The Macroeconomic Effects of Lump-Sum Taxes*

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Abstract

This paper measures tax multipliers using the property tax, the closest real-world counterpart to a lump-sum tax. As this tax has no supply or incentive effect, tax multipliers can be interpreted in terms of an aggregate demand channel working through a change in disposable income. 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 including more than a thousand tax changes. Our estimates lead to a reconciliation of narrative and structural approaches: we find using both types of methods that tax multipliers are between 2 and 3, in line with a growing consensus in the literature. Since the base for property taxes is not contemporaneously affected by GDP in most countries, our results confirm that the downward bias in structural VAR approaches comes from cyclical adjustment.

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> "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)

What are the effects of tax changes on output? How do tax changes impact the macroeconomy? Despite their importance, these two questions attract substantial controversy among academics and policymakers. The first question is still debated, because different empirical methodologies lead to heterogeneous estimates of tax multipliers: narrative methods such as Romer and Romer (2010), Cloyne (2013), and Hayo and Uhl (2014) arrive at high multipliers between 2 and 3, while structural methods following Blanchard and Perotti (2002) tend to find smaller multipliers. The second question is also controversial, because tax changes simultaneously impact agents' various incentives (supply), but also their overall disposable incomes (demand). Economists debate whether tax cuts operate mainly through supply or demand: Romer and Romer (2010) interpret their results as resulting from demand side effects, while Mertens et al. (2018) suggest that marginal tax changes have larger effects on output than average tax changes, which is suggestive of supply side effects. Our paper uses property tax changes – the closest real-world counterpart to a lump-sum tax – to contribute new evidence to these two debates.

Towards the first question, we find that tax multipliers are between 2 and 3, in line with a growing consensus in the literature using narrative methods, as surveyed in Ramey (2018).[1] However, a key novelty of our study is that we reconcile narrative and structural approaches. We arrive at a multiplier between 2 and 3 both when we rely on 100 property tax shocks identified through the narrative record, as well as when we use structural VAR approaches including more than a thousand tax changes. This is reassuring, because narrative methods are sometimes criticized for lack of replicability: according to Nakamura and Steinsson (2017), the burden of data collection in narrative methods implies that "data are (perhaps unconsciously) reverse-engineered to generate favored conclusions."

To the second question, we argue that because the property tax is the closest real-world counterpart to a lump-sum tax, the effects of the property tax can be interpreted in terms of aggregate demand effects working 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

[1] Ramey (2018) notes 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."

(1879). For the same reason, increases in property taxes are often recommended by international organizations, in policy discussions, as well as in the financial press.[2] 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.[3] We find in contrast to the supply side view that property taxes are no free lunch, and do cause declines in output, through a disposable income effect. We view our results as a compelling case which supports the view that aggregate demand can determine output, at least in the short run.

More precisely, we first use a narrative approach to identify more than one hundred 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 in Romer and Romer (2010) for the United States and Cloyne (2013) in the United Kingdom. The considerable data requirements of this approach make it challenging and time consuming to conduct. We study the different property tax systems, how often property taxes are revised, and what the motivations are for these revisions, and we identify more than 100 exogenous tax changes. We trace the average impact of such shocks on several macroeconomic aggregates, and our results are strikingly close to the results found in the literature using the narrative approach, both on output as well as on different components of output. Indeed, in our preferred specifications, a 1% of GDP increase in property taxes leads to a 2% to 3% reduction in output on average. The advantage of the narrative approach relative to structural methods is that it makes shocks observable, and allows to discuss case by case whether their motivations are indeed exogenous to the macroeconomy.

The appeal of property taxes is that the same results can be obtained when using all property tax changes in structural VAR approaches, instead of only those which were identified with the narrative approach. A first structural method consists in tracing out the effect of all 1000 property tax changes that we measure across countries, and to show that these property tax changes all have the same effects on output as the more than 100 tax changes that have been identified through our narrative methodology. We can do so as property tax changes are largely exogenous, unlike other tax changes, which are contaminated by output movements. However, the reason behind property tax changes might also be correlated with output – if, for example, property taxes are systematically increased during recessions. A second structural method consists in

[2]We give several examples in the **online appendix**, in particular Economist (2013b). To the best of our knowledge, the fact that property taxes have small effect on output has however never before been tested in the data.

[3]For example, Slack and Bird (2014) write: "Property taxes are generally considered by economists to be good taxes, and many countries are being advised to increase and improve their property taxes. In practice, however, property tax reforms have often proved to be difficult to carry out successfully."

using a Choleski decomposition, allowing property taxes to be endogenous to output, even contemporaneously. Both methods lead to very similar results, qualitatively and quantitatively, and confirm those of the narrative approach.

We believe that the reason why the property tax leads to similar results when all shocks are used is that the base which is used to calculate property taxes is not affected by GDP, at least contemporaneously.[4] Even in countries where a reassessment of cadastral values is frequent, such as the United States (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. This allows us to use property tax changes as accurate measures of shocks, without any need to use a cyclical adjustment. In contrast, the issue of automatic stabilizers has typically been addressed in structural VARs such as Blanchard and Perotti (2002) by using external information about the elasticity of tax revenues to output, and treating residuals from that structural relationship as "shocks." The recent literature has confirmed that cyclical adjustment is problematic in practice. Caldara and Kamps (2017) have shown that results coming out of a structural VAR are very sensitive to the choice of the elasticity of revenues to output. Mertens and Ravn (2014) have shown that when Romer and Romer (2010)'s narrative shocks are used to estimate the elasticity of tax revenues to output, the narrative and structural VAR approaches can be reconciled, which further points to the importance of cyclical adjustment.[5]

The rest of the paper proceeds as follows. Section 1 reviews the relevant literature. Section 2 presents the data. Section 3 presents the results of the narrative approach. Section 4 presents the results using all property tax changes using two structural methods. Section 5 discusses the external validity of our estimates. In section 6, we perform a list of robustness checks. Finally, section 7 concludes.

[4] 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 gain taxes, corporate taxes, etc.

[5] This reconciliation implicitely assumes that the narrative analysis has successfully identified exogenous shocks. We do not need this assumption, as the structural estimation is in our case independent from the narrative approach.

1 Literature

Our paper is closely related to the literature on tax multipliers using empirical methods.[6] 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 in order to take into account general equilibrium effects (for example, Nakamura and Steinsson (2014)). This literature on cross-sectional fiscal multipliers is surveyed in Chodorow-Reich (2017). Individual-level data, often based on administrative records, also allows to estimate the direct effects of tax cuts on households' consumption, using quasi-experimental methods, for example using the timing of tax cuts (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, with Friedman and Schwartz (1963), Romer and Romer (1989) and Romer and Romer (2004). Romer and Romer (2010), Cloyne (2013), Hayo and Uhl (2014) have also used this approach to characterize the effects of fiscal policy. The literature on fiscal multipliers has been recently surveyed in Ramey (2018). Event studies include Alesina et al. (1995), Alesina and Perotti (1997), Alesina and Ardagna (1998). Other methods are more structural, in that they use theory based restrictions in order 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 theory and find much higher tax multipliers. Following the debate around austerity in the aftermath of 2008 financial crisis, there has been a renewed academic interest around these issues, such as Blanchard and Leigh (2013), Alesina et al. (2015b), and Jordà and Taylor (2016).

[6] 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, which is not supported in our results. Therefore, our approach will be mostly a-theoretical. For example, Chahrour et al. (2012) have examined the Romer and Romer (2010) results using such DSGE models, but assuming that tax shocks were distortionary. Ramey (2016) and Nakamura and Steinsson (2017) give an overview of the current state of identification in macroeconomics, with interesting discussions on the interaction between theoretical and empirical methods.

Finally, the property tax, as well as the land tax, have 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 very popular in policy discussions. There are numerous calls by international organizations such as the IMF and the OECD to increase the role of the property tax. In the **online appendix**, we review through these classical authors, and policy reports more in depth. As much as the property tax is a relatively small tax relative to other taxes, it plays a very big role in policy discussions and in economics' thinking.

2 Data and summary statistics

We have assembled a country level unbalanced panel data set, including information on national accounts, tax revenues, aggregate and sectoral employment, and other miscellaneous financial variables, available from various international organizations and national statistical agencies. The property tax data comes from *OECD Revenue Statistics,* so that our sample includes the universe of 35 Organization for Economic Co-operation and Development (OECD) member countries.[7] Importantly, we have used all the data which was available to us (in particular, we did not make any discretionary choice in selectively dropping countries, years or quarters from our sample). Our data comes from the OECD whenever possible, and we complement it with other major institutional sources such as the Bank of International Settlements (BIS) and the International Monetary Fund (IMF), when the corresponding data was not available in any OECD dataset. The source for each variable is provided in the **online appendix**, where we also provide the full sample of countries as well as the time coverage. The resulting panel includes 1492 country-year, or 5968 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 of "recurrent taxes on immovable property" (item 4100) from the *OECD Revenue Statistics*. This sub-heading covers taxes levied regularly in respect of the use or ownership of immovable property. More details are given in the **online appendix**. A very important component of our data collection efforts is a database of more than 100 property tax shocks, identified using the historical

[7]The comprehensive sample of countries of 35 OECD countries is: 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. The sample coverage is in the **online appendix.**

record. This is a database that we have 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 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. Indeed, the same property tax revenue shock needs to be measured up against the size of the economy under consideration, that is a measure that is country and probably time specific. The *OECD Revenue Statistics* readily provide property taxes in national currency, as a % of GDP, and as a % of total taxation. However, although we would have preferred to use an existing variable than create a new one (out of concern, again, to reduce data snooping concerns), we are satisfied with neither 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 with different sizes. We cannot use property taxes as a percentage of GDP, or as percentage of total taxation either, because we worry that the movements of this ratio might be spuriously contaminated by movements in GDP or in the overall level of taxation – and this quantity also 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 as "standard" in the literature. In order 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 have 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 to property tax revenues. Our results were very robust, not only qualitatively but also quantitatively.

Institutional and historical work on the property tax. Finally, we have made our best effort to learn as much as possible about each country's property tax system. A summary of this research effort is provided in appendix B. For example, one thing we have learned is that the frequency with which fiscal values are revised to reflect the market price of housing varies much from country to country. Moreover, depending on the country, reevaluations are made at regular or irregular intervals. They sometimes follow the officially announced frequency, and sometimes do not. The institutional details matter more particularly for the narrative approach that we undertake in section

3; but also in general because we seek to understand in general how property taxes work in different countries, what is the motivation for their changes, and whether they can reasonably be considered as "shocks" from a macroeconomic standpoint.

Summary statistics. Summary statistics are presented in the **online appendix** for macroeconomic variables. We focus more particularly on the property tax, and gives the average and maximum amount of tax take by the property tax 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 question of studying tax multipliers. Indeed, we show that all types of taxes have a strong positive association to output (more particularly, consumption and income taxes), while property taxes do not. As stated previously, this is because the based for property taxes is revised only rarely, so that property tax revenues are not contaminated by short-run movements in GDP.

3 Narrative approach

3.1 Methodology

Our preferred empirical strategy consists in identifying property tax "shocks" using a narrative approach following Friedman and Schwartz (1963). We would like indeed to be able 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 different stated motivations behind property tax changes. These motivations are listed in section C.

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 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 collecting the data substantially, since only the actual dates where property tax changes are documented in the narrative record need to be investigated. We are able to use the narrative methodology for a panel of countries, a task that is usually considered too cumbersome. 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."

It is important to note that neither Romer and Romer (2010), nor Cloyne (2013) have been able to collect tax changes that actually took place. Indeed, these might be mechanically affected by changes in output. They could have thought of using cyclically adjusted revenues instead, which would have attempted to correct for the mechanic fluctuations in tax revenues coming from changes in output, and in some cases, unemployment measures, which contribute a lot to government deficits through reduced output, and associated transfers. However, these measures have limits and depend strongly on the specification of different models. According to Romer and Romer (2010): "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." Furthermore, as a matter of practical implementation, reliable measures of cyclically adjusted revenues are not available for many countries.

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

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

where ΔY_{it} 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, ΔT_{it} 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 take for the endogenous variables $P = 3$ as recommended by the standard lag selection criterion. In section D, we show that our results are robust to this choice. We also correct for the Nickell (1981) bias using an iterative bootstrap procedure.

IRFs. We compute the impulse response functions as a non-linear function of the estimated reduced form parameters $\{c_p\}_{p=1}^{P}$ and $\{b_q\}_{q=1}^{Q}$. This corresponds to the moving average representation of the auto-regressive 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",

initiated in the seminal work of Friedman and Schwartz (1963) and then 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 management.

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 very few exceptions, such as South Korea, where property taxes have been used as a means to stabilize the housing markets, governments around the world rarely think of using property taxes in order 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 look at the actual reasons given for the action and verify that they do not appear related to other factors affecting output in the near future. Multiple sources were used to examine the motivation of 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 very useful, notably OECD (1983b), Bird and Slack (2002) and Bird and Slack (2014). Details on the various sources which were used for each country are given in the **online appendix**.

We now wish to classify the main stated motivations for property tax changes identified through the narrative approach. In doing so, we have chosen to keep as close as possible to the previous literature, as well as to avoid discretionary choices as much as possible. We follow Romer and Romer (2010) and Cloyne (2013) in classifying property tax changes depending on whether they correspond to long run economic reforms, ideological changes, external changes, or deficit consolidation. We could not avoid adding a fifth category, which corresponds to property tax reassessments, and contribute more than 50% of our property tax changes. Reassessments are an essential feature of the property tax as valuation is the heart of the estimation of the tax base. They may increase effective tax rates without any change to nominal tax rates. These reassessments are sometimes automatic, and thus do not have a particular motivation. However, some reassessments are discretionary, and they may thus fall in one of the other four categories as well.[8] We describe this category first, as this is the most frequent motive for

[8]Reassessments may in particular be classified into the category "long-run economic reforms" if they aim to correct a structural problem, "external changes" if they are automatic or planned at a steady pace, and finally "deficit consolidation" as they reflect past changes in house prices.

property tax changes:

1. **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, notably as revisions are costly. According to Almy (2014), among unitary states, only Iceland and the Netherlands currently maintain this frequency.[9] Many of the reassessments are automatic, planned in advance. They often were initially planned at a steady pace. For instance, in Japan, a property tax reassessment takes place every three years. In the Netherlands, there has been a reassessment of property taxes every five years from 1975 to 1995. While many legislations specify a revaluation schedule, these schedules are often ignored in practice. For instance, in France, following the last general review of 1970, values were supposed to be updated every three years, but these reassessments were not implemented. In some countries, legislations define 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 the reassessment cycles. 61 shocks correspond to property tax reassessments.

2. **Long-run economic reforms (LR)**. We group under this label all the property tax changes which do not occur for reasons related to macroeconomic management. For example, governments may decide on enacting supply-side reforms as part of their 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. One example of a long-run economic reform is a move to more decentralization, and more autonomy of 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 gave more power to local collectivities. Local collectivities were given more autonomy, and were also allowed to set property tax rates. Our narrative analysis allows us to identify 40 shocks falling into this category.

3. **Ideological changes (I).** Ideological changes are taken 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 has been characterized as the "tax everyone loves to hate" (Rosengard (2012)). It is criti-

[9] Even in Iceland, where the assessment of property taxes is supposed to be based on the market value of the property, revaluations are infrequent in practice. The online appendix available **here** contains a more detailed description.

cized 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 were implemented in several countries. It is the case for instance of the "tax revolt" against the property tax in the 1970s in the United States that led to the famous 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, or the United Kingdom. 16 property tax changes can be classified as ideological changes.

4. **External changes (E).** According to Cloyne (2013), "external" changes are those imposed on policymakers from external bodies such as court judgments and the enforcement of European directives. In Spain, for example, two sentences of the Constitutional Court resulted in an decrease of property taxation in 1986 and 1987. The electoral cycle plays also an important role in property tax variations. It can be considered as an external change when there are legislations fixing election dates, so that elections occur on a regular cycle. Property tax changes can in particular be dependent on local electoral cycles. If the electoral cycle theory was originally created 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 are peeking in mid-term 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)). We identify 15 shocks corresponding to external changes.

5. **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 classify this type of tax changes as 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. So it is exogenous." More generally, we include into this category all decisions to correct past shocks, even if they are contemporaneously exogenous. It is the case for example for property caps that are the consequences 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.

Our **online appendix** gives more detail on the motivation for the property tax changes that we were able to identify.

3.3 Elements of a narrative analysis for Spain

In this section, we illustrate our methodology for a particular country, Spain, in which we can point to different categories of shocks. More detail, as well as more references are also given for Spain in our **online appendix**. The main sources we have 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 7 shocks in 1981, 1982, 1983, 1986, 1987, 1992, and finally 1994. We provide more detail below:

- **1981:** *Revision, Long Run, Deficit consolidation.* A first shock was the result of both a revision of cadastral values and of the Royal Decree Law of 1979 taken in a context of decentralization reforms.[10] 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 of some property taxes (the Urban Land Tax) and 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"). Indeed, social demands had increased since 1972 (the arrival of democracy) and were materialized with central government deficit. The government responded to those demands by exporting deficit to the local authorities. The package of measures provided in the decree law of 1979 thus addressed the "structural deficit of Local Corporations". The decree Law of 1979 was completed by the 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 the 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.

[10] 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 the appeasement of Catalan and Basque nationalism.

- **1983:** *Long run.* The shock was the result of a law which contained a package of measures designed to reinforce the capacity of 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, amidst 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 hindering the desirable revision of cadastral values and to move forward in coherence 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 sentence of the Constitutional Court on 19 December 1985. It resulted in a decrease in property 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 the year of local election – as already stated before, election years tend to be period of fiscal moderation.

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

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

Of course, property tax shocks sometimes come together with other economic reforms, other changes in taxes, etc. However, we have not found any systematic pattern of simultaneous policy changes across our more then 100 policy changes. In particular, we believe that it is very hard to think of a mechanism which could explain our results across our five categories of shocks, based respectively on long run economic reforms, ideological reforms, external changes, deficit consolidations, or expected and unexpected revisions in property taxes.

3.4 Results

Using more than 100 property tax shocks identified through the narrative approach allows to calculate the causal impact of property tax increase on output. As already stated, we present the results using the natural logarithm of macroeconomic aggregates in first differences, and allowing for three lags of the endogenous variable. The most straightforward specification would consist in directly calculating the impact of property tax shocks on output, without even controlling for lags of the endogenous variable. Doing so would only strengthen our results, as we show in section 6, where we perform a number of robustness checks.

Output. Figure 1 illustrates that in our preferred specification, a 1 percentage point of GDP increase in property taxes generates a large and persistent decrease in output, peaking at 3.0 percent after eleven quarters. This result is remarkably close to Romer and Romer (2010), who find a fall in output of 3.1 percent after 10 quarters in the United States. It is also strikingly close to the results in Cloyne (2013), who finds a fall of output of 2.5 percent after about three 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 have in theory the least detrimental impact on output: property taxes are very close to the second welfare's idealized notion of "lump-sum" taxes. We may go beyond the direct effects on output and investigate the mechanism through which property taxes reduce overall economic activity.

[INSERT FIGURE 1 ABOUT HERE]

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

One interpretation of the drop in consumption is that tax increases reduce agents' disposable income. However, given than 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. 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's benefits exhaustion after a few years, leading the multiplier effect to increase over time. We come back to this below when we discuss the rise in unemployment.

In terms of mechanism, our results are not consistent with "Ricardian" equivalence (Barro (1974), Barro (1989)). In fact, property taxes are very close to the idealized lump-sum tax, with small incentive effects, and therefore should have exactly zero impact on consumption under "Ricardian" equivalence. This is not what we find, which is consistent with a large body of evidence both at the micro and at the macro level (Poterba and Summers (1987), Summers et al. (1987)). It should be noted that this behavior is not necessarily inconsistent with rational expectations and consumption smoothing (although hand-to-mouth behavior has been documented as well, for example in Parker (1999) and Johnson et al. (2006)). Indeed, a tax increase might lead to a permanent increase in public debt.[11] If debt does not need to be reimbursed, which is possible in overlapping-generations model with dynamic inefficiency (Geerolf (2013)), then there is no offsetting effect of expected future tax increases.

Investment. We now look at the effect of property tax increases on investment. Figure 2(b) shows that non-residential investment also falls considerably. The peak impact on non-residential investment occurs after 11 quarters, with a 10.8 percent cumulative decline. This result again strikingly close to Romer and Romer (2010), who find a fall of gross private domestic investment of 11.2 percent. 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 (crowding-in). 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 on investment.[12] In this interpretation, investment is determined by aggregate demand, both components of which are subject to multiplier effects. Overall, the strong negative relationship between tax changes and non-residential 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 non-residential investment, which is also the result in Mertens and Ravn (2013) following

[11] In unreported regressions, we show that the impact on government consumption is very small (a few tenths of a percentage point) and not statistically significant.

[12] 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?"

both a change in average personal income tax rates as well as to average corporate income tax rates.

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 very similar to what happens for non-residential investment, which is intuitive: investment and hiring go hand in hand. For example, in a theoretical search and matching model, hiring effort – vacancy posting – is a costly investment made by firms, which allows them to make profits in the future. In a Keynesian interpretation, unemployment is lowered because aggregate demand increases, which reduces slack in the labor market. Once again, our results are consistent with evidence presented in 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 loss, or if they do not act as permanent income consumers, the rise in unemployment may also work to reduce agents' consumption. Note that the design of unemployment insurance could also perhaps explain the very protracted response of output and consumption, if consumption is further reduced at benefits exhaustion – which is strongly suggested by microeconomic data in Ganong and Noel (2017).

[INSERT FIGURE 2 ABOUT HERE]

Imports and exports. Figure 3 illustrates the effect of an increase on imports and exports. We find a more immediate effect on imports than exports, as some of the reduction in aggregate demand leads a reduction in external demand. The maximum impact on imports is -10.6 percent – a result again remarkably close to Romer and Romer (2010), who find a fall in imports of 10.1 percent. This result is not surprising. A tax increase does not just reduce 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 can also be understood theoretically. 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 towards an increase in net exports (exports - imports). Therefore, tax increases improve the country's external balance.

[INSERT FIGURE 3 ABOUT HERE]

Testing for exogeneity. The narrative record is in theory sufficient to establish exogeneity of the constructed series of property tax shocks. However, we may wish to test the exogeneity of our narrative tax series, at least to a certain extent. Here,

we follow here Romer and Romer (2010) and Cloyne (2013) in showing that property tax changes are not predictable using past values of GDP growth. One could indeed be worried that low GDP growth would lead governments to systematically raise more property tax revenues to meet revenue shortfalls. If GDP growth was 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. We have thus performed Granger causality tests to determine how predictable our property tax variable is on the basis of movements in output, which it was not at the 10% significance level. We have also test whether the decision to "act", defined as a dummy variable equal to 1 whenever property tax changes were not zero, can be forecast from past information following Mertens and Ravn (2013) and Cloyne (2013). Once again, the answer was no. Property tax changes are not caused by past GDP growth.

4 Structural approaches

Nakamura and Steinsson (2017) emphasize that one weakness of narrative methods is the "inherent opacity of the process by which the narrative shocks are selected."[13] Compared to previous narrative studies attempting 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, not how much these shocks were projected to raise in terms of revenues. Indeed, we are able to use the measure of tax changes which 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 the data collection efforts considerably. 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 and the next, we take this criticism at heart and we instead turn to a different methodology. Instead of using a narrative approach to look for property tax changes and their motivations, we instead use solely the time series of property tax revenues across countries, and we use all these changes, as if they all corresponded to actual property tax "shocks". In both cases, we find very similar results. We argue that this points to the robustness of our estimates. The narrative approach is still our preferred methodology, because it allows to flesh out the motivations for the shocks. However, we hope that the results in this section will alleviate the concerns of skeptical

[13] 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."

readers.

4.1 Auto-regressive distributed lag

A first possible approach is to keep as close as possible to the narrative approach. In this section, we estimate the same equation as in the narrative approach, 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 exogenous variables, we estimate an autoregressive distributed lag model denoted by $ADL(P,Q)$ for each of the 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):

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

We use different lag lengths P and Q, and show that our results are robust to these choices, albeit somewhat different quantitatively. As a baseline specification, we take $Q = 15$ lags for the tax variable, and $P = 3$ lags for the endogenous variable. We identify the effects of property tax shocks 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 to capture the effects of property tax shocks is then 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 (-2.7 percent after 15 quarters). This result is very close to the one found with the narrative approach, -3.05 percent after eleven quarters.

[INSERT FIGURE 4 ABOUT HERE]

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 to other macroeconomic factors. In other words, it must be that on average at least, policymakers do not change property taxes in response to macroeconomic conditions. This is a testable proposition, at least with macroeconomic data which is available to us. We have performed Granger causality tests, to assure ourselves that indeed, the autoregressive lag specification is not biased, and that our estimates are structural. 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, namely a structural VAR approach, following Sims (1980).

4.2 Structural VAR

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, then we can follow Sims (1980) and use a Choleski decomposition to measure the causal effect of property tax changes on macroeconomic aggregates. This strategy leads to more noisy estimates, whose overall magnitude is similar both to the narrative approach as well as to the autoregressive distributed lag model of section 4.1. Again, we conclude on the robustness of our findings.

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

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

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 finally $(\delta_p)_{p=1..P}$. 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 Choleski decomposition of the VAR, where taxes are ordered before macroeconomic aggregates. We can thus directly trace out 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 these structural shocks whose coefficients are the impulse response function coefficients, which we are interested in and calculate in the next section.

In contrast, Blanchard and Perotti (2002) make assumptions for how tax revenues mechanically vary with output. As a baseline, they assume that the elasticity of tax revenues with GDP is equal to $a_1 = 2.08$. They use a value of for the period ranging between the first quarter of 1947 and the fourth quarter of 1997 (p 1335). However, as they themselves note: "it increases steadily from 1.58 in 1947:1 to 1.63 in 1960:1 to 2.92 in 1997:4, which to them "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 a_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."

In fact, Caldara and Kamps (2017) show how sensitive results are to the choice of an elasticity. Mertens and Ravn (2014) also show that SVAR and narrative estimates can be reconciled when narrative shocks are used to estimate a_1. However, the estimation of a_1 then hinges of having identified narrative shocks correctly. We argue that our methodology allows to circumvent that difficulty.

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 (-2.9 percent after 13 quarters). This result is remarkably close to the one found with the narrative approach, -3.05 percent after eleven quarters.

[INSERT FIGURE 5 ABOUT HERE]

Our estimated tax multipliers are very close to those which have been estimated independently by Mertens and Ravn (2014), using the narrative record as an input to structural VARs, that is around 2 or 3.

Overall, these results confirm that the issue with structural approaches is with cyclical adjustment. As Riera-Crichton et al. (2016) argue: "Mirroring the discussion in the growth literature on the Solow residual, the cyclically adjusted measure implicitly attributes any change in revenues not associated with the estimated change in the tax base to policymakers' discretionary behavior. This source of measurement error would include, among many others, structural breaks, non-linearities and/or changes in agents' behavior over the business cycle, (...)." The fact that property tax revenues do not require a cyclical adjustment, especially in countries which revise the fiscal base only infrequently, implies that the multipliers found using a structural approach are similar to those found using a narrative approach.

5 Discussing the external validity

A distinguishing feature of our study is that it focuses on changes in property taxes, the closest real world counterpart to a lump sum tax. We have already explained the rationale behind such an approach (minimized incentive effects, and no need of cyclical adjustment). Our results are more broadly applicable, as the property tax is an instrument for the user cost of owner-occupied housing, which is of more general interest, for example for monetary policy. Of course, property tax multipliers may not correspond to general tax multipliers. At the same time, we think that this is an advantage of our study, since it allows us to focus on lump-sum taxes.

Property taxes as an instrument for the user cost of owner-occupied housing. We believe that the elasticity of macroeconomic aggregates to property tax changes is also interesting, because the user cost of owner-occupied housing plays an important role for the understanding of many macroeconomic policies, including monetary policy (but also financial regulation, interest deductibility, etc.). In some instances, the literature has already started to investigate the potential stimulative effects of such policies, but often using difference-in-difference methodologies. The appeal of our approach related to these studies is twofold. First, we are able to calculate the macroeconomic effect of these changes because we use aggregate data. Second, property tax changes are unidimensional transfers to homeowners, which may be easily quantified, unlike these policies which are often multidimensional and have complex microeconomic effects. Overall, we argue that property tax changes have some external validity for understanding a broad set of policies:

- **Mortgage interest tax deduction and other housing affordability policies.** Policy interventions in the housing market are pervasive. Many transfers and subsidies, such as the mortgage interest tax deduction, are conditional on homeownership. One important component of the 1986 tax reform was to remove the tax deductibility of interest on consumer debt except for mortgage debt. Today, the mortgage interest deduction is one of the largest tax expenditures in the United States, estimated to provide a $90 billion subsidy to homeowners in 2013. The effects of these policies have not been studied before empirically, at least in general equilibrium, certainly because they are multidimensional – for example, mortgage interest deductions reduce the amount levied by the personal income tax – and occur relatively infrequently.[14] Yet these policies have much in common with property taxes, in that they are transfers of cash conditional on owning a house, and act to modify the user cost of owner-occupied housing. Extrapolating our results on property taxes on these policies suggests that they might have strong stimulative effects as well.

