," *Journal of Economic Literature*, March 2012, *50* (1), 3–50.

Samuelson, Paul A., "Economists and the History of Ideas," *The American Economic Review*, 1962, *52* (1), 1–18.

Sims, Christopher A., "Macroeconomics and Reality," *Econometrica*, 1980, *48* (1), 1–48.

Slack, Enid and Richard M. Bird, "The Political Economy of Property Tax Reform," *OECD Working Papers on Fiscal Federalism*, April 2014, (18).

Smith, Adam, "An Inquiry into the Nature and Causes of The Wealth of Nations," 1776, p. 1131.

Straub, Ludwig, "Consumption, Savings, and the Distribution of Permanent Income," Working Paper 2019.

Summers, Lawrence, "Crises in Economic Thought, Secular Stagnation, and Future Economic Research," *NBER Macroeconomics Annual*, January 2017, *31* (1), 557–577.

Summers, Lawrence, Chris Carroll, and Alan S. Blinder, "Why is U.S. National Saving so Low?," *Brookings Papers on Economic Activity*, 1987, *1987* (2), 607–642.

Webb, Merryn Somerset, "How a levy based on location values could be the perfect tax," September 2013.

Zidar, Owen, "Tax Cuts for Whom? Heterogeneous Effects of Income Tax Changes on Growth and Employment," *Journal of Political Economy*, 2019, *127* (3), 1437–1472.

Appendices

A Data

A.1 Data sources

Our data come from various sources. Whenever possible, we have used OECD data and proceeded through this list sequentially.

Property taxes. We use data from OECD *Revenue Statistics* (dataset code: REV) to retrieve the time series of property taxes across countries. It is available here: `https://stats.oecd.org/Index.aspx?DataSetCode=REV#`. "Taxes on immovable property," the subheading we use, is defined in the OECD as follows: "These taxes are levied on land and building, in the form of a percentage of an assessed property value based on a national rental income, sales price, or capitalized yield; or in terms of other characteristics of real property, such as size, location, and so on, from which are derived a presumed rent or capital value. Such taxes are included whether they are levied on proprietors, tenants, or both. Unlike taxes on net wealth, debts are not taken into account in their assessment."

Macroeconomic aggregates. We use the *Quarterly National Accounts* (dataset code: QNA) from the OECD as our primary source for macroeconomic aggregates. It is available here: `https://stats.oecd.org/Index.aspx?DataSetCode=QNA#`. For example, the output measure has the series code B1_GE, and we use the seasonally adjusted volume estimates in national currency, with OECD reference year, and annual estimates, which are referred to as the VOBARSA measure. The following table provides details on all of the data series we use and how we refer to them in the paper, as well as how we transform them in the paper: "raw" refers to the original data; "LN_ll" refers to a log transformation and a country-level log linear detrending of the data; and "GDP" refers to a division by GDP.

Table 1: List of Variables

Variables	Code	Sources	Variable description	Frequency	Transformation
GDP	B1GE-VOBARSA	OECD	Gross domestic product - expenditure approach	quarterly	LN-ll
Consumption	P31S14-S15-VOBARSA	OECD	Private final consumption expenditure	quarterly	LN-ll
Investment	ITV	OECD	Gross fixed capital formation, total, volume	quarterly	LN-ll
Residential Investment	IHV	OECD	Gross fixed capital formation, housing, volume	quarterly	LN-ll
Non-residential Investment	NRIV	OECD	ITV−IHV	quarterly	LN-ll
Unemployment	UNR	OECD	Unemployment rate	quarterly	raw
Imports	P7-VOBARSA	OECD	Imports of goods and services	quarterly	LN-ll
Exports	P6-VOBARSA	OECD	Exports of goods and services	quarterly	LN-ll
House Prices	RHPI	Dallas Fed	Real House Prices	quarterly	LN-ll
Government Spending	P3S13-VOBARSA	OECD	General government final consumption expenditure	quarterly	GDP
Public Debt	GANUSDA	BIS	Credit to General government from All sectors	quarterly	GDP
Interest Rates	IRLT	OECD	Long-term interest rates, Per cent per annum	quarterly	raw
Wage	WRT	OECD	Wage rate, total economy	quarterly	LN-ll
Property Tax	4100	OECD	Recurrent taxes on immovable property	annual	GDP
Income Tax	1000	OECD	Taxes on income, profits, capital gains	annual	GDP
Social	2000	OECD	Social security contributions	annual	GDP
Payroll	3000	OECD	Taxes en payroll and workforce	annual	GDP
Wealth Tax	4000	OECD	Taxes on property	annual	GDP
Consumption Tax	5000	OECD	Taxes on goods and services	annual	GDP

Note: "raw" implies that the data has not been transformed, "LN-ll" refers to a log transformation, and a country-level log linear detrending of the data, "GDP" refers to a division by GDP.

A.2 Sample

Table 2: Data Sample

	nobs	period
Australia	200	1965-2014
Austria	204	1965-2015
Belgium	204	1965-2015
Canada	204	1965-2015
Chile	104	1990-2015
Czech Republic	92	1993-2015
Denmark	204	1965-2015
Estonia	84	1995-2015
Finland	204	1965-2015
France	204	1965-2015
Germany	204	1965-2015
Greece	200	1965-2014
Hungary	100	1991-2015
Iceland	156	1965-2015
Ireland	204	1965-2015
Israel	84	1995-2015
Italy	204	1965-2015
Japan	204	1965-2015
Latvia	84	1995-2015
Luxembourg	204	1965-2015
Mexico	140	1980-2014
Netherlands	204	1965-2015
New Zealand	204	1965-2015
Norway	204	1965-2015
Poland	96	1991-2014
Portugal	204	1965-2015
Slovak Republic	84	1995-2015
Slovenia	84	1995-2015
South Korea	176	1972-2015
Spain	204	1965-2015
Sweden	204	1965-2015
Switzerland	204	1965-2015
Turkey	204	1965-2015
United Kingdom	204	1965-2015
United States	204	1965-2015

Note: Our sample is the full sample of 35 OECD countries, and all available macroeconomic data for these countries as of July 2016, when we last updated the data.

A.3 Summary Statistics on the property tax

Table 3: Property taxes in GDP and in total taxes, by country

	Mean (% Tax)	Max (% Tax)	Mean (% GDP)	Max (% GDP)
Australia	5.1	6.9	1.3	1.6
Austria	0.8	1.5	0.3	0.5
Belgium	1.2	3.0	0.5	1.3
Canada	9.1	11.9	2.9	3.3
Chile	3.3	4.0	0.6	0.7
Czech Republic	0.6	0.8	0.2	0.3
Denmark	2.9	5.1	1.2	1.6
Estonia	1.0	1.2	0.3	0.4
Finland	0.6	1.7	0.2	0.8
France	3.8	5.7	1.6	2.6
Germany	1.1	1.5	0.4	0.5
Greece	0.5	3.7	0.2	1.3
Hungary	0.7	1.7	0.3	0.6
Iceland	3.6	5.4	1.2	1.8
Ireland	4.3	12.2	1.2	3.1
Israel	6.5	7.4	2.1	2.3
Italy	1.2	3.6	0.5	1.6
Japan	6.3	8.2	1.6	2.2
Latvia	2.7	3.6	0.8	1.1
Luxembourg	0.5	1.6	0.2	0.4
Mexico	1.2	1.8	0.2	0.2
Netherlands	1.6	2.6	0.6	1.0
New Zealand	6.2	8.8	1.9	2.3
Norway	0.6	1.1	0.2	0.4
Poland	3.5	4.4	1.2	1.5
Portugal	0.8	2.5	0.2	0.9
Slovak Republic	1.3	1.5	0.4	0.5
Slovenia	1.2	1.5	0.4	0.6
South Korea	2.8	3.9	0.6	0.9
Spain	1.6	3.5	0.5	1.2
Sweden	1.1	2.8	0.5	1.3
Switzerland	0.6	0.8	0.1	0.2
Turkey	1.3	5.3	0.2	0.6
United Kingdom	9.7	11.5	3.2	4.2
United States	10.9	13.7	2.8	3.3

Note: Source: *OECD Revenue Statistics* and authors' calculations.

