OECD Taxation Working Papers No. 49

Reassessing the regressivity of the VAT

Alastair Thomas

https://dx.doi.org/10.1787/b76ced82-en

OECD

OECD Taxation Working Papers

Reassessing the regressivity of the VAT

By Alastair Thomas

OECD Working Papers should not be reported as representing the official views of the OECD or of its member countries. The opinions expressed and arguments employed are those of the author(s).

Working Papers describe preliminary results or research in progress by the author(s) and are published to stimulate discussion on a broad range of issues on which the OECD works. Comments on Working Papers are welcomed, and may be sent to the Centre for Tax Policy and Administration, OECD, 2 rue André-Pascal, 75775 Paris Cedex 16, France (ctp.contact@oecd.org).

This working paper has been authorised for release by the Director of the Centre for Tax Policy and Administration, Pascal Saint-Amans.

This document and any map included herein are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Abstract

This paper reassesses the often-made conclusion that the VAT is regressive, drawing on tax microsimulation models constructed for an unprecedented 27 OECD countries. The paper first assesses the competing methodological approaches used in previous distributional studies, highlighting the distorting impact of savings patterns on cross-sectional analysis when VAT burdens are measured relative to income. As argued by IFS (2011), measuring VAT burdens relative to expenditure – thereby removing the influence of savings – is likely to provide a more meaningful picture of the distributional impact of the VAT. On this basis, the VAT is found to be either roughly proportional or slightly progressive in most of the 27 OECD countries examined. Nevertheless, results for a small number of countries highlight that broad-based VAT systems that have few reduced VAT rates or exemptions can produce a small degree of regressivity. Results also show that even a roughly proportional VAT can still have significant equity implications for the poor – potentially pushing some households into poverty. This emphasises the importance of ensuring the progressivity of the tax-benefit system as a whole in order to compensate poor households for the loss in purchasing power from paying VAT. In the broader context of the COVID-19 crisis, the findings of the paper suggest there may be scope in many countries for VAT reform to help address revenue needs, as this revenue may be generated with less significant distributional effects than previously thought. While standard VAT rates are high in many countries, OECD evidence shows that scope exists to broaden VAT bases. Nevertheless, any VAT increases, including VAT base broadening measures that impact the poor, should be accompanied by compensation measures for poorer households, such as targeted tax credits or benefit payments.

Table of contents

REASSESSING THE REGRESSIVITY OF THE VAT

Alastair Thomas[1]

1. Introduction

This paper reassesses the often-made conclusion that the value-added tax (VAT)[2] is a regressive tax. The paper first assesses the competing methodological approaches used in previous studies of the distributional effects of the VAT. It then draws on a household expenditure microdata set of unprecedented size to examine the distributional effects of the VAT in 27 OECD countries. A consistent microsimulation methodology is adopted to ensure cross-country comparability of results.

Most previous studies examining the distributional effects of the VAT have used cross-sectional household expenditure microdata to calculate and present average VAT rates measured in relation to either income or expenditure. This choice between income- or expenditure-based analysis has proved determinative. The common finding that the VAT is regressive has followed from the analysis of VAT burdens measured as a percentage of current income across the income distribution. Numerous European country studies (e.g., Leahy et al., 2011; Ruiz and Trannoy, 2008; O'Donoghue et al., 2004) adopt this analytical approach, and as a result conclude the VAT is a highly regressive tax. In contrast, studies that present VAT burdens as a proportion of current expenditure across either the income or expenditure distribution (e.g. Bird and Smart, 2016; IFS, 2011; Metcalf, 1994) tend to find that VAT systems are relatively proportional, or even slightly progressive.

As has been highlighted by various authors (e.g. IFS, 2011; Creedy, 1998; Metcalf, 1994), a key problem with the income-based approach is that it fails to account for savings behaviour. More specifically, it ignores the fact that income that is saved in the current year will still incur VAT when it is eventually consumed (as this VAT cannot be captured by an analysis based on data from a single year). Similarly, current expenditure, and the VAT incurred on it, may have been funded from income

[1] The author is a Senior Economist in the OECD's Centre for Tax Policy and Administration. This paper revises and substantially extends work presented in chapter 2 of OECD/KIPF (2014). Thanks for helpful comments to: Piet Battiau, David Bradbury, Bert Brys, Stéphane Buydens, Orsetta Causa, Boris Cournede, John Creedy, Florens Flues, Norman Gemmell, Michelle Harding, Erin Hengel, Dimitra Koulouri, Pierre LeBlanc, Horacio Levy, Giorgia Maffini, Stephen Matthews, Michael Sharratt, Kurt Van Dender, and country delegates to Working Party No 2 (WP2) on Tax Policy Analysis and Tax Statistics and Working Party No 9 (WP9) on Consumption Taxes of the OECD Committee on Fiscal Affairs. Financial support of this research from the Korea Institute of Public Finance (KIPF) and the European Commission is gratefully acknowledged. Thanks also to Eurostat, the KIPF, and the National Statistical Offices of Chile, New Zealand, Switzerland and Turkey for access to and assisistance with the household expenditure microdata used in this study.

[2] The term "VAT" is used to refer to any national tax by whatever name or acronym it is known such as Goods and Services Tax (GST) that embodies the basic features of a value-added tax i.e. a broad-based tax on final consumption collected from, but in principle not borne by, businesses through a staged collection process, whatever method is used for determining the tax liability (e.g. invoice-credit method or subtraction method).

earned in a previous year. Because savings rates tend to increase with income, this biases income-based VAT burden results downwards at higher income levels – hence the common conclusion that the VAT is regressive.

To fully take account of the impact of savings behaviour, a lifetime (or at least multi-period) analysis would ideally be undertaken, including the calculation of both lifetime income and lifetime VAT burdens. Unfortunately, any attempt at estimating lifetime income and lifetime VAT burdens is highly complex, even in a single-country context, and simply impracticable in a 27-country study such as this. However, in the absence of such information, measuring VAT burdens relative to current expenditure is likely to provide a more meaningful estimate of the lifetime distributional impact of the VAT than measuring VAT burdens relative to current income.

Effectively, measuring VAT burdens relative to current expenditure removes the influence of savings behaviour. It instead identifies how the presence of reduced VAT rates and exemptions move the actual VAT burden away from what would be due under a perfectly broad-based single-rate system (where all households would pay the same proportion of their expenditure in VAT). If consumption preferences and tax rates do not change over time, then such expenditure-based analysis will perfectly proxy a lifetime analysis. However, even where these assumptions fail to hold, as it is unaffected by savings behaviour, an expenditure-based analysis will still be preferable to an income-based analysis.