- **Conventional monetary policy.** Changing the policy rate may impact mortgage payments in countries that have adjustable rate mortgages, or fixed rate mortgages with an option to refinance through the expectations channel (Wong (2016) and Beraja et al. (2017)). One advantage of property tax shocks is that they allow to isolate a potential channel of monetary policy going through a reduction in mortgage payments, as in Auclert (2017). Indeed, property tax changes inform us on the macroeconomic effects of the user cost of owner-occupied housing more generally. Aggregate studies of monetary policy, in contrast, are only able to measure the combined effect of monetary policy, which may work through the inter-temporal substitution, the credit channel, the exchange rate channel, etc. Our results suggest that monetary policy can have strong effects through this channel. Guerrieri and Uhlig (2016) provide suggestive evidence showing that many initial delinquencies came about when the Federal Reserve started to increase short-term interest rates between 2004 and 2006. Of course, monetary policy does not take the form of direct transfers to homeowners from the government, unlike the mortgage interest deduction mentioned above. For example, monetary policy shocks take the form of transfers between agents, which sum to zero in the aggregate (Auclert (2017)). However, to the extent that lenders have low MPCs and borrowers high MPCs, they should lead to similar stimulative effects (at no cost to the taxpayer).

- **Unconventional monetary policy.** To the extent that quantitative easing

[14] There is however some theoretical work on the subject, which is mostly partial equilibrium (Sommer and Sullivan (2018)). The mortgage interest tax deduction is a particularly important component of the currently discussed tax plan.

has an impact on mortgage interest rates, as Di Maggio et al. (2016) suggest, then a stimulative effect going through the user cost of housing may explain why unconventional monetary policy has an effect on macroeconomic activity, and in particular consumption.

- **Financial regulation.** Finally, financial regulation and credit supply more broadly have impacts on mortgage spreads, as in Geerolf (2015). Financial deregulation may contribute to increase the quantity of credit supply and reduce its costs, including mortgage spreads, which is confirmed by the evidence in Favara and Imbs (2015). This paper suggests that it might contribute to an economic boom.

General tax multipliers? Of course, focusing specifically on an instrument to the user of cost of owner occupied housing may also be a weakness. Mertens and Ravn (2013) show that different types of taxes affect aggregate economic activity with varying intensities. In particular, if tax changes work mostly through disposable income effects, as our research suggests, then these effects might be maximized when they fall on consumers who have a relatively higher marginal propensity to consume. Property taxes fall on homeowners, which means that the share of the population that is concerned by the property tax is close to 50%, so agents with a relatively high marginal propensity to consume (Jappelli and Pistaferri (2014)). At the same time, property taxes have limited incentive effects, which motivated our empirical exercise in the first place. Therefore, general tax multipliers could even be larger than property tax multipliers.

Another argument is that the property tax is a particularly salient tax. This could potentially explain the very large effects we find, particularly on consumption. 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 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 later in this same article: "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."[15] The property tax is unusual is that it taxes revenues which do not correspond to any liquid flow of revenue, as it taxes "implicit rents". In most extreme cases, they may force homeowners who don't have enough liquid wealth to sell their house.

[15]Norregaard (2013) : "While economists tend to strongly favor increased reliance on property taxes owing to their attractive economic properties, there is a widespread popular and hence political resistance to their increased use stemming in part from their transparency and relatively limited scope for tax avoidance and evasion".

Overall, there are many reasons to believe that property tax multipliers might not be equal to "average tax multipliers". However, we also note that our results are between 2 and 3, in line with the growing consensus in the literature as surveyed in Ramey (2018).

6 Additional results and robustness checks

In this section, we provide a number of additional side results. We first look at the macroeconomic effect of different types of shocks, depending on their stated motivation. We then investigate whether property tax shocks have differential effects during expansions and recessions. Finally, we provide a decomposition of output into its components (consumption, investment, employment, etc.) for different methodologies in 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 where 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 the 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 have 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 different effects on macroeconomic activity. The first panel of Figure 6 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 also be some anticipation effect. Note that anticipation is not a problem for inference as it leads to downwardly biased estimates. In practice, microeconomic studies show that consumers do respond to predictable changes in income (Parker (1999), Mankiw (2000)).

Figure 6 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 very 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.

Finally, one could be worried that property tax increases for deficit consolidation are endogenous; although as already stated, this problem is largely taken care of by controlling for lags of GDP. We thus also estimate the baseline VAR, excluding narrative shocks corresponding to deficit consolidation measures. Once again, we find that our results are robust.

[INSERT FIGURE 6 ABOUT HERE]

Comparing multipliers during expansions and recessions. Figure 7 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 of our panel. The parameters of the algorithm are fixed such that a full cycle and each of its phase must last at least 6 quarters and 2 quarters, respectively. We define a recession as the two years period after a peak. All other quarters are defined as expansions.

Figure 7 shows that the effect of a property tax shock is larger during recessions than during expansions. More precisely, the point estimate for the fall in output is 4.5 percent after 11 quarters when the property tax increase occurs during a recession, whereas the peak effect is a fall in output of 2.1 percent 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). They show that multipliers of government purchases are larger in a recession.

These results can again be rationalized in a model where output is sometimes determined by aggregate demand. In a recession, aggregate demand is low, there are underutilized resources (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, the output effect are more muted although it should be noted that they are still significant.

[INSERT FIGURE 7 ABOUT HERE]

Results for components of GDP (ADL and SVAR). Figures 8 and 9 show results of the Autoregressive distributed lag model (ADL) and SVAR approaches for consumption, investment, imports and exports. Concerning household consumption (a), the peak effect is a fall of 3.3 percent with the ADL approach (Figure 8) and 3.5 percent with the SVAR approach (Figure 9). This is remarkably close to the result found with the narrative approach (-3.5 percent). Concerning total investment (b), we observe a fall of 16 percent with the ADL approach, and of 14.5 percent with the SVAR approach. The fall was lower with the narrative approach (-11 percent). Concerning imports (c), the peak effect if a fall of 7.5 percent with the ADL approach, and 7.3

percent with the SVAR approach. With the narrative approach, the fall was lower (-6.6 percent). Finally, concerning exports (d), we observe an increase of exports of 5.7 percent with the ADL approach, and 4.6 percent with the SVAR approach. With the narrative approach, the impact on exports is barely significant.

[INSERT FIGURE 8 ABOUT HERE]

[INSERT FIGURE 9 ABOUT HERE]

Deterministic or stochastic trends. The results in 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 10 shows the resulting impulse response function to a property tax shock, allowing for 4 lags of the endogenous variable in the main specification.

[INSERT FIGURE 10 ABOUT HERE]

Robustness to the number of lags (narrative approach). Figure 11 shows results of the narrative approach using different lags of the endogenous variable. In the panel (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 even larger effect than our baseline specification: the peak effect is a fall in output of 3.7 percent after eleven quarters. We then show the results with respectively 1, 2, 3, 4 lags of the endogenous variable. Results are very similar and show a large and persistent decline in output. The peak effect is a fall in output of 3.5 percent with 1 lag (b), 3.2 percent with 2 lags (c), 3.05 percent with 3 lags (d), 2.8 percent with 4 lags (e) after 11 quarters.

[INSERT FIGURE 11 ABOUT HERE]

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

[INSERT FIGURE 12 ABOUT HERE]

Finally, we have experimented with a number of other specifications. Point estimates as well as significance levels vary – for example, more lags usually lead to more noisy estimates, as more parameters need to be estimated. However, only under extreme specifications have we found tax multipliers than were lower than 2.

7 Conclusion

In this paper, we have used property taxes in order to study the effects of property tax changes on the macroeconomy. According to both classical and neoclassical economics, property taxes have the least harmful effects on economic activity, because they are the closest real-world counterpart to a lump-sum tax. However, to the best of our knowledge, this feature of property taxes are not been used in the empirical literature to measure tax multipliers. In this paper, we have shown that property tax increases lead to large and protracted reductions in output. We arrive at this same conclusion using very different methodologies, such as a narrative approach and a structural VAR approach. Property tax cuts stimulate consumption, investment, output. They increase employment and deteriorate the trade balance.

Our results are very similar to Romer and Romer (2010), to Cloyne (2013) and to Hayo and Uhl (2014). They are also close to those documented in Riera-Crichton et al. (2016) concerning the VAT tax, which is also a relatively regressive tax – from a Keynesian perspective, it thus falls on average on consumers with a higher marginal propensity to consume. It should be noted that although from a Keynesian perspective, government spending should be expected to have even larger effects on output than tax cuts, it seems to be the reverse empirically (Alesina and Ardagna (2010)).

These identified conditional moments are hard to reconcile with models based solely on the supply side and "Ricardian" equivalence, such as the neoclassical growth model. In contrast, our results are consistent with aggregate demand and conventional multiplier effects, where tax cuts raise consumption and output through a rise in disposable income, and investment and hiring.

Aside from allowing us to distinguish between competing macroeconomic models, our study more prosaically is the first to estimate the general equilibrium effects of property tax changes. Our results suggest that far from representing a free lunch, property tax increases are unfortunately detrimental to economic activity, at least in the short run. One qualification however, is that our results are silent about whether property tax increases coupled with an income tax reduction would stimulate GDP growth in the very long run (say, at an horizon of 10 years). At this horizon, our estimates are unfortunately too noisy, which leaves some room for the property tax to have positive effects. Still, we believe our results at least add a cautionary note to the appeal of the property tax.

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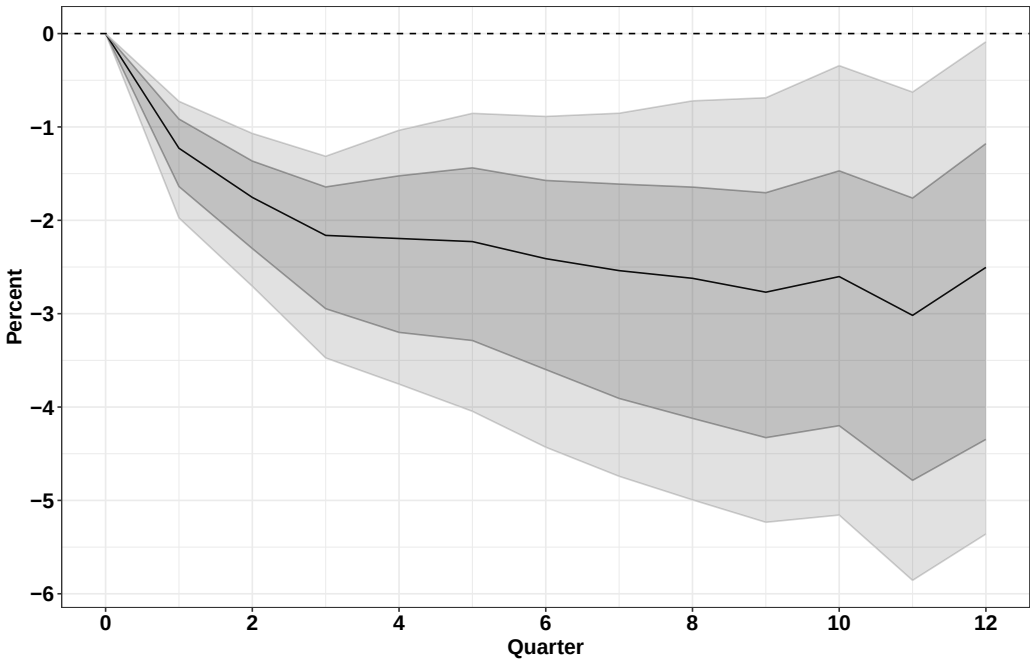
Appendices

A Figures

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

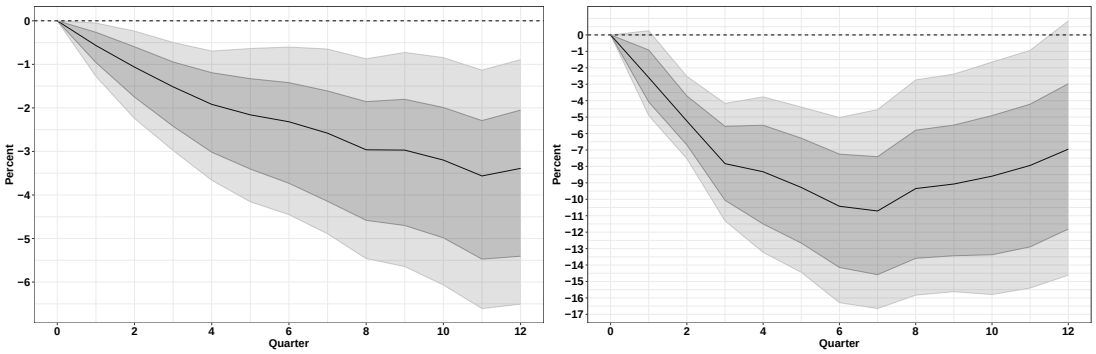


Note: This Figure shows the response to a 1 percentage point of GDP increase in property taxes. Shaded areas correspond to 68 and 90 % confidence intervals.

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

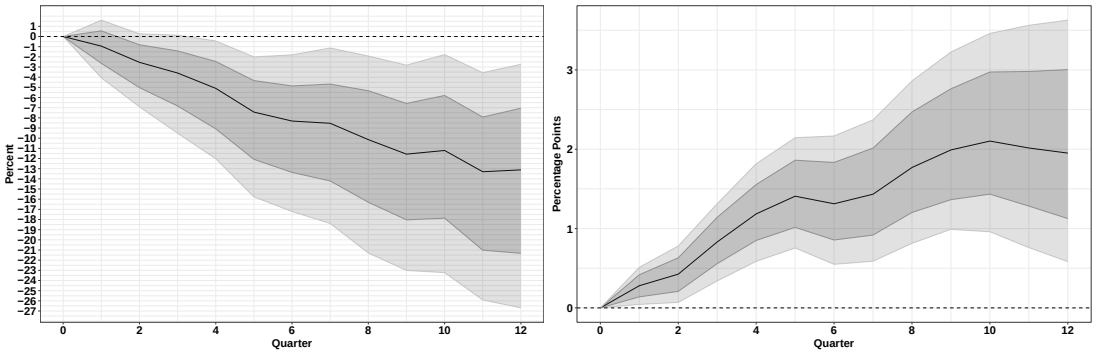
(a) Private Consumption

(b) Non-residential Investment



(c) Residential Investment

(d) Unemployment

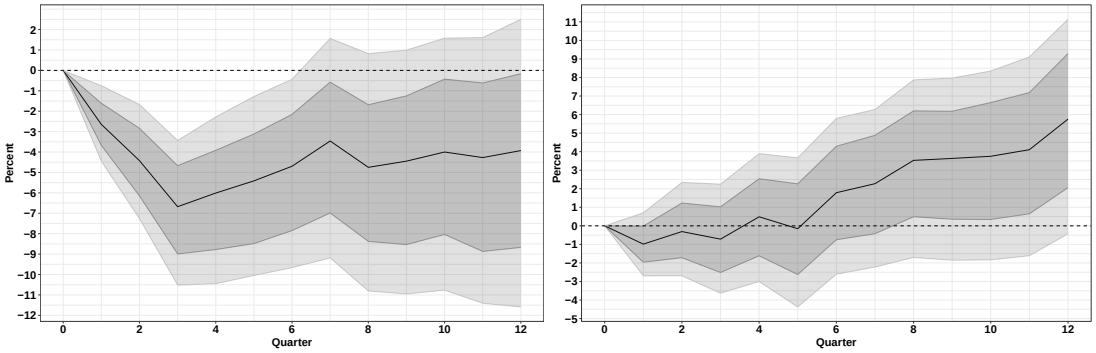


Note: This Figure shows the response to a 1 percentage point of GDP increase in property taxes. Shaded areas correspond to 68 and 90 % confidence intervals.

Figure 3: Response of Imports and Exports

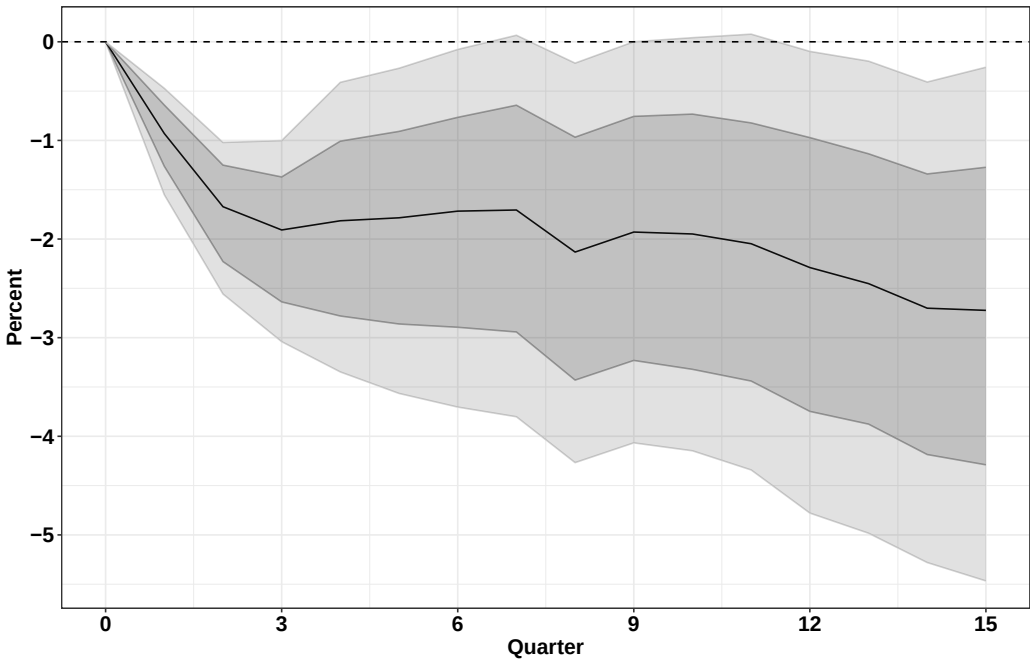
(a) Imports

(b) Exports



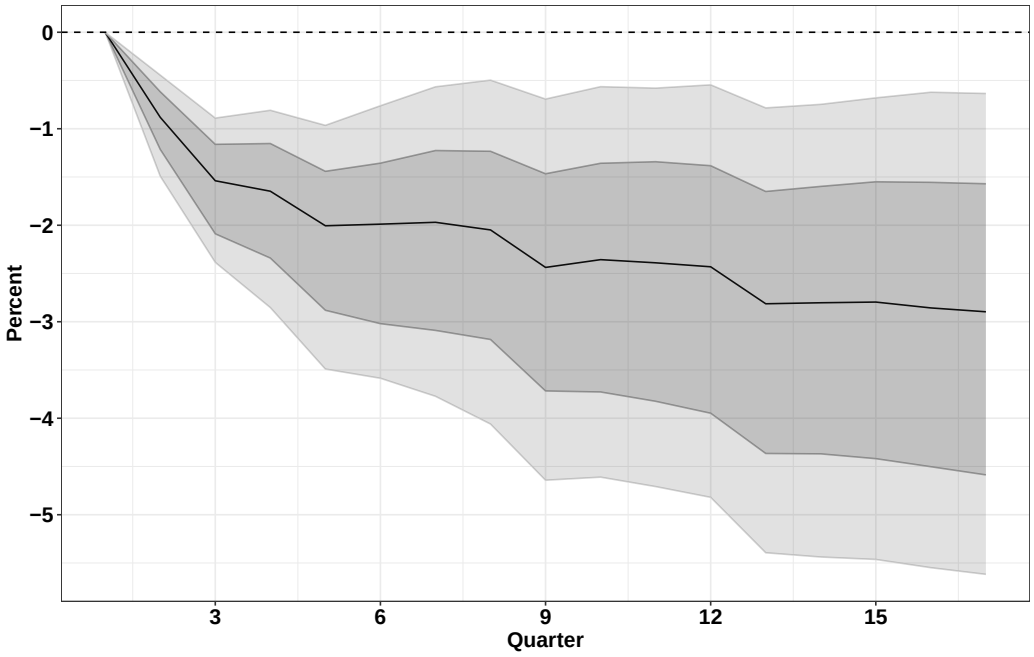
Note: This Figure shows the response to a 1 percentage point of GDP increase in property taxes. Shaded areas correspond to 68 and 90 % confidence intervals.

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.

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.

B 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.

C 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

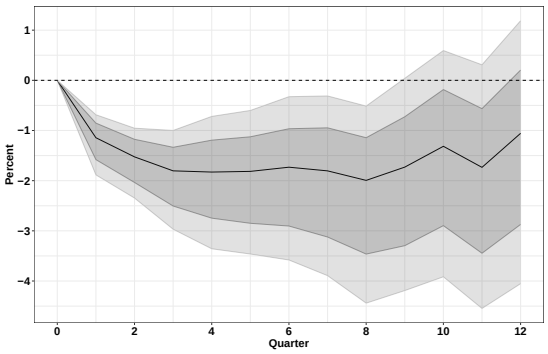
	1993	Introduction of the Council Tax (April 1993)	LR, I
United States	1975	Restrictions on property taxation by local authorities	I, D
	1978	Restrictions on property taxation by local authorities, notably California's Proposition 13 (1978), Tax revolt spread across the US	I, D
	1990	Revisions – reassessment 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.

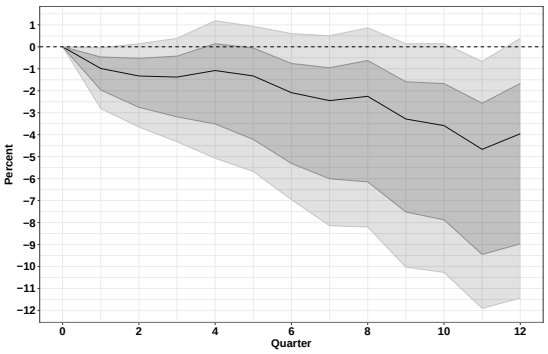
D Robustness

Figure 6: Effects of Differently Motivated Shocks

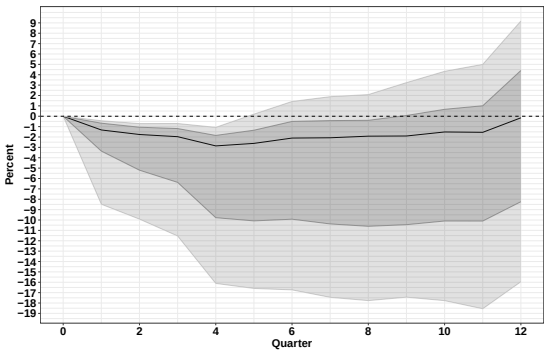
(a) Long Run



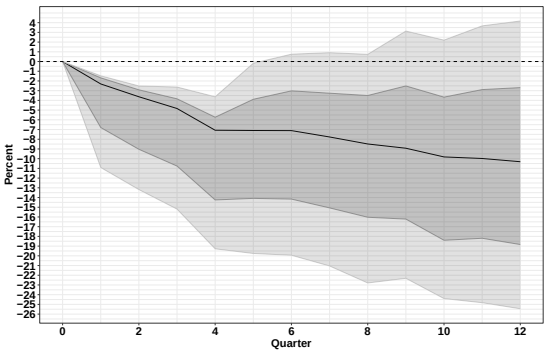
(b) Revision



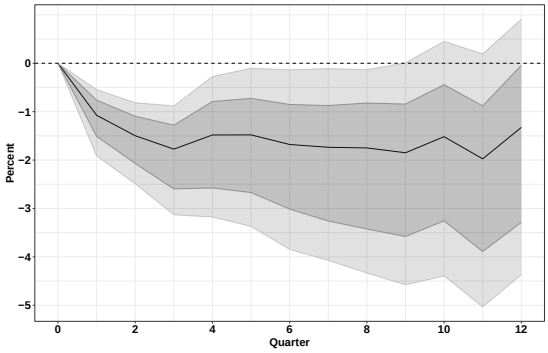
(c) Ideology



(d) Deficit Consolidation



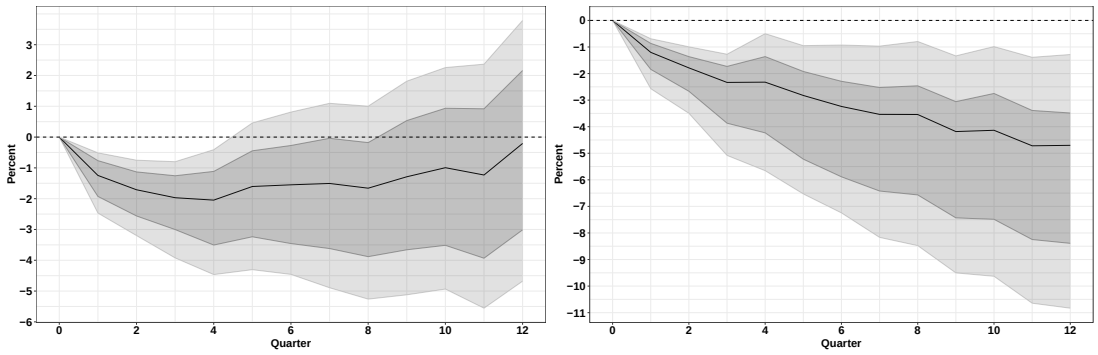
(e) All shocks without "Deficit Consolidation"



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 7: Differential Effects during Expansions and Recessions

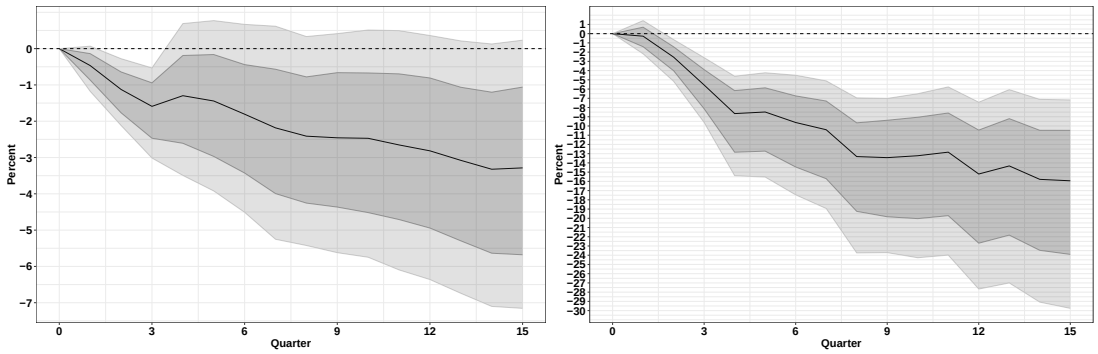
(a) Expansions (b) Recessions



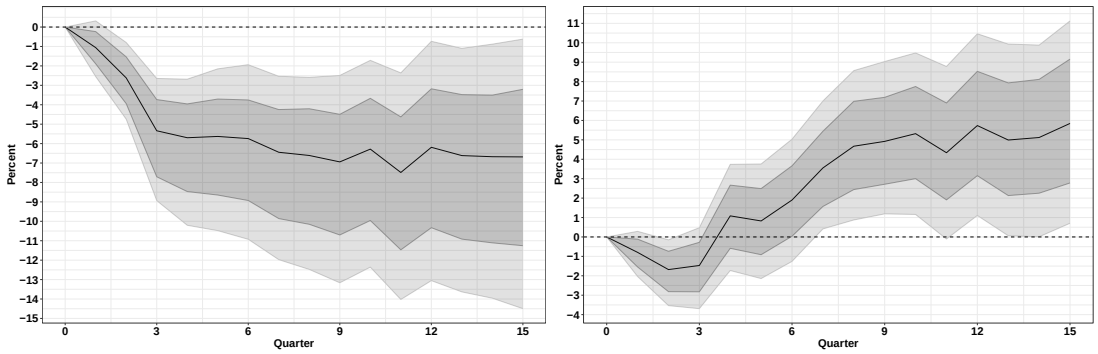
Note: This Figure shows the response to a 1 percentage point of GDP increase in property taxes. Shaded areas correspond to 68 and 90 % confidence intervals.