A.4 Cyclical property of tax revenues, by type of tax and country

Table 4: Elasticity of taxes to output, by country

	Property	Income	Social	Payroll	Wealth	Cons.
Australia	-0.06	1.37***		0.58	-0.27	0.16
Austria	-0.38	1.51***	0.68***	1.05***	0.19	0.83***
Belgium	-0.61	1.16***	0.59**	1.33	2.14	0.31
Canada	0.04	1.57***	1.31**	0.26	0.12	1.15***
Chile	0.08	3.75**	0.59***		1.48**	1.46***
Czech Republic	-1.31**	0.96*	1.07***		1.34*	0.64**
Denmark	-0.09	1.23***	-1.87	-3.07	0.99*	1.26***
Estonia	0.11	1.32***	0.61***		0.11	0.87***
Finland	-1.59	1.41***	1.01**	2.73	0.52	0.78***
France	-1.85	2.19***	0.91**	-0.78	-0.15	0.92**
Germany	0.06	1.94***	1.06***	12.01	0.38	0.94***
Greece	-0.48	0.96**	0.69**	0.31	0.3	0.56*
Hungary	-0.78	1.63*	1.58***	-2.67	0.44	0.43
Iceland	5.12***	4.32***	1.99***	6.85***	4.48***	4.23***
Ireland	-0.48*	0.64**	0.1	-0.68	0.4	0.45*
Israel	0.17	2.56***	0.79**	-0.75	0.58	0.13
Italy	-1.31	1.66***	1.13***	2.46	-0.29	1.46***
Japan	1.05***	2.2***	1.14***		1.28***	0.94***
Latvia	0.05	2.01***	1.18***	0.03	0.79	1.31***
Luxembourg	-0.38*	0.53*	0.09	0.62	1***	-0.09
Mexico	-1.71	-0.54	-1.12	-0.81	-1	-1.82
Netherlands	0.68	1.03***	0.64*		1.14**	0.97***
New Zealand	-0.03	0.5			0	-0.14
Norway	-0.49	2.15***	0.89*		0.69	1.27***
Poland	1.17	3.28***	1.29	3.39***	1.65**	1.27**
Portugal	0.93*	1.48***	0.94**	-0.93	1.56**	1.16***
Slovak Republic	0.26	1.85***	0.3		-0.09	0.53
Slovenia	0.39	2.06***	0.93***	10.97**	1.04	0.78**
South Korea	0.67	1.49***	2.05***	1.17**	1.36***	1.37***
Spain	-1.46	1.39***	2.1***		1.32**	0.8
Sweden	-2.54	0.67*	0.19	6.19**	-0.01	0.24
Switzerland	0.79***	0.55*	0.43		0.41	0.47**
Turkey	-0.95	-0.7	-1.48		0.1	-0.7
United Kingdom	0.04	0.25	0.21	-10.31	0.09	0.2
United States	-0.02	1.96***	0.72**		0.14	0.52**

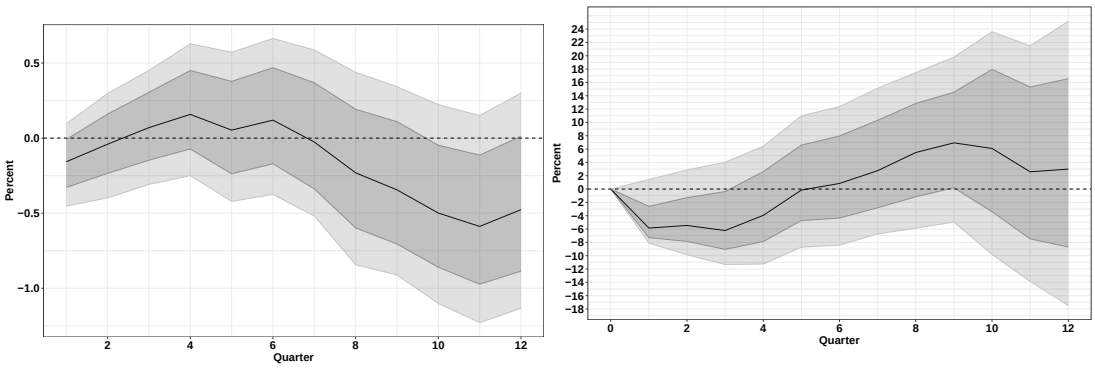
Note: Source: *OECD Revenue Statistics* and authors' calculations. This table shows the OLS regression coefficients of log tax revenues on log output, for different types of taxes. ***, **, * denote 1%, 5%, and 10% significance thresholds. "Property" corresponds to *recurrent taxes on immovable property* (OECD heading 4100), "income" to *taxes on income, profits and capital gains* (OECD heading 1000), "social" to *social security contributions* (OECD heading 2000), "payroll" to *taxes on payroll and workforce* (OECD heading 3000), "wealth" to *taxes on property* (OECD heading 4000) and "cons." (consumption) to taxes on goods and services (OECD heading 5000).

B Additional Results

Figure 8: Response of Government Spending and Public debt

(a) General government final consumption expenditure as a percentage of GDP

(b) Public debt as a percentage of GDP

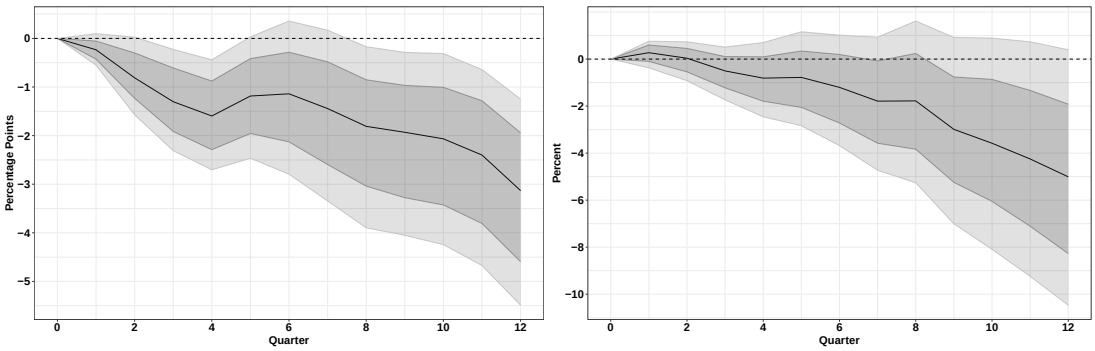


Note: This figure shows the response to a 1-percentage-point of GDP increase in property taxes. Shaded areas correspond to 68% and 90% confidence intervals.

Figure 9: Response of Interest rates and Wages

(a) Response of Interest rates

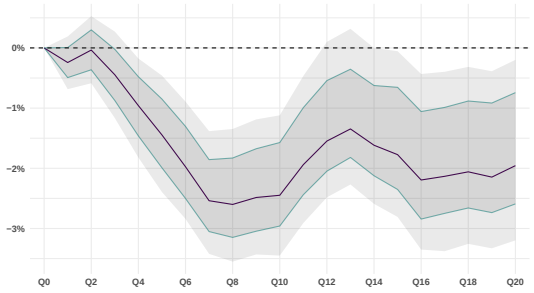
(b) Response of Wages



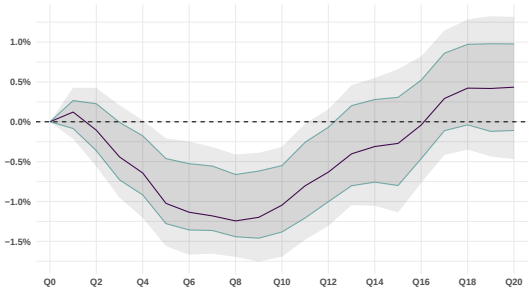
Note: This figure shows the response to a 1-percentage-point of GDP increase in property taxes. Shaded areas correspond to 68% and 90% confidence intervals.