The microsimulation results for the 27 countries examined broadly confirm the dichotomous results from the previous smaller-scale studies: the VAT appears to be regressive when measured as a percentage of current income in all 27 countries, but appears generally either proportional or slightly progressive when measured as a percentage of current expenditure. Savings patterns are also shown to be consistent across all 27 countries, with savings rates increasing as income increases and thereby driving the regressivity of the income-based results.

The expenditure-based average tax rate results are confirmed by calculations of expenditure-based summary indicators of progressivity and redistribution. Kakwani progressivity index results show a low degree of progressivity of the VAT in almost all countries, often extremely close to proportionality. The exceptions are Chile, Hungary, Latvia and New Zealand, where a very small degree of regressivity is found. Reynolds-Smolensky and Atkinson index results show the VAT to have minimal redistributive effect, despite significant average tax rates being applied.

To examine the effect of the VAT on the poor, the paper also calculates a range of Foster-Greer-Thorbecke poverty indices. Based on a relative poverty line of 50% of median equivalised individual gross expenditure, results show that the imposition of VAT increases the number of individuals below

the poverty line (the poverty headcount) by three percentage points, on average, from 8.1 to 11.1%. Poverty gap and squared poverty gap index calculations show similar increases.

Overall, the paper concludes that the VAT is generally either roughly proportional or slightly progressive, with this progressivity driven by the presence of reduced VAT rates and exemptions. This strongly contrasts with the general public perception, and the conclusion of much of the previous academic literature, that the VAT is regressive. Nevertheless, the results for Chile, Hungary, Latvia and New Zealand highlight that broad-based VAT systems that have few reduced VAT rates or exemptions can still produce a small degree of regressivity.

Furthermore, the results clearly show that even a roughly proportional VAT can still have a significant impact on the wellbeing of the poor – pushing some into poverty. This emphasises the importance of ensuring the progressivity of the tax-benefit system as a whole in order to compensate poor households for the loss in purchasing power from paying VAT.

In the broader context of the Covid-19 crisis, the findings of the paper suggest there may be scope in many countries for VAT reform to help address governments' revenue needs, as this revenue may be generated with less significant distributional effects than previously thought. While standard VAT rates are high in many countries, there is merit in considering raising revenue through the removal of reduced VAT rates that previous OECD research has shown to be highly ineffective at achieving distributional goals (OECD/KIPF, 2014). Nevertheless, the paper also illustrates that such reform should be accompanied by additional measures – for example, targeted tax credits or benefits – to compensate poorer households and prevent them falling into poverty.

This paper proceeds as follows: Section 2 briefly summarises previous empirical studies examining the distributional effects of the VAT. Section 3 then presents a simple two-period model to illustrate the distorting impact that savings behaviour has on distributional analysis based on cross-sectional data when VAT burdens are measured relative to income. Section 4 introduces the non-behavioural microsimulation methodology, and Section 5 presents the modelling results for 27 OECD countries. Section 6 provides some concluding comments.

2. Previous studies

A number of empirical studies have examined the distributional impact of the VAT. These have typically been undertaken using household expenditure survey microdata. The use of microdata enables the fine distinctions present in many countries between expenditure categories subject to different VAT rates to be accurately modelled. It also provides flexibility regarding how to measure distributional effects. In most cases, average VAT burdens measured as a percentage of disposable income or gross

(VAT-inclusive) expenditure are presented across equivalised disposable income or gross expenditure deciles, though summary measures of redistribution, progressivity and poverty effects are also often applied.[3] This section provides a summary of recent microdata-based studies of the distributional effects of the VAT.[4] It first discusses papers that favour analysing VAT burdens relative to current income, and then papers favouring an expenditure-based approach.

The most substantial cross-country study following the income-based approach is O'Donoghue et al. (2004). They incorporate household expenditure information into the EUROMOD tax-benefit microsimulation models for 12 European countries in order to compare the redistributive effects of consumption taxes with income taxes and social security contributions. The countries covered were Belgium, Finland, France, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom, drawing on household expenditure survey microdata from 1990-1996, depending on the country. They present tax burdens as a percentage of both disposable income and expenditure across equivalised disposable income deciles (as well as income-based Kakwani progressivity index results). However, they favour measuring consumption tax burdens as a percentage of income, and consequently conclude that both VAT and excise taxes are strongly regressive. In contrast, they find that benefits, pensions, and direct taxes produce significant progressivity.

Leahy et al., (2011) make the same regressive conclusion regarding the VAT in Ireland based on 2005 household expenditure survey microdata. They also find that removing the reduced VAT rates (i.e. aligning these rates with the standard VAT rate) on food and children's clothing would be regressive. Ruiz and Trannoy (2008) use 2001 household expenditure microdata for France, concluding also that consumption taxes are highly regressive (measured as a percentage of disposable income across equivalised disposable income deciles). They also simulate several reforms, including a revenue-neutral move to a single-rate VAT system. The simulation results highlight that in each income decile there are both winners and losers from such a reform. They conclude that the income tax, rather than consumption taxes, should be used for addressing redistributive objectives. Barreix, Bes and Roca (2009) present the results of several studies undertaken in Latin American countries between 2000-2004 which find similar regressive results following an income-based approach.[5]

[3] Disposable, rather than gross, income is typically used to remove the influence of the personal income tax.
[4] Warren (2008) summarises a number of earlier studies and provides a broad review of the different approaches to modelling the distributional effects of consumption taxes.
[5] Bachas et al. (2020) estimate informality Engel curves for 26 predominantly developing countries. They find that informality decreases as household expenditure increases, and conclude that this will create a degree of progressively in the VAT in developing countries. Similarly, Jenkins et al. (2006) find that informality creates progressivity in the VAT in the Dominican Republic.

Decoster et al. (2010) present results both as a proportion of disposable income and expenditure, noting the case for each approach but not stating a definitive preference for either. Using 1999-2005 household expenditure survey microdata for Belgium, Greece, Hungary, Ireland and the United Kingdom, they find consumption taxes to be regressive in all five countries when measured as a proportion of disposable income across income deciles, and proportional or progressive as a proportion of expenditure. Figari and Paulus (2012) draw on the same models as Decoster et al. (2010) to examine the redistributive impact of indirect taxes, imputed rent, cash transfers and direct taxes in the same five countries. They favour measuring indirect tax burdens relative to income in order to compare results with direct taxes, and conclude that indirect taxes are regressive in all five countries.

ONS (2019) presents results for the United Kingdom as a proportion of both disposable income and expenditure, but, as with Decoster et al. (2010), they do not express a clear preference for either approach. Using 2018 household expenditure survey microdata, they conclude that the VAT, and indirect taxes as a whole, are regressive when measured as a percentage of disposable income and "broadly neutral" when measured as a percentage of expenditure across the income distribution.