Figure 8: Results for Components of GDP – ADL Approach

(a) Consumption (b) Investment, Total



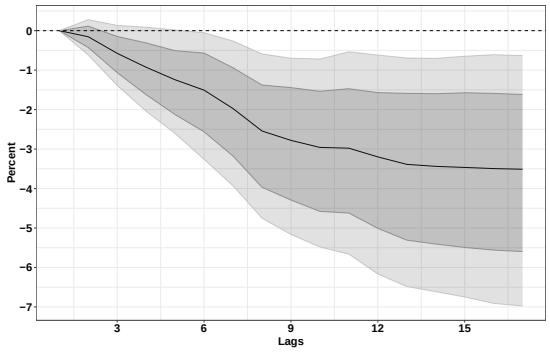
(c) Imports (d) Exports



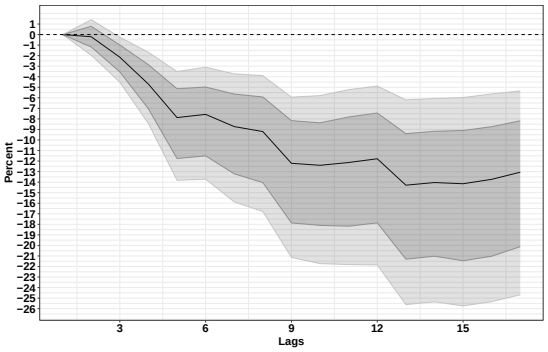
Note: This Figure shows the response to a 1 percentage point of GDP increase in property taxes. Shaded areas correspond to 68 and 90 % confidence intervals.

Figure 9: Results for Components of GDP – SVAR Approach

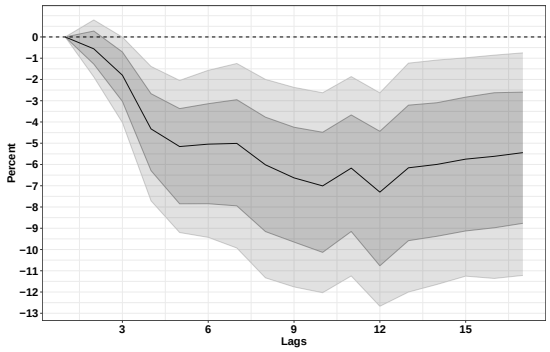
(a) Consumption



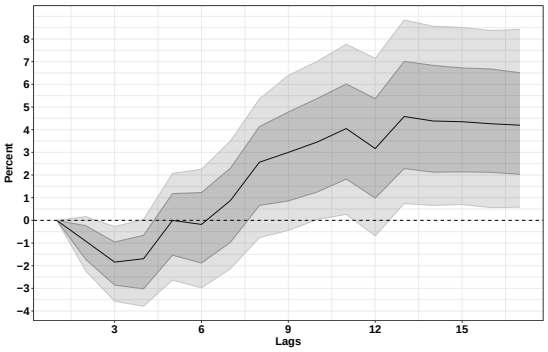
(b) Investment, Total



(c) Imports

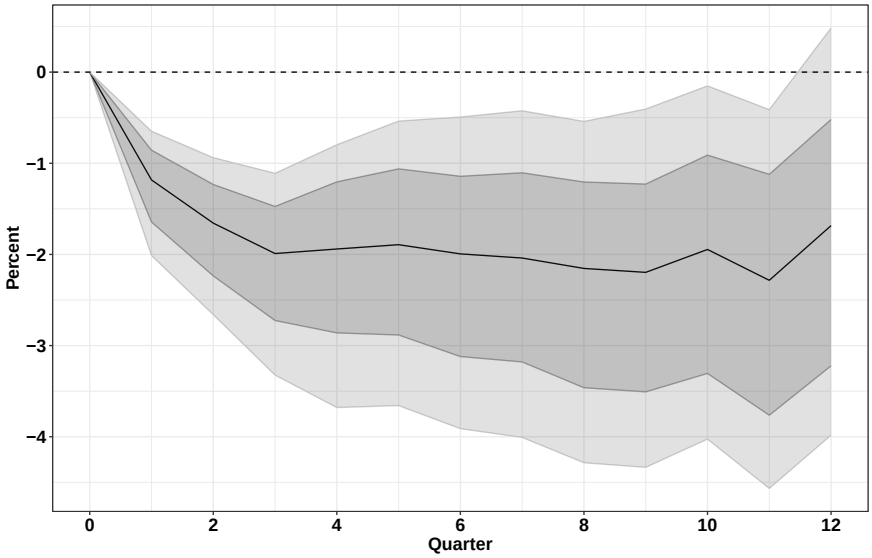


(d) Exports



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.

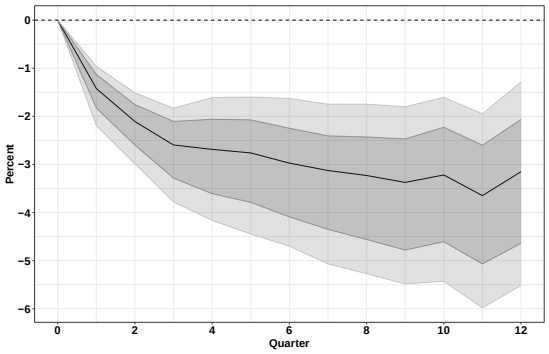
Figure 10: Deterministic Trend



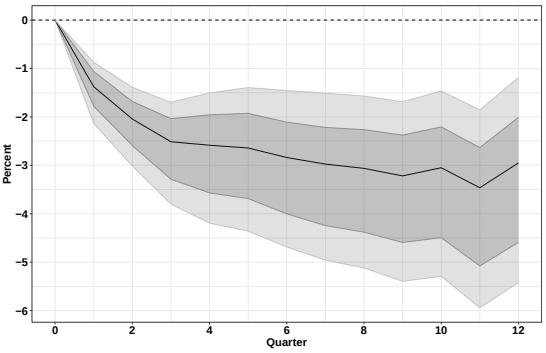
Note: This Figure shows the response to a 1 percentage point of GDP increase in property taxes. Shaded areas correspond to 68 and 90 % confidence intervals.

Figure 11: Number of Lags – for the endogenous variable P

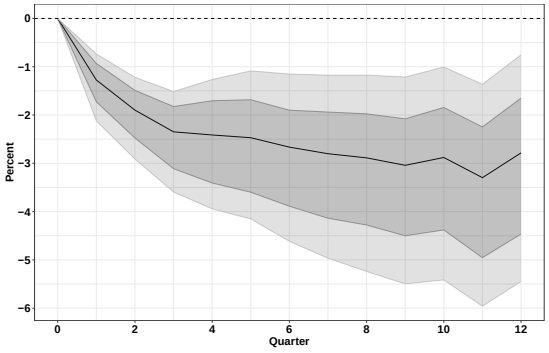
(a) Without controlling for lags of the endogenous variable ($P = 0$)



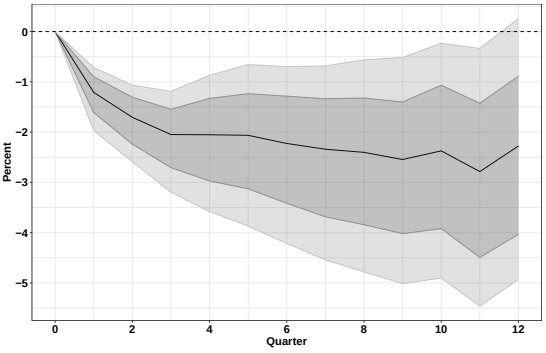
(b) 1 lag ($P = 1$)



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



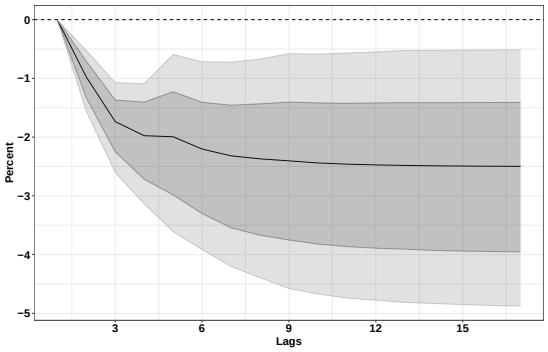
(e) 4 lags ($P = 4$)



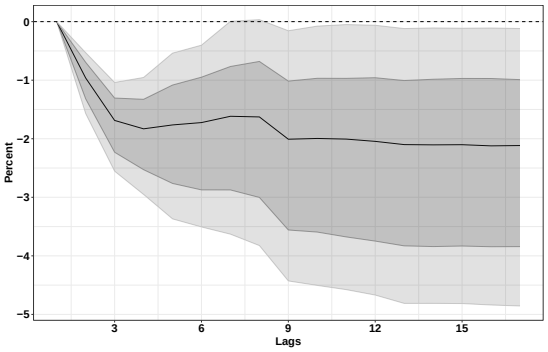
Note: This Figure shows the response to a 1 percentage point of GDP increase in property taxes. Shaded areas correspond to 68 and 90 % confidence intervals.

Figure 12: Number of Lags – SVAR

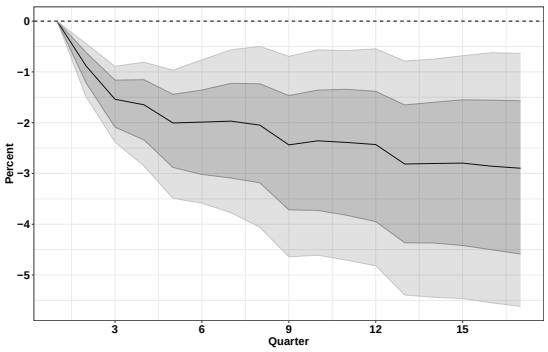
(a) 4 Lags



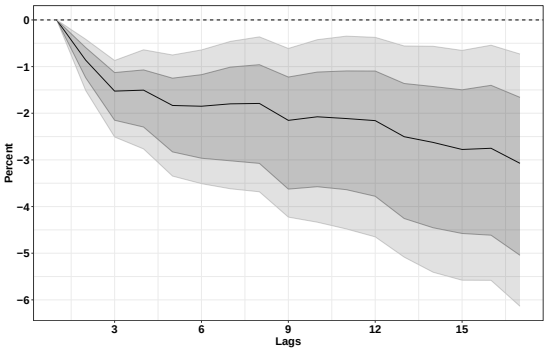
(b) 8 Lags



(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.

Appendix for Online Publication

E Data

E.1 Data sources

Our data comes from the OECD, the BIS, the IMF, the World Bank and the ECB. Whenever possible, we have used OECD data and have proceeded through this list sequentially.

Property taxes. We use 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 is referred to as the VOBARSA measure. The following table gives some detail for all the data series we use, 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, "GDP" refers to a division by GDP.

E.2 Summary Statistics

Table 3: Summary Statistics

	Mean	Std.
GDP	0.0001	4.267
Real GDP	-0.049	5.135
Property Tax (% of GDP)	1.922	3.957
Nominal GDP	0.206	16.610
Consumption	-0.050	4.430
Investment	-0.160	11.059
Exports	0.054	8.792
Imports	0.021	11.030
Res. Investment	0.032	15.366
Non Res. Investment	-0.012	8.815
Unemployment Rate	0.076	1.325

Note: With the exception of property taxes and unemployment, all variables are logged, detrended using a linear trend as specified in the text, and first-differenced. Property taxes are first-differences as a percentage of trend GDP, as specified in the text. The unemployment rate is in percentage and has not been logged.

E.3 Sample

Table 4: 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.

E.4 Summary Statistics on the property tax

Table 5: 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.

E.5 Cyclical property of tax revenues, by type of tax and country

Table 6: 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).

F General features of property taxes

F.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 typicaly not taken into account when assessing property taxes.

F.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. According to Slack and Bird (2014), "*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 (see Section G.10).

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 (up to a certain extent, see Section G.14) 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. It 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.

F.3 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.

F.3.1 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 be no 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 an other 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."

According to him, wages are the main component of what he called the "Margin of Cultivation". Speculation on land reduces the Margin of Cultivation, so wages and interest tend to decline:

"*Wealth produced in every community is divided into two parts by what may be called the rent line, which is fixed by the margin of cultivation, or the return which labor and capital could obtain from such natural opportunities as are free to them without the payment of rent. From the part of the produce below this line wages and interest must be paid. All that is above goes to the owners of land. [...] The speculative advance in land values tends to press the margin of cultivation, or production, beyond its normal limit, thus compelling labor and capital to accept of a smaller return, or (and this is the only way they can resist the tendency) to cease production.*"

He tried to explain the growing gap between rich and poor:

"*in spite of the increase of productive power, wages constantly tend to a minimum which will give but a bare living ... rent tends to even greater increase, thus producing a constant tendency to the forcing down of wages.*"

Henry George did not see an inherent antagonism between labor and capital. The antagonism was with rent-collectors:

"*... the value of land depending wholly upon the power which its ownership gives of appropriating wealth created by labor, the increase of land values is always at the expense of the value of labor. And, hence, that the increase of productive power does not increase wages, is because it does increase the value of land. Rent swallows up the whole gain and pauperism accompanies progress.*"

"*But labor cannot reap the benefits which advancing civilization thus brings, because they are intercepted. Land being necessary to labor, and being reduced to private ownership, every increase in the productive power of labor but increases rent—the price that labor must pay for the opportunity to utilize its powers; and thus all the advantages gained by the march of progress go to the owners of land, and wages do not increase.*"

Churchill (1909) made a famous speech entitled "*Land Price as a Cause of Poverty*".

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 (1999b) 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.*"

F.3.2 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 (2017), OECD (2016a), OECD (2016b), OECD (2015c), OECD (2015a), OECD (2015b)). The OECD wrote also several reports and working papers on the advantages and drawbacks of property taxes:

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."

OECD (2010f) *"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."*

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*".

F.3.3 IMF

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

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.*"

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*"

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*".

F.3.4 European Commission

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*".

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*".

F.3.5 Financial Press

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.*"

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."

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.*"

G Details for each country

G.1 Australia

Context Australia is a federation with three levels of government: federal, state, and local. There are six states, 143 urban municipalities and 587 regional and rural municipalities in the country.

There are various property taxes in Australia. They vary among the states. Property taxes comprise notably the land tax – created in 1956 – and municipal rates – introduced in 1906. The land tax is a state tax on the ownership of land. Each state government has its own legislation concerning its Land Tax and controlling local authorities in that State. Accordingly, there are some variations in practices between the States. Concerning *rates*, municipal rates are levied on a variety of tax bases in Australia. Local governments can levy a property tax on land value, rental value of land and buildings, improved value of land and buildings, etc. The tax base varies among each State. In Tasmania, land value base is annual rental value. In Queensland, land value is used for urban and rural areas. In South Australia, there are four councils tax land values and the remainder tax improved values. In Victoria, 61 municipalities use capital improved value, 11 municipalities use net annual value, and 6 municipalities use site value. In New South Wales, land value is used for residential property and assessed annual value for non-residential properties. In Australian Capital Territory, only the land is taxed (Almy (2001),Bird and Slack (2004)).

Concerning tax rates, for both land taxes and municipal rates, they are uniform but there are different rates for different land uses. The land tax is levied by states on the unimproved value of the land "at its highest and best use" either by a flat rate or a progressive rate. Municipal tax rates are determined on the basis of local budgetary requirements and include general rates on all property owners or specific rates imposed for a special purpose, e.g. for infrastructure improvements. (Bird and Slack (2004)).

The valuation cycle differs among states, ranging in general from 4 to 7 years –even if in the eighties the frequency of revaluations was every 2-3 years (OECD (1983b)). Values are not indexed or adjusted outside of the revaluation cycle. Valuations are established by the State's Valuer General; these values are used for both the land tax and the local government rates. There is a trend towards annual revaluation in some cases at the state level (for example, Western Australia) and in some cases at the city level (for example, Melbourne, Brisbane, and Cairns) (OECD (2014a), Bird and Slack (2004), OECD (1983b)).

Shocks. We do not identify property tax changes in Australia. There are specific difficulties in Australia for identifying exogenous tax changes as property taxes are different in the different States. Moreover, the valuation cycle differs among states, ranging from 4 to 7 years, even if there is a tendency towards annual revaluation in particular at the city level. Reassessment dates are thus difficult to identify. There are different dates for different local authorities. Each state government has its own legislation concerning the Land Tax.

G.2 Austria

Context Austria is one of the traditional federal countries in Europe, consisting of nine historical Lander (states), all of which have their own competencies, governments, and parliaments.

A large degree of autonomy is guaranteed to local governments (municipalities), although they are overseen especially by the Länder authorities. If these local governments have some degree of tax autonomy, the more important Länder lack tax autonomy almost completely[16]. Instead, an intricate tax-sharing system is the most important pillar of subnational budgets. Changes over the last three decades have tended to add ever more taxes to the tax-sharing base (Kim et al. (2013)) – more details on institutional features in Kim et al. (2013).

Concerning the property tax, Austria has essentially a single national property tax system, although sub-national governments have some discretion over reliance on immovable property taxes via their powers to set coefficients and rates (UN (2013)). Taxes on property used to play an important role but have been replaced by income and consumption taxes over time. Austria's real property tax is low by EU standards (Reiss and Köhler-Töglhofer (2011)).

Current tax on immovable property The sub-heading 4100 – "Recurrent taxes on immovable property" currently includes in Austria the Real Property Tax on Land & Buildings (LTA, LTB) (Blöchliger (2015)). The Tax was created in 1955 (Grundsteurer) (Almy (2013), Ernst (2009)). It covers land and buildings. Both residential and business properties are taxed. Undeveloped land and agricultural land are also taxed. The national government has the responsibility for the tax base setting.

Concerning assessment and valuation, the tax base for the real property tax is calculated using an assessment unit value, which was defined on January 1, 1973, and has been raised only three times since – updates every nine years in average. The Land tax —one of the two components of the property tax —is based on unit-value. The unit value is determined by several factors: the soil quality, the availability of water, and climate. The improvement of land does not influence the land tax (Navratil et al. (2014)).

Cadastral System The development of the Austrian cadastre in the 18th century became the model for cadastral systems in Europe until the advent of computers mapping. The original cadastral surveys made during the Austro-Hungarian Empire influenced many cadastral systems in Europe. Austria has today a modern digital cadastre (UN (2013)). Assessment is made by the Ministry of finance.

Shocks Revaluations should take place every nine years in Austria, but took place in practice in 1973 – implemented in 1975 – with updates in 1983, 1992, 2009 (Almy (2001), Reiss and Köhler-Töglhofer (2011)).

- **1975. Revision.** The shock was the result of the complete market value revaluation of 1973 that was implemented in 1975.
- **1983. Revision**. The shock was the result of an update of cadastral value (by a total of 35%) (Reiss and Köhler-Töglhofer (2011), Pitlik et al. (2012))
- **1992. Revision**, **Long Run**. The shock was the result of an update of cadastral value (Reiss and Köhler-Töglhofer (2011), Pitlik et al. (2012)). The update of cadastral value was accompanied by a reform of the property tax that was implemented to "achieve greater efficiency and simplification" (OECD (1993)). This reform had a "long-run" objective and was not designed to offset a shock – it can thus be classified as a "Long-run" economic reform following the classification of Romer and Romer (2010) and Cloyne (2013).

[16] According to Kim et al. (2013), "Tax autonomy is a rare exception, only 0.5% of all tax revenue stems from Länder taxes and 5.1% from local taxes. More than 85% of general government tax revenues stem from shared taxes. Tax policy and legislation are allocated to the federal level, tax collection to federal revenue offices".

- **2009. Revision**. The shock was the result of an update of cadastral value (Reiss and Köhler-Töglhofer (2011), Pitlik et al. (2012)).

G.3 Belgium

Context Belgium has a federal system of government with essentially a single national property tax system, although sub-national governments have some discretion over reliance on immovable property taxes via their powers to set coefficients and rates (UN (2013)). Belgium's property taxes are part of the personal and business income taxes (OECD (2015a)).

Current tax on immovable property The sub-heading 4100 – "Recurrent taxes on immovable property" currently includes in Belgium two taxes –on Households and on Businesses (Blöchliger (2015)).

The tax on households covers both land and buildings. It taxes residential property only. Undeveloped land and agricultural land are also taxed. Concerning assessment and valuation, the income method is used – cadastral income is a notional income deemed to represent the net annual income from the premises concerned, at the price of the year used as a reference for the most recent official valuation procedure (1975). Certain properties, such a second homes, are assessed at 140% of cadastral incomes. Market value updates occur every ten years. If the assessed value of the property is based on 1975 values, it has been indexed to the development of the CPI since 1991 (UN (2013)). The assessed value is on average below half of the market value (Johannesson-Linden and Gayer (2012)). The national and regional governments have the responsibility for the tax base setting.

The tax on Businesses has very close characteristics. It covers land and buildings. The main difference is that it taxes business only. The valuation method used is the income method, with updates every ten years. The index used for updating is also based on the consumer price index.

Cadastral System The Federal Public Service Finance is responsible for maintaining property tax records (UN (2013)).

Shocks

- **2005: Long Run, Ideology.** The shock was the result of the decision to end the Property tax credit for real estate investors (non owner-occupiers). The objective of the liberal government of Guy Verhofstadt was to favor home-ownership and not rental housing (Gayer et al. (2012), Valenduc and Van Reybrouck (2012)). [17] This was a structural reform not designed to offset a shock – it can be classified as a "Long-run" reform. The decision was also taken for philosophical reasons ("fairness"), so it can also be classified as an "ideological" change – following the classification of Romer and Romer (2010) and Cloyne (2013).

G.4 Canada

Context Canada is a federation with three levels of government: the federal government, provincial and territorial governments, and local governments. Under the Constitution, municipalities depend on the provincial government. The Provinces can create or reduce the number of municipalities, determine what they can make expenditures on, and what sources of revenue are available to them (Slack (2004)).

[17] According to Jurion (2008), "La réforme visait à favoriser les propriétaires d'une habitation unique, comme les ménages qui empruntent pour s'acheter leur logement". According to Pacioli (2005), "Ces modifications législatives constituent en réalité l'exécution de la déclaration du Gouvernement du 14 juillet 2003, dans laquelle nos représentants indiquaient souhaiter renforcer l'accès pour tous à une habitation propre. Le Gouvernement annonçait "comme première priorité l'accès pour tous à sa propre habitation"".

Current tax on immovable property Property taxes are one of the oldest forms of taxation in Canada, used primarily by municipalities and provincial governments. Municipalities impose property taxes on the value of residential, industrial, and commercial properties. They represent only a small portion of provincial revenues but they are the largest source of revenue to municipal governments. Provincial control over the tax means that there are similarities in the application of the property tax among municipalities within each province but variations across provinces (Bird and Slack (2004)). The provincial governments set the rules for how the tax base and tax rates are determined. Municipalities in all provinces levy property taxes to finance municipal services. In some provinces, the provincial government also levies a property tax to finance some of the costs of elementary and secondary education.

If there are variations in the application of the application of the property tax across provinces, property tax revenues at the federal level largely depend on the main evolutions in the largest provinces. For example, a shock in Ontario, the largest province in Canada with a population of 10.5 million and 4.2 million properties, can have a significant impact at the federal level. Ontario did a major reform of the property tax in 1988 (Slack (2004)). This reform was part of an overall reform of local government in Ontario that included municipal government restructuring (the number of municipalities in Ontario has been reduced from over 800 to about 500 since 1996) and a realignment of services between the provincial and municipal governments.

The burden of property taxes is typically high by OECD standards and proportionately hard on business (Bader (2008)). Duclos and Gingras (2000) emphasize that in Canada "*property taxes have an immediate effect on the valuation of the existing stock of property*".

Cadastral System In all provinces, the tax base for the property tax is real property, defined as land and improvements to the land. There is different treatment of machinery and equipment in different provinces; in some cases, machinery and equipment affixed to real property is included and in others it is not. All provinces assess properties at some percentage of market value. The date used to determine current value is the same for all municipalities across the province (Slack (2004)).

Shocks

- **1989: Revision.** The shock was the result of a property tax reassessment in 1988 in Ontario and Quebec, implemented for 1989 revenues. During this period –and until 1998–, property tax reassessments were made very infrequently in these two provinces. In 1988, a large property tax reassessment took place both in Quebec and Ontario – the two largest provinces in Canada. They represent together more than 60% of the Canadian population. Property tax changes in these two provinces thus have an impact at the federal level. In Quebec, the reassessment was the first one in 16 years to reflect updated property data (The Gazette (2006)) – for an history of assessment in Canada, see also Bezeau (1977) and Bird and Slack (2004). It was following a period of large increase in house prices.

- **1998: Long Run, Revision.** The shock was the result of the implementation of a new assessment system in Ontario. In January 1998, a uniform assessment system based on "current value" (or market value) was implemented province-wide in Ontario. For the years 1998-2000, every property was assessed as of the same valuation date of June 30, 1996 (Slack (2001), Slack et al. (2007)). This new assessment system had a "long-run" objective and was not designed to offset a shock – it can thus be classified as a "Long-run" economic reform following the classification of Romer and Romer (2010) and Cloyne (2013).

- **2000: Deficit, Ideology.** The shock was the result of the implementation of property tax caps in Ontario. In 1998, was decided a mandatory capping on property tax increases for the year 2000 (Legislation: Fairness for Property Taxpayers Act, 1998 (Bill 79)). It was also decided in 1999 property tax limits on newly-constructed properties starting in

2000. Finally, in 2000, a reform enacted new mandatory limits on reassessments related property tax increases (Legislation: Continued Protection for Property Taxpayers Act (Bill 140)). These policies contributed to a decline of property tax revenues in 2000 (Slack et al. (2007)). Property tax caps can have two motivations. They can be include in the category "Deficit consolidation" as they reflect past economic conditions and they are not motivated by a desire to return growth to normal. They can also fell into the category "ideological change" —- following the classification of Romer and Romer (2010) and Cloyne (2013) – as they were taken for "fairness" (as suggested by the name of the Legislation "Fairness for Property Taxpayers Act") and as an answer to the unpopularity of the property tax.

- **2001: Revision.** The shock was the result of a property tax reassessment in Ontario – for the taxation year 2001, values were assessed as at June 30, 1999 (Slack (2001), Slack et al. (2007)).

G.5 Chile

Context The property tax (impuesto territorial or contribucion a las bienes raices) is a national tax in Chile. It was established by Law 17,235 of 1969. It is assessed and administered by the national government. Although all the revenue from the tax goes to municipalities, only 40% of the revenues collected from the tax remains in the municipality where the property is located. The remaining 60% is directed to the Municipal Common Fund, a national revenue sharing system (Slack (2004)). Tax rates are set nationally, so local governments have no autonomy in this respect.

Concerning the tax base, the property tax is levied directly on the property, regardless of ownership or occupancy. There are two distinct tax bases –agricultural land and non-agricultural land. The fiscal value of land is obtained by multiplying the area of the land by the unit cost of a square meter. The unit value depends on the square (manzana) in which the plot is located.

Cadastral System The law mandates that the period between two consecutive assessments should not be longer than 5 years or shorter than 3 years. However, it is common to find that, using a Presidential power, assessments have been postponed. For example, there was a general reassessment in January 2000, although municipalities were given some freedom with respect to when they introduced the new values. In addition, values are updated every six months in accordance with changes in the consumer price index. A 1998 study reported that fiscal values on average were about 80% of market value (Slack (2004)). The national tax administration (SII) is responsible for assessment since the tax is a national tax.

Shocks We do not identify exogenous tax changes in Chile. Data for the property tax only start in 1997.

- A potential shock could have been 1987 where a revaluation of non-agricultural property was implemented. However, we do not have data for this period.
- A potential shock could have been the reassessment in January 2000. However, we do not find any significant change in property tax revenues during the period.

G.6 Czech Republic

Context Since 1 January 1993, Czech Republic was established with a new tax system. Fiscal decentralization was an essential part of the transition process from a command to a market economy, as the total size of the public sector had to be reduced and new local governments had to receive appropriate responsibilities and institutional capacity in order to be capable and accountable for their decisions. This implied that local governments should finance the services they provide either from user charges or taxes born by their residents. According to Sedmihradská (2012), "*The property tax, exactly the real estate tax, was the only potentially significant tax that could be assigned to local governments as a true local tax.*"

The property tax (real estate tax) was a component of this new tax system and its tax revenues were assigned to municipalities. The property tax had two components: tax on land and tax on buildings, while the tax on land was in most cases an *ad valorem* tax, the tax on buildings was an area based tax (Sedmihradská (2012)).

Current tax on immovable property The sub-heading 4100 – "Recurrent taxes on immovable property" currently includes in Czech Republic a property tax on land and buildings. Both residential and business are taxed –as undeveloped land and agricultural land.