Figure 10: Comparing with Romer and Romer's (2010) Fiscal shocks and Romer and Romer's (2004) Monetary shocks

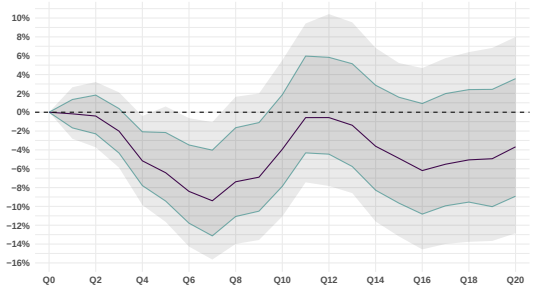
(a) Response of GDP with Romer and Romer (2010)'s shocks



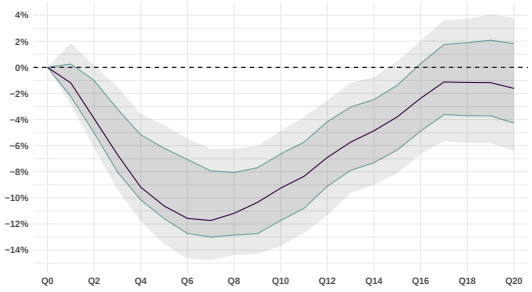
(b) Response of GDP with Romer and Romer (2004)'s monetary shocks



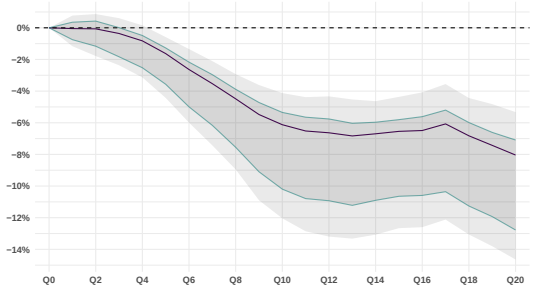
(c) Response of Residential Investment with Romer and Romer (2010)'s shocks



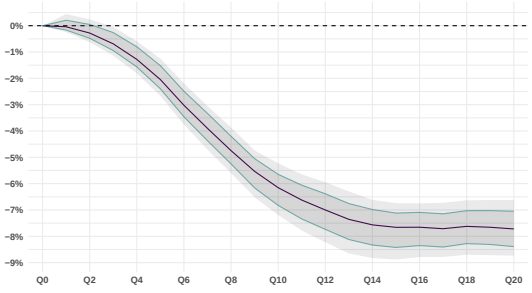
(d) Response of Residential investment with Romer and Romer (2004)'s monetary shocks



(e) Response of House prices with Romer and Romer (2010)'s shocks

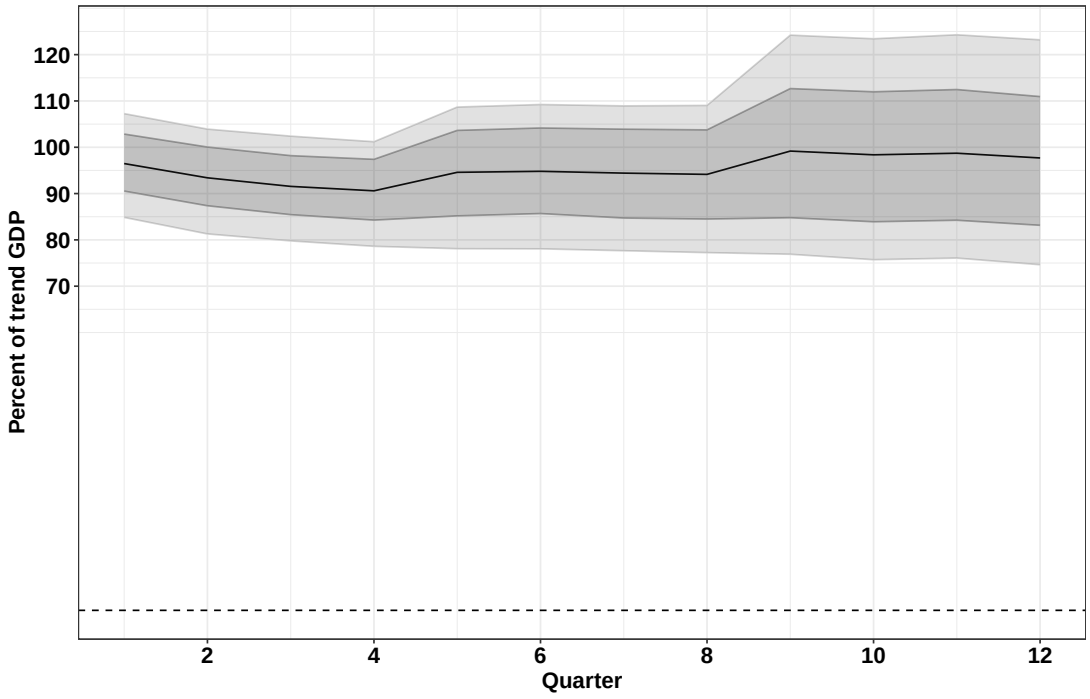


(f) Response of House prices with Romer and Romer (2004)'s monetary shocks



Note: Shaded areas correspond to 68% and 90% confidence intervals.

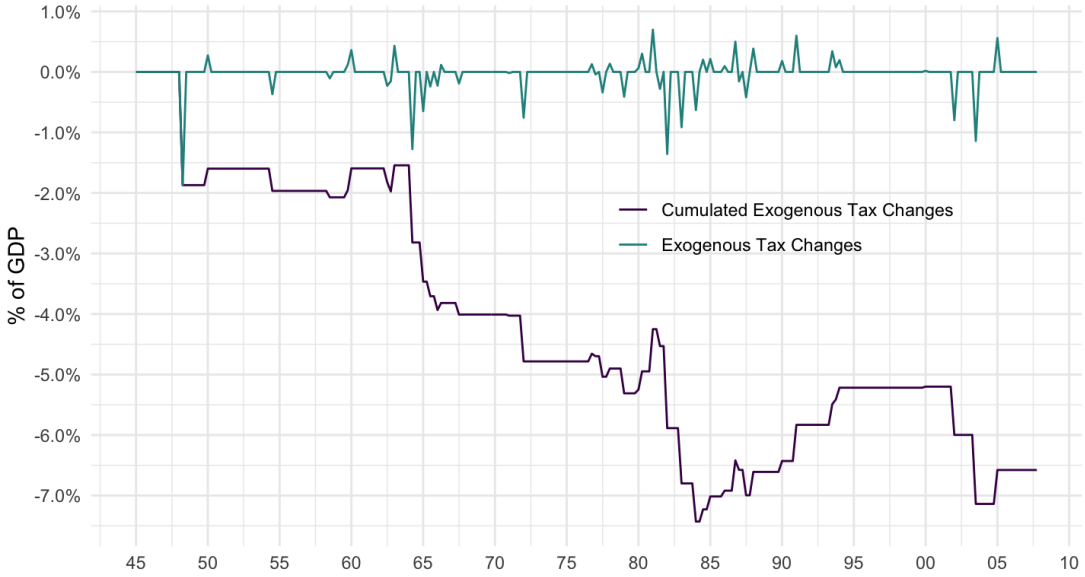
Figure 11: Persistence of Property Tax shocks



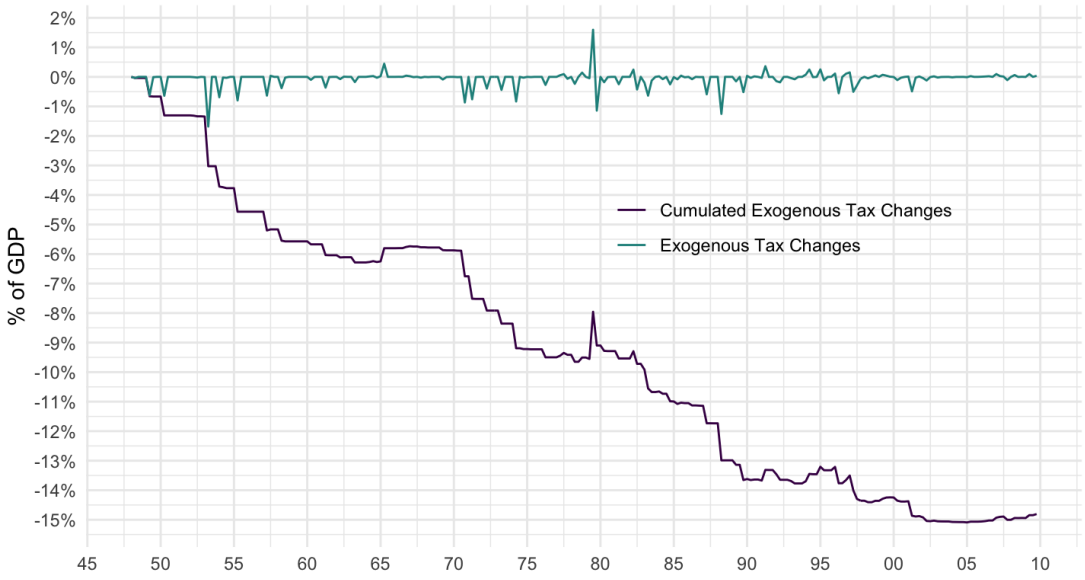
Note: This figure shows the response to a 1-percentage-point of GDP increase in property taxes. Shaded areas correspond to 68% and 90% confidence intervals.