The most substantial cross-country study definitively favouring the expenditure-based approach is IFS (2011). They drew together nine different country-specific studies with broadly similar microsimulation methodologies. The countries covered were Belgium, France, Germany, Greece, Hungary, Italy, Poland, Spain and the United Kingdom. The household expenditure survey microdata used ranged from 2004 to 2009, depending on the country. IFS (2011) present tax burdens as a percentage of both disposable income and expenditure (but across both equivalised disposable income and expenditure deciles). However, they argue that, due to the ability to borrow and save, measuring VAT as a percentage of income can create a misleading impression of the distributional effect of the VAT. As such, they conclude that expenditure-based results provide a better picture of the distributional effect of the VAT. Unsurprisingly, they find the VAT to be regressive in all nine countries when measured as a percentage of disposable income across income deciles. However, they found the VAT to be either roughly proportional or progressive in eight of the nine countries (Spain being the exception) when measured as a percentage of expenditure across equivalised income deciles (and in all nine countries across expenditure deciles).

Bird and Smart (2016) use 2009 household expenditure microdata to examine consumption taxes in Canada. As with IFS (2011), they argue that there is a better case for using consumption rather than income as the base for evaluating the progressivity of consumption taxes. On this basis, they conclude that the GST in Canada is mildly progressive. They find excise taxes to be regressive, although the progressivity of the GST means that the overall impact of consumption taxes is roughly proportional. Meanwhile, Bover et al. (2017) present results based on 2015 household expenditure data for Spain as

a percentage of both disposable income and expenditure, finding regressive and broadly proportional patterns, respectively. They prefer the expenditure-based approach on the grounds that expenditure rather than income is the legal base of the tax.

While the United States does not have a VAT, earlier work by Metcalf (1994) uses household expenditure microdata for 1990 to simulate its introduction. He presents simulated VAT burdens measured as a percentage of both gross income and expenditure, concluding that a VAT in the United States would be roughly proportional on a lifetime basis with expenditure used as a proxy for lifetime income. As with other studies, he finds the VAT would be regressive as a percentage of current income.[6] Caspersen and Metcalf (1994) go further and attempt to estimate lifetime income using panel income data for the United States that they then match with 1988 household expenditure microdata to simulate household VAT burdens as a percentage of lifetime income. They conclude a VAT in the United States would be slightly regressive based on their measure of lifetime income, and proportional using current expenditure as a proxy for lifetime income.

While not based on microdata, a final study of interest given its wide country coverage is IHS et al. (2015) which uses semi-aggregate expenditure data from 2005 to examine the distributional effects of the VAT in the 27 European Union (EU) member countries. They follow IFS (2011) in favouring the expenditure-based approach, and present average VAT burdens as a percentage of expenditure across disposable income quintiles. They find VAT systems to be broadly proportional or slightly progressive in all 27 EU member countries, with the exception of Hungary where the VAT was found to be slightly regressive. Their results must be considered with some caution because the use of aggregated data imposes a number of limitations on the analysis – in particular, it limits the ability to match expenditure categories to the correct VAT rates, and precludes household equivalisation adjustments. That said, they compare their aggregated data results with microdata-based results for three countries (Austria, Italy and the United Kingdom) and find them to be broadly similar.

3. The impact of savings on cross-sectional analysis of VAT burdens

As has been highlighted by various authors (e.g. IFS, 2011; Creedy, 1998; Metcalf, 1994; Caspersen and Metcalf, 1994), the driver of the stark difference in results between the income-based and expenditure-based approaches to measuring the distributional impact of a VAT (or other broad-based consumption tax) is the influence of savings behaviour. Specifically, a single-year income-based analysis ignores the fact that income that is saved in the current year will still incur VAT when it is

[6] Brashares et al. (1988) also present regressive income-based results for the United States, though they note there is a case for considering a lifetime analysis. The focus of their study is on examining design options to lower the VAT burden on low-income households.

eventually consumed. Similarly, current expenditure, and the VAT incurred on it, may have been funded from income earned in a previous year. Because savings rates tend to increase with income, this biases income-based VAT burden results downwards at higher income levels – hence the common conclusion that the VAT is regressive.

To fully account for the impact of saving behaviour, a lifetime (or at least multi-period) analysis – including calculation of both lifetime income and lifetime VAT burdens – would ideally be undertaken. Unfortunately, any attempt at estimating lifetime income and lifetime VAT burdens is highly complex, even in a single-country context, and simply impracticable in a 27-country study such as this. However, in the absence of such information, measuring VAT burdens relative to current expenditure is likely to provide a more meaningful estimate of the lifetime distributional impact of the VAT than current income would. This is illustrated below in a simple two-period model.

Consider a taxpayer that earns income of y_1 in period 1 and y_2 in period 2. Savings, equal to s, occurs in period 1 and is fully spent in period 2. For simplicity, bequests are ignored (although they could be incorporated without altering the results).[7] Also for simplicity, a two-rate VAT system is assumed, with x% of the taxpayer's consumption subject to taxation at rate t, and $(1-x)$% subject to a zero tax rate. If income from savings is not taxed[8] and the return on savings equals the discount rate, savings will cancel out over the two periods, so that the net present value of lifetime income, Y_{npv}, and lifetime consumption, C_{npv}, are the same and are equal to:

$$Y_{npv} = C_{npv} = (y_1 - s) + \frac{(y_2 + s(1+r))}{1+r}$$

$$= y_1 + \frac{y_2}{1+r}$$

The net present value of tax payments, T_{npv}, is:

$$T_{npv} = tx(y_1 - s) + \frac{tx(y_2 + s(1+r))}{1+r}$$

$$= tx(y_1 + \frac{y_2}{1+r})$$

[7] In order to avoid the double counting of income, bequests received would be included in period 1 income, and bequests given would be subtracted from period 2 income. The analysis then remains unchanged as long as t and x remain constant for both donor and recipient. Note that, while it could be argued that donors derive some consumption value out of providing a bequest, this would lead to the double counting of at least some income.

[8] If income from savings is taxed (as is common), then the income saved may incur higher total (income plus consumption) taxation than income immediately spent. However, as Creedy (1998) emphasises, it would be erroneous to attribute this increased tax burden to the VAT. Indeed, the NPV of the VAT paid (as opposed to income tax) will be unaffected by the taxation of income from savings as long as the taxpayer's discount rate equals the after-tax return on savings.