Concerning assessment and valuation, the tax base for the real property tax is calculated using an area-based assessment method –the surface of the buildings is used as the basis for measurement. Neither the tax on land nor the tax on buildings reflects actual market values. According to OECD (2010b), "in the current tax system, the real estate tax for residential buildings in the Prague area is CZK 4.5 per square metre, and for built land it is CZK 0.45 per square metre. Given current prices per square metre in Prague, this corresponds to an effective tax rate of roughly 0.013%". The national government is responsible for tax base setting (Blöchliger (2015)).

Property tax is low in Czech Republic in particular because it has many exemptions. Tax rates are defined in monetary terms (CZK) and depend on the use of the buildings. Residential and agricultural structures are taxed less than other buildings. In the case of residential buildings, the tax depends also on their location: it is higher in Prague and other major cities than elsewhere (OECD (2010b)).

Cadastral System The Ministry of Finance maintains an information system, which has links to the real property cadastre and the population register (UN (2013)).

Shocks

- **2009: Long run**. The shock was the result of a reform of local governance finance in a context of fiscal decentralization. Municipal autonomy regarding the property tax in the Czech Republic was very limited until 2008 when was implemented the most notable local government finance reform over the period. With this reform, local governments have been allowed to raise property tax rates. This created more stable and predictable revenues and higher degree of autonomy to the local governments. The development of tax autonomy was in practice implemented for 2009 revenues. There were no changes in the tax rates between 1993 and 2008. The reform led to a large increase of property tax in 2009, the first year of fiscal autonomy (Minárik (2015), Sedmihradská (2012)). Fiscal decentralization can fall into the category "Long-run" economic reforms – following the classification of Romer and Romer (2010) and Cloyne (2013).

G.7 Denmark

Context The tax reform of 1903 created the foundations for the Danish systems of taxes. The reform replaced a number of old property taxes with one property tax based on the market value of immovable property and revaluation of all properties every 4 years was introduced. In 1926 a land tax was introduced based on the market value of the land alone and the property tax became a tax on the value of the buildings (OECD (1983b)). Land was taxed at higher rates than the buildings. In 1958 the amounts for the building tax was fixed and collection of the building tax ended in 1986 (Muller (2005)).

Current tax on immovable property Today, in Denmark the property tax consists of a universal government property value tax (ejendomsværdiskat) based on the public property assessment –the Service Tax– and a regional specific municipal land tax (grundskyld) –the Land tax (Heebøll (2014), Blöchliger (2015)).

The arrangements for the two taxes are very similar. Land Tax is levied on all privately owned property. The Service Tax is levied on publicly owned property and on the value of

buildings on business property. The Land Tax in its present form was introduced in 1926 while the Service Tax was introduced in 1961. Both residential and business properties are taxed. Undeveloped land and agricultural land are also taxed. The base for the Land Tax is the market value of the land. The base for the Service Tax is, for publicly-owned property, land and buildings (at different rates) and for private business property it is the value of the buildings. The Land Tax is for municipalities levied as a proportional tax at varying rates. The Service Tax rates also vary, statutory limits being a given percentage on land and on the value of business property (OECD (1983b), Almy (2001)).

Concerning assessment and valuation, the valuation method of the land tax is based on sales prices. Market value are currently updated annually. The national government is responsible for the tax base setting. The Central Customs and Tax Administration develops mass appraisal models, relying on the sales comparison approach in the valuation of land and residences. The income approach is used for rented properties when sales are infrequent, and the cost approach is used for other types of property. Separate estimates of land values are made for the Land Tax. Under the Service Tax, building values are derived from estimates of total property value minus estimates of land value. Properties are revalued every two years, with residential properties be revalued in one year and the other categories of property being revalued in the next (UN (2013)).

Shocks

- **1979. Revision**. The shock was the result of a property tax reassessment. Since 1903 there has been a revaluation of all properties every 4 years (OECD (1983b)).
- **1981. Long Run, Revision.** The shock was the result of both a new assessment system and a revision. In 1981, annual updates were introduced. The updating factors were based on the property price trends for different types of properties in each geographical area. The updates were carried out during each of the three years between two revaluations. This indexation did, however, not reflect the actual development of values (OECD (1983b)). This new assessment system had a "long-run" objective and was not designed to offset a shock – it can thus be classified as a "Long-run" economic reform following the classification of Romer and Romer (2010) and Cloyne (2013).
- **1983. Revision**. The shock was the result of a property tax reassessment. Since 1903 there has been a revaluation of all properties every 4 years (OECD (1983b)).
- **1986. Deficit consolidation**. In 1986, the taxation rules were changed so that the value of the interest deduction available to homeowners was reduced – interests could be deducted from property income. This led to an increase of property taxes. According to Kristensen (2007), the effect of these measures manifested itself in earnest in 1987, when demand in the housing market fell drastically and falling prices brought housing construction to a standstill.
- **1987. Revision**. The shock was the result of a property tax reassessment (Muller (2005)). Since 1903 there has been a revaluation of all properties every 4 years.
- **1991: Revision**. The shock was the result of a property tax reassessment (Muller (2005)). Since 1903 there has been a revaluation of all properties every 4 years.
- **1995: Revision**. The shock was the result of a property tax reassessment (Muller (2005)). Since 1903 there has been a revaluation of all properties every 4 years.
- **1999: Revision**. The shock was the result of a property tax reassessment (Muller (2005)). From 1998 to 2002, values are determined by means of public assessments carried out every year (Muller (2005)).
- **2000: Revision**. The shock was the result of a property tax reassessment (Muller (2005)). From 1998 to 2002, values are determined by means of public assessments carried out every year (Muller (2005)).

- **2001: Revision**. The shock was the result of a property tax reassessment (Muller (2005)). From 1998 to 2002, values are determined by means of public assessments carried out every year (Muller (2005)).
- **2004, 2005: Ideology, Deficit consolidation.** The shock was the result of a tax freeze policy on property taxes. This meant that property taxes were fixed to their 2002 nominal levels, which gradually eroded the relative tax rate as housing prices increased. As emphasized by Dam et al. (2011), the housing market boom in the years 2000s was driven to some extent by the nominal freeze on the property value tax. If the tax freeze policy on property taxes was implemented in 2002, the first significant effects were on 2004 and 2005 – reassessment was supposed to be done annually during this period (Heebøll (2014)). The tax freeze policy was a central decision of the government formed by the Liberal Party and the Conservative People's Party (OECD (2003)).[18] Following the classification of Romer and Romer (2010) and Cloyne (2013), it can be classified as an "ideological change" as the decision was notably motivated by the large unpopularity of the property tax. It can also be classified into the category "Deficit consolidation" as the objective was to correct past shocks, and more precisely, past increases of the property tax (and to avoid further rise in taxes). The level of property taxation was seen as too high.
- **2008: Long Run.** The shock was the result of a reform to reinforce local self-government — known as a local government reform. It was decided the end of local tax controls from central government. The first year without individual local tax controls, property taxes increased dramatically, much more than expected by the central government (Blom-Hansen et al. (2013)). This local government reform can fall into the category "Long-run" economic reforms – following the classification of Romer and Romer (2010) and Cloyne (2013).

G.8 Estonia

Context In Estonia, land value is taxed, but not the value of buildings and apartments – it is the only OECD country which only has a land tax (Almy (2014), UN (2013)). This approach goes back to the early 1990s – the Land tax was enacted in 1993 – and was to support the objective of reinstating individual property rights for former owners or their heirs, irrespective of their present place of residence. The idea was to stimulate the more efficient use of reinstated and privatized land while not discouraging development by taxation of improvements. Besides, as in other transition countries, this mechanism was intended to protect the residents of privatized apartments whose payment capacity was often not correlated with the market value of the acquired asset (OECD (2009b)).

The land tax is levied and collected at a local level and tax revenues accrue fully to the local budgets of municipalities. The tax rate varies between 0.1-2.5% depending on the municipality and the usage of land (Commission (2012),OECD (2009b)). In international comparison, property tax revenues represent around 0.25% of GDP in Estonia, clearly below the OECD average level (OECD (2009b)).

The tax burden on land depends not only on the tax rate but also on the valuation of the tax base. Land value base rates are based on sales comparisons. Separate rates per square meter for each property type in each zone are developed. In rural areas, where there is little direct market evidence, values are extrapolated from areas where there is some evidence, so that there is a rational pattern in which similar properties have comparable values. Agricultural, forest, and some urban lands are valued on the profits basis (UN (2013)). The central government has the responsibility for the tax base setting. Land valuations are infrequent and are now out of line with market prices. The last assessment was carried out in 2001 (OECD (2009b)). A round of land valuation was planned for 2012 to bring land prices closer to market values (OECD (2011b)). However, this revaluation was not implemented, so land valuations are still out of line with market prices (OECD (2017)).

[18] According to OECD (2003), "Included in the definition of the tax freeze is a nominal ceiling on the property value tax. ...The nominal principle for property value tax implies that these taxes are not adjusted in parallel with inflation. ... In fact, the tax freeze is equivalent to a gradual tax".

Shocks

- A potential shock could have been the assessment carried out in 2001 (OECD (2009b), Commission (2012)). We do not find however a significant change in property tax revenues.
- A potential shock could have been the decision to abolish taxation of land under individual houses in 2013 so as to reduce tax burden of homeowners (OECD (2012a)). However, we do not find a corresponding change in property tax revenues following this date.

G.9 Finland

Context The property tax system in its present form was introduced in 1993. Before that, property taxation consisted of a complex system of fees and charges on real property, such as a discretionary property tax, the land tax, the street charge and the tax on income from housing (Kim et al. (2013)).

Current tax on immovable property At present, the property tax system consists of five taxes: the general real estate tax, the tax on permanent residential buildings, the tax on other residential buildings, the tax on power stations and the tax on nuclear power stations. Introduced in 1993, the real estate tax replaced the land tax, the street charge, the tax on income from housing, and presumptive income taxation. Both land and buildings are subject to the real estate tax. Land used for agriculture or forestry is exempt from real estate tax, whereas buildings located on the land in question are subject to real estate tax. Real estate tax is deductible from income taxation, provided that the real estate has been used for earning income. The owner of real estate is subject to real estate tax.

Municipalities are the recipients of real estate tax. Property taxes are collected by the central tax authority, but each municipality determines their own property tax rates within upper and lower limits set by the central government. The central government has adjusted the limits twice, in 1999 and 2010. As a result of the 1999 reform, about 49 per cent of the municipalities applied the new lower limit rate, whereas only 5 per cent applied the lowest allowed rate before the reform. 35% of the municipalities increased their rates from 1999 to 2000, and 15% were already applying the new lowest allowed rate in 1999 (Kim et al. (2013), Blöchliger (2015)). According to Kim et al. (2013), "*The long term political objective has been to increase the importance of property taxation in municipal finances and thus to reduce the pressure to increase local income tax rates. The upper and lower limits of property taxation were increased in 1999 and 2010, which forced some municipalities to increase their rates*".

Cadastral System According to the Income and Wealth Tax Act of 1974, building land should be assessed at its market value. This goal was however not achieved (Andelson and Virtanen (2001)). In practice, reassessments took place in 1993, 2009 and 2014. Today, revaluations are supposed to take place every five years (Blöchliger (2015)). The taxable value of land is based on the estimated market value of the site in the previous year. The taxable value of buildings is based on estimated construction cost less depreciation. The national government has the responsibility for tax base setting.

Shocks

- **1993. Revision, Long Run.** The shock was the result of a property tax reassessment (Johannesson-Linden and Gayer (2012)) and of the new Act on Municipal Tax on Real Property (Kiinteistöverolaki, Act 654/1992) which introduced the property tax system in its present form. Property taxation was reformed in Finland in 1993 to replace a disintegrated system of fees and charges on real property (Andelson and Virtanen (2001), Lyytikäinen (2012)). This reform – with a "long-run" objective and not designed to offset a specific shock – can be classified as a "long-run" economic reform (following the classification of Romer and Romer (2010) and Cloyne (2013)).

- **2000. Long Run, Ideology.** In Finland, municipalities choose property tax rates within limits set by the central government. In 1999, the government decided to raise the lower limits to the general property tax rate and the residential building tax rate for the year 2000. The lower limit to the general property tax rate rose from 0.2% to 0.5% and the lower limit to the residential building tax rose from 0.1% to 0.22%. The reform caused imposed increases in tax rates. The new limit to the general property tax was binding for approximately 40% of the municipalities and the new lower limit to the residential building tax was binding for roughly 30% of the municipalities. Before the reform, less than 5% of the municipalities applied tax rates corresponding to the lower limits. The reform implied large forced increases in tax rates for many municipalities (Lyytikäinen (2012), Kim et al. (2013)). The long term political objective was to increase the importance of property taxation in municipal finances as property tax was seen as the less distorsive tax (Kim et al. (2013)). This reform can be classified both as a "long-run" economic reform and as an "ideological change".
- **2010. Revision.** The shock was the result of a property tax reassessment in 2009, implemented for 2010 revenues (Johannesson-Linden and Gayer (2012), Andelson and Virtanen (2001)). Property tax revenues also increased in 2010 because of the reform in the minimum and maximum rates. Indeed, from 1st January 2010, the minimum tax rates applied to permanent dwellings and the general property tax were raised slightly (OECD (2010a), OECD (2012b)).
- **2014. Revision.** The shock was the result of a revision in 2014 to bring real estate valuations closer to market prices (OECD (2014b), OECD (2016a)).

G.10 France

Context There are a variety of taxes which apply to the ownership, occupancy or transfer of immovable property in France. The most important of these taxes are the Land and Buildings Tax ("Taxe foncière sur les propriétés baties"), the Property Tax ("Taxe d'Habitation") and the Land Tax (Taxe Fonciere sur les propriétés non-baties). The land and building tax ("Taxe foncière sur les propriétés bâties") was introduced in 1974. The tax base was originally the rental value of the property with a deduction of 50% cent from this amount, to take account of related expenses. The property tax (Tax d'habitation) was also introduced in 1975. The tax base is the rental value of dwellings and their dependencies (OECD (1983b)).

The last general review was on 1st January, 1970. Rental values were updated in 1978-1980 to take account of the trend in rents between 1970 and 1980. Rental values were then supposed to be updated every three years using coefficients determined within each region for each category of buildings or land. Between revaluations, rental values had to be uniformly revalued using a national coefficient for buildings and one for land. Each year, rental values had to be adjusted to take account of any changes which may affect their value (facilities, situation, etc.). These reassessment rules were however not implemented (OECD (1983b), Certu (2013)).

Current tax on immovable property The sub-heading 4100 – "Recurrent taxes on immovable property" currently includes in France the Land and Buildings Tax ("Taxe foncière sur les propriétés baties"), the Land Tax ("Taxe Foncière sur les propriétés non-baties") and the Property Tax ("Taxe d'Habitation") (Blöchliger (2015)). In these three cases, both residential and business properties are taxed.

Concerning assessment and valuation, the valuation method is based on the rental value. If the assessed value of the property is based on 1970 values, it has been indexed to the development of the CPI.

The national government has the responsibility for the tax base setting.

Shocks In France, it is possible to shed light on six different property tax shocks over the last forty years. These shocks are mostly consequences of decentralization policies.

- **1975: Long Run, Revision.** The shock was the result of the introduction of the land and building tax ("Taxe foncière sur les propriétés bâties") in 1974. New cadastral values were also implemented in 1975 (OECD (1983b), Guengant and Uhaldeborde (1984), Guengant and Uhaldeborde (1985), Certu (2013)). The objective of this law was to create a modern instrument of taxation. It was defined in the preamble of the Law of the 19 July 1974 ("*Les collectivités local vont se trouver dotées de l'instrument fiscal moderne qui leur était nécessaire*"). This reform can enter into the category "long-run economic reforms" – following the classification of Romer and Romer (2010) and Cloyne (2013).
- **1983-1984. Long Run.** Fiscal decentralization. The shocks were the result of the Defferre Laws in 1982-1983 that initiated the policy of decentralization in France. Prior to these laws, French municipalities and departments enjoyed very limited autonomy. The laws gave territorial collectivities in France separate defined responsibilities and resources. In particular, the 1983 laws dating from 7 January and 22 July defined the responsibilities of new bodies (the "Régions") and how they would be financed. If local authorities could set property tax rates since 1981, it was the need of increasing resources due to the new responsibilities of local collectivities that explained the rise of property taxes between 1983 and 1985, whose consequence was a gradual decrease of house prices (Guengant and Uhaldeborde (1992a)). More details in Guengant and Uhaldeborde (1984) and Guengant and Uhaldeborde (1985). These fiscal decentralization reforms can also fall into the category "long-run" reforms as they were structural reforms that were not necessarily economically motivated.
- **1992. Long Run.** The shock was the result of the ATR Law of the 6th February 1992. Increases in property taxes during this period can firstly be explained by this new decentralization reform – and can thus fall into the category "long-run reforms" as classified by Romer and Romer (2010) and Cloyne (2013). Intercommunality really emerged in France with this law which created the "communautés de communes". The law was an immediate success with more than 1000 "communautés de communes" created during the first five years. Intercommunality was the main cause of the increase of property taxes after 1992 (Charlot et al. (2008)). Decentralization reforms had permitted transfers of responsibilities to local authorities. Increasing responsibilities implied a need for increasing resources which explained the increase of property taxes. The rise of property tax was also partly the result of the Law of 1990 which planned a major revision of cadastral values. To offset the cost of this reform for the State, this law contained an increase of collection and recovery costs that led to an increase of property taxes in 1991-1992. However, because of its political costs, the revision of cadastral values was finally abandoned (Guengant and Uhaldeborde (1992a)).
- **2000. Long Run, External, Ideology.** The decline in property tax in 2000 had several causes. It was first linked to the electoral cycle and the pre-election period (local elections took place in 2001) – and can thus fall into the category "external changes". The government also decided to reduce the property tax ("Taxe d'habitation"), which was seen as an "unfair tax", see Serafini (2000), Valletoux and Mabille (2000), Guengant and Uhaldeborde (2001). This decision can be classified both as an "ideological change" and as a "long-run economic reform". According to Guengant and Uhaldeborde (2001), "*Parmi les multiples défauts de la taxe d'habitation, son caractère régressif, en soi peu surprenant pour un impôt indiciaire, est politiquement et socialement un catalyseur des reproches.*" This reform was also part of the policy of fiscal re-centralization that had started in 1998 (Cossardeaux (2000), Valletoux and Mabille (2000), Guengant and Uhaldeborde (2000), Guengant and Uhaldeborde (2001)) – and can thus again be classified as a "long-run" reform. Indeed, the increase of property taxes that had started in 1992 with the ATR law was halted in 1997-1998. Several property tax exemptions were voted in 1996-1997 (property tax exemptions for developed property during 5 years in urban free zones with the Law of the 14th November 1996; property taxes for undeveloped property are removed for the Régions and "départements" in 1996). Local authorities also started in 1997 a policy of tax moderation, notably because the parliament had secured the state grants to local governments with the Financial Stability Pact. This was also part of the policy of fiscal recentralization (Marini (2001)).

– Local Political Business Cycles. Originally, the electoral cycle theory was created to explain central government policies (Nordhaus (1975)). In spite of their more limited fiscal instruments, similar phenomena have been identified in a number of local government studies (Mouriuen (1989), Houlberg (2007), Geys (2006)). Mouriuen (1989) emphasizes that "if one wants to predict how local tax rates change, it is as important to know the number of years' to the next election as it is to know the change in the fiscal capabilities of local governments". By studying Denmark, Norway, Sweden, Finland, France and Italy in the eighties, he shows that tax rates are peeking in mid-term years, i.e. as far from elections as possible. Mouriuen (1989) and Houlberg (2007) suggest that in an electoral year, local authorities avoid increasing local taxes, which leads to a reduction of budget surplus and/or to increased indebtedness. Similarly, Geys (2006) has studied fluctuations in local government debts in Flemish Municipalities in 1977-2000 and finds that the growth rate of local public debt is significantly higher in election years. As emphasized by Nordhaus (1975), "voters do not take simple averages of economic variables over the last electoral period, but have a decaying "memory" of past. On election day, the memory of recent events is probably more poignant than that of ancient ills".

- **2010. External.** The increase in property tax was linked to the electoral cycle and the post-election period as local elections took place in 2008 – see in particular Dgcl (2008)[19], Régis (2009)[20], AMF (2008), Pellefigue (2012). The context was favorable to an increase in property tax as local authorities did not increase property tax rates before the elections —catch-up phenomenon — and as house prices were increasing dramatically without changes of cadastral values.

ANNEX:

- **More details on the 1975 shock.**
  - Introduction of the land and building tax ("Taxe foncière sur les propriétés bâties") with the Law of the 19 July 1974. It is defined by the government in the Preamble of the Law: "*Les collectivités local vont se trouver dotées de l'instrument fiscal moderne qui leur était nécessaire. Il importe à présent de maintenir, de manière permanente, la valeur de cet instrument. A défaut, les pouvoirs publics se trouveraient, a moyen ou à long terme, dans l'obligation de procéder à une nouvelle révision qui représenterai une servitude importante et entraînerai des déplacements notables de charge fiscal*". A property tax reassessment was supposed to take place every six years following this law. These reassessments were not implemented (Foncière Noyer (2017), Guengant and Uhaldeborde (1984)).
  - New cadastral values were also implemented in 1975. "*L'ordonnance n° 59-108 du 7 janvier 1959 portant réforme des impositions perçues au profit des collectivités locales et de certains organismes ou établissements publics a prévu la suppression de la contribution foncière des propriétés bâties et son remplacement par une taxe foncière sur les propriétés bâties. Son entrée en vigueur était liée notamment à la réalisation d'une révision générale des évaluations des propriétés bâties. Celle-ci a été effectuée suivant les règles prévues par la loi n° 68-108 du 2 février 1968, modifiée par les articles 15 à 17 de la loi de finances rectificative pour 1970. Cette révision achevée, la loi n° 73-1229 du 31 décembre 1973 a fixé au 1er janvier 1975 la*

[19] According to Dgcl (2008), "*Ce phénomène est classique en cas d'élections : une plus grande stabilité des taux en période préélectorale et davantage d'augmentations aussitôt les élections passées. Des raisons électorales et pratiques conduisent à d'augmenter les taux en début de mandat en lien notamment avec la définition des projets à moyen terme. Dans cette logique de cycle, la hausse des taux consécutive aux élections pourrait également se manifester à l'occasion des votes des taux en 2009.*"

[20] According to Régis (2009), "*La question du timing électoral a probablement eu un effet non négligeable sur la détermination des taxes. En général, plus on s'approche des élections, plus il devient difficile d'augmenter les impôts. En 2009-2010, les exécutifs municipaux ont donc eu tendance à accroître la pression fiscale pour rattraper l'absence de hausse des années passées*".

date d'application des résultats de la révision des évaluations des propriétés bâties" (DGFIP (2012)).

- **More details on the 1983-1984 environment.**
  - Guengant and Uhaldeborde (1984): *"L'accélération de la hausse de la taxe d'habitation en 1983 s'explique en partie par un effet pervers de la politique de dégrèvement de l'État. Dans le but d'alléger la charge des occupants de logement, le Gouvernement décidait de supprimer les frais de non-valeur prélevés jusqu'en 1981 au taux de 3,6 %. Or de nombreuses communes ont confisqué à leur profit cette réduction des frais annexes en augmentant en proportion le taux de la T.H."*

G.11 Germany

Context Germany has a federal systems of government with essentially a single national property tax system, although sub-national government have some discretion over reliance on immovable property taxes via their powers to set coefficients and rates (UN (2013)). The property tax system was created in 1938 (OECD (1983b)).

The property tax in Germany is a local tax exclusively levied on real estate. This property tax ("Grundsteuer") is in two parts ("Grundsteuer A" and "Grundsteuer B"). Local authorities are free to fix the tax rate. Property tax A is levied on forestry, land and agricultural production; it is designed both as a land tax and as a tax on agricultural and forestry operations. It yields very little. Grundsteuer A accounted for in average only 0.5% of local authorities' tax revenues in 1999. The other part of the tax, Grundsteuer B, is levied on all other land and buildings. It is affected by the difficulties surrounding valuation and updating of the tax base (Frécon (1999), Voss (2017)). The legislation of the Grundsteuer is under the federal government, whilst the Landers are responsible for the administration.

Cadastral System The property tax is based on fiscal value, which for residential and commercial property is determined as a multiple of the average rent per m2 that could have been obtained for a comparable property. The multiples vary with such factors as size of community, age of structure, or use. Urban land values are based on average prices per m2. Although the law requires values to be updated every six years, the values are based on 1964 values indexed to 1974. More precisely, in the western part of the country, the latest valuation of land and real estate was conducted between 1964 and 1974; where the new Länders are concerned, only very partial valuations dating back to 1935 are available, since none exist for property not inventoried at the time. Farmland is valued on the basis of soil classifications established in 1935. Fiscal values usually are lower than actual values (UN (2013), Almy (2001), Frécon (1999)).

Shocks

- **1984. Long Run.** The shock was the result of the Property Tax Law of 1982 with effect from 1984 revenues. With this reform, almost all property tax base exemptions were abolished (OECD (1983b), OECD (1983a), OECD (1984)). The objective was to standardize the tax rate for all German states to simplify and give more transparency to the tax system. This can be classified as a "long-run" economic reform – following the classification of Romer and Romer (2010) and Cloyne (2013).
- Another potential shock would be the reunification. After reunification, East-German municipalities were allowed to independently set, for the first time in decades, property tax rates. However, we do not find during this period a significant change in property tax revenues. This seems in line with results found by Baskaran (2015). Baskaran (2015) tests whether the tax rates chosen by East-German border municipalities were influenced by the tax rates of adjacent West-German municipalities. He finds no evidence of mimicking for property taxes.

G.12 Greece

Context Until 2011, the property tax in Greece was particularly low and produced very little revenue. A new property tax was introduced in 2011 as part of the stabilization program.

Shocks We do not identify exogenous tax changes in Greece. Property tax revenues were negligible until a recent period, and so were property tax changes. As emphasized by Blöchliger (2015), the property tax-to-GDP ratio was almost nil in Greece, something that we verify in our data, as can be seen on Table 7, as property taxes were only 0.2% of total tax revenues in 1990 in Greece. However, several reforms have very recently increased significantly property tax revenues with the objective of cyclical stabilization. Table 8 shows that in 2014, property taxes were 1.2% of Greece's total tax revenues in 2014.

- A potential shock could have been in 1982 with a new regulation concerning immovable assets. Pursuant to the provisions of Article 19-35 law of property Act 1249/82, immovable property, situated in Greece and belonging to any individual or legal entity, was subject to an annual tax on real property from 1982 onwards. The basis of the tax was the "net annual value" of the immovable property (OECD (1983b)). However, we do not observe a significant property tax change during this period.
- *Endogenous shock.* A potential shock could have been in 2011 with the introduction of a property tax collected through the Public Power Corporation (PPC). This new tax was an area-based property tax levied on the occupants of residential and commercial buildings that are connected to electricity. Collection of the tax was administered by the electricity company and the tax liability appeared on electricity bills. The area-based tax was calculated by multiplying the size of the property in square meters times a multiplier which decreases with the age of the property times a zone rate which reflects the location of the property. The new tax measure, "Special Duty on Buildings Powered by Electricity," was legislated by the Greek Parliament in 2011. We do not include this property tax change as it was "introduced as part of the fiscal reforms resulting from Greece's on-going economic problems" (Slack and Bird (2014)). According to IMF (2013a), "The authorities are taking steps to ensure the implementation of the 2013 fiscal target. They committed to: (i) a tighter payment schedule of the final installment of the property taxes collected via electricity bills by the public power company (PPC)". We cannot consider this shock as exogenous as it was implemented with the objective of cyclical stabilization. As a robustness check in Section L of this Online Appendix, we include this reform in our sample of shocks (Figure 20).
- *Endogenous shock.* A potential shock could also have been the introduction in 2014 of a unified state-level property tax. It was replacing two property taxes – the real estate based wealth tax (FAP) and the property tax collected through the Public Power Corporation (PPC). The new property tax taxes properties, not individuals, and has a broader base that includes residential, commercial, industrial, and agricultural properties. The assessment methodology is similar to the PPC tax using the zone price of property, size of the building, and an age coefficient (Slack and Bird (2014)). We cannot however consider this shock as exogenous as it was also implemented with the objective of cyclical stabilization (IMF (2014)). As a robustness check in Section L of this Online Appendix, we include this reform in our sample of shocks (Figure 20).