Figure 12: Persistent shocks in Romer and Romer (2010) and Cloyne (2013)

(a) Persistent shocks in Romer and Romer (2010)



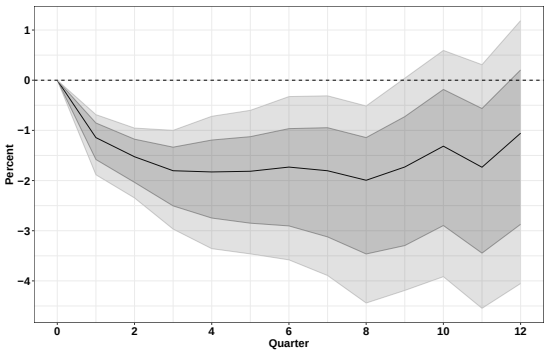
(b) Persistent shocks in Cloyne (2013)



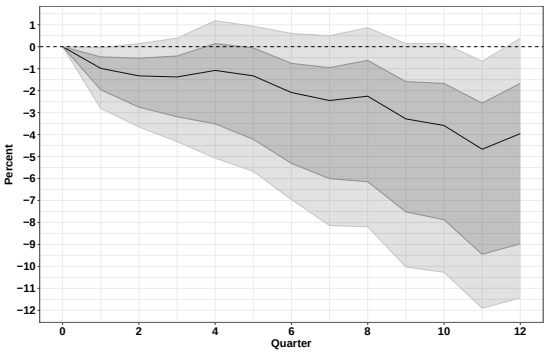
C Robustness

Figure 13: Effects of Differently Motivated Shocks

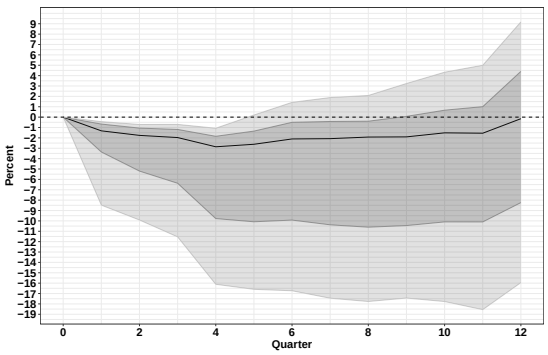
(a) Long Run



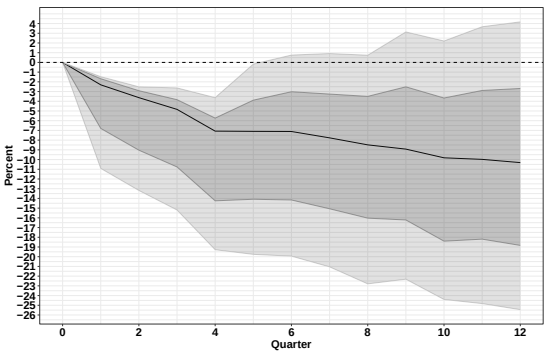
(b) Revision



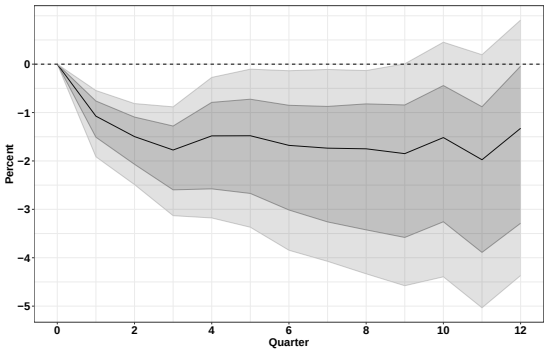
(c) Ideology



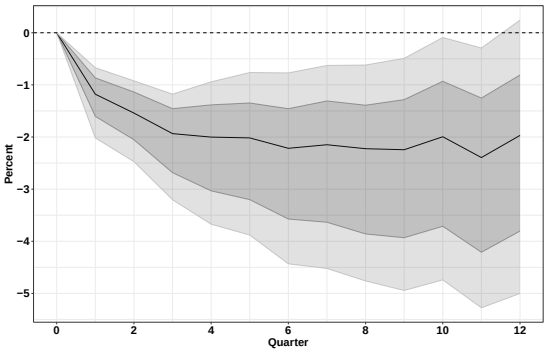
(d) Deficit Consolidation



(e) All shocks without "Deficit Consolidation"



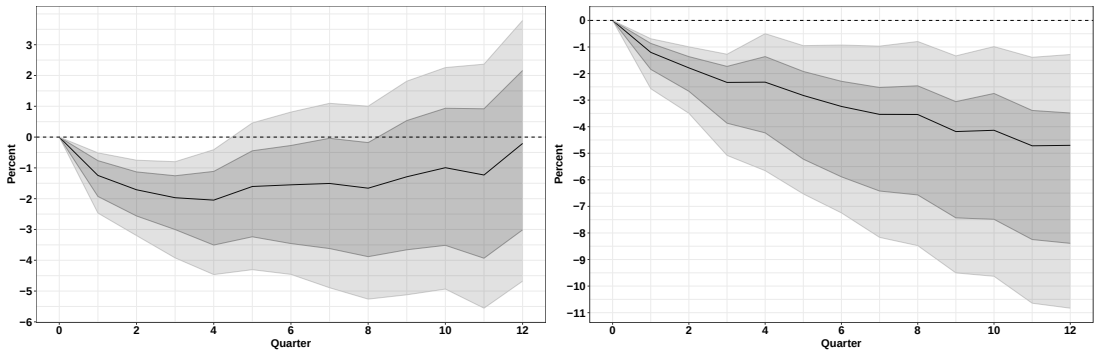
(f) All shocks without non-automatic revisions



Note: This figure shows the response to a 1-percentage-point of GDP increase in property taxes. Shaded areas correspond to 68% and 90% confidence intervals.

Figure 14: Differential Effects during Expansions and Recessions

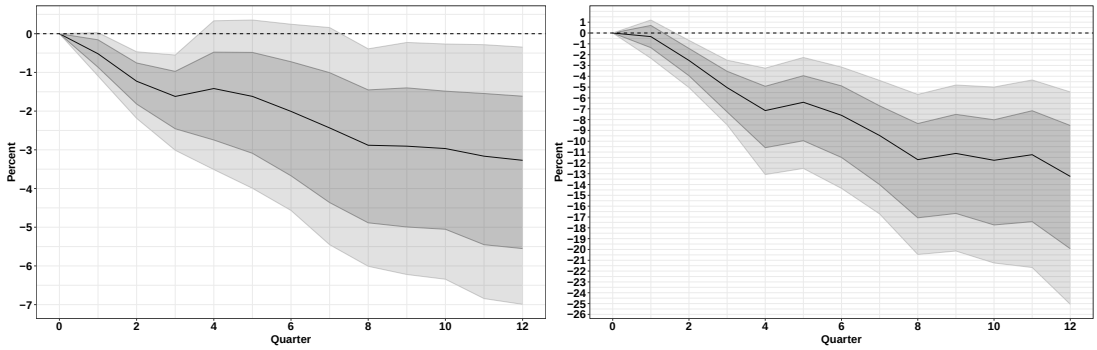
(a) Expansions (b) Recessions



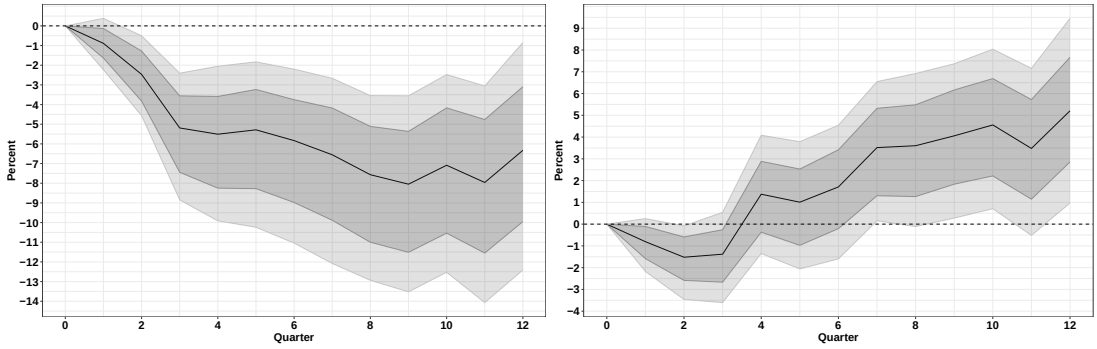
Note: This figure shows the response to a 1-percentage-point of GDP increase in property taxes. Shaded areas correspond to 68% and 90% confidence intervals.