As such, the average tax rate paid over the taxpayer's lifetime is:

$$\frac{T_{npv}}{Y_{npv}} = tx$$

Knowing the lifetime average tax rate, this can then be compared with income-based and expenditure-based calculations of the average tax rate for a single period. If data are only available for period 1, the income-based average tax rate, calculated as t_1/y_1, is:

$$t_1/y_1 = \frac{tx(y_1 - s)}{y_1}$$

It is clear from this that, if any savings occurs, the income-based single period average tax rate will be an inaccurate measure of the lifetime average tax rate. Households that save will have a lower single period average tax rate than their lifetime average tax rate (the greater the amount of savings the lower the average tax rate). Meanwhile, households that dis-save will have a higher average tax rate than their lifetime average tax rate. If richer households save a greater proportion of their income than poorer households (which, as shown in Section 5, is true on average in all 27 countries), then the average tax rate for richer households will be lower than for poorer households and the VAT will appear regressive.

In contrast, the expenditure-based average tax rate, calculated as t_1/c_1, is exactly the same as the lifetime average tax rate:

$$t_1/c_1 = \frac{tx(y_1 - s)}{(y_1 - s)}$$

$$= tx$$

Measuring VAT burdens relative to current expenditure, rather than income, removes the influence of savings behaviour. The average tax rate is instead driven by the consumption pattern of the household, as captured by x. The distributional impact of the VAT is therefore driven by how x varies across taxpayers. If x is constant across all taxpayers then the VAT will be proportional. However, if x is lower for poorer taxpayers – i.e. if a smaller proportion of poorer households' expenditure is subject to the standard VAT rate than of richer households' expenditure – then the VAT will be progressive. Conversely, if x is higher for poorer taxpayers then the VAT will be regressive. This is of course an empirical question, which is examined in the microsimulation modelling to follow.[9]

[9] In practice, VAT structures are typically more complex than in this simple model, often involving multiple reduced VAT rates as well as exemptions. However, it remains the variation in consumption patterns across households that drives the distributional impact of the VAT – variation which is captured in the underlying HBS data used in the modelling to follow.

In practice, the expenditure-based current period average tax rate will still be an imperfect estimate of the lifetime average tax rate. In particular, the above model assumes that both t and x are constant over the taxpayer's lifetime. If, however, VAT rates decrease over time then the taxpayer's lifetime tax burden will be overestimated (and vice versa). Likewise, if the household's expenditure pattern shifts over time towards less heavily taxed goods, then the lifetime tax burden would also be overestimated (and vice versa).[10] This could have a regressive impact if, for example, the richest households spend a greater proportion of their savings on less-taxed items such as private education than other households do. Despite these limitations, by removing the strong influence of savings behaviour, analysis based on current expenditure will still provide a far more accurate picture of the distributional effect of the VAT than an analysis based on current income.

A number of additional arguments can also be made for preferring an expenditure-based analysis over an income-based analysis. These include that current expenditure may provide a better measure of an individual's welfare than current income (see, for example, Meyer and Sullivan, 2003), and that current expenditure may be a better proxy for lifetime income than current income (see, for example, Metcalf, 1994).[11] More generally, it is arguable that any tax should be assessed relative to its base because a tax cannot redistribute something that it is not applied to – and the base of the VAT is expenditure. Importantly, as emphasised by IFS (2011), the above savings-based rationale does not rely in any way on these additional arguments. Eliminating the distorting impact of savings behaviour remains the clearest rationale for preferring an expenditure-based analysis.

Section 5 presents both income- and expenditure-based results, together with savings patterns, for all 27 countries to further illustrate the distorting impact of savings behaviour on income-based results. But conclusions regarding the distributional effects of the VAT reflect the expenditure-based results.

4. Methodology

4.1. Data

The microsimulation models use expenditure microdata from household budget surveys (HBSs) to model the VAT in 27 OECD countries. The HBSs are sample surveys of households carried out

[10] As noted above, if bequests are incorporated into the model, then t and x should also be constant for both donor and recipient.

[11] There is some debate as to whether consumption provides a good proxy for lifetime income as this is based on the idea that households smooth consumption across their lifetimes as predicted by the life-cycle and permanent-income hypotheses. These hypotheses are debated though. For example, the estimated presence of a fraction of individuals who consume their current income rather than their permanent income indicates a substantial departure from the permanent-income hypothesis. Flavin (1981) and Campbell and Mankiw (1989, 1990) report that consumption is sensitive to income, and suggest that the permanent income hypothesis is not valid because some consumers are credit-constrained and spend their entire income. Factors such as inheritance, insurance and habits may also affect individuals' savings and consumption.

periodically by National Statistical Offices. They provide detailed information on household consumption expenditure on goods and services, possession of durable goods and housing. They also offer demographic and socio-economic characteristics, including disposable income.

To enhance consistency across countries, standardised Eurostat-format HBS microdata are used where possible. For countries where data are not available in this format, national survey data are adjusted to match as closely as possible the Eurostat format. This harmonised format enables a standard model to be developed and applied to each country. Microdata for 27 OECD countries has been obtained.

The Eurostat-format HBS microdata are provided by European Union countries to Eurostat once every five years. The data in the most recent data-provision round (the "2010 wave") relate to various years from 2008 to 2012, and were made available to researchers in 2016. The countries for which Eurostat-format data have been obtained (with year in parenthesis) are: Finland (2012); France, Portugal (2011); Belgium, the Czech Republic, Denmark, Estonia, Greece, Hungary, Ireland, Italy[12], Latvia, Luxembourg, Poland, the Slovak Republic, Slovenia, Spain, Sweden, the United Kingdom (2010); Austria (2009); Germany (2008); and the Netherlands (2004). Data for the Netherlands is from Eurostat's 2005 data-provision round. Non-Eurostat format microdata has also been obtained for: New Zealand (2016)[13]; Chile, Korea (2012); Switzerland (2011); and Turkey (2010).[14]

The standardised Eurostat format breaks household expenditure into more than 200 different categories, thereby enabling the often fine distinctions between expenditure categories subject to different VAT rates to be accurately modelled. Data for Chile, New Zealand, Korea and Switzerland provide an even greater number of expenditure categories.

As with any survey data, the HBS data are subject to some limitations. In particular, the representativeness of the data may be affected by sampling error, though this will be lower the larger the sample size. While sample sizes vary considerably, they are greater than 3,000 in 23 of the 27 countries (see Table 1). The representativeness of the Czech Republic and German surveys is also questionable as these two countries adopt a quota selection rather than probability sampling approach.[15]

[12] Note that the data for Italy does not include an income variable, which limits some of the analysis that can be undertaken for this country.
[13] Access to the New Zealand Household Economic Survey data used in this study was provided by Statistics New Zealand under conditions designed to give effect to the security and confidentiality provisions of the Statistics Act 1975. The results presented in the study are the work of the author, not Statistics New Zealand.
[14] A new round of HBS microdata (relating for the majority of countries to surveys undertaken in 2015) is expected to be made available to researchers by Eurostat in late 2020.
[15] See Eurostat (2015) for a discussion of the accuracy of the 2010 wave of Eurostat HBS microdata.