G.13 Hungary

Context In Hungary, several property taxes aSre levied at the municipal level. The land tax and the building tax are governed by separate laws – an option chosen only by Hungary among OECD countries. Hungary allows municipalities to impose a tax on certain undeveloped plots of land, a general tax on buildings, and real property tax on holiday properties (Almy (2014)). The most important property tax is the residential building tax, which only less than 20% of municipalities opted to levy in 2012 (OECD (2014c)). Local governments can indeed decide whether to impose recurrent property taxes on immovable property, and not all local

governments impose such taxes (UN (2013)). The tax rate is set by municipalities, with a maximum of HUF 1 722 per square meter or 1.8% of the assessed market value of the property (Commission (2012), UN (2013)). A national tax on properties was briefly introduced the 1st, January 2010 and abandoned after its design was judged unconstitutional several months after the same year (OECD (2014c), OECD (2010c)).

Concerning valuation and assessment, properties are valued using arbitrary point values, such as per-square meters and location in the case of land, or in the case of buildings, per-square meters and according to use (whether office or residential). Such values were deliberately set low in the early 1990s when Hungary lacked a properly functioning property market and have never been re-evaluated since (OECD (2007a), (OECD (2014c)). County fee offices (Illetikhivatal) maintain records related to property transactions. The legal cadastre is managed by the land offices (Földhivatal).

Since January 2014, the number of local governments levying building tax, land tax and communal tax has grown so by 2015 over 85% of municipalities has introduced such taxes (OECD (2016b)).

Shocks We do not identify exogenous tax changes in Hungary. Property tax revenues represent a very small share of GDP in Hungary.

- *Endogenous shock.* Property tax revenues significantly increased in 2012-2013. This was due to the increase of the number of local governments introducing property taxes during this period (OECD (2016b)). We do not consider these variations as exogenous as these new taxes were introduced in a context of recession with the objective of "cyclical stabilization" (of Hungary (2012)). As a robustness check in Section L of this Online Appendix, we include these reforms in our sample of shocks (Figure 20).

G.14 Iceland

Context Iceland is divided into regions, constituencies and municipalities. 74 municipalities govern local matters like schools, transport, and zoning.

Municipalities levy a real estate tax (fasteignagjöld) on the estimated value of immovable property, based on size, etc (IMF (2010)). Assessments for the tax are based on the market value of the property. The Land Registry of Iceland, established in 1976, is responsible for registering real property and determining valuations and assessments. Regulations require the Land Registry to determine a "reference value" for real properties, which shall then be adjusted to market value and separated between land and buildings. The basis of assessments for the local property tax is market value as of the prior November, except that real estate assessments for farms are based on use-value. The Land Registry must determine values by December 31 (Gloudemans (2007)). If assessment is supposed to be based on the market value of the property, in practice, revaluations are infrequent and there is an over-reliance on indexing. For example, values in Reykjavik approximately doubled between 2001 and 2007 while the general revaluation was in 2001. According to Gloudemans (2007), "this over-reliance on value indexing runs counter to the general notion that properties should be revalued annually or on a regular, frequent cycle with indexing used to keep values current and reasonably in line in intervening years. [...] Indexing can be used for short periods of time but becomes problematic when markets are changing rapidly. The Land Registry of Iceland should revalue regularly, decreasing its reliance on index factors".

Concerning property tax rates, the property tax is levied by municipalities, but subject to central government rate caps of 0.625 percent on residential and agricultural properties and 1.65 percent on commercial properties. According to IMF (2011), "most local governments currently raise the maximum or close to the maximum revenue permitted from commercial properties, but some raise substantially less than the maximum from residential properties". Property tax varies considerably by region: whereas many rural jurisdictions impose rates at or close to the maximum, most jurisdictions in the Reykjavik area tend have substantially lower rates.

Shocks

- A potential shock could have been in 1994 when local authorities received the right to levy a tax on commercial property (OECD (2001)). We do not observe however a significant change in property tax revenues.
- A potential shock could have been 2001 when the Land Registry of Iceland conducted a general reappraisal of urban areas (Gloudemans (2007)). We do not observe however a significant change in property tax revenues.
- **2009. Revision**. The shock was the result of a revaluation of dwellings conducted by the Land Registry of Iceland (UN (2013)).

G.15 Ireland

Context During a long period, the only tax on immovable property in Ireland was known as Rates, a tax created in 1838 and levied by local authorities (OECD (1983b)). Up to 1978, valuation was based on 1847 property values. This system was replaced by a residential property tax in 1983 (Gooney (2015)).

Current tax on immovable property The sub-heading 4100 – "Recurrent taxes on immovable property" currently includes in Ireland the Local Property Tax (LPT) and the Non-Principal Private Residence Charge (NPPR) (Blöchliger (2015)).

The Local Property Tax (LPT) covers land and buildings. Both residential and business properties are taxed. Concerning assessment and valuation, the tax base for the real property tax is calculated using sales prices. The frequency of market value updates is every three years – with a last market value update in 2013. The national government has the responsibility for the tax base setting.

The Non-Principal Private Residence Charge (NPPR) covers buildings only. Business properties are taxed. Concerning assessment and valuation, the tax base for the tax is calculated using a fixed lump sum method.

Shocks

- **1978. Long Run.** The shock was the result of the abolition of "rates" in a context of fiscal centralization. Prior to 1977, all property owners in Ireland had to pay "rates" -based on the "rateable valuation" of the property -to the local council. Under the system of domestic rates, valuation was based on 1847 property value and so perceived as antiquated and "inequitable". The 1st January, 1978, domestic properties, the domestic portion of mixed properties, secondary schools, community halls and farm outbuildings were removed from the tax base. Rates for private residences were abolished with local authorities instead receiving funding from central government. Prior to the 1977 abolition of Domestic Rates, local authorities were self-financing 41% of their budgets. Following from this, in 1982 the percentage of overall local government financing from rates dropped to 12% (Gooney (2015), Healy (2006), OECD (1983b)). This (fiscal) centralization reform can fall into the category "long-run" reforms – following the classification of Romer and Romer (2010) and Cloyne (2013).
- **1983. Long Run.** Ireland introduced a residential property tax in 1983 which initiated a new phase of fiscal decentralization (Rae et al. (2006)). This 1983 Act was following measures that had limited the fiscal autonomy of local authorities during the previous years. The Government had introduced a cap on rate poundage increases between 1978 and 1981, thus preventing local authorities from deciding their own level of grant support and also protecting the remaining ratepayers. Up until 1982, the Government maintained their newly acquired responsibility and the grant more or less kept pace with rates of inflation (Healy (2006)). The 1983 Act introduced an annual residential property tax which is payable by an individual on the market value of residential property in Ireland owned and occupied by him on 5th April in each year. Irrespective of the individual's actual

tenure of interest in property owned by him, the market value was calculated as if he had an unencumbered fee - simple interest in the property. Tax was charged at the rate of 1.5 per cent on the excess of the amount of the market values of all residential properties of an individual over an exemption limit, which in 1983 was Ir.£65,000 (OECD (1983b)). This (fiscal) decentralization reform can fall into the category "long-run" reforms – following the classification of Romer and Romer (2010) and Cloyne (2013).

- **1995. Ideology.** The shock was the result of a wave of tax protests leading to new property tax exemptions. Because of its lack of equity, the property tax was very unpopular. The tax when introduced in 1983 initially sought to exempt houses of lower value and households where the income was under a certain threshold. In 1994 however these exemption limits were reduced dramatically thus bringing in a significantly increased number of persons into the charge to tax. This reform became very unpopular and the Budget 1995 reversed the 1994 changes. This led to new property tax exemptions and a decline of property tax revenues (Mayor et al. (2010)). This shock with very strong political motivation can be classified as an "ideological change" – following the classification of Romer and Romer (2010) and Cloyne (2013).
- **1998. Long Run, Ideology.** The shock was the result of the abolition of the residential property tax because of the large unpopularity of this tax. Despite the 1995 exemptions, the tax was still very unpopular with the general public for its perceived lack of equity. The Residential property tax was thus abolished with effect from 1998. The tax was very unpopular notably because of the narrow tax base and the high administrative costs. There was also a high perception of inequity and it was considered as a "Dublin tax" as the capital accounted for almost two thirds of the revenue collected (Mayor et al. (2010), Norregaard (2013)). This shock can also be classified as an "ideological change". It can also be considered as a structural reform or a "long-run" reform in the classification.
- **2014. Long Run.** The shock was the result of the implementation of a new annual Local Property Tax (LPT) charged on all residential properties. The LPT is a self-assessment tax and is collected by the Revenue Commissioners. The tax payable is based on the market value of relevant properties. More precisely, it is based on the chargeable value of a residential property on the valuation date. The chargeable value is defined as the market value that the property could reasonably be expected to fetch in sale on the open market on the valuation date. The valuation date is 1 May 2013. This valuation applies until 1 November 2019 (Gooney (2015)). This new tax can be considered as a structural reform – not designed to offset a specific shock –and can thus be classified as a "long-run" reform.

G.16 Israel

Context Property taxation is more extensive in Israel than in many other OECD economies. Property taxes are the main sources of locally generated income in Israel (OECD (2011a)).

The arnona is Israel's form of local property tax. It is imposed on residential and nonresidential properties, as well as occupied undeveloped land and agricultural land located within the jurisdiction of a local authority. The user of the property, not the owner, pays the arnona. The municipalities are empowered to collect this local property tax.

The tax is not based on the value of the property. It is based on the surface area and type of property. The arnona is a factor by which the size of the property (in square meters) is multiplied, to obtain the annual payment charged by the municipality for that given property for that given year. According to Darin (1999), "the arnona system is not egalitarian compared to taxation based on the property value. Since the system disregards value, the equity issue can not be part of it."

If the arnona system is based on the surface area, there is no law that determines the way to measure the surface area of the apartments. In some municipalities, the area of an apartment includes a portion of the common space, such as staircases, lobby, etc. Other municipalities measure the apartments themselves, without the common area, but including the internal and external walls. According to Darin (1999), "One problem that arises from this variety of measuring systems is that there is obviously no way to really compare the arnona

rates of different municipalities. Furthermore, it is impossible to establish the "real" size of one's apartment, because in addition to the arnona system of measurement, at least two other systems are applied: for building permits and for the properties registry".

Since each municipality determines its own arnona, neighboring communities may have utterly different taxation systems, which makes the system "incomprehensible" (Darin (1999)). According to Harel (2004), " Israelis have over 40 laws, regulations and orders dealing with arnona, and every year 266 different arnona ordinances are adopted by local municipalities. Municipalities use many different methods making tax comparisons very difficult. There are some 1,300 different methods used to compute arnona in Israel." There are indeed as many property tax systems as municipalities in Israel. Annually, each local authority publishes a tax ordinance within its jurisdiction declaring the rules of taxation and exemptions (Horne and Felsenstein (2010), Harel (2004), Darin (1999)).

As part of the 2017-18 budget, the government introduced a new tax on the owners of multiple residential properties, which took effect on January 1, 2017. The tax is levied on the value of the properties, irrespective of their use or rental status/income.

Shocks

- **1998. Long Run**. The shock was the result of the national "Arrangements Law" which included a clause pegging the rate of arnona increases to increases in the consumer price index (CPI). This led to an increase in property tax revenues. The main objective of this reform was to reduce local autonomy and to make the system less "incomprehensible" by reducing the heterogeneity among local evolutions of the arnona (Darin (1999)). This structural reform can be classified as a "long-run" economic reform – following the classification of Romer and Romer (2010) and Cloyne (2013).

G.17 Italy

Context Property tax is Italy was fundamentally reformed in 1993 and 2012. In 1993, the "Municipal Tax on Properties" ("Imposta Comunale sugli Immobili", aka "ICI") was introduced in the Italian legislation. This tax was however unpopular. There was also a suspicion of widespread avoidance, particularly in the South of the country. The revenue was further limited by the fact that the basis was given by capitalizing cadastral rents, which were largely underestimated with respect to their effective values.

Twenty years later, the introduction of the Imposta Municipale (IMU) at the start of 2012 fundamentally reformed, and increased, property taxation in Italy. In replacing the previous Imposta Comunale sugli Immobili (ICI), it brought primary residences back into the tax base and scaled up cadastral values by adjusting them with ad hoc factors. As part of the IMU reform, an ad hoc increase in property values was indeed implemented through the application of multiplicative factors to the tax base (IMF (2013c)).

Current tax on immovable property The sub-heading 4100 – "Recurrent taxes on immovable property" currently includes in Italy the Imposta Municipale Propria (IMU) and the Tributo per i servizi indivisibili (TASI) (Blöchliger (2015)).

The Imposta Municipale Propria (IMU) covers land and buildings. Both residential and business properties are taxed, with the exception of owner-occupied properties. Undeveloped land and agricultural land are also taxed.

The Tributo per i servizi indivisibili (TASI) covers buildings only. Both residential and business properties are taxed.

Concerning assessment and valuation, the tax base for the tax is calculated using sales prices and a cost method. The current property valuation system is based on estimates of market rental values from 1988-89, and so is out of date. The basis for both the old ICI and the current IMU is the concept of cadastral rental value. This is an estimate of what the "normal" (i.e., average for similar properties in the same general location) rental value of the subject property would be as of 1988-89. It is based on location and building type with no information on type of construction, building condition or even age of building. As part of the IMU reform, an ad hoc

increase in property values was implemented through the application of multiplicative factors to the tax base. The revaluation coefficient for houses was 1.6; for other types of properties, reevaluation ranged from 1.2 to 1.6 percent (IMF (2013c), Del Guidice (2012)). The national government has the responsibility for the tax base setting.

Shocks

- **1993. Long Run.** The "Municipal Tax on Properties" ("Imposta Comunale sugli Immobili", aka "ICI") was introduced in the Italian legislation by the law by Decree number 333 on July 11th, 1992 and subsequently transformed into law on December 30th, 1992. The ICI tax base included three main categories: buildings, building plots, and farmlands. Under the ICI system, the tax base for "buildings" was the land registry value defined as an estimate of what the rental value of the property would have been in 1988-1989, which was used as a base biennium. The tax was introduced as part of the process of decentralization (Luigi (2002)) – this reform can thus be classified as a "long-run" economic reform.
- **2012. Long Run, Deficit consolidation**. The shock was the result of a major change of the property tax system. The newly appointed central government implemented a law which re-designed significantly the municipal system on property taxes. The introduction of the Imposta Municipale (IMU) at the start of 2012 fundamentally reformed, and increased, property taxation in Italy. It brought primary residences back into the tax base and scaled up cadastral values by adjusting them with ad hoc factors. Property tax revenue more than doubled in 2012 to 1.5 percent of GDP. As part of the implementation of the IMU, cadastral values were adjusted by a common factor within each property type. The revaluation coefficient for houses was 1.6; for other types of properties, reevaluation ranged from 1.2 to 1.6 percent. These factors resulted in a significant increase in taxable value by about 50 percent overall (IMF (2013c)). IMU tax was introduced to decentralize taxation, increase resources to local authorities and empower local people to the running of their own district (Del Guidice (2012)). According to Del Guidice (2012), "*the central government introduced a new tax on the main dwelling and increased by an exogenous factor the (by then obsolete) land registry estimates of the rental values to calculate the tax base for the main dwelling and other residential properties. [..] The timing and depth of the legislated changes were largely unanticipated*". IMU results in a massive increase of property taxation in Italy (Del Guidice (2012)). There were long run motivations to this law: decentralization and fiscal autonomy – this reform can thus be classified as a "long-run" economic reform. The law was also part of a consolidation plan, which was itself meant to ensure long-run growth – we can thus also classified this reform into the category "Deficit consolidation" following the classification of Romer and Romer (2010) and Cloyne (2013). On 4th December 2011, the newly appointed Italian government led by Mr. Monti indeed announced a plan which was meant to "ensure fiscal stability, growth and equity" (Del Guidice (2012)).

ANNEX:

More details on the 2012 shock in Del Guidice (2012): "*The introduction of the IMU tax significantly reformed the property tax regime along three dimensions. First, it included the land registry value of the main dwelling in the tax base, previously excluded. Second, the land registry values (for both main dwellings and other properties) were scaled up by an exogenous factor (homogeneous across all municipalities and equal to 1.6 for residential dwellings), so as to increase the tax base by an average of 49 percent. [...] Finally, the IMU system set the basic tax rate on primary (other) residences at 0.4 (0.76) percent of the registry value but allowed municipalities to modify this rate within a 0.2 (0.3) percent band. Furthermore, the government set the basic deduction at 200 Euros plus an additional 50 Euro deduction per children less than 26 years old (up to a maximum of an additional 400 Euros): while municipalities were allowed to modify this, around 98 percent of local governments chose the basic deduction of 200 Euros.6 Overall, the IMU system determined a sharp increase in residential property taxation: the*

revenues on the main properties increased from 0bn Euros in 2011 to 4.0bn Euros in 2012 while those on other properties increased from 7.8bn in 2011 to 17.9bn in 2012. Between 2011 and 2012, total tax revenues on residential properties increased by 14.1bn Euros corresponding to around 0.90 percent of Gross Domestic Product (GDP) in 2012."

G.18 Japan

Context Japan has a three-tier governmental system that consists of the national government, 47 prefectures (middle-level governments equivalent to States in the United States) and 3230 municipalities (cities, towns and villages).

Under the Japanese local tax system, the Local Tax Law at the national level gives municipalities the legal basis to levy various local taxes including the fixed property tax. Municipalities levy the fixed property tax on land, houses and buildings, and tangible business assets by passing their own by-laws in accordance with the Local Tax Law (Kitazato (2003), OECD (1983b)).

Current tax on immovable property There are two main taxes on immovable property in Japan: the Fixed Assets Tax (Kotei-shisan-Zei) and the City Planning Tax (Toshi-keikaku-Zei). Each is levied by municipal governments (Blöchliger (2015)). The taxes have many common administrative features. The Fixed Asset and City Planning taxes are taxes levied on owners of fixed assets (land, buildings) on the first of January each year by the relevant city, town or village office (in the 23 Wards of Tokyo this is the Tokyo Metropolitan Government). The tax amount is based on a fixed asset valuation that is revised once every 3 years. Following a revision a notice of the current valuation is sent to the taxpayer. Based on that notification, the tax is paid in either a single lump sum, or four annual installments (Livable (2014)). According to Bird and Slack (2004), "*the assessed value of land and houses or buildings listed in the tax register book is revised every three years according to a survey of the market price of land and the cost of replacement of houses or buildings. When the re-assessment is carried out all over Japan every three years, sometimes the assessed value of land rises considerably.*" The last market value update was in 2013.

We now give more details on the two main property taxes.

The Fixed Assets Tax was introduced in 1950. Beneficiaries are municipal governments. The tax base is the assessed value of land, buildings or tangible business assets respectively (OECD (1983b), Blöchliger (2015)). Land values are assessed market prices determined by reference to the actual market prices of similar land; buildings values are assessed replacement costs allowing for depreciation. These are assessed every three years. Municipal governments are responsible for tax collection but they have no discretion to change the tax base. The tax is levied each year on assets existing on 1st January. Municipal government valuations are co-ordinated as they are made with reference to rules laid down by the central government (OECD (1983b), Kitazato (2003) and TMGBT (2016)).

The City Planning Tax was introduced in 1956. Beneficiaries are municipal governments. The tax base is the assessed value of land and buildings located in the urbanization promotion areas in the city planning zone of a municipality. The valuation procedure is the same as for the Fixed Assets Tax. The tax period is the same as the period for the Fixed Assets Tax. Municipal governments have no discretion to change the tax base but they have some discretion over the tax rate (OECD (1983b), Kitazato (2003) and TMGBT (2016)).

Shocks In Japan, property tax reassessment takes place every three years (Aveline (1995), Yamamoto and Miyakawa (1996), Kitazato (2003), Yamamoto and Miyakawa (1996), Livable (2014), TMGBT (2016)).

- **1977. Revision.** The shock was the result of a property tax reassessment (OECD (1983b), Livable (2014)).
- **1980. Revision.** The shock was the result of a property tax reassessment (OECD (1983b), Livable (2014)).

- **1983. Revision.** The shock was the result of a property tax reassessment (OECD (1983b), Livable (2014)).
- **1986. Revision.** The shock was the result of a property tax reassessment (Kitazato (2003), TMGBT (2016), Livable (2014)).
- **1989. Revision.** The shock was the result of a property tax reassessment (Kitazato (2003), TMGBT (2016), Livable (2014)).
- **1992. Revision.** The shock was the result of a property tax reassessment (Kitazato (2003), TMGBT (2016), Livable (2014)).
- **1995. Revision.** The shock was the result of a property tax reassessment (Kitazato (2003), TMGBT (2016), Livable (2014)).
- **1998. Revision.** The shock was the result of a property tax reassessment (Kitazato (2003), TMGBT (2016), Livable (2014)).
- **2001. Revision.** The shock was the result of a property tax reassessment (Kitazato (2003), TMGBT (2016), Livable (2014)).
- **2004. Revision.** The shock was the result of a property tax reassessment (TMGBT (2016), Livable (2014)).
- **2007. Revision.** The shock was the result of a property tax reassessment (TMGBT (2016), Livable (2014).
- **2010. Revision.** The shock was the result of a property tax reassessment (TMGBT (2016), Livable (2014)).
- **2013. Revision.** The shock was the result of a property tax reassessment (TMGBT (2016), Livable (2014)).

G.19 Latvia

Context Unlike the other Baltic states, Latvia has several layers of subnational government – rural municipalities and towns, local urban governments (big cities), and regional governments. There are almost 500 rural municipalities and 73 towns, mostly with populations less than 5,000. Regions have their own budgets but financially they are almost entirely dependent upon transfers. According to Bird and Slack (2004), "although the municipalities have significant "own" tax revenue, and all revenue from land and property taxes accrues to those governments, in fact they have no revenue autonomy since all local taxes are entirely determined by the central government, which sets both the tax base and the tax rate".

The current property tax in Latvia came into force in 1998 and more fully in 2000. Before that, separate taxes were imposed on land and buildings under two 1991 acts on Land Tax and Property Tax respectively. The Real Estate Tax imposed by the 1998 law was imposed on both land and buildings at a rate of 1.5% of cadastral value until 2002, and thereafter at a rate of 1.0%. These rates are set by the national government, and local governments cannot alter them. Although the real estate tax is a national tax, both local and national governments are responsible for its administration. The State Revenue Service is responsible for collecting data on taxable properties and for assessment. Local governments are responsible for calculating the tax, billing it, and collecting it.

The cadastral value is supposed to be "market based" capital value, calculated taking into account price levels realized in the real estate market over at least a two-year period. Revaluation is required at least every five years (Bird and Slack (2004)).

Shocks

- **1998. Long Run**. The shock was the result of the implementation in 1998 of a new property tax. From 1 January 1998, the law "On Land Tax" (1990) became invalid and it was replaced with the law "On Immovable Property Tax" (1997) (Štucere and Mazūre (2013)) . This led to an increase in property taxes (IMF (2000)). The objective of the

reform was "to ensure maximum simple and fair taxation of immovable property through the principle of neutrality, i.e. low tax rate, wide range of taxpayers, and minimum tax reliefs" (Štucere and Mazūre (2013)). This structural reform can be classified as a "long-run" economic reform – following the classification of Romer and Romer (2010) and Cloyne (2013).

- **2010. Long Run**, **Deficit consolidation**. Latvia implemented reform measures in 2010 by introducing a residential property tax on buildings to complement the existing land tax (Norregaard (2013)). The aim was to modernize the system to have a property tax system more efficient and closer to the European Union tax policy principles. If this reform was taken with a long-run objective, we should notice that there was also during this period a consolidation plan (Gabrielle Guidice et al. (2012)). Following the classification of Romer and Romer (2010) and Cloyne (2013), we thus classify this shock into the categories "long-run" reforms and "deficit consolidation".
- In 2013, local governments were given more leeway to adjust the rates within a pre-defined bracket of 0.2-3%. However we do not observe significant changes in tax revenues as local governments competed for taxpayers (OECD (2015d), Štucere and Mazūre (2013)).

G.20 Luxembourg

Context The property tax in Luxembourg is a local tax, imposed by Municipalities. The property tax "impôt foncier" is particularly low and produces very little revenue. While land prices have been rising steadily, the basic property assessment that is used, with annual adjustments, to calculate the property tax dates back to 1941.

More precisely, the tax is calculated as the product of three factors: the "unit value", a base rate and a communal rate. The basic assessment dates back to 1941. To these values a "base rate" is then applied, varying between 7 and 10 per 1 000, as established in an ordinance issued on 1st July 1937. This produces a "taxable base", to which a "communal rate" is then applied for calculating the property tax. Since no new evaluation of property values has taken place since 1941, values finally retained are very far from market prices. As emphasized by OECD (2008c), "the yield of this tax has been steadily declining. It is no longer productive or equitable and it provides no incentive. By way of indication, the effective rate, i.e. the ratio between the tax paid and the monetary value of the land, is generally below 0.5% and frequently less than 0.1%. This tax, which is not very popular anyway, is therefore of little significance in communal budgets and cannot be used in its current condition as an incentive in the context of a proactive land policy".

Shocks We do not identify exogenous tax changes in Luxembourg as property tax revenues are negligible, and so are property tax changes (in average property tax changes represent less than 0.01% of GDP). As emphasized by Blöchliger (2015), the property tax-to-GDP ratio is almost nil in Luxembourg. We can also see this both on Table 7, as well as on Table 8: property taxes were 0.4% of total revenues in 1990, and 0.2% of total revenues in 2014.

G.21 Mexico

Context Mexico is a federal country, with 31 states and a Federal District (Mexico City). It also has over 2600 local governments.

The property tax ("predial") is the single most important source of own revenue for the local government, but the base and rate of this tax are set by the state, not by the local government. There are thus wide variations from state to state in the importance of this tax (Bird and Slack (2004).

Concerning assessment and valuation, the tax base for land and property is the assessed value determined by the State Land Registry and the local treasury department, which are jointly responsible for an annual assessment. In practice, the assessed value of the land is usually less than the market value. Assessed values are indexed by the Consumer Price Index annually.

Shocks Because of the wide variations from state to state in the tax base and tax rates, we do not identify exogenous tax changes at the Federal level. Both the tax base and tax rates are determined individually by each of the 31 states. As assessment is supposed to be annual, it is also difficult to identify specific dates in the reassessment cycles. Moreover, as emphasized by Blöchliger (2015), the property tax-to-GDP ratio is almost nil in Mexico. We can also see this both on Table 7, as well as on Table 8: property taxes were 1% of total revenues in 1990, and 1.4% of total revenues in 2014.

G.22 The Netherlands

Context The Municipal Tax on immovable property (Onroerende-Zaakbelastingen "OZB") is the main property tax in the Netherlands. It was introduced gradually between 1970 and 1979 to replace the personal tax and land tax (OECD (1983b)). Beneficiaries are municipalities. The government has the responsibility for the tax base setting. It is a property tax on buildings. Both residential and business properties are taxed (Blöchliger (2015)).

The municipality sets the tax rate as part of the annual budget process – at the time of introduction it was decided that the tax should not be used to get the municipal budget closed (Lichfield and Connellan (2000)). The tax has two components: one is a tax upon owners and the other is a tax upon users. The occupier's portion is not payable on vacant property. Until 1990, the government laid down maximum revenue limits for the owner part of the tax and the occupier part of the tax, and generally allowed tax rate changes which keep revenue within these limits. Substantial rate changes were disallowed (OECD (1983b)). Since 1990 there is no limitation regarding tax rates, but the owner tax rate may not exceed 125 percent of the user tax rate. The total amount raised by a municipality from its property tax is subject to specific limits. Within these, there is a wide variety in the tax burden between municipalities (Lichfield and Connellan (2000)). Until 1991, the collection (and thus the sending of the bills) was provided by the tax office.

Since January 1, 2006, the user tax for homes was abolished.

Valuation System Property tax reassessment took place every five years from 1975 to 1995. Assessments are prepared by the central government on the basis of information provided by municipalities. There are two tax base options. The municipality may choose between a value base or an area base for the tax. The value base relies on capital market value and adjusted replacement cost, while the area basis utilizes the square meters multiplied by factors for location, views and quality.

In 1992, a new valuation statute established a valuation supervision board to oversee municipal valuations. The basis of valuation was the fair market value of the property, but under certain circumstances an adjusted replacement value was applied.[21] According to Lichfield and Connellan (2000), for property taxation more than 98 percent of their municipalities utilize a market value base. Alternatively the tax is based on surface area. If a municipality chooses the area basis for the property tax, the actually measured area is first adjusted for the property's nature, location, quality and use. Specific multiplier for each of these factors are designed to reflect differences in market values among other properties. Market value is therefore indirectly a factor even in taxation on the basis of surface area. This system of multipliers is so complex that most municipalities originally using the area basis have changed to the value basis (Lichfield and Connellan (2000)).

