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VAT revenue elasticities: an analytical approach

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Abstract: In this paper we construct analytical estimates of the elasticity of VAT revenue with respect to underlying gross income and expenditure for the household sector in Ireland. The responsiveness of VAT revenue to changes in gross income steadily increased up to the late 2000s as marginal income tax rates fell. The introduction of the income levy and the doubling of the health levy resulted in a reduction in the VAT elasticity, as higher income tax rates also reduced the disposable income available for expenditure. This spill-over effect highlights the importance of judging the broader implications of tax policy. It also suggests that policymakers during any subsequent fiscal crisis should be cautious when choosing the composition of tax adjustments, as there is a clear trade-off to be made. The VAT revenue elasticity is lower for Ireland than estimates for the UK, New Zealand and Australia, possibly reflecting the greater progressivity of the Irish income tax system compared to other OECD countries.

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VAT revenue elasticities: an analytical approach

Abstract: In this paper we construct analytical estimates of the elasticity of VAT revenue with respect to underlying gross income and expenditure for the household sector in Ireland. The responsiveness of VAT revenue to changes in gross income steadily increased up to the late 2000s as marginal income tax rates fell. The introduction of the income levy and the doubling of the health levy resulted in a reduction in the VAT elasticity, as higher income tax rates also reduced the disposable income available for expenditure. This spill-over effect highlights the importance of judging the broader implications of tax policy. It also suggests that policymakers during any subsequent fiscal crisis should be cautious when choosing the composition of tax adjustments, as there is a clear trade-off to be made. The VAT revenue elasticity is lower for Ireland than estimates for the UK, New Zealand and Australia, possibly reflecting the greater progressivity of the Irish income tax system compared to other OECD countries.

I. Introduction

Value added tax (VAT) is applied in many countries¹, and in those it typically accounts for a significant share of total tax receipts. VAT revenues typically make up just over a quarter of Exchequer tax receipts in Ireland, in line with the EU28 average. However, there is significant variation across the EU, with VAT accounting for 21% of tax receipts in Italy while accounting for 50% in Croatia.²

VAT is currently the second largest revenue-raiser in Ireland after income tax and was the largest prior to the recession. As such, fluctuations in VAT revenue have a high automatic impact on total tax revenue. Given the significance of VAT as a revenue source it is important to understand the relationship between VAT revenue and underlying activity, which is captured by the VAT elasticity. Accurate estimates of the VAT elasticity are important for forecasting.

In this paper we use data from five successive waves of the Household Budget Survey (HBS), a nationally representative survey of private households that documents household expenditure.³ The time period covered is 1994/95 to 2015/16. Given the data source, we restrict ourselves to analysis of the household sector. Other actors in the economy also pay VAT, for example firms, but they are outside the scope of this research. Although it is difficult to fully determine the incidence of VAT, the European Commission estimates that household

¹ Exceptions include several oil-producing countries (e.g. Saudi Arabia, UAE), special status territories (e.g. Hong Kong, Gibraltar) and tax havens (e.g. Bermuda, Cayman Islands). While the USA does not have a value added tax, most states collect a sales tax.

² Source: Eurostat Government Finance Statistics for 2016.

³ HBS surveys have been carried out periodically in Ireland since 1951.

final consumption expenditure is the source for roughly two-thirds of total VAT receipts collected in Ireland (European Commission, 2017).⁴

This paper builds on the analysis of Acheson *et al.* (2017) on income tax revenue elasticities, by applying a similar methodology to VAT. The VAT revenue elasticities are constructed analytically using household expenditure for goods and services commanding different VAT rates, estimated at different points on the income distribution. The approach allows us to reflect the structure of the VAT system as well as the income tax system. Changes in the elasticities are a function of fiscal changes (in income tax or VAT), expenditure pattern changes, and savings behaviour. The analysis demonstrates that changes in the income tax system have been more influential than expenditure pattern or savings changes in determining VAT revenue responsiveness.

Firstly, we find that the responsiveness of VAT revenues to changes in household gross income steadily increased up to the late 2000s as marginal income tax rates fell, leaving households with higher post-tax incomes. However, the introduction of the income levy and the doubling of the health levy in 2009, caused a notable decline in the automatic responsiveness of VAT revenues to income growth, as higher income tax rates also had the effect of reducing on the margin the resources available to be taxed via indirect taxes. When comparing this elasticity to other countries, we find that it is lower than estimates for the UK, New Zealand and Australia, possibly reflecting the greater progressivity of the Irish income tax system compared to other OECD countries (as income tax progressivity implies less household resources at the margin available for expenditure).

Secondly, we find that the responsiveness of VAT revenues to changes in household expenditure is higher, reflecting the fact that VAT revenues will be more responsive to direct changes in the tax base (expenditure) rather than to a variable that only partially determines the base (gross income). However, we find that this elasticity is notably lower in the 2000s compared to the 1990s, and the change reflects two developments. Firstly, the switch from a tax-free allowance to a tax credit-based income tax system in 2001 led to a sharp drop in average tax rates and an increase in the progressivity of the income tax system. This change appears to have had a knock-on effect on VAT elasticities. In addition, steadily increasing household savings ratios from the 1990s into the 2000s also reduced the elasticity. It is this second elasticity that is the relevant one for forecasting VAT revenues.

The rest of the paper proceeds as follows. Section II provides a brief overview of VAT and the economic cycle. Section III describes the trends for underlying factors which influence VAT revenues. Section IV describes the methodology and the data used. Section V discusses the results. Finally, Section VI concludes and discusses the policy implications.

⁴ We note that households may also pay partial or full VAT on the intermediate consumption of firms, but the precise incidence is a function of unknown price elasticities of demand. However, the effect will ultimately be captured in household final consumption expenditure.

II. VAT and the economic cycle

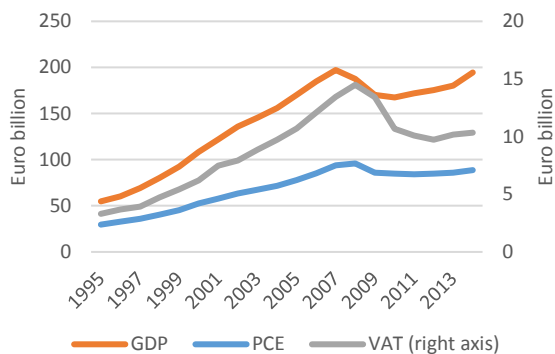
VAT revenues may exhibit low volatility over the economic cycle since household expenditure, which is the main tax base for VAT receipts, is a relatively stable component of GDP i.e. households engage in consumption smoothing. However, consumption smoothing mechanisms could fail if an economic slowdown is prolonged or households' access to credit is restricted. VAT receipts may also be volatile due to other components of the VAT base, such as gross investment, which is far more sensitive to the economic cycle.

In Ireland's case, VAT revenues are pro-cyclical to household expenditure (see Figure 1). However, the fact that VAT receipts contracted relatively more severely than expenditure during the recession highlights an important feature of Irish VAT, which is the contribution of the housing sector to VAT revenues (see Figure 1b). The Department of Finance estimates that the proportion of VAT arising solely from the purchase of new houses in the 2000s was over 10 percent on average, with this proportion dropping sharply in subsequent years.⁵ This feature of Irish VAT also explains why receipts have not returned to their pre-crisis levels, in line with GDP, over the recovery years.