Table 1. Household Budget Survey datasets

	Year	Sample size
AUT	2009	6,534
BEL	2010	7,177
CHE	2011	9,730
CHL	2012	10,528
CZE	2010	2,932
DEU	2008	53,996
DNK	2010	2,484
ESP	2010	22,203
EST	2010	3,632
FIN	2012	3,551
FRA	2011	15,797
GBR	2010	5,263
GRC	2010	3,512
HUN	2010	9,937
IRL	2010	5,891
ITA	2010	22,246
KOR	2012	13,463
LUX	2010	3,492
LVA	2010	3,798
NLD	2004	1,570
NZL	2016	3,490
POL	2010	37,412
PRT	2011	9,489
SLV	2010	3,924
SVK	2010	6,143
SWE	2010	2,047
TUR	2010	10,082

Non-sampling errors are also possible. For example, measurement error may occur – due either to inaccurate recall or to intentional under-reporting of certain types of expenditure (such as alcohol, tobacco and gambling). Non-response bias may occur, although survey weights are typically adjusted to account for non-response. There are also coverage limitations, as surveys typically aim to measure only expenditure in private households (excluding, therefore, collective households such as retirement homes, boarding schools and prisons). Finally, a small number of data entry errors also appear to have occurred in some surveys – with, for example, an unrealistically high expenditure level for a particular item, or zero expenditure being reported for all food categories.

The reliability of the income data is also an issue. Previous studies (e.g. Decoster et al., 2010) suggest that income is generally under-reported to at least some extent in household budget surveys. There is also evidence to suggest that income may tend to be under-reported to a greater extent for some income

sources (e.g. self-employment income) than others (see, for example, Hurst et al., 2014). Additionally, income data at low income levels may be misleading due to the presence of households with transitorily low income (Bozio et al., 2012; Decoster et al., 2010).

To mitigate data quality concerns, a number of observations were removed from the sample prior to undertaking simulations. These were: observations with an expenditure-to-income ratio greater than four; observations with negative income; and observations with zero food expenditure.

4.2. The microsimulation models

The microsimulation models are constructed for each country by matching the detailed expenditure categories from the HBS data to their corresponding VAT rates (as applicable in the year of the HBS data).[16] A microsimulation program then calculates the amount of VAT paid by each household by applying the VAT rates to the corresponding expenditure amounts (working backwards from gross expenditure, as the tax base is net expenditure). The models calculate VAT burdens for each household, and these amounts are then weighted up to the population using household survey weights. A number of assumptions and adjustments are made in undertaking these calculations as described below.

The modelling assumes that the VAT is fully passed through to the final consumer in prices. This is a standard assumption made in the empirical literature (see, for example, IFS, 2011; Leahy et al., 2011; Decoster et al., 2010). In theory, it is possible for the VAT to be less than fully or even more than fully passed on to consumers, depending on the structure of the particular market. Empirical evidence, however, is inconclusive, and so full pass-through is assumed in the absence of clear guidance to the contrary.[17]

Modelling consumer durables and housing poses a problem as these are infrequent purchases and the HBS data only provides a snapshot of expenditure. Ideally, the cost of durables would be apportioned over their useful life in order to reduce any overstatement of expenditure for households that have

[16] VAT rates were taken from various editions of the OECD's "Consumption Tax Trends" publication (OECD, 2006-2016) and the European Commission's "VAT Rates Applied in the Member States of the European Union" publication (European Commission, 2004-2012), and were verified by country delegates to Working Party No. 9 on Consumption Taxes of the OECD's Committee on Fiscal Affairs. Verification of rates by national officials occurred as part of an OECD project undertaken by the author on the "Distributional Effects of Consumption Taxes in OECD Countries".

[17] IHS (2011) present a detailed review of both the theoretical and empirical literature on VAT pass-through. They find a wide range of empirical results in the literature, covering full, less than full, and more than full pass-through. They conclude that full pass-through is more likely to be found in more competitive markets and for broader VAT reforms. More recently, Benzarti et al. (2020) find evidence for European countries of significantly stronger pass-through of VAT increases than VAT decreases. In contrast, Benedek et al. (2019) find no significant evidence of asymmetric responses to price changes in European countries. They also find roughly full pass-through of standard VAT rate changes, but only around 30% pass-through for changes in reduced VAT rates. Meanwhile, Gaarder (2018) finds the introduction of a reduced VAT rate on food in Norway to have resulted in full pass-through to prices.

undertaken such purchases during the survey period (or any understatement for households that made such purchases outside the survey period). However, this would require accurate information on length of ownership and expenditure on durables (both purchased within and outside the survey period), and is therefore not a feasible option. On the other hand, not modelling consumer durables would underestimate consumption and tax revenue significantly. I therefore include consumer durables in the modelling with the sole exception of motor vehicles. Motor vehicles are excluded on the basis that they are the largest infrequently purchased consumer durable and their inclusion would be the most likely to impact the expenditure-based ranking of households implicit in the summary indicators presented in Section 5.

The HBS data does not include a variable for house purchases. However, actual rental expenditure is available in all 27 countries and imputed rental expenditure in 23 countries. For countries where both rental and imputed rental expenditure data are available, both are included in the modelling to ensure comparability between renters and homeowners. For countries where only actual rental expenditure is available, this is excluded from the modelling – again to ensure comparability between renters and homeowners. Imputed rental income (varying from imputed rental expenditure due to mortgage costs) is available for 20 countries and is included where available.

A final modelling difficulty relates to exempted goods and services. While no VAT is imposed on sale to the final consumer, some VAT may still be embedded in the final price due to the inability of businesses to claim input tax credits in relation to the production of exempted goods and services. Input-output tables could potentially be used to estimate this embedded tax separately for each country.[18] However, such a resource intensive exercise is beyond the scope of this paper. Instead, VAT exemptions are treated as zero rates in the modelling. This assumption, however, is likely to result in some underestimation of actual VAT revenue in the models.

4.3. Accuracy of the models

The aggregate VAT revenue simulated by the models does not correspond with the VAT revenue actually collected in the corresponding year (in general it is underestimated). This is largely due to issues already discussed above: the under-reporting of some expenditure by households; coverage being limited to private households; the exclusion of expenditure on motorcars and housing (as new house purchases are often subject to VAT); and treatment of VAT exemptions as zero rates.[19] In addition, fraud is not simulated in the models – which may result in some overestimation of revenue.