Shocks

[21] In practice, dwellings are grouped into categories, each category containing similar dwellings in the same general location. For each category separately, one or two of reference points (i.e. representative dwellings) are chosen. Every five years -and then four years after 1995–, these reference points are revalued. The result is then applied to all other dwellings and that category: sometimes the results are applied after adjustment for price raising and price lowering factors. Municipalities usually employed outside experts to perform their own revaluation. here are separate calculations for land and buildings, but only one value is assessed for the entire property (Lichfield and Connellan (2000)).

- **1976. Revision**. The shock was the result of a property tax reassessment. Property tax reassessment took place every five years from 1975 to 1995 – with changes implemented the year after (OECD (1983b)).
- **1981. Revision.** The shock was the result of a property tax reassessment. Property tax reassessment took place every five years from 1975 to 1995 – with changes implemented the year after (OECD (1983b), Almy (2001)).
- **1986. Revision.** The shock was the result of a property tax reassessment. Property tax reassessment took place every five years from 1975 to 1995 – with changes implemented the year after (Almy (2001), Kathmann (2014)).
- **1991. Revision.** The shock was the result of a property tax reassessment. Property tax reassessment took place every five years from 1975 to 1995 – with changes implemented the year after (Almy (2001), Kathmann (2014)) .
- **1995. Long Run**. The shock was the result of an increase in property taxes as the government wanted to reduce the support for owner-occupied dwellings (OECD (1996)). The objective was to scale back homeownership subsidies. Property tax deductions for new owner-occupied dwellings were abolished. The aim of government formed by the Labour Party and the Liberal Party (People's Party for Freedom and Democracy) was to liberalize the housing market and thus to reduce housing subsidies. This reform can be classified as a "long-run" economic reform – following the classification of Romer and Romer (2010) and Cloyne (2013).
- 1996. Revision. There was a property tax reassessment in 1995 (Almy (2001), Kathmann (2014)). We do not include this shock as it was a minor revision with no significant change in property tax revenues. Following the Act for Real Estate Reassessment (1995), revisions then took place every four years.
- **2000. Revision.** The shock was the result of a property tax reassessment. Valuations for property tax were subject to "Wer waardering onroerende zaken" which is the Property Act of 1 January 1995. This law is the basis of both local and central government taxation and states that valuations should take place every four years (Lichfield and Connellan (2000)).
- **2004. Revision.** The shock was the result of a property tax reassessment. Valuations for property tax were subject to "Wer waardering onroerende zaken" which is the Property Act of 1 January 1995. This law is the basis of both local and central government taxation and states valuations should take place every four years (Lichfield and Connellan (2000)).
- **2006. Ideology, Long Run, Revision.** The shock was the result of a policy in favor of home-ownership. In 2005 the government introduced the Hillen Law –implemented in 2006 –a large tax deduction for homeowners. The Hillen law permitted a property tax deduction if the amount of home-owner's property tax was higher than the interest paid on the mortgage (Ott and Wirschke (2012)). The user tax for homes was also abolished. The result was that home owners did not pay net taxes on their property. This favourable tax treatment of homeownership was motivated by political and ideological motives as homeownership is politically very popular ("the dream for homeownership"). A priva There was finally a new reassessment in 2005 –implemented for 2006 revenues.
- **2009. Long Run, Revision.** The shock was the result of a decision of the government to increase taxation of ownership, through higher property taxes. In particular, imputed rent was increased to 2.35% of house values, for properties worth more than € 1 million (OECD (2008b), OECD (2010e)). The tax treatment of owner-occupied housing was indeed considered as too favorable as the deduction of mortgage interest could often exceed the amount of imputed rent. The objectives were to reduce subsidies to owner-occupied housing and to reinforce tax neutrality. The interest deductibility on owner-occupied housing also tended to marginalize the private rental market in the Netherlands, since interest payments could only be deducted for owner-occupied housing. There was finally a new property tax reassessment that year. Since 2008, it was supposed to be an annual reassessment (Kathmann (2014)).

G.23 New Zealand

Context There were traditionally two taxes on immovable property in New Zealand: the Rates, which are levied by local authorities, and the Land Tax which was levied by the central government – the Land Tax was repealed in 1992.

Land Tax The land tax was introduced in 1892. The tax base was based on the land value of a property, including the value of all improvements up to ground level. There was no discretion over the tax base or the tax rate as this is a central government tax.

Concerning the valuation procedure, revaluations were carried out by the central government's valuation department and took place every five years (OECD (1983b)). The Land Tax was repealed in 1992 (Simpson and Figgis (1998)).

Rates The Rating Act was enacted in 1967 and it superseded the Rating Act of 1925. The power to levy Rates has been granted to local authorities. Local authorities may use anyone of the following tax bases: i) annual values of properties ii) capital values of properties iii) land values of properties. Assessments are prepared by local authorities. The tax is assessed annually. The liability for payment lies with the occupier of any rateable property (OECD (1983b)).

Concerning the valuation procedure, revaluations are carried out by the central government's Valuation Department. A district valuation roll is prepared for each district, which shows the land value, the capital value and where applicable, the special rateable value or the rates postponement value for each property. Revaluations were supposed to take place every five years – three years during the nineties. In practice, revisions did not take place at a regular pace. Where the annual value rating system is in force, local authorities are responsible for compiling their own valuation rolls. This may be done either annually or triennially.

Current tax on immovable property The sub-heading 4100 – "Recurrent taxes on immovable property" currently includes in New Zealand a property tax on land and buildings — the Rates (Blöchliger (2015)). Today, the valuation method used is mostly based on sales prices. The frequency of market value updates varies. Local governments have the responsibility for the tax base setting.

Shocks

- **1977. Revision**. The shock was the result of a property tax reassessment (OECD (1983b)).
- **1981. Revision**. The shock was the result of a property tax reassessment (OECD (1983b)).
- **1983. Ideology, Long Run.** The shock was the the result of the implementation of new exemptions on the Land tax linked to the unwillingness of the government to tax capital. The land tax was then undermined by exemptions: in 1983, only five per cent of total land value was taxed, "agricultural land being explicitly exempted and residential land effectively exempted by the exemption of $175,000$ dollars for all landowners". One of the major explanations of these exemptions was the unwillingness of New Zealand's government to tax capital (New Zealand's Parliament (1981), New Zealand's Parliament (1983), Barrett and Veal (2012)) mainly for ideological motives. Land taxes were also thought to be duplicative due to their similarity to local authority property rate levies (Grimes and Liang (2007)).
- **1992. Ideology.** The shock was the result of the abolition of the Land tax following the Land Tax Abolition Act (1990) which took effect from 31 March 1992. The tax was very unpopular with lobby groups of land tax payers because of valuation problems creating inequity ("Ideological change"). Two other main reasons explains why the tax was abolished. The tax administration was dissatisfied with having an incomplete base for land taxation, as agriculture and principal residence were excluded, and preferred its

complete abolition to continuation of the existing emasculated business land tax. Local Government wanted also abolition so it could expand its tax effort to fill the tax vacumn that would be created. After the abolition of the national land tax in 1992, only local authorities have levied property taxes (Barrett and Veal (2012)). See Reece (1993) for more details on the cause of the abolition of land tax.

- **1998. Revision.** The shock was the result of a property tax reassessment. A that time, valuations were carried out on a three-year cycle –even if in practice revisions did not take place at a regular pace. As house prices increased significantly between 1994 and 1997, there was a large revaluation in 1997 – effective in 1998–, in particular in Auckland which accounts for one third of total population (Grimes and Liang (2007)).

G.24 Norway

Context Local governments in Norway can choose to have property taxation or not. The choice to have property taxation is regulated by the property tax law of June 6th, 1975 (Fiva and Rønning (2006)). This Law restricted residential property taxation to urban areas.

Current tax on immovable property The sub-heading 4100 – "Recurrent taxes on immovable property" currently includes in Norway a tax on land and buildings (Blöchliger (2015)). Both residential and business properties are taxed.

Concerning assessment and valuation, the tax base for the property tax is calculated using sales prices. The frequency of market value updates is every ten years. The national government has the responsibility for the tax base setting.

The introduction of a recurrent tax on immovable property is left at the discretion of each municipality. All property tax revenues accrue to the relevant municipality. The property tax rate, if any, shall be between 0.02 and 0.07 pct. of the valuation basis – determined by valuation every ten years (of Finance (2014).

Shocks We do not identify exogenous tax changes in Norway.

- 1975. A potential shock could have been the Property Tax Law of June 6th 1975. This law restricted residential property taxation to areas that completely or partially have the characteristics of an urban areas or areas where such characteristics were developing. Until 1975 two tax laws existed in Norway, one for towns and one for the countryside. While residential property taxation was mandatory in towns, school districts on the countryside could choose to levy residential property taxation (Fiva and Rønning (2006)). Following the Property Tax Law of 1975, we do not observe however a significant property tax change during this period. One explanation could be that the definition of an urban area was not clear cut and there were during the period many court cases where property owners argued that the area under taxation was not urban. It was only in 1992 that the Local Government Act removed the formal division between town and other local governments. There were no longer any need for the central government to assign town status, and from 1996 on, the local governments could choose to define themselves as towns (Fiva and Rønning (2006)).
- 2007. A potential shock could have been the consequence of the 2007 Budget. The government raised the base for the property tax by allowing municipalities to tax properties also outside of densely populated areas. Municipalities could make use of this increased flexibility to raise taxes (OECD (2007c)). However, we cannot observe any significant change in property tax revenues during this period.

G.25 Poland

Context Poland consists of 16 regions, 314 counties, and 2,480 municipalities. Of the three levels of local governments, only municipalities have taxing power. However, the bulk of municipal revenue comes from tax sharing of personal and corporate income taxes and intergovernmental grants. The revenue from property tax, over which municipalities have taxing power,

occupies about 13% of total municipal revenue (Kim et al. (2013)). Property tax is by far the most important of the local taxes.

There are several types of property taxes in Poland. The agricultural property tax was introduced in 1985. In 1986, the real estate tax was introduced to expand non-income tax base. The lack of markets forced the use of an area tax basis. In 1991, the tax was assigned to municipalities (Brzeski (2003), UN (2013)).

Concerning property tax rates, the national budget stipulates maximum and minimum property tax rates. Municipalities are given the taxing power to set the rate below that maximum level. The property is levied both on housing and commercial properties: buildings, plots of land which are not subject to agriculture or forest taxes, lakes, water reservoirs and "other architectural objects" such as airports, etc.

Concerning assessment and valuation, the tax is not directly dependent on the value of property, but is paid "per square meter". The tax is paid both by owners and users/leaseholders. The structure of taxation is heavily biased towards taxing commercial properties, while revenues from housing properties generate very small amounts. Local governments are responsible for the real estate tax administration (Brzeski (2003)). According to Slack and Bird (2014), "Centrally granted exemptions are a hot political issue. Local governments argue that the central government should compensate them for the loss of revenues and the introduction of new exemptions should require local government consent".

Shocks

- **2001. Long Run**. The shock was the result of a rationalization of the real estate tax that led to a broader tax base coverage (Brzeski (2003)). Following the classification of Romer and Romer (2010) and Cloyne (2013), we can classify this shock into the categories "long-run" reforms.
- The electoral cycle could also have been an explanation of variations of property tax revenues. The electoral cycle could have some impact but only for taxes imposed on citizens – and not on business entities. However, the limited role of local taxes in Poland suggests that the impact should be relatively weak. As suggested in Kim et al. (2013), "*tax policy is not an important dimension of local political debates, so it should not be very vulnerable to election campaigns. Empirical results for the period 2001-2012 suggest that the importance of taxes for building political capital before elections may be even less important than expected*".

G.26 Portugal

Context Up to 2003, property tax or rates ("contribuição autárquica") were levied annually on land or buildings by the local authority ("cámara municipal"). The tax was payable by property owners and not by tenants. Property tax was based on the fiscal or rateable value ("valor tributavel") of a property as shown in the fiscal register ("matriz predial"). The fiscal value of a property was well below its actual value, although there had been a number of revaluations. A property's fiscal value was based on its market value, location and the standard of local services. Property was valued under three classifications: urban property ("prédios urbano"), rural property ("prédios rustica") and a mixture of these two ("prédios misto") (OECD (1983b), Norton (2014)). This tax was replaced in 2003 by the Imposto Municipal sobre Imóveis (IMI).

Current tax on immovable property The sub-heading 4100 – "Recurrent taxes on immovable property" currently includes in Portugal a tax on land and buildings – the Imposto Municipal sobre Imóveis (Blöchliger (2015)). Both residential and business properties are taxed. Undeveloped land and agricultural land are also taxed.

Concerning assessment and valuation, the tax base for the property tax is calculated using sales prices. More precisely, the "Imposto Municipal sobre Imóveis" is computed on the tax registration value of urban and rural properties located in Portuguese territory. It is due by the owner, the usufructuary, or the holder of the surface right of a property with reference to

31 December of the year that it concerns.The tax registration value is determined by means of valuation, based on the type of property (PwC (2016)). Market value updates are supposed to occur every three years. The national government has the responsibility for the tax base setting.

Shocks

- **2003. Revision, Long Run.** The shock was the result of the implementation of a new Property Tax and of a large property tax reassessment (Johannesson-Linden and Gayer (2012)). The Imposto Municipal sobre Imóveis (IMI) entered into force the 1st January 2003 –substituted the old Municipal Property Tax "Contribuição Autárquica". The main intention of the law was to bring the assessment values (Valor Tributável) more in line with market values as there was a big discrepancy between the two (Snapper (2004), Raposo and Evangelista (2016)). This modernization of the property tax can be classified into the category "long-run" economic reforms.
- **2013. Revision.** The shock was the result of a property tax reassessment. The revision of the cadastral value of the housing stock was completed by the first quarter of 2013 (European Commission (2012)). Urban properties were subject to a general review with effects on 1 January 2013.

G.27 Slovak Republic

Context Slovakia was a part of federal Czechoslovakia from 1918 to 1993. With the end of the Soviet Union, both the Czechs and the Slovaks were in transition to market systems. Reestablishing local autonomy and utilizing the property tax as a fundamental revenue source to finance municipal services were potentially important elements of this transition. In the early 1990´s it was expected that the property tax would play a significant role in the process of fiscal decentralization. However, early in the transition, the Slovak central government preferred to ignore local self-government.

Property tax policy is established by the central government and national legislation, but the day-to-day administration of the property tax is largely the domain of Slovak municipalities — there are 2,781 municipalities and only a few have a population in excess of 50,000. The taxation of land is based on the area of each individual parcel; similarly, the taxation of buildings is based on the number of square meters of a structure's floor space, including the land area under the buildings. There has been an independent tax on apartments since 1997 (Bryson (2006), Sedmihradská (2012)).

There were no changes in the tax rates in Slovakia until 2005, when a new law came in force. The original law on property tax was indeed replaced in 2005 by the law on local taxes (Act No. 582/2004 Coll.). This law unified the approach to the land tax, which became an *ad valorem* tax with the tax rate 0.25%. The new law in force since 2005 basically gave municipalities a free hand to set the tax rates. Revenues from property taxation are among the lowest in the OECD (OECD (2009a)). The tax base does not follow market values.

Shocks

- **2005. Long Run.** The shock was the result of the property tax reform that gave municipalities a free hand to set the tax rates. The objective of this law was to give more tax autonomy to municipalities in a context of fiscal decentralization (Sedmihradská (2012)) – it can thus be classified into the category "long-run" economic reforms. This structural reform also changed the tax base for property taxation from size to (partially) value assessments (OECD (2004)).

G.28 Slovenia

Context Currently in Slovenia, real property attracts two main taxes: the tax on Real Property –introduced in 1988 ; the Charge for the Use of Building Ground –introduced in 1984. They are revenue sources for municipalities. The Real Property Tax is a relatively unimportant

tax for local governments and is levied on properties such as buildings, apartments, garages, second homes and boats used for recreational purposes. The taxpayer is the actual/beneficial owner of the property. In practice, the base of the real property tax is quite narrow with few taxpayers due to the exemption of residential property below 160m2. The Charge has a broader base but has exemptions on new and refurbished property. Agricultural and forestry land is also exempted from both taxes.

The two taxes are area-based property taxes. More precisely, the taxable base for property is the "assessed value" according to specific criteria based on a points system. The number of points is related to specific characteristics of the property such as area (m2), age, quality and heating system and is uniform across the country. The municipality set annually the value of the "m2" and the value of the "point". Concerning tax rates, they depend on the type of construction and the assessed value and are generally progressive. According to IMF (2016), "the effective tax rate dispersion among municipalities for residential properties ranges from 0.002 to 0.4 percent and for commercial properties between 0.1 and 3 percent. This reflects on municipal fiscal autonomy in determining rates and exemptions."

Slovenia has been engaged for over a decade in a process to introduce an *ad valorem* property tax (Norregaard (2013)). A Real Property Tax Act of 2013, substituting the two existing property tax systems with a "unified real estate tax", became effective 1 January 2014. The goal was to impose it on all real estate. The tax base would have been market value. However, the Constitutional Court of Slovenia declared the new Acts to be unconstitutional due to flawed procedures and contested tax designs, forcing the authorities to reinstate the old regime with its low collection ratio (OECD (2015c)). As emphasized by IMF (2016), "given that both the old property taxes are not linked to market value they evidence little volatility, even in times of global financial crisis".

Shocks We do not identify exogenous tax changes in Slovenia. Taxes on immovable property are low in Slovenia compared to the OECD average (OECD (2009c), IMF (2016)). The taxation of real property affects indeed in practice only large residential property and secondary houses.

- In 1998, as an attempt to increase property tax revenues, the government introduced modernization initiatives to the real estate registration methods with the ultimate objectives of updating the land and building cadasters, land registry, and agricultural land use database, all necessary steps towards introducing a modern market based property tax. The long-term objectives of these reforms were the implementation of better harmonized real estate records, for modernizing real estate market valuation and taxation. These reforms did not lead however to effective changes in the the property tax system. They were followed by the Real Estate Registration Modernization Project, an attempt to establish an ad valorem property tax between 2000 and 2005. According to IMF (2016), "the implementation of the value based property tax has been stalled".
- On 1 January 2014, a new real estate tax based on market value was introduced—as a part-attempt to raise additional revenues in support of the fiscal consolidation program. For a variety of tax design reasons, the new consolidated tax was, however, annulled by the Constitutional Court on 31 March 2014. As such, the former real property tax and Charge which applied before 1 January 2014 were reinstated (IMF (2016)).

G.29 South Korea

Context Local tax rates in South Korea are uniform across local governments despite the fact that the Local Tax Act permits local governments to independently adjust the standard tax rates within certain boundaries (typically 50%). Therefore, although revenue from "autonomous" local taxes accounts for more than 60 percent of total local tax revenues, local taxes in South Korea are *de facto* shared taxes (Kim et al. (2013)).

Current tax on immovable property The sub-heading 4100 – "Recurrent taxes on immovable property" currently includes in South Korea the property tax on land and buildings (Blöchliger (2015)). Both residential and business properties are taxed. Undeveloped land and

agricultural land are also taxed. Concerning assessment and valuation, the tax base for the real property tax is calculated using sales prices. Reassessments are supposed to take place annually. The national government has the responsibility for the tax base setting.

Shocks

- 1979. *Endogenous shock*. The shock was the result of a large increase of taxation on idle land to increase housing supply. This was part of an economic stabilization program. In June 1978, the Minister of the Economic Planning Board announced that the government would start restructuring all the laws concerning land to optimize land use and to return the rise in land value to society. The government announced also restrictions of private landownership. Indeed, monopoly pricing by landowners was a problem. Landowners refused to sell their land by reason of the low prices offered by the developers whereas the government wanted to utilize private developers to increase housing supply. The government planned to increase housing provision by fostering large developers.[22] As house and land prices rose fast, the government also tightened its control of the property market through the imposition of heavy taxes on non-business purpose land and idle land. The objective was to tax idle land to increase housing supply. The Korea Land Development Corporation (KLDC) was also established in January 1979 as a specialized agency to develop land. It was given the authority to expropriate land for housing and priority rights over non-business purpose land. It could also preempt idle land held by individuals and corporations. Land acquired by the KLDC was to be provided for collective housing development (Lim (1994)). As a robustness check in Section L of this Online Appendix, we include this reform in our sample of shocks (Figure 20).
- **1991-1992. Long Run, Revision.** The shocks were the results of the implementation of a new system for assessing land –to provide an unified and realistic measure of land – and of two reassessments. A global land tax, under which the property tax operates as a personal tax with a progressive rate system, was introduced in 1990. With the new system for assessing land, the objective of the government was to raise the landholding tax assessment to 60 percent of the actual market price by 1992. Reassessments took place in 1991 and 1992. One of the major reasons for poor performance of property-related taxes was indeed unrealistically low and extremely uneven assessment of real assets for tax purposes. A survey by the Ministry of Home Affairs reported that the average assessment for property tax was 23 percent of the actual value in Seoul and 46.2 percent in Kyungbuk province as of 1988 (Kwack and Lee (1992)). The implementation of this new system for assessing land can be classified into the category "long-run" economic reform.
- **2006-2007. Long Run, Revision.** The shocks were the results of a property tax reassessment and of the implementation of a new national property tax in a context of fiscal re-centralization.
  - **2006**. The shock was the result of the creation by the government of the Comprehensive Property Tax (CPT), a national tax on property applied to households and firms owning housing with a combined assessed value exceeding 900 million won. The CPT was very progressive with rates from 1% to 3% and a top rate 20 times higher than the lowest rate of local property tax on households set at 0.15%. Thus, the burden on CPT-payers was heavy. The objective of this tax was to recentralize the property tax and was also part of the long-run effort to raise the effective tax rate on property (OECD (2007b)). Its introduction was accompanied by a scaling back of the local property tax (OECD (2008a)). In addition to the CPT, the evaluation of real estate values for local tax purposes was brought closer into line with market values. The evaluation was raised from 36% of the value of the house

[22] In December 1978, the government introduced a registration system of housing developers. This was partly to control the irresponsible behaviour of some housing developers, such as construction of poor quality housing and deceptive advertisements for housing sizes and facilities. Such activities were prevalent in the period of the housing development boom in 1977 and 1978 (Lim (1994)).

as assessed by the Ministry of Construction and Transportation (MCT) to 50%. Given that the MCT's assessed value is about 80-90% of the market price, the tax base has risen from about 29-32% of the market value to 40-45% (OECD (2008a)). Following the changes in the valuation of real estate for the local property tax and the introduction of the CPT, "the total tax on holding property rose to 0.8% of GDP" in 2006 (Kim et al. (2013)).

  - **2007**. The shock was the result of a policy of fiscal centralization and of a reassessment. The Comprehensive Property Tax (CPT) was strengthened in 2006. The government also announced in 2006 that the ratio of the assessed price used to set the tax base for the local property tax will be raised from 50% in 2006 to 100% by the mid-2010s. The tax base was increased from 50% of the assessed value in 2006 to 70% in 2007, resulting in sharp increases in property tax assessments for some households (OECD (2007b)). The question of property tax is deeply linked in South Korea to the issue of fiscal (de)centralisation. Local governments had during a long period limited spending responsibilities as key services such as education and police services were funded primarily by the central government. Consequently, achieving a significantly higher effective rate on property was linked to fiscal decentralization to give more spending responsibilities to local governments (OECD (2007b)). In 2007, the government decided on the contrary to reinforce fiscal centralization to gain more control of property tax revenues.

- 2009. *Endogenous shock*. The objective of this decision was to boost demand**.** In February 2009 came tax cuts for homeowners (GPG (2011)). In an effort to stimulate their stalled domestic property market, South Korea introduced new measures, including reducing property taxes and the level of capital gains tax on land sales, in the hope that this will reverse the drop in demand.. Since South Korea's property market had seen a huge drop in domestic demand, the Korean Ministry of Strategy and Finance decided to ease the tax system in the country in a bid to lift the economy. The tax cuts were also part of an effort to help businesses cope with the economic crisis (Deshayes (2009)). This decision is excluded from our exogenous tax shocks database. As a robustness check in Section L of this Online Appendix, we include this reform in our sample of shocks (Figure 20).

G.30 Spain

Context The two historical taxes on immovable property in Spain are the Rural Land Tax and the Urban Land Tax. These two taxes were introduced in 1893. Beneficiaries were local authorities. Local authorities had no discretion over the tax base. During a long period period, tax rates were determined centrally and could only be changed by law (OECD (1983b), Miranda Hita (2004)).

Current tax on immovable property The sub-heading 4100 – "Recurrent taxes on immovable property" currently includes in Spain a property tax on land and buildings – the Rural land tax and the urban land tax. (Blöchliger (2015)). Both residential and business properties are taxed. Undeveloped land and agricultural land are also taxed.

Concerning assessment and valuation, the tax base for the property tax is calculated using sales prices. The national government has the responsibility for the tax base setting. Assessments are prepared by agencies representing both central and local government. During a long period, rural property was revalued every five years and urban property every three years – though there were urban revaluations in 1979 and 1981 (OECD (1983b)).

Shocks We identify 7 shocks relative to property taxes in Spain: 1981, 1982, 1983, 1986, 1987, 1992, and finally 1994.

- **1981: Revision, Long Run, Deficit consolidation.** A first shock was the result of both a revision of cadastral values and of the Royal Decree Law of 1979 taken in a context

of decentralization reforms. Indeed, if Spain's 1978 Constitution assigns all taxation responsibilities to the central government, 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 the appeasement of Catalan and Basque nationalism (Kim et al. (2013)). In this context of decentralization, the decree law (11/1979) authorized gradual increases in property taxation. It notably introduced an extensive package of measures for the reorganization of local treasuries, ranging from doubling the base of some property taxes (the Urban Land Tax) and the subsequent revision of all cadastral values. To reinforce decentralization, property taxes were converted into local taxes ("long run economic reform" category). They were also increased to deal with the structural deficits of local communities ("Deficit consolidation"). Indeed, social demands had increased since 1972 (the arrival of democracy) and were materialized with central government deficit. The government responded to those demands by exporting deficit to the local authorities. The package of measures provided in the decree law of 1979 thus addressed the "structural deficit of Local Corporations". The decree Law of 1979 was completed by the 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 the Urban Land Tand (OECD (1983b), Miranda Hita (2004)).

- **1982: Revision.** The 1982 shock was the result of a revision of cadastral values – an increase of 35% of cadastral values of the Urban Land Tax (Miranda Hita (2004)).
- **1983. Long Run.** The shock was the result of Law 24/1983 which contained a package of measures designed to reinforce the capacity of local self-finance: it authorized local authorities to establish a surcharge on property taxation. The surcharge was effectively applied, amidst 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 hindering the desirable revision of cadastral values and to move forward in coherence with the principle of financial autonomy (Miranda Hita (2004)).
- **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 –there was a revaluation every 5 years of the rural land tax following the 1981 revision. The surcharge of Law 24/1983 was indeed overturned by sentence of the Constitutional Court on 19 December 1985. It resulted in a decrease in property taxation. 1986 was also a pre-election period –local election in 1987 – that tends to be periods of fiscal moderation (Miranda Hita (2004)).
- **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 the year of local election –election years tend to be period of fiscal moderation (Miranda Hita (2004)).
  - Local Political Business Cycles. Originally, the electoral cycle theory was created to explain central government policies (Nordhaus (1975)). In spite of their more limited fiscal instruments, similar phenomena have been identified in a number of local government studies (Mouriuen (1989), Houlberg (2007), Geys (2006)). Mouriuen (1989) emphasizes that "if one wants to predict how local tax rates change, it is as important to know the number of years' to the next election as it is to know the change in the fiscal capabilities of local governments". By studying Denmark, Norway, Sweden, Finland, France and Italy in the eighties, he shows that tax rates are peeking in mid-term years, i.e. as far from elections as possible. Mouriuen (1989) and Houlberg (2007) suggest that in an electoral year, local authorities avoid increasing local taxes, which leads to a reduction of budget surplus and/or to increased indebtedness. Similarly, Geys (2006) has studied fluctuations in local government debts in Flemish Municipalities in 1977-2000 and finds that the growth

rate of local public debt is significantly higher in election years. As emphasized by Nordhaus (1975), "voters do not take simple averages of economic variables over the last electoral period, but have a decaying "memory" of past. On election day, the memory of recent events is probably more poignant than that of ancient ills".

- **1992. Revision, External.** The shock was the result of a large revision of cadastral values in 1991, implemented in 1992. The revision is popularly known as "catastrazo", a meaningful term that became synonym of a large increase of the cadastral values. In effect, the cadastral revision of 2,447 locations came into effect -representing cadastral registration of more than 22% of all urban units in the territories comprised in the common system. The process was completed by the update of rural cadastral values by 50% (Silva (2005), Miranda Hita (2004)). The property tax increase was also the consequence of the electoral cycle. The context was indeed favorable to an increase in property tax as local authorities did not increase property tax rates before the elections —catch-up phenomenon. In particular, a 1987 Law had enabled local authorities to significantly increase property tax rates. This possibility was used in 1991 after the municipal elections.
- **1994. Revision.** The shock was the result of a revision of cadastral values, effective the 1 January 1994.