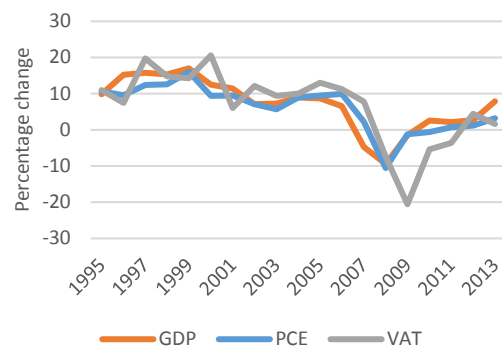
The HBS does not provide information on the date and value of house purchases so VAT arising from the purchase of new houses is excluded from our analysis. We expect that this provides clearer results, which are less affected by the housing-bubble and which provide a more intuitive analysis of the VAT elasticity as an automatic stabiliser of the economy.

Figure 1: VAT revenue and personal consumption expenditure

(a) nominal values



(b) annual nominal growth rates



Source: Department of Finance and CSO

Note: Personal Consumption Expenditure (PCE) is used as the tax base in Department of Finance VAT forecasting. The vast majority of PCE is composed of household final consumption expenditure, with final consumption expenditure by non-profit institutions serving households (NPISH) and government typically accounting for about 5 percent of PCE.

⁵ Note the Department makes the early 2000s calculation using average new house prices and the volume of transactions. For 2010 onward, the CSO Residential Property Price Index (RPPI) series covering the value of transactions by stamp duty event, across all buyer types for new dwellings, is applied.

III. Factors affecting VAT

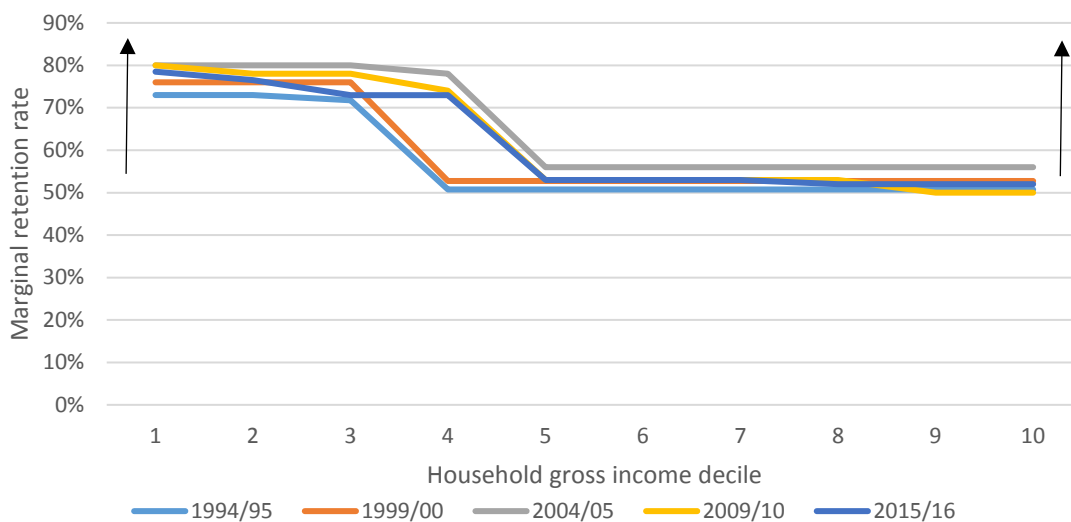
VAT revenues are directly affected by VAT tax rates and exemptions⁶, household income, savings, and expenditure patterns. However, they are also indirectly affected by factors like other types of taxation, the level of wages, inflation, house prices, and the housing market in general. We also expect that VAT revenues will depend on the size of the black economy in a country. In this section, we focus on two of the most important factors affecting VAT, which will enable us to more easily understand the results arising from our analytical estimates in Section IV.

3.1. Disposable income and the income tax system

As VAT revenues derive from expenditure out of disposable income, it is necessary to consider the income tax system first. The marginal income tax rate determines how much of each additional euro of gross income is taxed. The marginal retention rate, which equals 1 minus the marginal tax rate, will therefore indicate how much of each additional euro of gross income is retained as disposable income.

During the 1990s and 2000s, marginal tax rates fell considerably in Ireland. Figure 2 shows this effect for the Single category taxpayer. In all income deciles marginal tax rates fell, meaning that marginal retention rates, and therefore disposable income on the margin, increased over time. By 2015/16, the marginal retention rate was higher at all points on the income distribution compared to 1994/95, but the peak occurred in 2004/05 i.e. prior to the recession and collapse in public finances. Increasing marginal retention rates over time may work to increase the VAT elasticities with respect to income and expenditure, as households increasingly retained more disposable income on the margin.

Figure 2: Marginal retention rate for income tax, single taxpayer category



Source: Household Budget Survey

Note: the method by which households are designated as Single category income taxpayers is outlined fully in the Methodology section.

⁶ Appendix 1 provides a brief overview of VAT in Ireland.

The other key income tax development to affect disposable income over the period was the switch from a tax-free allowance system to a system of tax credits in fiscal year 2000/01. Figure 3 highlights the impact this had on average tax rates for different indicative income levels. Between 2000 and 2002, average tax rates reduced sharply by between 4 and 9 percentage points.⁷ Broadly speaking, the reductions were greater for lower income taxpayers, which implies an increase in the progressivity of the income tax system because of this change. Progressivity implies less household resources at the margin available for expenditure, which may work to decrease the VAT elasticities with respect to income and expenditure.

Figure 3: Average tax rate for Single taxpayer



Source: Budget 2004 documentation, available at www.budget.gov.ie

Note: the Single taxpayer pays the full rate of PRSI. The short calendar year in 2001 lasted nine months from 1 April to 31 December, in preparation for the switch from an April to April fiscal year to a January to December fiscal year.

3.2. Savings

As household disposable income increases due to, amongst other factors, discretionary income tax policy changes, households need to choose how to allocate additional disposable income between expenditure and savings. The HBS data allow us to examine this household response and to see whether it has changed across time. Figure 4 shows the median savings ratio for all households (yellow bars) and also for different household categories. The savings ratio is one minus the ratio of expenditure to disposable income.⁸

As our definition of expenditure includes mortgage repayments, this savings ratio refers to savings over and above mortgage repayments (in contrast to the National Accounts definition of the savings ratio). The ratio increased rapidly over time, with households moving from a typical pattern of dissaving in the 1990s to saving in the 2000s. Devoting an increasing share of disposable income to savings over time may result in lower VAT revenue responsiveness.

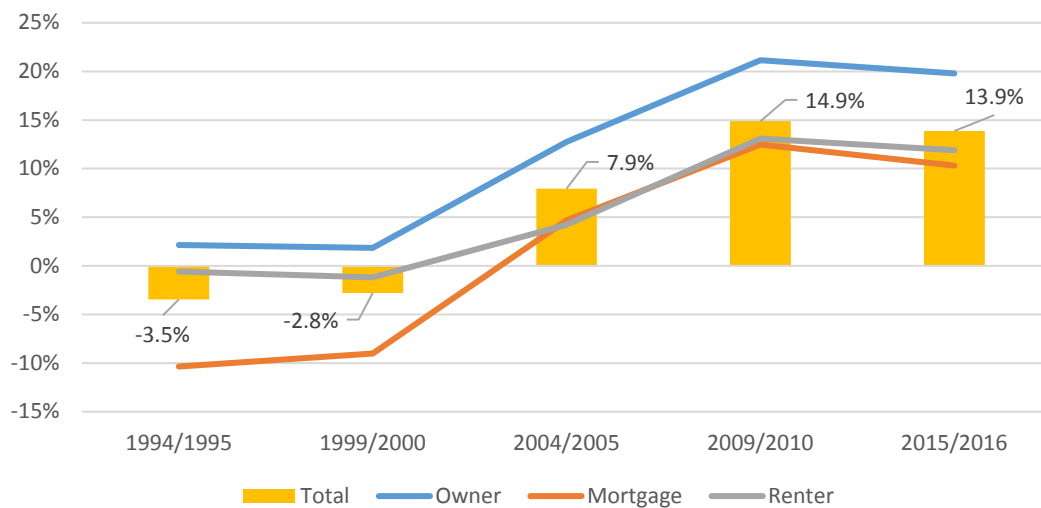
⁷ 2000 and 2002 are compared as these represent 12-month periods. The 2001 year was only nine months (from a Budget perspective).