Figure 15: Results for Components of GDP—ADL Approach

(a) Consumption (b) Investment, Total



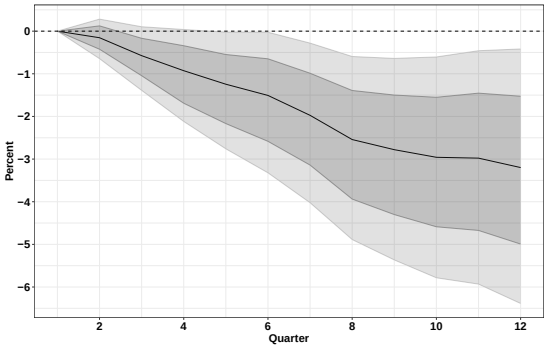
(c) Imports (d) Exports



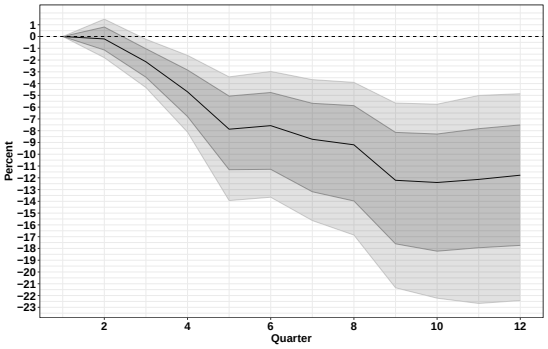
Note: This figure shows the response to a 1-percentage-point of GDP increase in property taxes. Shaded areas correspond to 68% and 90% confidence intervals.

Figure 16: Results for Components of GDP—SVAR Approach

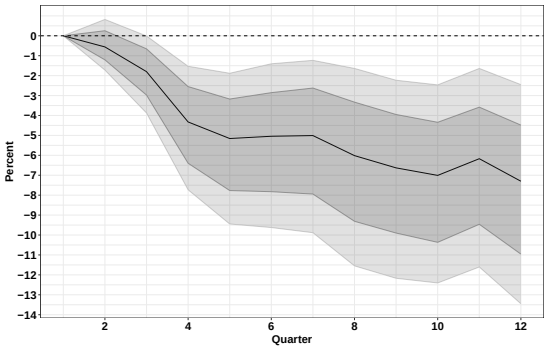
(a) Consumption



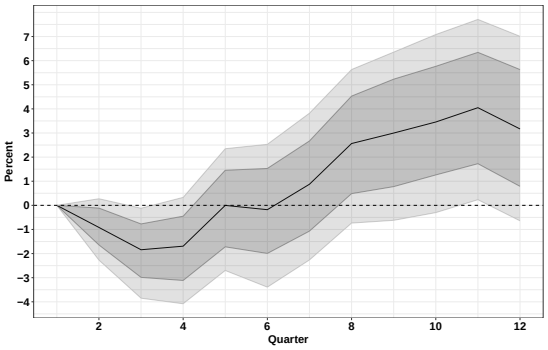
(b) Investment, Total



(c) Imports

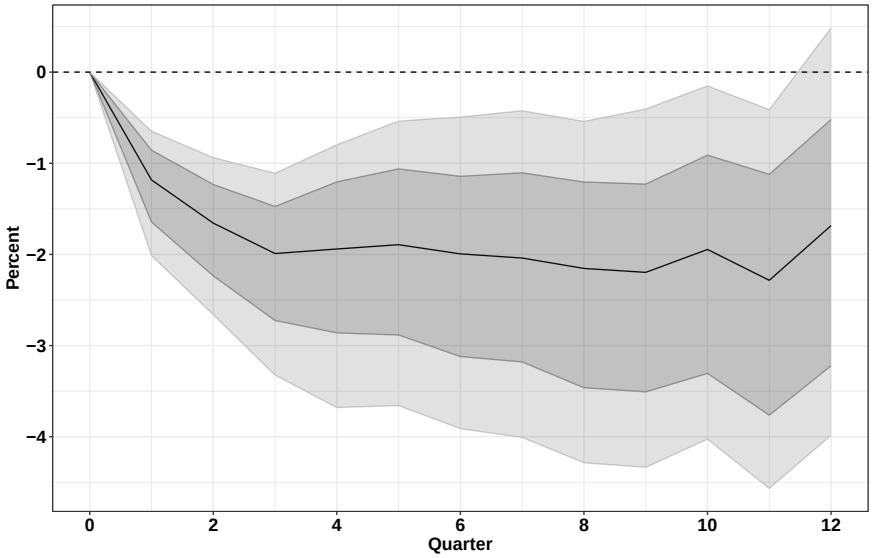


(d) Exports



Note: This Figure shows the response to a 1-percentage-point of GDP increase in property taxes. Shaded areas correspond to 68% and 90% confidence intervals.

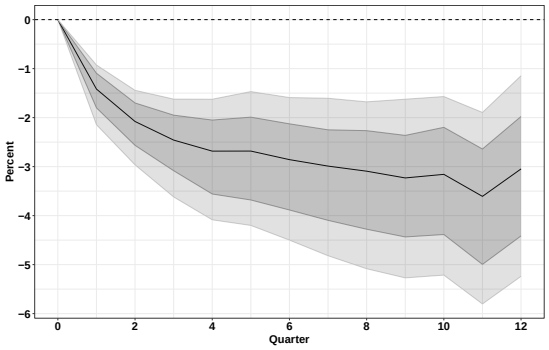
Figure 17: Deterministic Trend



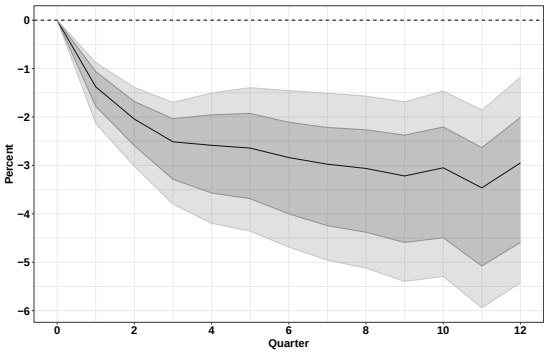
Note: This figure shows the response to a 1-percentage-point of GDP increase in property taxes. Shaded areas correspond to 68% and 90% confidence intervals.

Figure 18: Number of Lags for the endogenous variable P—Narrative Approach

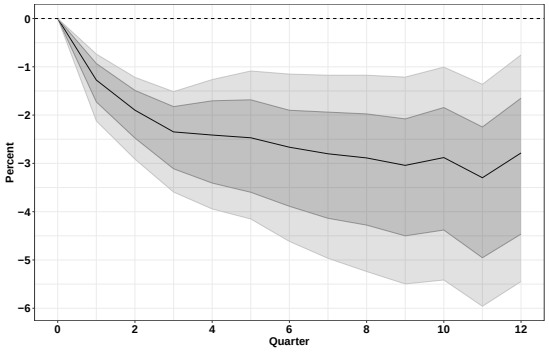
(a) Without controlling for lags of the endogenous variable ($P = 0$)



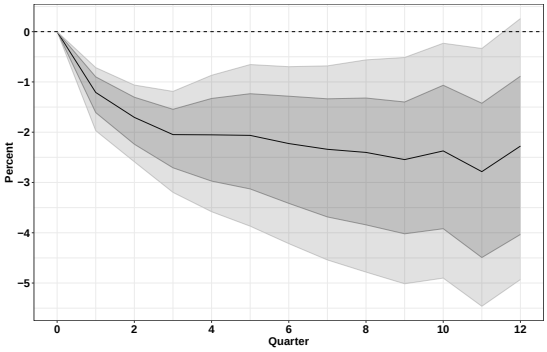
(b) 1 lag ($P = 1$)



(c) 2 lags ($P = 2$)



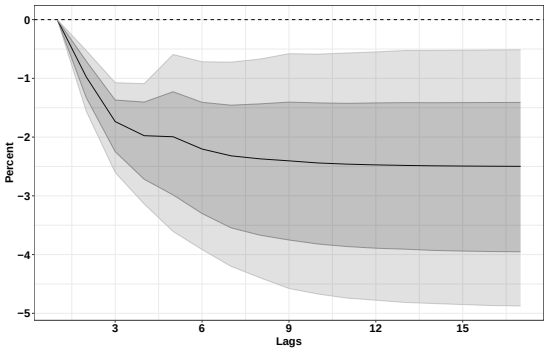
(e) 4 lags ($P = 4$)



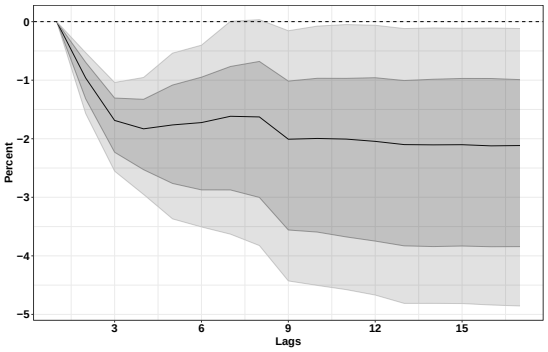
Note: This figure shows the response to a 1-percentage-point of GDP increase in property taxes. Shaded areas correspond to 68% and 90% confidence intervals.