[18] See Warren (2008) for a discussion of the use of input-output tables.
[19] The imposition of VAT on new house purchases is intended to proxy for the imposition of VAT on housing rent. The actual incidence is subject to some debate, but where the VAT is passed on in the form of higher rent, this embedded VAT will not be captured in the modelling.

Regarding the coverage of the HBS data, in addition omitting VAT paid by collective households, VAT paid by the public sector, charities and businesses will also not be accounted. That said, as businesses can be expected to pass on the VAT to the final consumer this VAT will still generally be captured in the micro-data. However, annual revenue figures may include some VAT paid by businesses that has not yet been passed on to the consumer (and not yet claimed back by the business) and this VAT will not be simulated by the model.

4.4. Presentation of results

The models are used to produce a range of results that are presented in the next section. Average VAT rates are calculated for each household, using both disposable income and gross expenditure as the welfare metric, and are calculated across both disposable income and gross expenditure deciles.

Disposable income, rather than gross income, is used as the base for average tax rate calculations to avoid the influence of progressive personal income taxes on the results. Using gross income would increase the regressive appearance of the VAT because, as income increases, the base would include increasingly larger income tax payments that would not be consumed and subject to VAT. Additionally, from a practical perspective, gross income is not available in the majority of the HBS datasets. As with most previous studies, gross (VAT-inclusive) expenditure, rather than net (VAT-exclusive) expenditure, is used as the base for average tax rate calculations. Note that this is different to the VAT-exclusive manner in which statutory VAT rates are typically expressed.

In calculating the results, the individual rather than the household is adopted as the unit of analysis. This ensures that equal weighting is given in the analysis to the welfare of each individual. In contrast, use of the household as the unit of analysis would mean that the welfare of a one-person household was given as much weight as that of a large household with many individuals. That approach, while often adopted for ease of computation, is difficult to justify for welfare analysis.

The key difficulty in applying the individual as the unit of analysis is the fact that while some demographic information in the HBS microdata is provided on an individual basis, income and expenditure data are provided on a household basis. To adjust the unit of analysis to the individual it is therefore necessary to multiply household survey weights by household size (this is done for all analyses with the exception of aggregate tax revenue estimation). Implicit in this approach is the assumption of equal sharing of resources within a family so that the measured welfare of each household member (whether income or expenditure) is identical.

Prior to adjusting the welfare metric to an individual basis, it is also necessary to make adjustment for different degrees of need within a household. For example, a child will require less food to maintain the

same welfare level as an adult. Additionally, households can be expected to benefit from economies of scale – for example, additional heating costs associated with a second occupant of a house will be significantly lower than for the first occupant. Equivalisation is undertaken using the following parametric equivalence scale:

$$m_i = \left(n_{a,i} + \theta n_{c,i}\right)^{\alpha}$$

where m_i is the equivalent size of household i, θ measures the degree of need of children relative to adults; α specifies economies of scale in consumption; $n_{a,i}$ is the number of adults in household i and $n_{c,i}$ is the number of children.

As noted by Creedy and Sleeman (2006), this parametric scale was introduced by Cutler and Katz (1992) and is an extension of the simpler n_i^{α} form used by Buhmann et al. (1988) and Coulter et al. (1992). The scale explicitly allows for adjustment of need between adults and children, and of economies of scale with increases in need-adjusted household size. A further benefit of the approach is that its explicit nature easily enables sensitivity analysis. The parameters adopted in the paper are $\theta = 0.5$ and $\alpha = 0.7$.[20]

In addition to average tax rate results, three summary indicators of progressivity and redistribution are calculated. The first indicator is the well-known Kakwani (1977) progressivity index. The Kakwani index is an indicator of global progressivity, traditionally of the income tax, but commonly also applied to benefit systems and expenditure programs. Adapting it to examine VAT with expenditure as the welfare metric, it can be calculated as the difference between: the VAT concentration coefficient calculated with individuals ranked by equivalised gross expenditure; and the Gini coefficient of equivalised gross expenditure.

Gini and concentration coefficients are both measures of dispersion from equality across a cumulative frequency distribution. As such, the Kakwani index measures how much further from equality is the distribution of VAT paid than the distribution of gross expenditure (without changing the ranking of individuals). It can range from -1 to 1; with a positive figure reflecting progressivity and a negative figure reflecting regressivity. The Kakwani index (π^K) can be expressed as follows:

[20] A commonly used alternative equivalence scale is the "OECD modified" scale which gives a fixed weighting of 1 to the first adult household member, 0.5 to the second and additional household members aged 14 and over, and 0.3 to each child under 14. While this scale adjusts for the relative need of adults and children, it does not continuously adjust for economies of scale as second and subsequent children all receive the same weighting. The equivalence scale parameters chosen in this paper produce a close match with the OECD modified scale, but provide for additional economies of scale at greater household sizes. Sensitivity analysis conducted on the two parameters shows some variation in results for changes in both parameters, but not significant enough to alter the study's overall conclusions. See Appendix 1 for detail.

$$\pi^K = \ C_{VAT}^G \ - G_G$$

or:

$$\pi^K = 2\int_0^1 \left[L_G(p) - L_{VAT}^G(p)\right] dp$$

where C_{VAT}^G is the concentration coefficient for VAT (with individuals ranked by gross expenditure); G_G is the Gini coefficient for gross expenditure; $L_G(p)$ is the Lorenz curve for gross expenditure and $L_{VAT}^G(p)$ is the concentration curve for VAT (with individuals ranked by gross expenditure).

The second indicator computed is the Reynolds-Smolensky (1977) index, which provides a measure of the overall redistributive effect of a tax (and/or transfer). It is also typically used in an income tax context, but can again be adapted to examine VAT with expenditure as the welfare metric. In this context, it is calculated as the difference between the Gini coefficient on equivalised gross expenditure and the concentration coefficient on equivalised net expenditure, ranked by gross expenditure. As such, the Reynolds-Smolensky index measures how much further from equality is net expenditure than gross expenditure (without changing the ranking of individuals). It can be expressed as follows:

$$\pi^{RS} = G_G - \ C_N^G$$

or:

$$\pi^{RS} = 2\int_0^1 \left[L_N^G(p) - L_G(p)\right] dp$$

where C_N^G is the concentration coefficient for net expenditure (with individuals ranked by gross expenditure) and $L_N^G(p)$ is the concentration curve for net expenditure (with individuals ranked by gross expenditure).[21]

The Kakwani and Reynolds-Smolensky indices are linked. The overall redistributive effect measured by the Reynolds-Smolensky index can be broken down into two components, a progressivity component measured by the Kakwani index, and an average tax rate component, as follows:

$$\pi^{RS} = \frac{t}{1-t}\pi^K$$

where t is the effective average tax rate.