⁸ Note that at a given point in time, the explanation for why this ratio could be negative is due to the use of personal credit, previous savings or unrecorded income to finance current expenditure.

It is notable that owner households (i.e. households without a mortgage) have the highest savings ratio in any given year. This very likely relates to their age profile and the smaller share of housing costs in their expenditure. The savings ratio for mortgaged and renter households converged over time, despite the older age profile of mortgaged households and the fact that their disposable income is typically twice as large as renter households. However, some of this convergence is likely due to the definition of savings used here as savings over and above mortgage repayments.

The trends in Figure 4 are consistent with increased levels of household disposable income, some of which arose out of changes to the income tax system. But other factors influence the savings ratio, such as: the real interest rate on savings; income expectations; age; the availability of credit; the tax treatment of savings; the development of savings institutions; and the desire to secure a deposit on a house. Income expectations are likely to have played a key role in Ireland, especially once the recession occurred. We expect that during and directly after the crisis, households sought to repair their balance sheets, thus displaying a behavioural change towards increased savings.

Figure 4: HBS median savings ratio for different household types

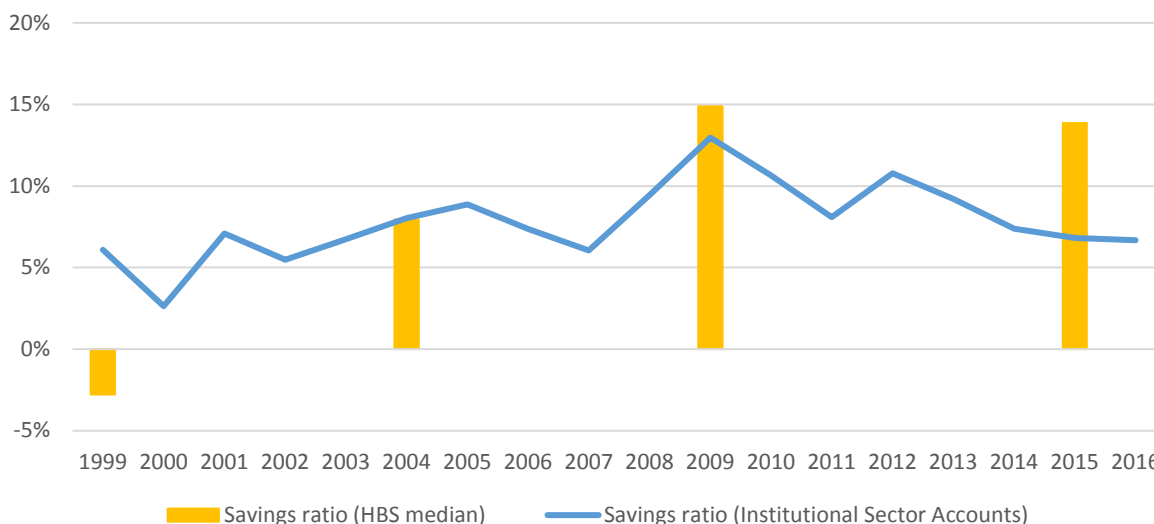


Source: Household Budget Survey

Note: each annual result is the median result for that household category in that year.

National Accounts data broadly mirror the trend of increased savings observed in the HBS microdata (Figure 5). The household savings ratio increased steadily throughout the 2000s, peaked in 2009 at the height of the recession as households sought to repair their balance sheets, and subsided thereafter to pre-crisis levels.⁹

Figure 5: Institutional Sector Accounts household savings ratio



Source: HBS, CSO Institutional Sector Accounts (ISA)

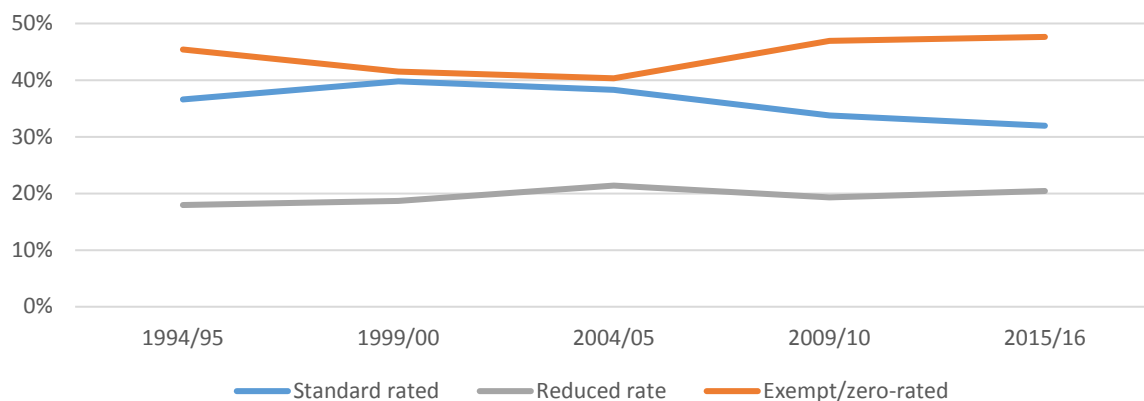
Note: In ISA, the Household Saving Ratio is Gross Household Saving (B.8g) expressed as a percentage of total resources, i.e. the sum of Gross Household Disposable Income (B.6g) and the Adjustment for the Change in Pension Entitlements (D.8).

3.3. Changing expenditure patterns

VAT revenue elasticities can change when expenditure patterns change. Typically, rising disposable incomes are associated with a decreasing expenditure share devoted to exempt or zero-rated goods (i.e. essential items). This pattern is observed in Ireland over the decade from 1994 to 2004 (Figure 6). However, the 2009/10 HBS indicates that the share increased sharply in the late 2000s. By 2015/16, the share of expenditure being allocated to exempt/zero-rated was at a similar level to that observed in 1994, despite incomes being far higher in the more recent period. This behaviour, which we find is identical for all income deciles, will first amplify and subsequently moderate the responsiveness of VAT revenue to changes in either income or expenditure.

⁹ We note that the ISA definition of savings differs from ours in two key respects. Firstly, in both the HBS publication and this paper, household expenditure includes mortgage repayments. Therefore, the household savings ratio that is created from the HBS micro-data – one minus the ratio of expenditure to disposable income – refers to savings *over and above mortgage repayments*. The ISA household savings ratio, by contrast, includes mortgage repayments. Other things equal, we would expect the savings ratio we calculate to be *lower* than the ISA household savings ratio. Secondly, the ISA ratio is impacted by imputed rent for owner-occupiers (as this appears in the definition of final consumption expenditure, accounting for roughly ten percent of final consumption expenditure since the late 1990s). All else equal, this means that the HBS ratio is *higher* than the ISA ratio. Figure 5 suggests it is the latter effect which dominates the comparison from the late 2000s onward.