Figure 19: Number of Lags—SVAR

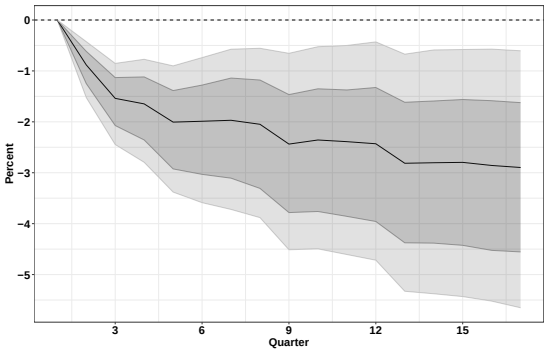
(a) 4 Lags



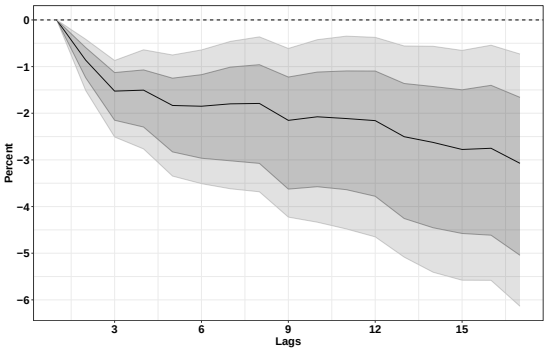
(b) 8 Lags



(c) 12 Lags



(d) 16 Lags



Note: This figure shows the response to a 1-percentage-point of GDP increase in property taxes. Shaded areas correspond to 68% and 90% confidence intervals.

D General features of property taxes

D.1 General presentation

The sub-heading 4100—"Recurrent taxes on immovable property"—covers taxes levied regularly in respect of the use or ownership of immovable property. These taxes are levied on land and building, in the form of a percentage of an assessed property value based on a national rental income, sales price, or capitalized yield; or in terms of other characteristics of real property, such as size, location, and so on, from which are derived a presumed rent or capital value. Such taxes are included whether they are levied on proprietors, tenants, or both. A major difference compared to taxes on net wealth is that debts are typically not taken into account when assessing property taxes.

D.2 Property valuation

Two distinct assessment methodologies are commonly used for valuing property: area-based assessment (the surface of the property is used as the basis for measurement) and value-based assessment, with the latter being divided into capital and rental value approaches. Under the rental value approach, property is assessed according to estimated rental value. Slack and Bird (2014) note that "*in theory, there should be no difference between a tax on market value and a tax on rental value. When a property is put to its highest and best use and is expected to continue to do so, rental value will bear a predictable relationship to market value—the discounted net stream of net rental payments will be approximately equal to market value*". Most countries use a mixture of systems, as illustrated by Slack and Bird (2014): "*For example, a country employing market-value assessment may tax single-family residences on the basis of values estimated by what is called the comparable sales method, commercial properties on the basis of values estimated by capitalizing some income stream, industrial properties largely on the basis of their estimated depreciated cost method, and rural properties on the basis of a more or less refined area (value per unit) method*". Some countries use area-based systems of taxation because they lack the necessary information, expertise, and resources to determine market values (e.g. Greece) or sometimes, as in the case of France, because they consider that the implementation of the market-value approach would be politically unacceptable.

In principle, valuations should be updated annually to keep pace with changes in price levels. This frequency is not common in practice. Among unitary states, only Netherlands and Iceland currently maintain this frequency. More commonly, legislation specifies a revaluation schedule, even if often these schedules can also be ignored. When properties are reappraised on a fixed cycle, one option is to revalue all districts at the same time in one large project. Another is to stagger the reappraisals (so-called "rolling revaluations"), as is the current practice in Denmark, which revalues on a two-year cycle. Some countries have currently no legal revaluation requirements, including Austria, Estonia, and United Kingdom (Almy (2014)).

Indexing is often chosen when the interval between reappraisals is long. Indexing can reduce shocks caused by reappraisals. According to Almy (2014), Austria, Belgium, Finland, France, Germany, Spain, and Sweden follow this approach. Often, the index used is not based on trends in property prices alone but is based on consumer prices generally or on construction costs.

E Views on the Property Tax

In this section, we illustrate our claim that strong views are held among economists, international organizations (OECD, IMF, European Commission), as well as in the financial press (*The Economist*, *The Financial Times*), on the output effects of the property tax. We also show that these views are mainly, if not only, based on theoretical arguments. Moreover, these arguments are mostly based on neoclassical economics, and on the limited supply effects of the property tax (even more forcefully for the land tax). In contrast, the potential disposable demand (Keynesian) effects of property taxes are rarely, if ever, considered.

E.1 Property tax from an historical perspective

Smith (1776) considered the topic of taxes on residential land values (which he called "ground-rents"), on houses ("house-rents") and on agricultural land ("the ordinary rent of land"):

"Both ground-rents and the ordinary rent of land are a species of revenue which the owner, in many cases, enjoys without any care or attention of his own. [...] *Ground-rents and the ordinary rent of land are, therefore, perhaps, the species of revenue which can best bear to have a peculiar tax imposed upon them.* "

Adam Smith advocated a land-value tax saying that "nothing [could] be more reasonable":

"As soon as the land of any country has all become private property, the landlords, like all other men, love to reap where they never sowed, and demand a rent even for its natural produce. [...] Nothing can be more reasonable, than that a fund, which owes its existence to the good government of the state, should be taxed peculiarly, or should contribute something more than the greater part of other funds, towards the support of that government. [...] Land is a subject which cannot be removed; whereas stock easily may. [...] Land is a fund of a more stable and permanent nature."

Such a tax would not be distortionary:

"No discouragement will thereby be given to any sort of industry. The annual produce of the land and labour of the society, the real wealth and revenue of the great body of the people, might be the same after such a tax as before."

"A tax upon the rent of land cannot raise rents, because the neat produce which remains, after replacing the stock of the farmer, together with his reasonable profit, cannot be greater after the tax than before it..."

"The rent of land, therefore, considered as the price paid for the use of the land, is naturally a monopoly price. It is not at all proportioned to what the landlord may have laid out upon the improvement of the land, or to what he can afford to take; but to what the farmer can afford to give".

Ricardo (1817) defined land rents as "*that portion of the produce of the earth which is paid to the landlord for the use of the original and indestructible powers of the soil*".

Mill (1848) was another advocate of a land value tax:

"*The ordinary progress of a society which increases in wealth, is at all times tending to augment the incomes of landlords; to give them both a greater amount and a greater proportion of the wealth of the community, independently of any trouble or outlay incurred by themselves. They grow richer, as it were in their sleep, without working, risking, or economizing. What claim have they, on the general principle of social justice, to this accession of riches? In what would they have been wronged if society had, from the beginning, reserved the right of taxing the spontaneous increase of rent, to the highest amount required by financial exigencies?*"

George (1879) was probably the most famous advocate of a land value tax:

"Go, get yourself a piece of ground, and hold possession ... you need do nothing more. You may sit down and smoke your pipe; you may lie around like the lazzaroni of Naples or the leperos of Mexico; you may go up in a balloon, or down a hole in the ground; and without doing one stroke of work, without adding one iota to the wealth of the community, in ten years you will be rich! In the new city you may have a luxurious mansion; but among its public buildings will be an almshouse."

Churchill (1909) made a famous speech entitled "*Land Price as a Cause of Poverty*", in which he advocated a land-value tax:

"The unearned increment derived from land arises from a wholly sterile process, from the mere withholding of a commodity which is needed by the community".

Friedman (1999) called the land value tax, "*the least bad tax*". He argued: "*It's not unpopular for good economic reasons. It's unpopular in my opinion for one simple reason: It's the only tax left on the books for which people have to write a big check.*"

E.2 OECD Reports

The OECD is a strong advocate of the development of property taxes. This a very frequent recommendation, notably in the country-specific economy surveys (for recent examples, see in particular OECD (2016b), OECD (2015a)). The OECD has also written several reports and working papers on the advantages and drawbacks of property taxes.