G.31 Sweden

Context The law on Property Tax was passed by the Riksdag in 1984 and spells out what should constitute the tax base and the tax rates. Prior to that, the law on property assessment known as the Real Property Assessment Law was promulgated in 1979.

The Property tax is a state tax in Sweden and for that matter property taxes collected are not retained by the municipalities but rather they are channeled into state treasury and form part of state revenue.

Cadastral System In Sweden, assessment is done by the Central Government and collection of tax by the Swedish Tax Agency. The law on assessed real estate was first introduced in 1810, and initially, the assessed value was determined every three years; however, during the 1900s, the assessment period was changed to every five years (OECD (1983b)). Occasionally, the time period between assessments exceeded five years. In 1985, the Swedish government decided that the assessed value of property should be determined every six years, with a minor revision in between (Stenkula (2014)). Revaluations are the responsibility of the central government.

Current tax on immovable property The sub-heading 4100 – "Recurrent taxes on immovable property" currently includes in Sweden a property tax on land and buildings (Blöchliger (2015)). Both residential and business properties are taxed.

Concerning assessment and valuation, the tax base for the property tax is calculated using sale prices. The general revaluation cycle is every three years – properties are fully updated every sixth year, with a minor revision in between (Johannesson-Linden and Gayer (2012), Kampamba et al. (2016)). The assessed value of property is determined for different types of property each year (e.g., apartment buildings, one- or two-dwelling buildings). The assessed value of property should correspond to 75 percent of the market value of the property (assessment ratio). More precisely, the market value is based on the average sales price from the local market two years back in time, e.g. the property tax assessment for residential properties that was done in Sweden in 2012 was based on the development of the sales prices of the local property market from 2008 to 2010 (Kampamba et al. (2016), Lundberg and Waldenstrom (2016) and Baah Futa (2004)).

The national government has the responsibility for the tax base setting.

Shocks

- **1985: Long Run**. The shock was the result of the introduction of a specific real estate tax at the local level to render the tax system more equitable and neutral. Hence, in the mid-1980s, owner-occupied houses were taxed in three different ways with an imputed rent income ("villaschablon"), with a specific real estate tax (state level), and with a guaranteed tax (local level) (Stenkula (2014), Lunde and Whitehead (2016)).
- **1991: Long Run.** The shock was the result of the Reform of the property Tax in 1990 –implemented in 1991– with a motivation of fiscal simplification. The 1990-1991 tax reform abolished in particular the system with imputed income on owner-occupied. A new property tax of 1.5 percent replaced the old scheme of taxing imputed income. One main reason for these changes was to simplify the tax system (Agell et al. (1995)). The tax reform included also new rules for the taxation of homeownership. It reduced property tax reductions due to deductibility of interest expenses on household mortgage loans. During the 1980s, the scope of deductions had indeed been gradually reduced, and in principle, the tax could be reduced by a maximum of approximately 50 percent of the interest paid in 1985. After the 1990-1991 tax reform, the tax could be reduced by 30 percent of the interest paid up to SEK 100,000 and 21 percent above this level (Stenkula (2014)).
- **1993: Revision.** The shock was the result of a property tax reassessment. Between 1990 and 1993 the real price of owner-occupied homes fell by around 25 percent (Agell et al. (1995)). The reassessment took into effect the decline in house prices.
- **1996: Long Run.** The shock was the result of an extension of the property tax to encompass broader property categories. The reason for the increase and broadening of the real estate tax in 1996 was argued to be a way to finance membership in the EU (Stenkula (2014)).

G.32 Switzerland

Context Property taxes in Switzerland are levied by Cantons and/or communes. Each of the twenty-six cantons has its own legislation and in some cantons there is no recurrent tax. For example, in the Canton of Zurich, property taxes are levied by communes. Until 1974, communes were permitted to levy the recurrent tax if they wished to do so; since then, they have been required to do so (OECD (1983b)).

Current tax on immovable property The sub-heading 4100 – "Recurrent taxes on immovable property" currently includes in Switzerland taxes on land and buildings (Blöchliger (2015)). Both residential and business properties can be taxed. The real estate tax is levied in more than half of the cantons. Concerning assessment and valuation, the tax base for the property tax is calculated using both sales prices and an income method. Market value updates are irregular and depend on the Canton. For example for the Canton of Bern, the last market value update was in 1998.

Shocks.

- **1983. Long Run, Ideology.** The shock was the abolition of the recurrent tax on immovable property in the Canton of Zurich as from 1st January, 1983 (OECD (1983b)). Indeed, the Canton of Zurich is the most populated in Switzerland – around one fifth of total population. This reform had thus consequences at the national level.

G.33 Turkey

Context Turkey has an unitary national government with 67 Provinces. The immovable property tax was introduced in 1971. It is a central government tax. Property tax is paid each year on the tax values of land and buildings. Land generally is taxed at 0.1 %, while buildings generally are taxed at 0.2 % (UN (2013)). Turkey in 2000 imposed a special extra property tax

for one-year tax to pay for 1999 earthquake damages. The tax was equal to the property tax paid in 1999.

Valuation and assessment The value of immovable property is declared by the taxpayer at four-year intervals (OECD (1983b), Blöchliger (2015)). The Directorate of Land Registry and Cadastre is responsible for the registers used in property taxation. Minimum land tax values are set by the tax administration for each site in towns, cities, and villages. The Property Tax Department publishes land value books, which for each municipality give land value rates by street and sometimes by street segment. The declared value may not be less than a fixed minimum value (UN (2013)).

Shocks We do not identify exogenous property tax shocks in Turkey. The difficulty for identifying shocks comes from the self-declaration system – the value of immovable property is declared by the taxpayer at four-year intervals. In practice, it is difficult to get them to do so. Because of the self-declaration system, it is also difficult to identify specific valuation dates. Finally, we should notice that property tax revenues are not available between 1987 and 1997.

G.34 United Kingdom

Context Since medieval times, the main tax on immovable property in the United Kingdom was Rates. This tax was levied by rating authorities (i.e. in England and Wales the lower tier of local government) (OECD (1983b)). The system of local taxation on domestic property changed in the early 1990s. The long standing system of domestic rates was replaced during a short period by the community charge (or poll tax as it was commonly known) in 1990 but the unpopularity of this tax led to its abandonment after only three years. The property-based council tax was introduced by the Local Government Finance Act 1992, commencing on 1 April 1993.

Current tax on immovable property The sub-heading 4100 – "Recurrent taxes on immovable property" currently includes in the United Kingdom the Council Tax (CT) and Non Domestic Rates (NDR) (Blöchliger (2015)).

Concerning the Council Tax, it covers land and buildings. Both residential and business properties are taxed. Concerning assessment and valuation, the tax base for the property tax is calculated using sales prices. The last market value update was in 1991. The national government has the responsibility for the tax base setting.

Concerning Non Domestic Rates (NDR), this tax covers business only, including machinery. Concerning assessment and valuation, the tax base is calculated using sales prices, completed by a cost method and an income method. Market value updates are supposed to take place every five years — the last market value update was in 2010.

Shocks

- **1973: Revision**. The shock was the result of a property tax revision in England. Revaluations were at that time scheduled to occur every five years, though they did not always take place on schedule. Revaluations occurred in 1973 in England and Wales, 1978 in Scotland, and 1976 in Northern Ireland (OECD (1983b)).
- **1986: Revision**. The shock was the result of a property tax revaluation in 1985, implemented in 1986. The revaluation of 1985 was accompanied by a sudden increase in the effective level of local taxation that generated the political pressure to abolish the rating system altogether. The effects of the 1985 revaluation are said to have precipitated the decision to abolish the residential property tax (Smith (1991)).
- **April 1, 1993: Long Run, Ideology**. The shock was following the introduction of the Council Tax implying the creation of a new property tax. The community charge was

replaced by the council tax on April 1, 1993.[23] The community charge was extremely unpopular. The tax was based on the fact that an individual lived in a particular local authority, rather than on the value of the property occupied or the individual's ability to pay (Adam et al. (2010)). It was felt to be regressive and too expensive to collect, and collection rates were low. The unpopularity of the tax combined with low collection rates led to public unrest and to the abolition of the poll tax and its replacement with a residential property tax (the council tax) (Bird and Slack (2004), Rosenthal (1999)). The council tax was more like the previous property tax (known as domestic rates). It reintroduced a connection between property valuation and tax liability. The introduction of the Council tax coincided with a fall in the real price of housing (Rosenthal (1999)).

G.35 United States

Context A tax on the capital value of real (immovable) property is levied by some 50,000 local governments (there are more than 89,000 local governments in the United States) under laws enacted by the 50 state legislatures. There is no federal government participation in the enactment or administration of the property tax, but federal government departments and agencies do gather statistics.

The property tax has a particular status and history in the United States. According to Cabral and Hoxby (2012), "*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... People hate the property tax more than other taxes, which could explain that there are fairly regular "tax revolts" against the property tax, many of which are based on local or statewide referenda*". These property tax revolts led to several waves of property tax limits – these limits often remain binding for a number of years–even decades. As noted by Cabral and Hoxby (2012), in contrast, successful revolts against other taxes, such as the income or corporate tax, are rare and often temporary. Because of tax revolts and their consequences, notably tax limits, property tax revenue has declined greatly as a share of all taxes collected in the U.S. It has also declined as a share of U.S. GDP. See also OECD (1983b).

The cycle of reassessment One of the most significant structural features of property tax in the US is the cycle of reassessment. If in theory, in many States, authorities are supposed to assess real property on its fair market value, annual assessment is very rare in practice. They do not revalue every year as revaluations are costly[24]. Assessment occurs at legally defined intervals in most of the United States. The cycle of reassessment is the solution found to balance the need for frequent revaluations against their cost by adjusting the maximum period between two revaluations. For more details on the assessment cycle, see Rappa (2012).

[23] The long standing system of domestic rates was replaced by the community charge (or poll tax as it was commonly known) on 1 April 1990. We do not include the 1990 reform in our sample of exogenous tax changes for three reasons. Firstly, the property tax (domestic rates) was replaced immediately by the poll tax. If the category "Recurrent taxes on immovable property" (4100) of the OECD declined in 1990, the category "Other taxes" (6000) where was registered the poll tax increased very significantly. Secondly, if property tax was suppressed, local taxation increased during that year with the replacement by the poll tax –the switch from domestic rates to the community charge even led to a large increase in local taxes (Hughes (1989)). On average, the revenues raised from local taxation increased by close to 30 per cent in 1990/1991 over the previous year (Ridge and Smith (1991)). Total tax revenues in the UK increased by 8%. This shock is thus very specific as the decline in property tax revenues in fact implied a large increase in both local and total taxation. This is in sharp contrast with the 1993 shock. The creation of a new property tax with the introduction of the Council tax was accompanied by a significant increase in total tax revenues. Finally, the 1990 reform would be an outlier in our sample of shocks. As a robustness check in Section L of this Online Appendix, we include the 1990 reform in our sample of shocks and we find a maximum fall of output of 2 percent after eleven quarters (Figure 20).

[24] It is important to notice that assessed values change only from specific action by some unit in the assessment system. According to Mikesell (1980), "*Nothing automatically picks up these value changes... This process is often nothing more than simply recopying last year's values, sometimes with a flat percentage increase in all values. Annual assessment in these circumstances becomes no reassessment until obvious inequities force a special mass reappraisal of all real property*".

Shocks

- **1975: Ideology, Deficit consolidation, Long Run**. The shock was the result of restrictions on property taxation. A surge of rate limits and levy limits began in the early 1970s (Paquin (2015)). If the Californian tax-revolt movement that led to Proposition 13 in 1978 was the most well-known, widespread and fiscally constraining tax-limitation measure passed to date, it was not the first. In the early 1970s, several states placed caps on property tax rates or limited the growth in property tax revenues. The decline in property tax thus began before 1978 (O'sullivan et al. (1995)). A large number of restrictions[25] were in particular implemented or effective in 1975: Minnesota (Levy limit), Montana, New York (Assessment limit), Washington (Levy limit), Alabama (Levy limit), Alaska (Municipal rate limit and levy limit), Delaware (Levy limit), Iowa (Municipal rate limit), Indiana (Local rate limit and Levy limit), Delaware (levy limit), Iowa (municipal rate limit), Indiana(Local rate limit and levy limit), New Mexico (county and municipal limits), North Carolina (County and Municipal rate limits, Louisiana (statewide limits), Montana (Assessment limit), Maryland (assessment limit) (Paquin (2015)). Figure 13 (extracted from Cabral and Hoxby (2012)) describes this surge in the number of laws limiting property taxes during the period 1973-1975. [26]

- **1978: Ideology, Deficit consolidation, Long Run**. The shock was the result of large wave of restrictions on property taxation by local authorities. This new wave of tax revolts really began in California when voters endorsed Proposition 13 in 1978. California's passage of Proposition 13 sparked a dramatic surge in property tax limit enactments, with states passing additional restrictions on rates, levies, and for the first time on a large scale, on growth in assessed values. Several limits were implemented and effective in 1978: California (Assessment limit and overall rate limit), Idaho, Iowa (assessment limit), Louisiana (levy limit), Michigan (levy limit), Nebraska (levy limit) (Paquin (2015)). Tax revolt quickly spread across the US – 43 states implemented local property tax limitations within 2 years. Tax revolt era restrictions have been cited as one reason for a secular decline in property tax reliance among state and local governments (Bahl et al. (1990), Coyle McCabe (2000)). Figure 13 (extracted from Cabral and Hoxby (2012)) describes the surge in the number of laws limiting property taxes during this period. It shows in particular the surge in 1978 of the number of newspaper articles in the US containing the phrase "tax revolt" that were focused on property taxes. In Section K of this Online Appendix, we add as robustness checks shocks in 1979 and 1980 as tax revolt spread within 2 years.

  - California's assessment limit "Proposition 13" passed with overwhelming support and set off a wave of assessment limit enactments across the country.[27] The initiative reset assessed property values to 1975-1976 levels and limited growth in assessed values to inflation, not to exceed 2 percent per year. Under the law, market value reassessment could occur only upon transfer of the property. Proposition 13 also limited property taxation by capping property tax rates at 1 percent (Paquin (2015)).

- **1990, 1991: Revision.** The shocks were the results of assessment cycles. Valuation dates occurred in most States in 1990 and 1991 – see U.S. Department of Commerce (1992) in particular Appendix G (table 14 reproduced in this document)). See also U.S.

[25] Unlike rate limits which restrict the rates applied to assessed values for the purpose of taxation, levy limits restrict the amount of revenue raised through property taxation or the growth in property tax revenues. Although four states enacted levy limits in the early half of the 20th century, levy limits did not gain traction until the 1970s.

[26] In Section K of this Online Appendix, we add as a robustness check a shock in 1974, the first year when these limits started to have a significant effect in property tax revenues. Main limits were however effective and implemented in 1975.

[27] Assessment limits are the newest form of property tax limitation. Unlike rate and levy limits, assessment limits restrict assessed value increases. Only Maryland and New York had enacted partial limits on property tax assessments prior to California's taxpayer initiative, Proposition 13, in 1978.

Department of Commerce (1990). Following the house price boom starting in the mid-eighties, reassessments realigned property tax to the large increase in market values. There was notably a large reassessment in 1989 in Texas and Illinois. Assessment level increased more than 500% during the beginning of the nineties in the following States: Alabama, Arizona, Kansas, Massachusetts, Montana, Utah, Tennessee, Wyoming, Texans and New Mexico. It increased between 50% and 499% in the following states: Florida, Iowa, South Dakota, West Virginia, Oklahoma, Hawaii and the New Hampshire (Liorens-Rivera (1996)).

- **1993, 1995: Ideology, Deficit consolidation, Long Run.** The shock was the result of restrictions on property taxation (Paquin (2015)). Very significant limitations were enacted in several states in the early 1990s. Figure 13 (extracted from Cabral and Hoxby (2012)) describes the surge in the number of laws limiting property taxes during this period – a total of 34 laws were enacted. Most of these restrictions on local revenue raising came through ballot initiatives – there were over 150 such measures put on the ballot during the 1990s (Mullins and Wallin (2004)). During this period, state governments have become the focus of tax and expenditure limitations[28].
  - In 1992, Colorado voters approved one of the most severe restrictions on state and local fiscal autonomy (Mullins and Wallin (2004)). The same year, restrictions on property taxation were also taken in Arizona, Connecticut, Iowa, Mississippi, Oklahoma, Rhode Island and Virginia –with noticeable effects on 1993' property tax revenues. In 1993, new restrictions were taken in Louisiana, Minnesota and Washington ; in 1994 in Florida, Michigan, Rhode Island and Wisconsin; in 1996 in California. One should notice that there is often a delay between the laws and real effects on property tax revenues.

ANNEX: MORE DETAILS

1. **Property tax revolts and the enactment of property tax limits**. As emphasized by Cabral and Hoxby (2012), "*Figure 5* [Figure 13 r*eproduced in this document] shows that events that are subjectively described as property tax revolts are in fact associated with the enactment of property tax limits. It shows the number of laws enacted that limit property taxes, by year (left-hand vertical axis). It also shows the number of newspaper articles that use the phrase "tax revolt" and that focus on property taxes, by year (right-hand vertical axis). One may observe that the two lines exhibit similar patterns: there was a great surge in tax property limit laws in the late 1970s, a smaller surge around 1989-91, and a yet smaller surge around 1973. (The 1973 surge is not matched by a surge in newspaper articles because the newspaper archive has poor coverage for the first half of the 1970s.) A total of 51 property tax limit laws were enacted between 1978 and 1980, and a total of 34 laws were enacted between 1990 and 1992. There are scarcely any years, however, when there were not at least a few property tax limits enacted. Since these laws, once enacted, are only occasionally rescinded, the total number of property tax limit laws in 2000 was 3.5 times the number in 1970.* "
2. **Assessment cycle**. The term commonly refers to the time period required for an intensive review (often called "reassessment") of each assessed value within a jurisdiction, whether or not changes have occurred in the property involved. (U.S. Department of Commerce (1972), U.S. Department of Commerce (1982)).
   - *Assessment cycles: various States* (by population size of the State):

   (a) New York: varies (National Association of Counties (2015)), annually in the eighties and nineties (U.S. Department of Commerce (1982), U.S. Department of Commerce (1992)).

[28] While before 1970 only 2 states had tax and expenditure limitations in place, by 2001 there were 53 limitations adopted in 31 states. Twenty-six have been adopted since 1990, in 20 states (Mullins and Wallin (2004)).

(b) Texas: Prior to January 1, 1984, at least once every 4 years (U.S. Department of Commerce (1982)) ; after this date, at least once every 3 years (U.S. Department of Commerce (1992), Higginbottom (2010), National Association of Counties (2015)).

(c) Florida: at least every 5 years (Higginbottom (2010)).

(d) Pennsylvania: Statutes specify annual assessment in counties of the first class and triennial assessments in second through eighth class counties (U.S. Department of Commerce (1982), U.S. Department of Commerce (1992)).

(e) Illinois: General reassessment is required in all counties every 4 years (U.S. Department of Commerce (1972), U.S. Department of Commerce (1992), Higginbottom (2010), National Association of Counties (2015)). As emphasized by U.S. Department of Commerce (1992), "In counties having the township form of government and a population of less than 1,000,000 the general assessment year is 1963 and every fourth year thereafter [...] In counties having the commission form of government and a population of less than 1,000,000, the general assessment year is 1962 and every fourth year thereafter".

(f) Ohio: at least every 6 years (U.S. Department of Commerce (1982), U.S. Department of Commerce (1992), National Association of Counties (2015), Higginbottom (2010)). More precisely, "Reappraisal of all realty is required every 6 years in each county. In the third calendar year following such reappraisal, the commissioner of tax equalization may order a reassessment of the real property" (U.S. Department of Commerce (1982), U.S. Department of Commerce (1992)).

(g) North Carolina: Counties are required to revalue every 8 years (U.S. Department of Commerce (1982), U.S. Department of Commerce (1992)). More recently, the assessment cycle has changed: between 4 and 8 years (National Association of Counties (2015)).

(h) Georgia: every 3 years (National Association of Counties (2015)).

(i) Virginia: reassessments are to occur every 4 years(U.S. Department of Commerce (1982), U.S. Department of Commerce (1992), National Association of Counties (2015)). The assessment cycle is more precisely every 2 years in cities and every 4 years in counties (U.S. Department of Commerce (1992), Higginbottom (2010)).

(j) Massachusetts: every 3 years (Higginbottom (2010), National Association of Counties (2015)).

(k) Indiana: every four years (National Association of Counties (2015), Higginbottom (2010)). The assessment cycle was every 8 years before 1987. According to U.S. Department of Commerce (1982), "A general reassessment beginning July 1, 1987, and each eighth year thereafter is required". In the nineties, the assessment cycle became every four years (" A general reassessment beginning July 1, 1993, and each fourth year thereafter is required", U.S. Department of Commerce (1992)).

(l) Missouri: every 2 years (National Association of Counties (2015), Higginbottom (2010)).

(m) Wisconsin: Each taxation district is required to assess property at full value at least once in every 5-year period (U.S. Department of Commerce (1982), National Association of Counties (2015), Higginbottom (2010)).

(n) Tennessee: every 6 years (National Association of Counties (2015), Higginbottom (2010)). The reassessment cycle was every 5 years in the eighties and nineties ("Beginning January 1, 1981, reappraisal and equalization is required every 5 years", U.S. Department of Commerce (1982), U.S. Department of Commerce (1992)).

(o) Washington: at least every 4 years (Higginbottom (2010)). More precisely, "an active revaluation program is required, to include revaluing all taxable real property within the county at least once every 4 years, with physical inspection of all such realty at least once every 6 years" (U.S. Department of Commerce (1982), U.S. Department of Commerce (1992)).

(p) Maryland: every 3 years (U.S. Department of Commerce (1992), Higginbottom (2010)).

(q) Minnesota: at least every 4 years (Higginbottom (2010)). According to U.S. Department of Commerce (1982)and U.S. Department of Commerce (1992), "In 1976 and thereafter, assessor shall actually view and determine market value of each real property at maximum intervals of 4 years".

(r) Louisiana: at least every 4 years (U.S. Department of Commerce (1982), U.S. Department of Commerce (1992), Higginbottom (2010)).

(s) Alabama: at least every 4 years (National Association of Counties (2015), Higginbottom (2010)).

(t) Kentucky: at least every 4 years (U.S. Department of Commerce (1992), Higginbottom (2010)). The reassessment cycle was every 2 years up to the nineties (U.S. Department of Commerce (1982)).

(u) South Carolina: at least every 5 years (National Association of Counties (2015), Higginbottom (2010)).

(v) Colorado: every 2 years (U.S. Department of Commerce (1982), National Association of Counties (2015), Higginbottom (2010)). U.S. Department of Commerce (1982) gives more details: "Between 1979 and 1982, revaluation required on basis of 1977 value levels and 1977 procedures; implementation in 1983. Between 1983 and 1985, revaluation required on basis of 1981 value levels and 1984 procedures; implementation in 1986. Between 1986 and 1987, revaluation required on basis of 1984 value levels, for implementation in 1988. Thereafter, 2-year cycle governs".

(w) Connecticut: at least every 10 years (U.S. Department of Commerce (1982), U.S. Department of Commerce (1992), Higginbottom (2010)), and only very recently every 4 years (National Association of Counties (2015)). According to U.S. Department of Commerce (1982)and U.S. Department of Commerce (1992), "Commencing October 1, 1978, municipalities required to revalue all real property no later than 10 years following the last preceding revaluation and every 10th year after each such revaluation".

(x) Oklahoma: every 4 years (U.S. Department of Commerce (1992), National Association of Counties (2015), Higginbottom (2010)). According to U.S. Department of Commerce (1992), "The 4-year cycles begin on January 1, 1991 and every succeeding fourth year". Before 1991, the reassessment cycle was every 5 years ("Subsequent to an initial mandatory revaluation to have been completed before January 1, 1972, each assessor is required continuously to maintain an active program to revalue all taxable property within the county at least once each 5 years", U.S. Department of Commerce (1982)).

(y) Oregon: at least once every 6 years (U.S. Department of Commerce (1982), U.S. Department of Commerce (1992), National Association of Counties (2015)).

(z) Iowa: every 2 years (U.S. Department of Commerce (1982), U.S. Department of Commerce (1992), Higginbottom (2010), National Association of Counties (2015)). According to U.S. Department of Commerce (1982) and U.S. Department of Commerce (1992), "Real estate was listed and assessed in 1981. The same action occurs every 2 years thereafter".

H Figures

Figure 13: FIGURE EXTRACTED FROM Cabral and Hoxby (2012)

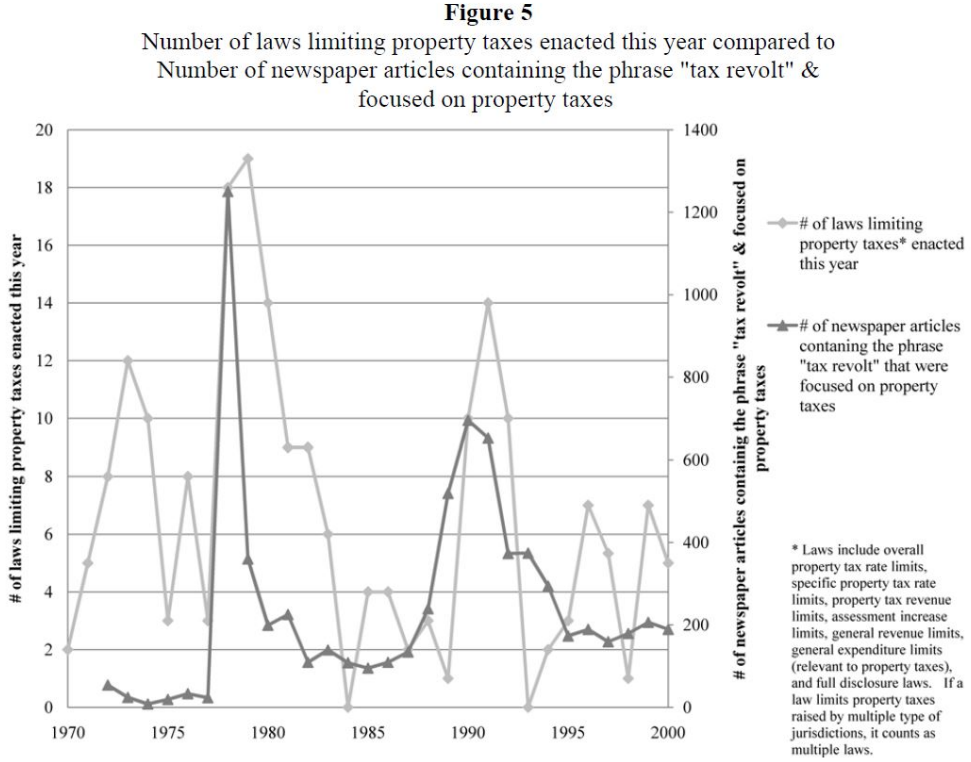


Figure 14: Valuation dates in the seventies in the US (Source: U.S. Department of Commerce (1977))

Table G. Valuation Dates Applicable to Assessed Value in This Report

State	Valuation date	State	Valuation date
Alabama	October 1, 1976	Missouri	January 1, 1976
Alaska	January 1, 1976	Montana	January 1, 1976
Arizona[1]	January 1, 1976	Nebraska	January 1, 1976
Arkansas	January 1, 1976	Nevada	January 1, 1976
California	March 1, 1976	New Hampshire	April 1, 1976
Colorado	January 1, 1976	New Jersey	October 1, 1975
Connecticut	October 1, 1975	New Mexico	January 1, 1976
Delaware	Kent County, May 31, 1976; New Castle, March 22, 1976; Sussex, May 1, 1976	New York	May 1, 1975, generally, but varies among cities and towns
		North Carolina	January 1, 1976
District of Columbia	January 1, 1976 (personal property July 1, 1976)	North Dakota	February 1, 1976
		Ohio	January 1, 1976 (personal property December 31, 1975)
Florida	January 1, 1976		
Georgia	January 1, 1976	Oklahoma	January 1, 1976
Hawaii	July 1, 1976	Oregon	January 1, 1976
Idaho	January 1, 1976	Pennsylvania	No fixed dates (August 1, to September 13, 1975)
Illinois	January 1, 1976 (personal property April 1, 1976)	Rhode Island	December 31, 1975
Indiana	March 1, 1975	South Carolina	December 31, 1974
Iowa	January 1, 1976	South Dakota	February 1, 1976
Kansas	January 1, 1976	Tennessee	January 1, 1976
Kentucky	January 1, 1976	Texas	January 1, 1975
Louisiana	January 1, 1975	Utah	January 1, 1976
Maine	April 1, 1976	Vermont	April 1, 1976
Maryland	January 1, 1976	Virginia[2]	January 1, 1976
Massachusetts	January 1, 1976	Washington	January 1, 1976
Michigan	December 31, 1975	West Virginia	July 1, 1976
Minnesota	January 1, 1976	Wisconsin	May 1, 1975
Mississippi	January 1, 1976	Wyoming	February 1, 1976

[1] Data are preliminary for 1976. [2] Except for jurisdictions using fiscal year.