Figure 6: Expenditure shares of different VAT-rated goods

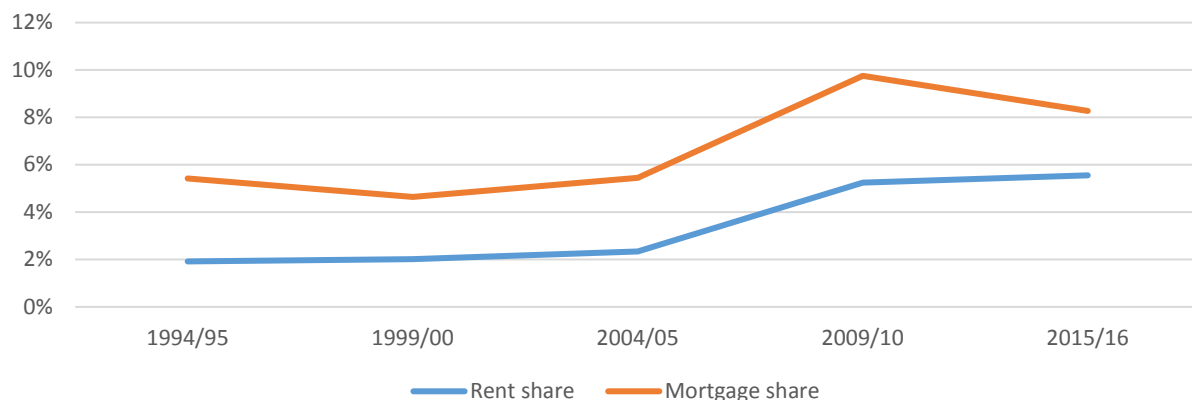


Source: Household Budget Survey

Note: definition of expenditure is not the VAT base (which would exclude exemptions by definition). Instead, it is the definition of household expenditure as used in HBS less pension contributions.

The Irish pattern can be explained when we consider the various expenditure categories in the HBS and their respective tax treatments. Over time, Irish households have spent an increasing amount on housing costs, which are exempt from VAT (Figure 7). Mortgage repayments and rent as a share of total expenditure have increased substantially since the late 1990s. The reduction in the mortgage share in 2015/16 is due to the overall level of expenditure increasing while the level of mortgage expenditure remained stable between 2009/10 and 2015/16.

Figure 7: Share of total expenditure devoted to VAT-exempt mortgage repayments and rent



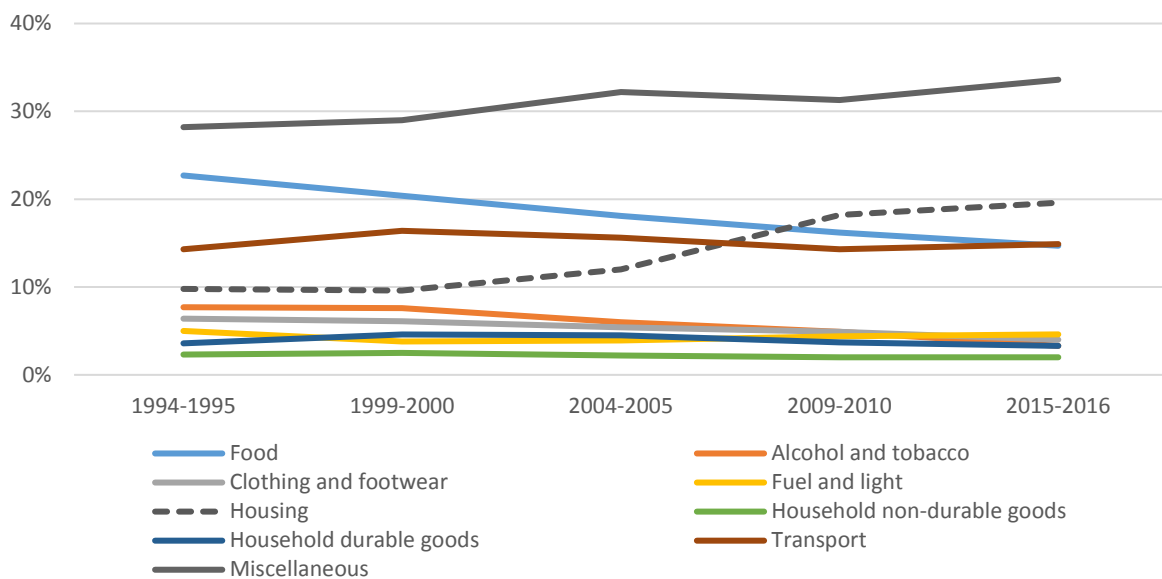
Source: Household Budget Survey

Note: definition of expenditure is the definition of household expenditure as used in HBS less pension contributions.

Figure 8 shows the full range of Irish expenditure shares over time. The latest year is very similar to the EU28 pattern, as food, fuel, housing, and transport account for about half of overall expenditure.¹⁰

¹⁰ According to Eurostat, a quarter of EU28 household expenditure (24.5% of total) was devoted to housing, water, electricity, gas and other basic needs in 2016. Transport represents a large share as well (12.9% of total) and food and beverages follow with 12.2% of the total. In other words, basic needs account for almost half of total household expenditure (49.6%) in the EU28.

Figure 8: Expenditure shares for different expenditure categories over time



Source: Household Budget Survey publication

Note: the HBS publication includes pension contributions in the definition of expenditure (categorised as Miscellaneous), which this paper excludes them as they more accurately represent deferred consumption i.e. savings.

IV. Methodology and data

This section presents the methodology we use to estimate the analytical VAT revenue elasticities. We apply the Creedy and Gemmell (2006) approach, which will account for different responses at different points on the gross income distribution, as well as allowing full incorporation of VAT and income tax system parameters.

Consider an average gross income of y_i and an average expenditure of c_i , where the subscript i represents an income decile from the income distribution for each of the three income taxpayer categories (single, married one earner and married two earner). Let T_{il} denote the total VAT tax paid by this decile i for good l , and T_i be the total VAT tax paid across all goods in decile i . When we refer to good l we are categorising expenditure items by the four different VAT rates applicable to the household sector.¹¹ Let ϵ_{il} be the total expenditure elasticity of demand for good l , and mtr_{y_i} , atr_{y_i} are the marginal income tax rate and average income tax rate respectively. Then the VAT elasticity with respect to gross income is given by:

$$\Omega_{T,y_i} = \left(\frac{1-mtr_{y_i}}{1-atr_{y_i}} \right) \sum_{l=1}^4 \frac{T_{il}}{T_i} \epsilon_{il} \quad (1)$$

This results in thirty estimates, corresponding to the ten income deciles for each of the three income taxpayer categories. An aggregate elasticity is calculated as a weighted sum of these, where the weights are each decile-taxpayer's share of total VAT revenue.

¹¹ The VAT system has four tax rates which affect household expenditure, namely the zero-rated products and services, the 9% reduced rate in labour-intensive and tourist sectors, the 13.5% rate applied primarily to energy and housing, and finally the 23% rate for all other consumption goods.

Note that the value of the first term in brackets in equation (1) is determined by the progressivity of the income tax system and must be less than one for a progressive income tax.¹² Thus, this first term captures the fact that higher income tax progressivity simultaneously reduces the expenditure available to be taxed via indirect taxes. Intuitively, if income tax progressivity increases, this means that the proportion of gross income retained by households in the form of disposable income falls on the margin as we move from lower to higher income deciles, which in turn reduces the VAT revenues arising from those households. From equation 1, we also observe that elasticity (1) mechanically increases as marginal tax rates decrease (with the effect moderated by the decreased average tax rate in the denominator, which decreases less than proportionally when the marginal tax rate falls).