In an OECD study, *OECD (2010f)* writes:

"The analysis suggests a tax and economic growth ranking order according to which corporate taxes are the most harmful type of tax for economic growth, followed by personal income taxes and then consumption taxes, with recurrent taxes on immovable residential property being the least harmful tax. A revenue-neutral tax reform that shifts the balance of taxation more toward consumption and recurrent residential property taxes could thus strengthen the growth of output over the medium term." "Taxes on residential property are likely to be best for growth, also because they could contribute to the usage of underdeveloped land and because most OECD countries provide various tax preferences for owner-occupied housing (such as deductibility of interest on house loans and exemptions from capital gains tax), which result in a misallocation of capital towards housing, away from other investments. In this situation, the pre-tax rate of return on housing investment is below the pre-tax rate of return on investment elsewhere in the economy. This implies that increasing recurrent taxes on immovable property will shift some investment out of housing into higher return investments and so increase the rate of growth."

Blöchliger (2015): "*The tax on immovable property is usually seen as one of the most efficient and least detrimental taxes to economic growth. The tax base is immovable and inelastic, i.e. households usually react little to changes in tax policy. The property tax differs from income or business taxes which tend to change behaviour – to work, to save, to invest – more markedly". "Since property taxation largely maintains households' decisions to save and invest, it should be less of a drag on economic growth. OECD analysis suggests that immovable property taxes are the least harmful to economic growth.*"

Slack and Bird (2014): "*Property taxes are generally considered by economists to be good taxes, and many countries are being advised to increase and improve their property taxes (IMF (2013b)). In practice, however, property tax reforms have often proved to be difficult to carry out successfully. [...] Economists consider taxes on immovable property good taxes, especially for local governments, for a number of reasons. It is difficult to evade the tax because property is immovable: the tax base cannot shift location in response to the tax and it cannot be hidden. In addition, the property tax is considered to be efficient because it distorts the allocation of resources less than other taxes. Since changes in property taxes are, to a large extent, capitalized into property values their impact on economic behaviour is likely to be smaller than other taxes such as income and sales taxes. [...] Where property taxes are levied largely by local governments they promote local autonomy and accountability owing to the connection between many of the services provided at the local level (for example, schools, roads, transit, parks) and property values. [...] Despite its virtues, however, the property tax is not popular with taxpayers and politicians. It has been characterized as the "tax everyone loves to hate" (Rosengard (2012)). It is criticized for many reasons: as unfair, because it is unrelated to ability to pay or to benefits received, as unsuitable because it supports services that are not related to property and as inadequate because it does not provide sufficient revenue to meet local expenditure needs. It has also been criticized for its negative effects on housing, land use, and urban development.*"

Brys et al. (2008): "*Property taxes do not affect the decision to supply labour, invest in human capital, produce, invest, and innovate as much as do other taxes*".

E.3 IMF Reports

The IMF is also a strong advocate of the development of property taxes. The property tax is seen as a growth-friendly, efficient tax.

IMF (2013b): *"There is a strong case in most countries, advanced or developing, for raising substantially more from property taxes". "Property taxes appear to be relatively growth-friendly and can serve equity and accountability aims." "Recurrent taxes on residential property are widely seen as an attractive and underexploited revenue source: the base is fairly immobile and hard to hide, the tax comes at the top of the hierarchy of long-run growth-friendliness mentioned earlier, and it can be made progressive through a basic allowance or by varying the rate with the value of the property. It has particular appeal as a source of local-government finance, since property values will reflect the benefits of local public spending". "Property taxes, in the form of recurrent taxes levied on land and buildings, are generally considered to be more efficient than most other taxes, primarily because of the immobility of the location-specific attributes reflected in property prices: a pleasant summer house by the lake is hard to put in an offshore bank account. Studies of the growth hierarchy have indeed generally found taxation of immovable property to be more benign for economic growth than other forms of taxation, in particular compared with direct taxes (OECD (2010f))."*

IMF (2014): "*Shifting the tax-structure toward property taxation and VAT is commonly found to be growth enhancing*".

Norregaard (2013): "*The tax on immovable property has been characterized as probably the most unpopular among tax instruments, in part because it is salient and hard to avoid. But economists continue to emphasize the virtues of the property tax owing to its relatively low efficiency costs, benign impact on growth, and high score on fairness." "Considerations of economic efficiency strongly underpin the case for exploiting property taxes to their fullest potential. Their well-known efficiency enhancing properties derive mainly from the immobility of the tax base which, when underpinned by efficient and accurate valuation systems, entail clear benefits in different respects..."*

"Property taxes in the form of recurrent taxes levied on land and buildings, are generally considered to be more efficient than other types of taxes in that their impact on the allocation of resources in the economy is less adverse—by not affecting decisions to supply labor and to invest (including in human capital) and innovate..."

*"If a newly introduced (or an increase in an existing) property tax is fully capitalized in property prices, present property owners would suffer a one-off loss in wealth, while new property owners would not be affected: once introduced (or increased), property taxes do not affect the rate of return and are therefore considered neutral to investment behavior. This quality follows from the fact that the property tax, to the degree it is a tax on accumulated wealth, does not alter future behavior. International evidence suggests that immovable property taxation may be more benign than other tax instruments with respect to its effect on long-term growth. In recent studies, in part based on a broad review of the literature, OECD (*Brys et al. (2008) *and OECD (2010f)) establishes a "tax and growth ranking" with recurrent taxes on immovable property (and residential property in particular) being the least distortive tax instrument in terms of reducing long-run GDP per capita, followed by consumption taxes (and other property taxes), personal income taxes, and finally corporate income taxes as the most harmful for growth. Hence, a revenue neutral growth-oriented tax reform would involve shifting part of the revenue base from income taxes to consumption and immovable property.*"

Ormaechea and Yoo (2012): "*A revenue-neutral rebalancing that reduces income taxes while increasing consumption and property taxes is associated with faster long-term growth*".

E.4 European Commission Reports

The European Commission (2017): "*Recurrent taxes on real estate property have attracted increasing attention from policy makers because in many countries where they are low they offer a potential source for increasing revenue, while at the same time they are considered to be the least detrimental to economic growth given the immobility of the tax base*".

The European Commission (2012): "*A tax on residential property can be advocated on efficiency grounds, acknowledging that taxes on immovable property are found to be among the least detrimental taxes to economic growth". "a recurrent tax on residential housing supply is generally considered as less adverse than other types of taxes, as it has little impact on the decisions of economic agents. It has indeed relatively little influence on labour supply, investment in human capital, production and innovation compared to other taxes. Residential property is thus considered as an efficient tax base as the distortion related to the implementation of a recurrent tax on it is small*".

E.5 Financial Press

The Economist (2013b): "*Ask an economist about which are the most efficient kinds of taxes, and property taxes will be high up on the list. They distort behaviour less, and are more growth friendly, than taxes on income, employment or even consumption.*"

The Economist (2013a): "*Taxing land and property is one of the most efficient and least distorting ways for governments to raise money. A pure land tax, one without regard to how land is used or what is built on it, is the best sort. Since the amount of land is fixed, taxing it cannot distort supply in the way that taxing work or saving might discourage effort or thrift. Instead a land tax encourages efficient land use. Property developers, for instance, would be less inclined to hoard undeveloped land if they had to pay an annual levy on it. Property taxes that include the value of buildings on land are less efficient, since they are, in effect, a tax on the investment in that property. Even so, they are less likely to affect people's behaviour than income or employment taxes. A study by the OECD suggests that taxes on immovable property are the most growth-friendly of all major taxes. That is even truer of urbanising emerging economies with large informal sectors. [...] Property taxes are a stable source of revenue in a globalised world where firms and skilled people can easily move. They are also less prone to cyclical swings. In the financial bust America's state and local governments saw smaller declines in property taxes than other forms of revenue, largely because the valuations on which tax assessments are based were adjusted more slowly and less dramatically than actual prices. Property taxes may even restrain housing booms by making it more expensive to buy homes for purely speculative purposes.*"

In the Financial Times (Webb, 2013): Concerning land or location value tax (LVT): "*In theory, it is not just an excellent tax but the best of all possible taxes. Once the initial valuations have been done, it is phenomenally easy to collect and all but impossible to avoid. It also discourages speculation and stops in its tracks the endless cycle of investment in land and property purely to rent it out. It promises no more property boom and bust. But, as it is not collected on any improvements made to land or to buildings on land, it does not discourage productive activity. Instead, it encourages people to bring idle land into use, to improve land they own and to be as productive as possible (when you have a pure LVT, earned income isn't taxed at all). The end result is, in theory at least, good for society, good for the state, good for equality and good for growth.*"

F Property tax systems across countries

Country	Adm. Level	Cadastral values
Australia	Local councils	Land valuations made every 4 to 7 years.
Austria	Federal rate multiplied by a municipal coefficient	From 1973, updates every 9 years on average.
Belgium	Regional and Local	From 1975, with updates every 10 years. Indexed to the CPI since 1991.