Figure 15: Valuation dates in the eighties in the US (Source: U.S. Department of Commerce (1982))

Table H. Valuation Dates Applicable to Assessed Value in This Report

State	Valuation date	State	Valuation date
Alabama	October 1, 1980	Nevada	Roll containing property assessed between July 1 and December 15, 1980
Alaska	January 1, 1981		
Arizona	January 1, 1981		
Arkansas	January 1, 1981	New Hampshire	April 1, 1981
California	March 1, 1981	New Jersey	October 1, 1980
		New Mexico	January 1, 1981
Colorado	January 1, 1981	New York	May 1, 1981, generally, but varies among cities and towns
Connecticut	October 1, 1980		
Delaware	Kent County, May 31, 1981; New Castle, March 22, 1981; Sussex, May 1, 1981	North Carolina	January 1, 1981
		North Dakota	February 1, 1981
District of Columbia	January 1, 1981 (personal property July 1, 1981)	Ohio	January 1, 1981 (personal property December 31, 1980)
Florida	January 1, 1981		
Georgia	January 1, 1981	Oklahoma	January 1, 1981
Hawaii	January 1, 1981	Oregon	January 1, 1981
Idaho	January 1, 1981	Pennsylvania	No fixed dates; roll containing 1981 values used as basis for 1982 tax bills
Illinois	January 1, 1981		
Indiana	March 1, 1981		
Iowa	January 1, 1981		
Kansas	January 1, 1981	Rhode Island	December 31, 1980
Kentucky	January 1, 1981	South Carolina	December 31, 1980
Louisiana	January 1, 1981	South Dakota	January 1, 1981
Maine	April 1, 1981	Tennessee	January 1, 1981
Maryland	January 1, 1981	Texas	January 1, 1981
Massachusetts	January 1, 1981	Utah	January 1, 1981
Michigan	December 31, 1980	Vermont	April 1, 1981
Minnesota	January 2, 1981	Virginia[1]	January 1, 1981
Mississippi	January 1, 1981	Washington	January 1, 1981
Missouri	January 1, 1981	West Virginia	July 1, 1980
Montana	January 1, 1981	Wisconsin	January 1, 1981
Nebraska	January 1, 1981	Wyoming	February 1, 1981

[1]Except for seven independent cities using a July 1, 1981, valuation date.

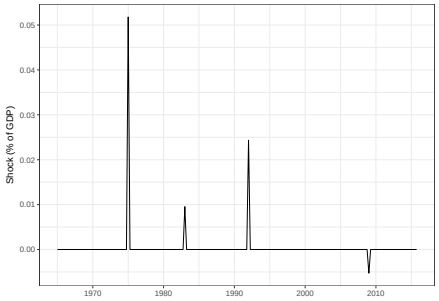
Figure 16: Valuation dates in the nineties in the US (Source: U.S. Department of Commerce (1992))

State	Valuation date	
Alabama	October 1, 1990	(Section 40-7-2, Code of Alabama)
Alaska	January 1, 1991	(Section 29.45.10, Alaska Statutes)
Arizona	January 1, 1991	(Section 42-221, Arizona Revised Statutes)
Arkansas	January 1, 1991	(Section 26-26-1201, Arkansas Code)
California	March 1, 1991	(Section 401.3, California Revenue and Taxation Code)
Colorado	January 1, 1991	(Section 39-1-105, Colorado Revised Statutes)
Connecticut	October 1, 1990	(Section 12-622, General Statutes of Connecticut)
Delaware:	Assessments must be completed by the following dates in each county:	
Kent County	April 1, 1991	(Title 9 Section 8310, Delaware Code, Revised)
New Castle County	March 1, 1991	(Title 9 Section 8310, Delaware Code, Revised)
Sussex County	February 15, 1991	(Title 9 Section 8310, Delaware Code, Revised)
District of Columbia:		
Real property	January 1, 1991	(Section 47-820, District of Columbia Code)
Personal property	July 1, 1991	(Section 47-1523, District of Columbia Code)
Florida	January 1, 1991	(Section 192.042, Florida Statutes)
Georgia	January 1, 1991	(Section 48-5-10, Official Code of Georgia)
Hawaii	January 1, 1991	(Section 246-3, Hawaii Revised Statutes)
Idaho	January 1, 1991	(Section 63-102, Idaho Code)
Illinois	January 1, 1990	(Section 9-100, Illinois Compiled Statutes)
Indiana	March 1, 1991	(Section 6-1.1-1-2, Indiana Code)
Iowa	January 1, 1991	(Section 428.4, Code of Iowa)
Kansas	January 1, 1991	(Section 79-1475, Kansas Statutes Annotated)
Kentucky	January 1, 1991	(Section 132.220, Kentucky Revised Statutes)
Louisiana	January 1, 1991[1]	(Section 47:1952, Louisiana Revised Statutes)
Maine	April 1, 1991	(Title 36, Section 708, Maine Revised Statutes Annotated)
Maryland	January 1, 1991	(Tax-Property Section 8-104, Annotated Code of Maryland)
Massachusetts	January 1, 1991	(Chapter 59, Sections 2A, 18, and 21, Annotated Laws of Massachusetts)
Michigan	December 31, 1990	(Section 211.24b, Michigan Compiled Laws or Section 7.24(2), Michigan Statutes Annotated)
Minnesota	January 2, 1991	(Section 273.01, Minnesota Statutes)
Mississippi	January 1, 1991	(Section 27-35-3, Mississippi Code)
Missouri	January 1, 1991	(Section 137.075, Revised Statutes of Missouri)
Montana	January 1, 1991	(Section 15-8-201, Montana Code Annotated)
Nebraska	January 1, 1991	(Section 77-1301, Revised Statutes of Nebraska)
Nevada	July 1, 1990	(Section 361.260, Nevada Revised Statutes)
New Hampshire	April 1, 1991	(Section 74:1, New Hampshire Revised Statutes Annotated)
New Jersey	October 1, 1990	(Section 54:4-23, New Jersey Statutes Annotated)
New Mexico	January 1, 1991	(Section 7-38-7, New Mexico Statutes Annotated)
New York	January 1, 1991, unless otherwise specified by special act	(Section 301, New York Real Property Tax Law)
North Carolina	January 1, 1991	(Section 105-285, General Statutes of North Carolina)
North Dakota	February 1, 1991	(Section 57-02-11, North Dakota Century Code)
Ohio:		
Real property	January 1, 1991	(Section 5711.03, Ohio Revised Code)
Personal property	December 31, 1990	(Section 5711.03, Ohio Revised Code)
Oklahoma	January 1, 1991	(Title 68 Section 2817, Oklahoma Statutes)
Oregon	July 1, 1991	(Section 308.210, Oregon Revised Statutes, effective 1991)
Pennsylvania:	Date not specified, but roll containing 1991 values (as basis for 1992 tax bills) was used. Assessments must be completed during the following months:	
Philadelphia	September 1991	(Title 72, sections 5341.1, ff., Pennsylvania Statutes)
Other counties:		
Second class	September 1991	(Title 72, section 5452.9, Pennsylvania Statutes)
Second class A and third class	July 1991	(Title 72, section 5348, Pennsylvania Statutes)
Fourth through eighth class	July 1991	(Title 72, section 5453.601, Pennsylvania Statutes)
Rhode Island	December 31, 1990	(Section 44-5-1, General Laws of Rhode Island)
South Carolina	December 31, 1990	(Section 12-37-900, Code of Laws of South Carolina)
South Dakota	January 1, 1991	(Section 10-6-2, South Dakota Codified Laws)
Tennessee	January 1, 1991	(Section 67-5-504, Tennessee Code Annotated)
Texas	January 1, 1991	(Sections 25.001, ff., Texas Tax Code)
Utah	January 1, 1991	(Section 59-2-704, Utah Code Annotated)
Vermont	April 1, 1991	(Title 32 Section 3482, Vermont Statutes Annotated)
Virginia	January 1, 1991[2]	(Sections 58.1-3010 and -3281, Code of Virginia)
Washington	January 1, 1991	(Section 84.40.020, Revised Code of Washington)
West Virginia	July 1, 1990	(Section 11-3-1, West Virginia Code)
Wisconsin	January 1, 1991	(Section 70.10, Wisconsin Statutes)
Wyoming	February 1, 1991	(Section 39-2-101, Wyoming Statutes Annotated)

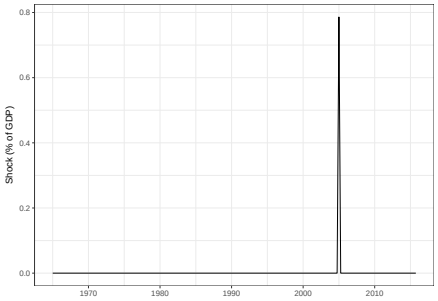
I Shocks

Figure 17: Narrative Shocks

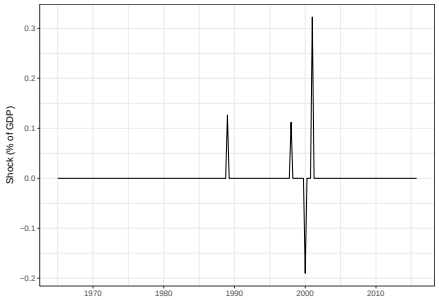
(a) Austria



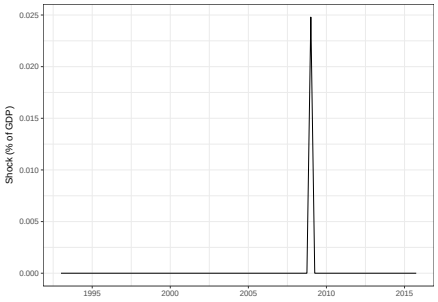
(b) Belgium



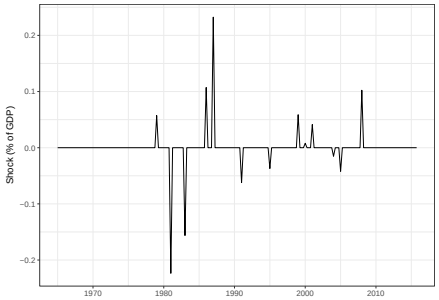
(c) Canada



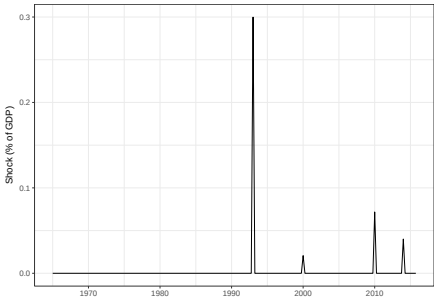
(d) Czech Republic



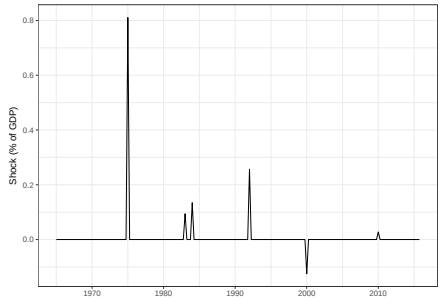
(e) Denmark



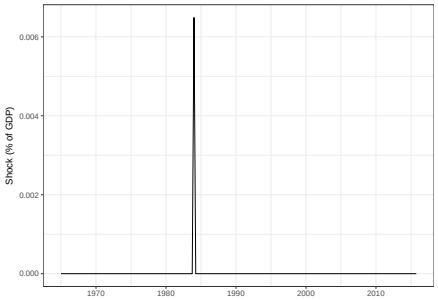
(f) Finland



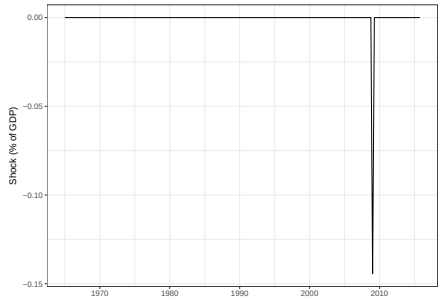
(g) France



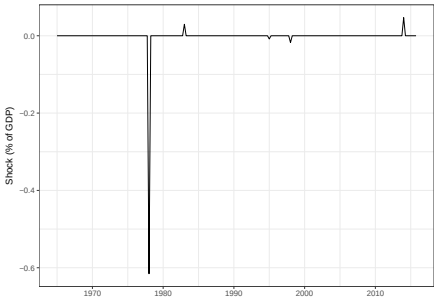
(h) Germany



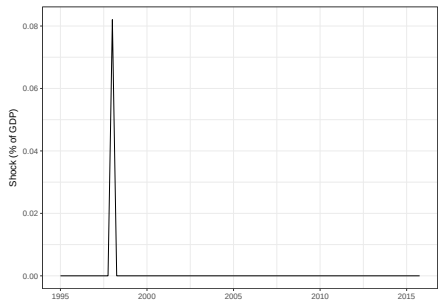
(i) Iceland



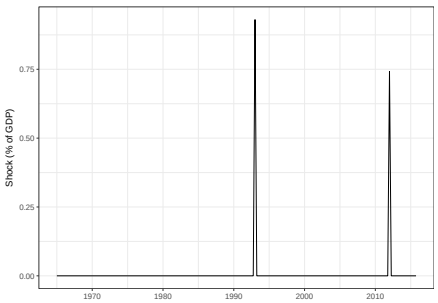
(j) Ireland



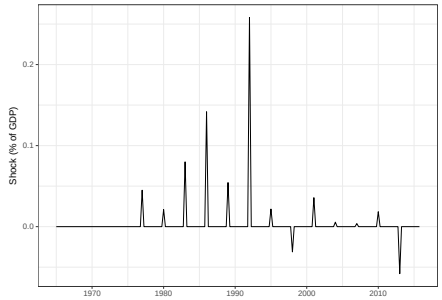
(k) Israel



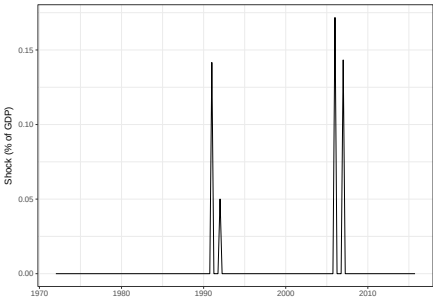
(l) Italy



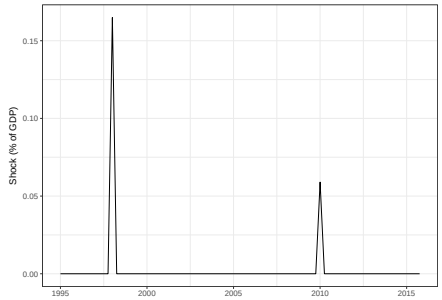
(m) Japan



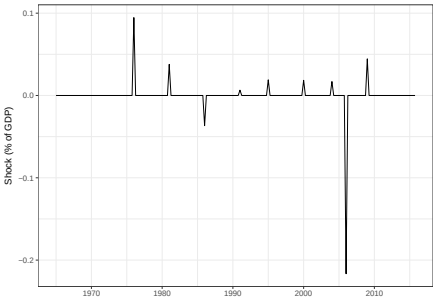
(n) Korea



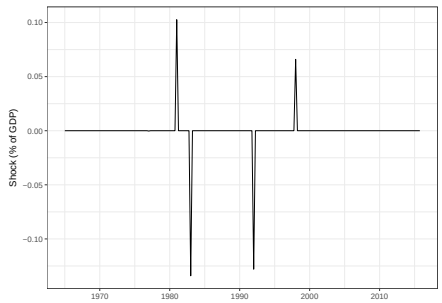
(o) Latvia



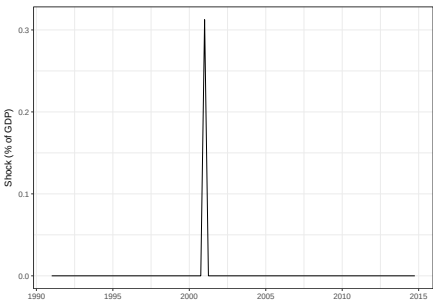
(p) Netherlands



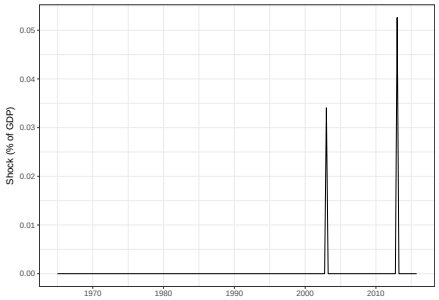
(q) New Zealand



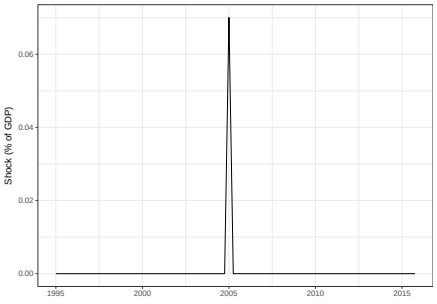
(r) Poland



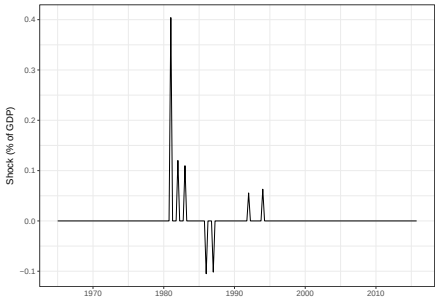
(s) Portugal



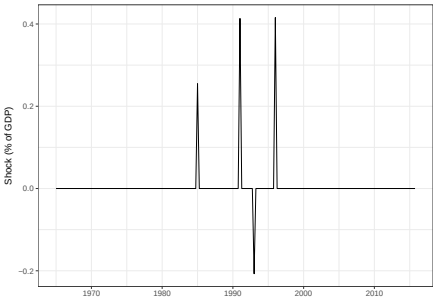
(t) Slovak Republic



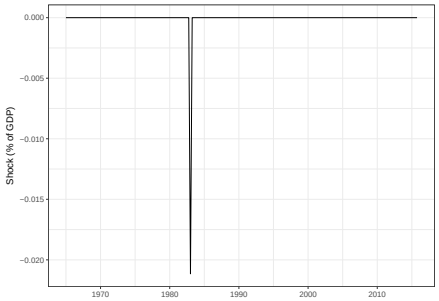
(u) Spain



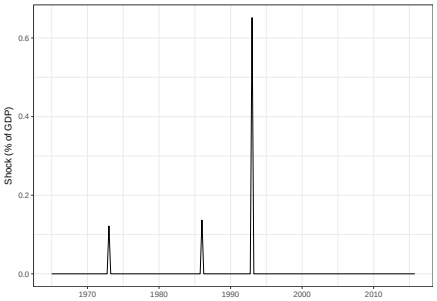
(v) Sweden



(w) Switzerland



(x) United Kingdom



(y) United States

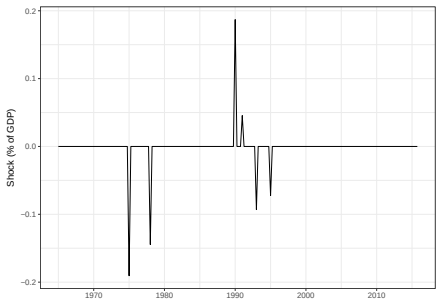


Table 7: Share of Taxes in each Country in 1990

	4100	1000	2000	3000	4000	5000
Australia	5.3	57.1	0	6.1	8.9	27.8
Austria	0.7	25.5	32.9	6	2.7	31.5
Belgium	0.9	36.9	33.2	0	3.8	26.1
Canada	8.3	48.6	12.1	2.3	10	25.8
Chile	3.4	23.2	9	0	6.2	62.9
Denmark	2.3	61.2	0	0.7	4.3	33.9
Finland	0.2	39.2	25.6	0	2.4	32.5
France	3.4	16.1	44.1	1.9	6.3	28.4
Germany	1	32.4	37.5	0	3.4	26.7
Greece	0.2	19.9	30.2	0.7	4.6	44.5
Iceland	3.6	29.7	3.1	3.5	8.4	51.3
Ireland	2.5	38	14.1	1.3	4.6	41.9
Italy	0	36.5	32.9	0.3	2.3	28
Japan	5.4	50.2	26.4	0	9.4	13.7
Luxembourg	0.4	40.2	27.5	0	8.4	23.6
Mexico	1	34	16.8	1.8	1.9	44
Netherlands	1.6	32.3	37.4	0	3.7	26.4
New Zealand	6.3	59.6	0	0	6.8	33.6
Norway	0.7	35.2	26.3	0	2.9	35.5
Portugal	0.9	25.7	27.2	0	2.7	44.2
South Korea	2.6	32.8	10.1	0.4	11.8	44.3
Spain	1.4	30.6	35.4	0	5.5	28.4
Sweden	1.2	41.6	27.2	2.5	3.5	25
Switzerland	0.5	47.4	23.5	0	8.1	20.8
Turkey	0	33.5	19.7	0	2.3	27.9
United Kingdom	6.7	39.3	17	0	8.2	31
United States	10.4	45.2	25.6	0	11.6	17.6

Table 8: Share of Taxes in each Country in 2014

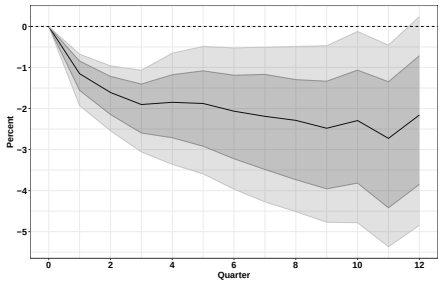
	4100	1000	2000	3000	4000	5000
Australia	5.6	57.9	0	5.1	10.1	26.9
Austria	0.5	29.5	34.2	6.9	1.4	27.3
Belgium	3	35.8	31.6	0	7.9	23.9
Canada	9.7	48	15.1	2	11.7	23
Chile	3.2	33	7.2	0	4.2	55.3
Czech Republic	0.7	21.4	43.8	0	1.3	32.9
Denmark	2.8	64.9	0.1	0.7	3.7	30.2
Estonia	0.9	22.8	33.6	0	0.9	42.1
Finland	1.7	35	28.9	0	3	32.8
France	5.7	23.8	37.4	3.5	8.5	24.1
Germany	1.2	31.1	38.1	0	2.6	27.7
Greece	1.2	23.7	28.7	0	4	43.4
Hungary	1.6	17.7	32.7	1.5	3.4	44
Iceland	4.2	46.6	9.5	0.9	6.4	31
Ireland	3.4	40.3	17.3	0.6	7.7	33.6
Israel	6.6	30.9	16.4	3.8	9.5	39.4
Italy	3.6	32	29.8	0	6.6	27
Japan	6.4	31.8	39.7	0	8.5	19.8
Latvia	2.8	25.9	29.1	0	3.6	40.9
Luxembourg	0.2	34.6	28.7	0	7.8	28.8
Mexico	1.4	37.6	20.6	2.5	2.1	35.8
Netherlands	2.6	25.6	39.6	0	3.9	29.6
New Zealand	6	55.4	0	0	6.2	38.4
Norway	0.9	42.5	25.7	0	3.1	28.7
Poland	3.9	19.7	38.1	0.7	4.3	36.1
Portugal	2.5	30.8	26.2	0	3.6	38.2
Slovak Republic	1.4	21	42.9	0	1.4	34.2
Slovenia	1.4	17.9	39.4	0.1	1.7	40.4
South Korea	3.2	29.1	26.9	0.3	11	30
Spain	3.5	28.7	34.4	0	7	28.5
Sweden	1.9	34.9	23.2	10.6	2.5	28.4
Switzerland	0.6	45.7	24.9	0	6.6	22.4
Turkey	1	21.1	28.5	0	4.9	44.1
United Kingdom	9.6	34.9	18.7	0	12.7	33.2
United States	10.1	47.7	24.1	0	10.8	17.4

J Excluding the United States and Federal countries

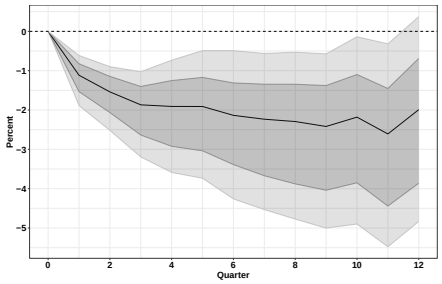
We test that our narrative approach is robust excluding US exogenous shocks (Figure 18 (a)). We have with this methodology 95 exogenous property tax shocks. We then test that our narrative approach is robust excluding Federal countries where property tax shocks were identified at sub-federal levels (States, Landers, ...) (Figure 18 (b)). With this specification, we exclude the shocks in Canada (see Section G.4), the 1998 shock in New Zealand (the other shocks in New Zealand were identified at the federal level, Section G.23), the shock in Switzerland (G.32), the shocks in the United States (G.35). We keep with this specification 89 exogenous property tax shocks.

Figure 18: Narrative Approach without US Shocks and Federal countries

(a) Without US shocks



(b) Without Federal countries

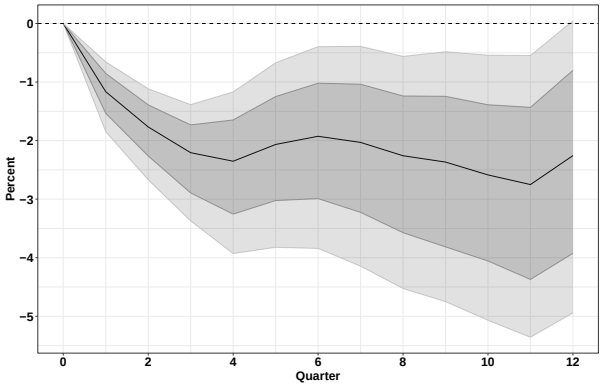


K Lateral shocks

We test that our narrative approach is robust including significant variations of the property tax directly surrounding our exogenous tax shocks. We take only variations of the property tax -directly before and after the date of the shocks - that is, should they have the same sign as the exogenous shock. We have with this methodology 154 exogenous property tax shocks. The shocks are shown in the following table.

Country	**Shocks**
Canada	1988, 1990
Czech Republic	2010
Denmark	1978, 1980, 1982, 1984, 1990, 1994, 1996, 2002
Finland	1994
France	1976
Iceland	2010
Ireland	1977, 1979
Israel	1997
Japan	1976, 1978, 1979, 1981, 1982, 1984, 1985, 1991, 1993, 1997, 2008, 2012
Korea	1980, 1990, 1993
Latvia	1997
Netherlands	1977, 1978, 1982, 2001, 2003
New Zealand	1982, 1991, 1999
Portugal	2002, 2004, 2014
Spain	1985, 1993
Sweden	1990
United Kingdom	1994
United States	1974, 1979, 1980, 1992, 1996

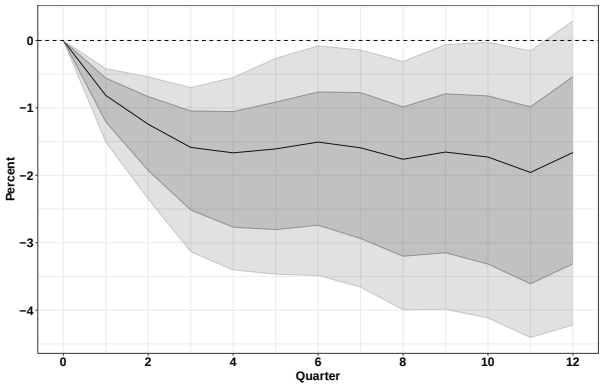
Figure 19: Narrative Approach with Lateral Shocks



L Endogenous shocks

We test that our narrative approach is robust including endogenous shocks and outliers.We add to the list of shocks described in Section K the endogenous shocks identified in Greece in 2011 and 2014 (see discussion in Section G.12), in Hungary in 2012 and 2013 (G.13), in South Korea in 1979 and 2009 (G.29). We include also the 1990 reform in the United Kingdom that we discuss in Section G.34. We have with this methodology a list of 161 property tax shocks.

Figure 20: Narrative Approach with Endogenous Shocks



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