Due to the impact of the income tax system, VAT revenues are likely to be income-inelastic from the perspective of households i.e. VAT revenues increase by proportionally less than an increase in gross income. This contrasts with income tax revenue elasticities, where revenues typically increase by proportionally more than an increase in gross income for progressive income tax systems (see Acheson *et al.* (2017) for further detail). As VAT revenues are likely to be income inelastic, we expect elasticity (1) to be less than one.¹³

Note that ϵ_{il} measures the proportional change in household expenditure on goods taxed at rate l divided by the proportional change in total household expenditure, for a given decile i . When expenditure on different VAT rated goods grows proportionally with total expenditure then ϵ_{il} is one. However, usually we observe changing expenditure patterns over time and different expenditure shares for different rated goods over the income distribution.

To estimate the second elasticity, the VAT revenue elasticity with respect to expenditure, we introduce to our analysis the marginal propensity to consume out of disposable income, given by γ_i , and the ratio of expenditure to gross income (c_i/y_i). These two terms will indirectly capture savings behaviour: as the household savings ratio increases, the elasticity will decrease, and vice versa. The responsiveness of VAT revenues with respect to expenditure is given by:¹⁴

$$\Omega_{T,c_i} = \frac{c_i \Omega_{T,y_i}}{\gamma_i (1 - mtr_i) y_i} \quad (2)$$

A revenue elasticity, for any tax, can be defined as the ratio of its marginal tax rate to its average tax rate. This ratio has a second interpretive function as it also corresponds to a definition of progressivity (when the ratio is above one, a tax is progressive). In this case, elasticity (2) is the appropriate elasticity to consider when determining the progressivity of VAT as it concerns the VAT tax base (expenditure) rather than an indirect measure of activity (gross income). We expect the second elasticity to be close to one, as VAT revenue typically

¹² Acheson *et al.* (2017) show that the income tax revenue elasticity is the ratio of the mtr to atr and that this ratio is a measure of progressivity. For progressive taxes, the ratio is above one.

¹³ Although VAT revenues from the household sector will be income-inelastic, there will still be a positive correlation between revenues and income. This, along with the pro-cyclicality of investment, explains why overall VAT revenues are pro-cyclical, as highlighted in Figure 1.

¹⁴ The second elasticity relies on the product rule of elasticities: $\Omega_{T,y_i} = \Omega_{T,c_i} * \Omega_{c_i,y_i}$. The first elasticity in equation (1) can be written as the product of the effect on tax revenue of a change in the tax base and the effect on the tax base of a change in income.

increases proportionally as expenditure increases (if it were a progressive tax, we would expect elasticity (2) to be greater than one).

We also know that elasticity (2) will be higher than elasticity (1) because it concerns the tax base itself, so revenue responsiveness can be expected to be larger than for an indirect measure of activity such as gross income. Mechanically, the ratio of VAT revenues to expenditure is larger than the ratio of VAT revenues to disposable income, as disposable income includes savings as well as expenditure.

To derive the above elasticities, we use data from the last five waves of the HBS. All variables, except for mtr_{yi} , are derived directly from the HBS microdata. mtr_{yi} is calculated as the sum of the marginal income tax rate, health levy, income levy and USC at any given income level. It is important to note that the household's marginal tax rate will depend on its composition. For example, a single earner will face a higher marginal tax rate than a dual-earning couple, at certain income levels. Thus, to calculate the mtr_{yi} , we take into account household composition (single/married) and the number of tax units in the household.¹⁵ Finally, we estimate the elasticity ϵ_{il} by running a log-log regression of the expenditure shares of different VAT-rated goods on total expenditure.

The HBS publications include pension contributions in their definition of household expenditure. In this paper, however, we remove pension contributions to arrive at an adjusted value of household expenditure and instead allocate pension contributions to household savings to ensure consistency with the CSO Institutional Sector Accounts (ISA). It is appropriate to remove pension contributions from expenditure as such contributions are viewed by households as a form of deferred consumption i.e. saving. However, this may have some consequences for interpreting the distribution of VAT revenues, as the share of expenditure going toward pension contributions is close to zero in the first three deciles but over 10% in the top decile.

Our results will over-estimate VAT revenue from goods which are also liable for excise, but we expect that this is more than countered by the fact that individuals under-report alcohol/cigarette expenditure in budget surveys. Murphy (1976) estimates that such under-reporting is of the order of 60%, which we find is also comparable to the 2015/16 HBS data when we compare them to expenditure data from the National Accounts. This is further discussed in the Appendix where we compare the HBS variables to data from other sources.

V Results

5.1. Baseline results

5.1.1. Response of VAT revenues to changes in household gross income

The VAT elasticity in equation (1) is the responsiveness of VAT revenues from the household sector to changes in gross income. In Figure 9 we see the trend of this elasticity over time. We note that the VAT system itself has been reasonably constant over the twenty-year period

¹⁵ It should be noted that due to a lack of data we are not able to capture cases where there are other earners in the household, such as adult children living in the parental home.

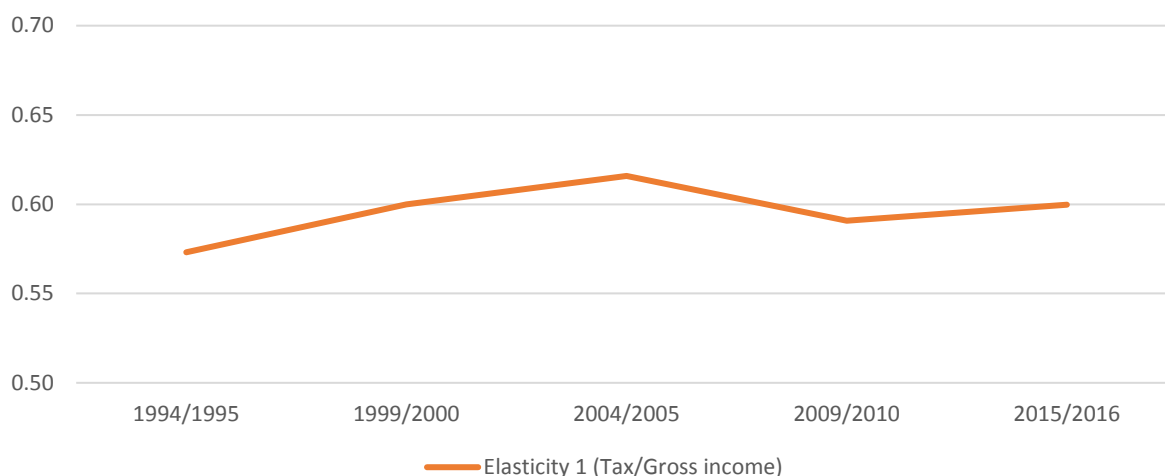
under review (except for the new 9 percent rate in 2011). The two key elements which determine the trend of this elasticity are the income tax system and expenditure patterns.

From Figure 9, we observe that the elasticity steadily increased until 2004/05 before it decreases in 2009/10. The initial upward trend coincides with a period of decreasing marginal income tax rates (as shown in Figure 2). However, the doubling of the health levy and the introduction of the income levy in the 2009 Budgets caused a notable decrease in the VAT elasticity in 2009/10, as marginal income tax rates increased for households.

In 2015/16, the VAT revenue elasticity is estimated at 0.6, only marginally higher than in 2009/10, suggesting that the implementation of USC has a similar impact on VAT revenues as the previous levies. This result means that for every one percent increase in gross income, VAT revenues are expected to automatically increase by 0.6 percent (under the current VAT and income tax systems). The VAT revenue elasticity is income inelastic as expected as, on the margin, a progressive income tax system reduces the gross income available for expenditure, particularly for higher income households.