Canada	Municipal governments	Market value in most provinces (with an annual reassessment). Before 1998, reassessments were made infrequently.
Chile	Nationally set tax rates	Updated at least every 5 years (10 years before 2006).
Czech Republic	Local	Based upon floor-area.
Denmark	Municipal tax and National tax	Updated annually. Tax freeze policy implemented from 2002. 1998-2002: every year. Every four years from 1903 to 1997.
Estonia	Municipality	From 2001.
Finland	Municipality	Market value in theory. In practice, reassessment in 1993, 2009 and 2014. Today, reassessments are supposed to take place every 5 years.
France	Local	From 1970.
Germany	Federal rate multiplied by a municipal coefficient	From 1964.
Greece	National tax of 2011	Based upon floor-area.
Hungary	Local	Properties are valued using arbitrary point values, such as per-square meters and location.
Iceland	Local government	If assessment is supposed to be based on the market value of the property, in practice, revaluations are infrequent.
Ireland	National	Every 3 years in theory. Last market value update: 2013 – this valuation applies until 2019. From 1983 to 1997, residential property tax based partly on the market value of an owner-occupied house. Up to 1978, valuation based on 1847 property values.
Israel	Local government	Based on the surface area and type of property. Starting in 2017, new tax levied on the value of properties.
Italy	Local government	From 1988. Correction factor was increased by 60 % in 2012.
Japan	Central government	Adjusted every three years
Latvia	State	Land was valued in 1998, and buildings were valued in 2000. Valuations are on a five-year cycle.
Luxembourg	Local government	From 1941.
Mexico	Local state	Market value. Annual assessment in theory. In practice, assessed value is usually less than the market value.
Netherlands	Local	Every five years from 1975 to 1995. Every four years from 1995 to 2005. Updated annually by municipalities since 2008.
New Zealand	Local	Frequency of market value updates varies. Official land valuation in average every two or three years. Before 1992, revaluations took place in average every 5 years – 3 years during the nineties.
Norway	Municipalities	Assessed value of the property (about 25 % of the market value) – the frequency of market value updates is every ten years.
Poland	Local	Based upon floor-area.

Portugal	Municipalities (min/max rates determined at the national level)	Officially adjusted every 3rd year. But some values were not updated between 2003 and 2013. Revision of the cadastral value of the housing stock in 2013.
Slovak Republic	National and municipalities	From 2004. The tax base does not follow market values.
Slovenia	Municipalities	Based upon floor-area.
South Korea	Local and national	Reassessments are supposed to take place annually – not the case in practice. Regular updates. Reassessments in 1991-1992, 2006-2007.
Spain	Tax levied by municipalities	Up to the nineties, rural property revalued every 5 years and urban property every 3 years. Revisions in 1991 and 1994.
Sweden	Municipal tax	Since 1985, revaluation cycle every 3 years (properties fully updated every 6 year, with a minor revision in between).
Switzerland	Cantons	Depending on the specific Canton, every 5-10 years in average.
Turkey	Local	Valuation every four years.
United Kingdom	Local taxation	From April 1991.
United States	Local government level	In theory, mostly at the fair market value. In practice, reassessment cycles – revaluations in average every 4-5 years in most States.

G Narrative Record—Tax Changes

Country	**Year**	**Description**	**Category**
Austria	1975	Change of cadastral value in 1973, implemented in 1975.	R
	1983	Updates of 1973 cadastral values	R
	1992	Updates of 1973 cadastral values	R
	2009	Updates of 1973 cadastral values	R
Belgium	2005	Property tax credit on personal income tax. Policy in favor of home-ownership.	LR, I
Canada	1989	Property tax reassessment	R
	1998	New assessment system	LR, R
	2000	Property tax caps	D, I
	2001	Property tax reassessment	R
Czech Republic	2009	Fiscal decentralization, municipal autonomy	LR
Denmark	1979	Property tax reassessment (every 4 years until 1998)	R
	1981	New assessment system	R, LR
	1983	Property tax reassessment	R
	1986	End of full deduction in the taxable income of mortgage interest payments.	D
	1987	Property tax reassessment	R
	1991	Property tax reassessment	R
	1995	Property tax reassessment	R
	1998	Property tax reassessment (every year until 2002)	R

	1999	Property tax reassessment	R
	2000	Property tax reassessment	R
	2001	Property tax reassessment	R
	2004	Tax freeze policy on property taxes	I, D
	2005	Tax freeze policy on property taxes	I, D
	2008	Local government reform, end of local tax controls from central government, local self-government	LR
Finland	1993	New Municipal Tax on Real Property, Revision	LR, R
	2000	Changes in the statutory lower limits to the property tax rates	LR, I
	2010	Property tax reassessment	R
	2014	Property tax reassessment	R
France	1975	New property tax	LR, R
	1983	Fiscal decentralization	LR
	1984	Fiscal decentralization	LR
	1992	ATR Law, Decentralization	LR
	2000	Policy of fiscal recentralization, Electoral cycle	LR, E
	2010	Electoral cycle, Post election context	E
Germany	1984	Reform of the Property tax – abolition of tax base exemptions.	LR
Iceland	2009	Property tax reassessment	R
Ireland	1978	Fiscal centralization	LR
	1983	New Property Tax	LR
	1995	Wave of tax protests, unpopularity of the property tax, lack of equity	I
	1998	Abolition of property tax, unpopularity of the property tax	I, LR
	2014	New property tax	LR
Israel	1998	Reform of the property tax (Arnona)	LR
Italy	1993	Creation of a real estate tax (Imposta comunale sugli immobili)	LR
	2012	Major change in property tax system	LR, D
Japan	1977	Property tax reassessment (every three years).	R
	1980	Property tax reassessment	R
	1983	Property tax reassessment	R
	1986	Property tax reassessment	R
	1989	Property tax reassessment	R
	1992	Property tax reassessment	R
	1995	Property tax reassessment	R
	1998	Property tax reassessment	R
	2001	Property tax reassessment	R
	2004	Property tax reassessment	R
	2007	Property tax reassessment	R
	2010	Property tax reassessment	R
	2013	Property tax reassessment	R
Latvia	1998	Property tax reform	LR
	2010	New residential property tax on buildings	LR, D
Netherlands	1976	Property tax reassessment (every five years from 1975 to 1995)	R
	1981	Property tax reassessment	R
	1986	Property tax reassessment	R
	1991	Property tax reassessment	R

	1995	Reduction of the support for owner-occupied dwellings	LR
	2000	Property tax reassessment	R
	2004	Property tax reassessment	R
	2006	Large tax deduction for homeowners + Property tax reassessment.	LR, I, R
	2009	Higher taxation of ownership, Property tax reassessment	LR, R
New Zealand	1977, 1981	Property tax reassessment	R
	1983	New exemptions on the Land tax, Unwillingness of government to tax capital	I
	1992	Abolition of the land tax	I
	1998	Property tax reassessment	R
Poland	2001	Reform of the Property Tax – broader tax base coverage.	LR
Portugal	2003	New Property tax + Property tax reassessment	R, LR
	2013	Property tax reassessment	R
Slovak Republic	2005	Property tax reform – fiscal decentralization	LR
South Korea	1991	New system for assessing land to provide a realistic measure of land. Property tax reassessment.	LR, R
	1992	New system for assessing land to provide a realistic measure of land. Property tax reassessment.	LR, R
	2006	Reassessment and new property tax, fiscal centralization	LR, R
	2007	Property tax reform and reassessment.	LR, R
Spain	1981	Reorganization of local treasuries, revision of cadastral values	LR, R, D
	1982	Revision of cadastral values	R
	1983	Law of 1983	LR
	1986	Sentence of the constitutional court + Revision	E, R
	1987	Sentence of the constitutional court + Local election	E
	1992	Revision of cadastral values	R
	1994	Revision of cadastral values	R
Sweden	1985	New Property tax	LR
	1991	Property tax reform	LR
	1993	Property tax reassessment	R
	1996	Property tax reform	LR
Switzerland	1983	Abolition of the recurrent tax on immovable property in the Canton of Zurich	LR, I
United Kingdom	1973	Revision	R
	1986	Revision	R
	1993	Introduction of the Council Tax (April 1993)	LR, I
United States	1975	Restrictions on property taxation by local authorities	I, D
	1978	Restrictions on property taxation by local authorities, notably California's Proposition 13 (1978), Tax revolt spread across the US	I, D
	1990	Revisions – reassessment cycles	R

1991	Revisions – reassessment cycles	R
1993	Restriction on property taxation	I, D
1995	Restriction on property taxation	I, D

Note: "R" means reassessments, "LR" long-run economic reforms, "D" deficit consolidation, "I" ideological changes, "E" external changes.