[21] An alternative measure of the redistributive effect simply compares the Gini coefficient on gross expenditure with the Gini coefficient on net expenditure. Unlike the Reynolds-Smolensky (RS) index, ranking of individuals now differs between the two component indices. The difference between this redistributive effect (RE) index and the Reynolds-Smolensky index reflects a ("Atkinson-Plotnick") re-ranking effect. The RE index can be expressed as: $\pi^{RE} = G_G - \ G_N$, or: $\pi^{RE} = 2\int_0^1 [L_N(p) - L_G(p)]\, dp$, where G_N is the Gini coefficient for net expenditure and $L_N(p)$ is the Lorenz curve for net expenditure.

This relationship highlights the fact that redistribution can be achieved even by a tax system with only a small degree of progressivity if the average tax paid is high. Equally, a tax system with low tax rates requires a highly progressive system to achieve the same degree of redistribution.

A characteristic of the Gini-based dispersion measures on which the Kakwani and Reynolds-Smolensky indices are based is that they are less responsive to changes at the tails as compared to the middle of the distribution being examined. The third indicator computed – the change in the Atkinson (1970) inequality index – enables greater emphasis to be applied to the bottom of the distribution by specifying the degree of inequality aversion. The Atkinson index is based on the social welfare function:

$$W = \frac{1}{n}\sum_{i=1}^{n}\frac{x_i^{1-\varepsilon}}{1-\varepsilon}$$

for $\varepsilon \geq 0$ and $\varepsilon \neq 1$. If $\varepsilon = 1$, $W = 1/n\sum_{i=1}^{n} log\, x_i$. W is social welfare, x is the welfare metric (usually income, but in this case, expenditure), and ε is the inequality aversion parameter. A higher value of ε can be seen to result in greater weight being placed on lower levels of expenditure in calculating social welfare. From this function, the "equally distributed equivalent" expenditure can be derived. The "equally distributed equivalent" expenditure (x_{ede}) is the expenditure level that, if it were attained by every individual, would give the same total welfare as the actual distribution. It is given by:

$$x_{ede} = \left(\frac{1}{n}\sum_{i=1}^{n}x_i^{1-\varepsilon}\right)^{1/(1-\varepsilon)}$$

The Atkinson index (A_ε) itself is then defined as the proportional difference between the arithmetic mean ($\bar{x}$) and the "equally distributed equivalent" expenditure, as follows:

$$A_\varepsilon = 1 - \frac{x_{ede}}{\bar{x}}$$

The difference between the index calculated using equivalised gross and equivalised net expenditure can then be calculated as an alternative measure of redistribution to the Reynolds-Smolensky indicator. Calculations are made for three levels of inequality aversion: $\varepsilon = 0.2$, 0.7 and 1.2.

Finally, a range of poverty measures are also calculated to examine the effect of the VAT on the poor. By comparing poverty measures based on gross expenditure vs net expenditure, the analysis identifies the extent to which the imposition of VAT can increase poverty. While the academic literature provides a wide range of potential poverty measures, I focus on three indices in the Foster-Greer-Thorbecke (1984) family of poverty measures. Foster-Greer-Thorbecke (FGT) poverty measures follow the form:

$$P_\alpha = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z - y_i}{z}\right)^\alpha$$

where α is a measure of the index's sensitivity to poverty, z is the poverty line, y_i is the chosen welfare metric (in our case equivalised expenditure), n is the number of individuals, and q is the number of poor (individuals with expenditure below the poverty line).

By varying α, the FGT index can examine different aspects of poverty. I present results for three values of α: 0, 1 and 2. For $\alpha = 0$, the index presents the "poverty headcount" – the proportion of the population that are below the poverty line. While this is a very commonly used measure, and has immediate intuitive appeal, by focusing purely on the frequency of poverty it fails to account for two additional aspects of poverty: the depth of poverty and the degree of inequality among those in poverty.

Setting $\alpha = 1$, presents the "poverty gap" index – the average distance between the poverty line and the level of equivalised expenditure (as a percentage of the poverty line). This provides a measure of the depth of poverty. Finally, setting $\alpha = 2$ presents the "squared poverty gap" index. This measure weights each individual's poverty gap (as a percentage of the poverty line) by the size of their poverty gap (as a percentage of the poverty line), thereby giving greater importance to the poverty gap of those experiencing more severe levels of poverty. As such, the index takes into account the degree of inequality amongst the poor in addition to the frequency and depth of poverty.

To calculate each index, a poverty line must be determined to distinguish poor from non-poor. This is, to a large extent, an arbitrary decision and has a significant effect on the magnitude of the computed poverty indices.[22] A poverty line can be set in absolute terms (i.e. as a fixed expenditure level) or relative terms (e.g. as a percentage of median expenditure). In the context of a cross-country study such as this, a relative poverty measure has the advantage of providing a comparable point across countries. Eurostat, for example, adopts a relative poverty line of 60% of median equivalised disposable income in its cross-country analyses, while the OECD Income Distribution Database adopts a poverty line of 50% of median equivalised disposable income for computing its headline poverty indicator.[23] I apply a fixed poverty line of 50% of median equivalised gross expenditure.

[22] Sensitivity analysis in Appendix 1 shows the significant variation in results for different poverty lines. While the magnitudes vary, the overall conclusion that the imposition of VAT increases poverty is unaffected.
[23] See Eurostat (2018), OECD (2016, 2018b).

5. Simulation results

5.1. Average tax rate results

Tables 2-3 present, for each of the 27 OECD countries, the average VAT burdens faced by households as a percentage of disposable income and as a percentage of expenditure, respectively, across equivalised disposable income deciles. Tables 4-5 present the same calculations across equivalised expenditure deciles. The overall trends are summarised in Figure 1 which presents the simple averages across all countries of the results presented in Tables 2-5.

Table 2 (and the left hand panel of Figure 1) shows VAT payments as a percentage of disposable income decreasing as income increases in all countries. For example, the proportional VAT burdens faced by the top income decile are less than half those faced by the bottom income decile in Chile, France, Ireland, Korea, Luxembourg, Latvia and New Zealand. Much smaller differences are observed in the Czech Republic, Germany, Finland, Poland and the Slovak Republic, but the VAT clearly still has a regressive effect in every country. This trend is confirmed by the strongly downward sloping 27-country average shown in the left hand panel of Figure 1.