During the financial crisis, one of the key revenue-raising measures was to increase income tax revenue by introducing a new levy in 2009 and subsequently USC in 2011. As discussed in the methodology section, there is a connection between income tax and VAT stemming from the influence of marginal and average income tax rates on VAT revenue responsiveness. By employing an analytical estimation of the VAT revenue elasticity, we are able to capture this spill-over effect. As marginal income tax rates increase, the VAT revenue automatically generated from an increase in gross income decreases. The combined revenue impact from introducing a new income tax is thus less than may have been assumed at the time of the policy change. Our results underscore how decisions affecting income tax revenues may have important and unintended consequences for indirect tax revenue growth.

Figure 9: VAT revenue elasticity with respect to changes in gross income



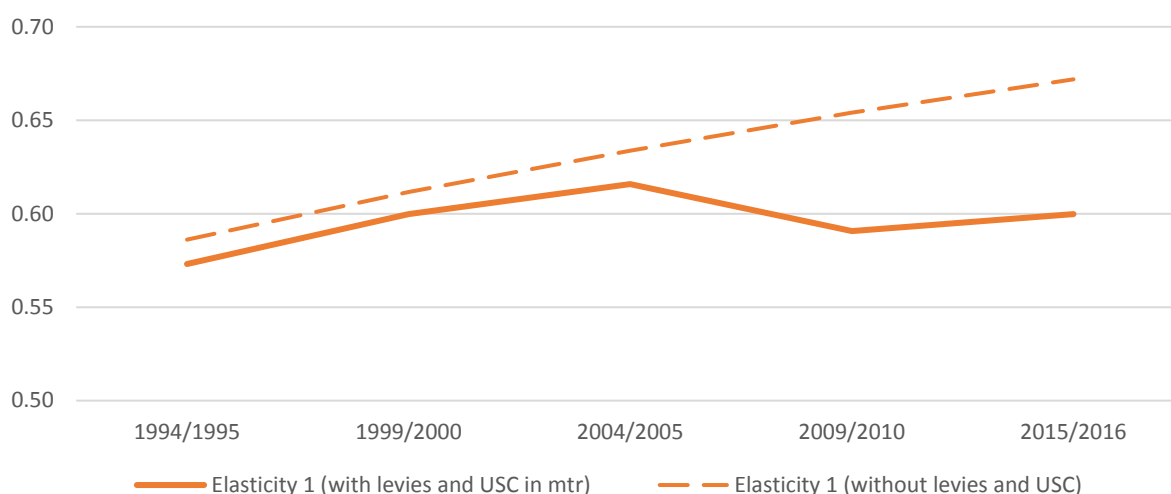
Note: expenditure here is defined as the HBS definition less pension contributions. In 2004/05, spending on SSIA is also excluded as this is a form of saving.

Turning to expenditure patterns, if the share of expenditure on goods and services liable to VAT at the standard rate increases, then the elasticity will increase; conversely, increased expenditure shares on zero-rated or exempt goods and services will reduce the elasticity.

Figure 6 demonstrated that the typical household increased its share of expenditure on positive-rated expenditure items between 1994/95 and 2004/2005, but that the share declined thereafter as housing costs increased. This change in expenditure patterns implies less VAT revenue for a given level of expenditure (or income) in the later years, and so the VAT elasticity would decline. This explanation is also consistent with what we observe in Figure 9.

However, we believe that changes in expenditure patterns play a weaker role in the elasticity compared to changes in the income tax system. This can be demonstrated by removing the health and income levies and USC from the calculation of the marginal income tax rate in all years. Figure 10 shows that when we remove these additional taxes on income, the VAT elasticity with respect to gross income rises smoothly throughout all years. Under this alternative scenario, marginal rates of income tax would have continued to fall throughout the period. Both calculations of the elasticity in Figure 10 rely on the same expenditure patterns, which indicates that the income tax system has a stronger influence on VAT revenues than even the notable developments in the Irish housing market over this time.

Figure 10: the influence of the income tax system on elasticity (1)



Note: expenditure here is defined as the HBS definition less pension contributions. In 2004/05, spending on SSIA is also excluded as this is a form of saving.

Finally, we note that the low value of the VAT revenue elasticity compared to other countries (0.6 in 2015/16) likely reflects the more progressive nature of the Irish income tax system compared to other OECD countries. The estimate for the UK in the 1990s is approximately 0.7, 0.8 for Australia in the mid-1990s and 0.9-1.0 in New Zealand in 2001, depending on assumptions about savings (see Creedy and Gemmill (2004, 2006, 2003) for further details).

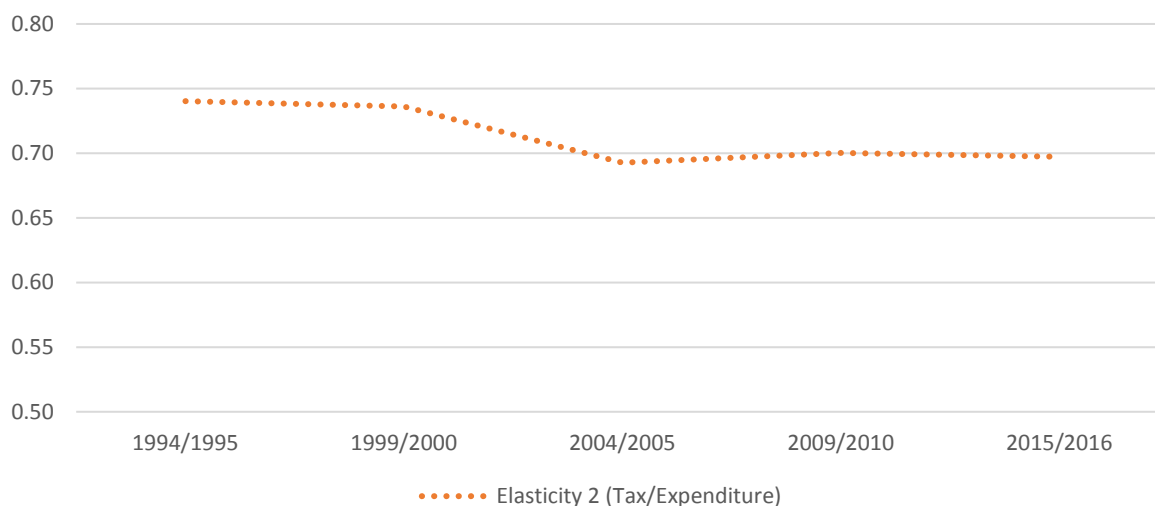
5.1.2. Response of VAT revenues to changes in household expenditure

The VAT revenue elasticity with respect to expenditure is higher than the elasticity with respect to gross income for all years (Figure 11).¹⁶ This is expected as VAT revenues will be

¹⁶ Running a log-log regression as a robustness check on our calculations, using CSO Personal Consumption Expenditure and Exchequer VAT revenue data, gives a higher value for the elasticity. This higher value can be explained by the fact that Exchequer VAT revenues include VAT from all sectors (not just households) and also includes VAT arising from the sale of new houses.

more responsive to direct changes in their base (expenditure) than to a variable that only partially determines the base (gross income). As elasticity (1) appears as part of the formula for elasticity (2), both elasticities are impacted in an identical way by changes in expenditure patterns.

Figure 11: VAT revenue elasticity with respect to changes in expenditure



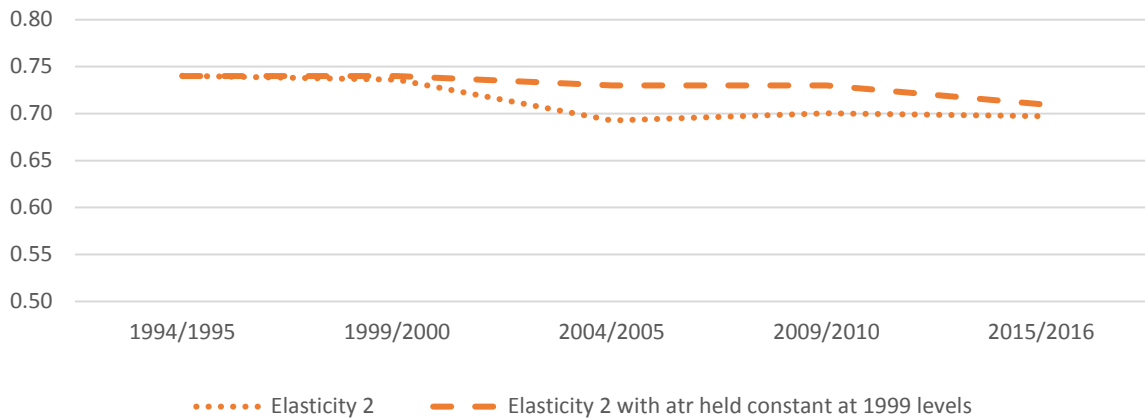
The most notable feature of the VAT elasticity with respect to expenditure in Figure 11 is that it is much lower in the 2000s than the 1990s. Based on the discussion in Section III, this may be explained by a combination of changing progressivity in the income tax system and rising savings ratios over the longer-term.

The VAT elasticity with respect to expenditure is impacted by the income tax system in a unique way, as it is only the average income tax rate that influences the result. Equation 2 shows that the elasticity increases as the average tax rate increases, albeit less than proportionally. Intuitively, this is due to the role the average tax rate plays in defining progressivity. When the average tax rate falls relatively faster for low-income taxpayers than high-income taxpayers, the progressivity of the income tax system rises and, as discussed previously, this has a knock-on effect in lowering both the VAT elasticity with respect to income and expenditure.

One prominent example of when the average tax rate fell in this manner is the 2000/01 switch to tax credits. To better understand how such changes in the income tax system may affect this VAT elasticity, we consider in Figure 12 a scenario where tax credits were not introduced in April 2001 and the tax-free allowance system continued into the 2000s.¹⁷ The analysis is performed by setting the average tax rate for all households at their 1999 pre-tax credit levels for the years 2004/05, 2009/10 and 2015/16. As can be seen from Figure 12, there is a much lower decline in the elasticity in the 2000s when it is adjusted in this manner (as the scenario implies lower income tax progressivity). The scenario demonstrates how the tax credit system plays an important role in determining average income tax rates, progressivity and therefore the VAT elasticity with respect to expenditure.

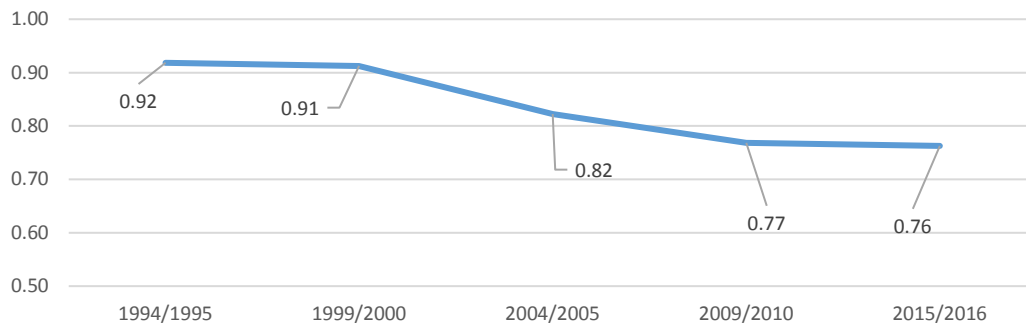
¹⁷ Savings and expenditure behaviour remain identical for the two elasticities in Figure 12.

Figure 12: the influence of the tax credit system on elasticity (2)



Another key difference between the two elasticities is that the impact of savings behaviour is explicitly modelled in the second elasticity. In equation 2, the ratio of expenditure to gross income (ci/yi) provides an indication of the savings ratio (for a given income tax structure). As highlighted directly in Figure 4 above and indirectly in Figure 13 below, the savings ratio increased over time which would cause the elasticity to fall.¹⁸ This development occurred at the same time as all households experienced falls in marginal income tax rates and the behavioural change toward increased savings is likely to be at least partially influenced by this.

Figure 13: ratio of consumption to gross income for the median household



Source: Household Budget Survey

However, as can be seen in both Figures 4 and 13, savings rose strongly in 2009/10 during the recession as households sought to repair their balance sheets and possibly as their future income expectations deteriorated. All else equal, we would expect to see a steadily declining elasticity in Figure 11 rather than the observed “level shift”. But, importantly, Ireland experienced two Budgets in 2009 which increased the health levy and introduced an income levy. As a result, average tax rates and marginal tax rates increased. The appearance of a “level shift” can thus be explained by a combination of increased savings in the 2000s relative to the

¹⁸ We note that the 2004/05 HBS contains data on household contributions to the Special Savings Incentive Account (SSIA) scheme. This variable is excluded from the paper’s definition of household expenditure and is therefore included in the savings ratio.

1990s and a one-off sharp increase in income tax in 2009, which counteracts the impact of increased savings in that year.

Overall, our analysis highlights that this elasticity is notably impacted by changes in the income tax system, changes in savings behaviour, and the interaction between the two. The lack of stability in this elasticity over time signifies the complexity of forecasting VAT revenues, as other policy parameters and savings preferences can have such a strong bearing on the results.

5.2. VAT revenue elasticity and the housing market

To further explore the relationship between VAT revenues and the housing market, we briefly examine VAT revenue responsiveness by household tenure category. During the last twenty years, the share of expenditure devoted to housing increased considerably (see Figure 7). As mortgage repayments and rent are both VAT-exempt, this may have a substantial impact on VAT revenue responsiveness. To examine this, we created disaggregated versions of the second elasticity for three household categories: owners, mortgage-holders and renters. It is evident that the latter two categories, mortgage-holders and renters, have different expenditure patterns than owners who do not have the same housing costs. It is also possible that the savings patterns of all three categories have changed in reaction to developments in the housing market. For owners and mortgage-holders, a wealth effect may have reduced the need for precautionary savings. For renters, savings may have increased in reaction to rising house prices. Furthermore, all three categories' savings ratios could plausibly be affected by changes in the income tax system too.

We find that all three tenure types show the same decline in revenue responsiveness that was documented in Figure 11 previously. The VAT elasticity with respect to expenditure is similar for renters and mortgaged households, but the owner elasticity is notably lower. This reflects their higher savings ratios (see Figure 4). Given the similarity of the disaggregated results to the aggregate result in Figure 11, developments in the income tax system - falling marginal tax rates and the switch to tax credits – again appear to be a more prominent explanation for trends in VAT revenue responsiveness than developments in the housing market.¹⁹ However, it is notable that when looking at VAT revenue responsiveness by tenure, outright ownership appears to be a more strongly differentiating factor than renters versus non-renters.

We note that older research using the HBS found no evidence for changes in the marginal propensity to consume triggered by changes in the housing market (Moreno-Badía, 2006; Hogan and O'Sullivan, 2003). Possible explanations for this may be that: households view wealth increases (i.e. house price increases) as transitory; strong bequest motives may come with this form of wealth; increased investment rather than consumption (e.g. house extensions) may occur; and households may be unable to draw equity out of the housing asset. More recent research (McCarthy and McQuinn, 2014) found evidence of a wealth effect, but tested the elasticity of consumption with respect to house prices, rather than the MPC, with the latter being the more standard indicator of a wealth effect.

¹⁹ We underline that this paper focused only on VAT revenues arising from household final expenditure; VAT revenues arising from the purchase of a new home is outside the scope of the study given the data constraints imposed by using household budget surveys.

VI Conclusions and Policy Discussion

This paper produces tractable analytical estimates of VAT revenue elasticities with respect to gross income and expenditure in Ireland for the period 1994-2016. For the most recent wave of the Household Budget Survey (2015/16), the size of the elasticity suggests that a 1% increase in gross income automatically increases VAT revenues by 0.6%. This is lower compared to estimates from other countries. A 1% increase in expenditure, on the other hand, automatically increases VAT revenues by 0.7%. It is the latter elasticity which is relevant for forecasting.

Our approach allows us to clarify the determinants of VAT revenue responsiveness. VAT responsiveness to changes in household gross income steadily increased up to the late 2000s as marginal income tax rates fell, leaving households with higher post-tax incomes. However, the introduction of the income levy and the doubling of the health levy in 2009 caused a notable decline in the automatic responsiveness of VAT revenues to income growth, as higher income tax rates reduced disposable income available for expenditure and hence the potential base to be taxed via indirect taxes.

This spill-over effect highlights the importance of judging tax policy in the round and not at the level of one individual tax. It also suggests that policymakers during any subsequent fiscal crisis should be cautious when choosing the composition of tax adjustments, as there is a clear trade-off to be made. While it may be easier to focus on each tax separately, our analysis highlights how decisions affecting income tax revenues can have important and unintended consequences for VAT revenue growth.

Expenditure patterns changed substantially over the 1990s and 2000s, as households increased their spending on VAT-exempt goods and services (in particular housing). This development would be expected to reduce VAT revenue responsiveness over time. However, and perhaps surprisingly given developments in the housing market, we find that this had a weaker impact on the VAT elasticity than developments in the income tax system. Likewise, household savings ratios increased over time, and while this had some bearing on VAT revenue responsiveness, the income tax system still emerges as the key influence.

VAT forecasting relies on the VAT elasticity with respect to expenditure. Currently, the Department of Finance uses an elasticity of 1.0 to forecast VAT revenues from all sectors of the economy, whereas our results suggest a value of 0.7 specifically for VAT revenues arising from household final expenditure. Importantly, as the calculation in this paper only concerns household final expenditure rather than the full VAT tax base, and as the elasticity is not stable over time, further analysis is required before a recommendation for tax forecasting could be made. Nevertheless, by demonstrating how VAT revenues respond to changes in the income tax system, savings and expenditure composition, this paper adds considerably to the understanding of VAT in Ireland.

Appendix 1: the Irish VAT system

Ireland adopted VAT in 1971 in preparation for joining the European Economic Community (EEC) in 1973. It replaced two pre-existing turnover taxes in Ireland. All EU member states broadly align their rules for VAT within an agreed legal framework – mainly the EU VAT Directive (2006/112/EC) - that sets out minimum and maximum rates. Like most countries, Ireland exempts financial intermediation services like banking from VAT due to the practical difficulties of administering the tax in this area. It also exempts other goods and services for social reasons, for example funeral undertaking and health services.

Ireland has five positive VAT rates, although only the three levied on the household sector are of concern in this paper. The main zero-rated items are food, oral medicines, books and children's clothes and footwear. A reduced rate of 9% (in 2018) primarily applies to labour-intensive and tourism-facing sectors such as restaurants, hotels and various entertainment services. A rate of 13.5% (in 2018) applies to fuel used for heating and lighting, new houses, construction and general repairs. To account for the fact that many farmers are not registered for VAT and therefore cannot reclaim VAT paid, a special arrangement is in place where farmers can charge VAT registered customers who can claim VAT back at a rate of 5.4% and 4.8% for livestock. All other items bear a rate of 23 percent (in 2018).

The Irish VAT system has seen very few changes for households in the period under review. The only major change of note was the introduction of the 9% reduced rate in mid-2011 (reduced from 13.5% for the majority of the goods and services in question).²⁰ The income tax system, by contrast, has changed considerably over the period: it has become more progressive and marginal tax rates have fallen at all points on the income distribution. The income levy was introduced as an additional tax on income in 2009 and the Universal Social Charge (USC) replaced both this and the health levy in 2011.

The Irish VAT system is highly non-uniform, in fact more so than most EU states with the exception of the UK. Large components of domestic consumption are exempt and there is more than one positive rate. This design is historical in nature, reflecting the fact that the turnover taxes, which were replaced by VAT, were also highly non-uniform. It also reflects distributional objectives. Nevertheless, VAT is found to be regressive with respect to the income distribution and roughly proportional with respect to the expenditure distribution.

From an international aspect, while VAT is applied in many countries, it is not universally applied. The standard VAT rates across the EU range between 17% (Luxembourg) and 27% (Hungary) and averages 21.5%. Most EU countries also have reduced rates of VAT, often as low as 5%, and some exemptions. Apart from heterogeneity with respect to VAT rates, there is also a significant difference in the importance of VAT as a source of revenue. For the EU the average tax revenue raised through VAT equates to 7% of GDP and 26% of total tax receipts. Again, there is significant variation with VAT accounting for just 21% of tax receipts in Italy while accounting for 50% in Croatia in 2016.

²⁰ There have been various VAT changes for farmers, but these are outside the scope of this paper.

Appendix 2: HBS details

HBS wave	Survey period	Number of households surveyed
1994-1995	May 1994 and July 1995	7,877
1999-2000	June 1999 and July 2000 inclusive	7,644
2004-2005	October 2004 and December 2005 inclusive	6,884
2009-2010	August 2009 and September 2010 inclusive	5,891
2015-2016	February 2015 and February 2016 inclusive	6,839

Appendix 3: checking HBS data against other sources of aggregate data

HBS wave	Total household expenditure calculated in the HBS as a proportion of final consumption expenditure of households and NPISH in the Institutional Sector Accounts	Total household expenditure calculated in the HBS as a proportion of final consumption expenditure of households and NPISH in the Institutional Sector Accounts <i>less imputed rent*</i>	Total VAT revenue calculated in HBS as proportion of <u>household</u> VAT revenue from Exchequer returns**
1994-1995	73%	80%	73%
1999-2000	77%	87%	70%
2004-2005	79%	90%	65%
2009-2010	73%	84%	68%
2015-2016	81%	94%	71%
Average	76%	87%	69%

*Imputed rent is included in the Institutional Sector Accounts to ensure home ownership patterns do not distort macroeconomic aggregates. It is not appropriate to include it when making a comparison with household-level microeconomic data.

** Data from the Exchequer returns do not distinguish VAT liabilities by sector or economic activity. However, the European Commission has estimated the share attributable to household final consumption and their analysis is used in this calculation. Typically, the household sector's share is roughly two-thirds of total VAT liabilities in Ireland (European Commission, 2017).

The low coverage of household VAT revenues in the HBS (69 percent of the equivalent Exchequer figure on average) is partially explained by the well-known under-reporting of expenditure on alcohol and tobacco in household surveys. In 2015/16, for example, this under-reporting accounts for roughly half of the gap between the HBS estimate of VAT revenues and the equivalent figure derived from the Exchequer returns.

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