As the averages in Figure 1 highlight, the results presented in Tables 3-5 strongly contrast with the regressive trend in Table 2. Table 3 shows VAT payments as a proportion of expenditure to be either roughly proportional, or slightly progressive (across income deciles) in most countries – though generally average tax rates do not increase monotonically. The results for Estonia, Hungary, Luxembourg, Latvia and New Zealand arguably suggest a small degree of regressivity (though again average tax rates are not monotonically decreasing). A small number of countries – e.g. Chile, Germany and Korea – show a peak in the middle of the income distribution, though the average VAT burden in Germany and Korea is still higher for the top income decile than the bottom.

Turning to the expenditure decile results, Table 4 shows a highly progressive trend for VAT burdens measured as a percentage of income. This strong progressive trend is highlighted in the right hand panel of Figure 1. In contrast, when measured as a percentage of expenditure, the VAT appears slightly progressive in most countries (Table 5). In Latvia the VAT appears roughly proportional, while in Chile there is again a peak in the middle deciles. In Hungary, Korea and New Zealand the VAT appears slightly regressive (though, again, results are not monotonically decreasing).

The highly regressive results in Table 2 when measuring VAT as a percentage of income across income deciles are consistent with previous analyses of VAT burdens as a percentage of income (as summarised in Section 2). The driving influence of savings behaviour on these results is illustrated by the expenditure-to-income ratios presented across income deciles in Table 6 and in the left-hand panel of

Figure 2. At low income levels, households tend to be net borrowers in all countries, so average VAT burdens as a percentage of income appear relatively high. Savings rates then rise with income, lowering average VAT burdens. At high income levels, households tend to be net savers, and consequently VAT burdens as a percentage of income appear relatively low.

Equally, the highly progressive results shown in Table 4 are driven by savings behaviour. This is illustrated by the expenditure-to-income ratios presented across expenditure deciles in Table 7 and in Figure 2 (right hand panel). At low expenditure levels, households tend to be net savers, so VAT burdens as a percentage of income appear relatively low. Savings rates then fall as expenditure increases, increasing the average VAT burdens. At very high expenditure levels, households tend to be net borrowers, and so VAT burdens as a percentage of expenditure appear relatively high.[24]

In contrast, the expenditure-based results in Tables 3 and 5 remove the influence of savings behaviour. As noted in Section 3, they instead identify how the presence of reduced VAT rates and exemptions move the actual VAT burden away from what would be due under a perfectly broad-based single-rate system (where all households would pay the same proportion of their expenditure in VAT). As such, they are likely to provide a more meaningful estimate of the distributional impact of the VAT.[25]

Focusing on the expenditure-based results, the broad conclusion can be drawn that the VAT in most of the countries covered is either roughly proportional or slightly progressive. This confirms other recent expenditure-based analysis for several countries by IFS (2011), and challenges the general public perception, and the conclusion of much of the previous academic literature, that the VAT is regressive. A weakness of the above decile-based analysis is that it does not always provide a conclusive picture of the overall distributive impact of the VAT as non-monotonic patterns can arise across deciles. As such, a range of summary measures are presented in the next section. While imposing additional value judgements, their more structured framework enables definitive conclusions to be made regarding the overall distributional impact of the VAT in each country.

[24] As these savings patterns suggest, income deciles and expenditure deciles are not perfectly correlated. On average across 25 countries, 72% of individuals in a particular expenditure decile are within (plus or minus) two deciles of the same income decile. However, only 22% of individuals, on average, are in the exact same income and expenditure decile. For the bottom and top deciles, there is a greater correlation – with 42% and 43% of individuals, respectively, in the same income and expenditure decile (and 64% and 65% within one decile). Note that the calculations presented in this footnote exclude Korea and New Zealand due to data access limitations.

[25] With regard to ranking households from lifetime poor to lifetime rich, there is an arguable case for measuring tax burdens across the income and expenditure distributions. Current expenditure has arguably a more direct link to well-being as it is the consumption of goods and services that produces utility rather than the earning of the income that funds the consumption. Additionally, ranking by current income can misrepresent some households – e.g. students, retirees – as poor, when they may be significantly better off in a lifetime context. That said, ranking by current expenditure can also misrepresent some households – e.g. those currently saving heavily to fund future spending – as worse off than they are in a lifetime context. For households that are not saving or borrowing, either measure is likely to be as good a proxy for lifetime income, and hence a good means of ranking households.

Figure 1. Household average VAT burdens: all-country simple average

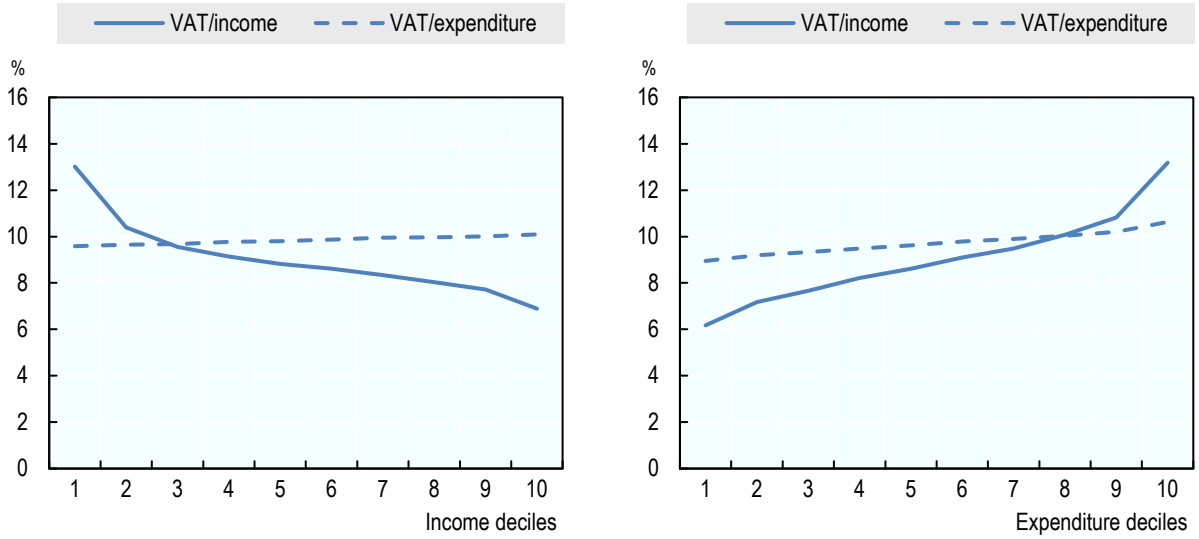


Figure 2. Expenditure-to-income ratio: all country simple average

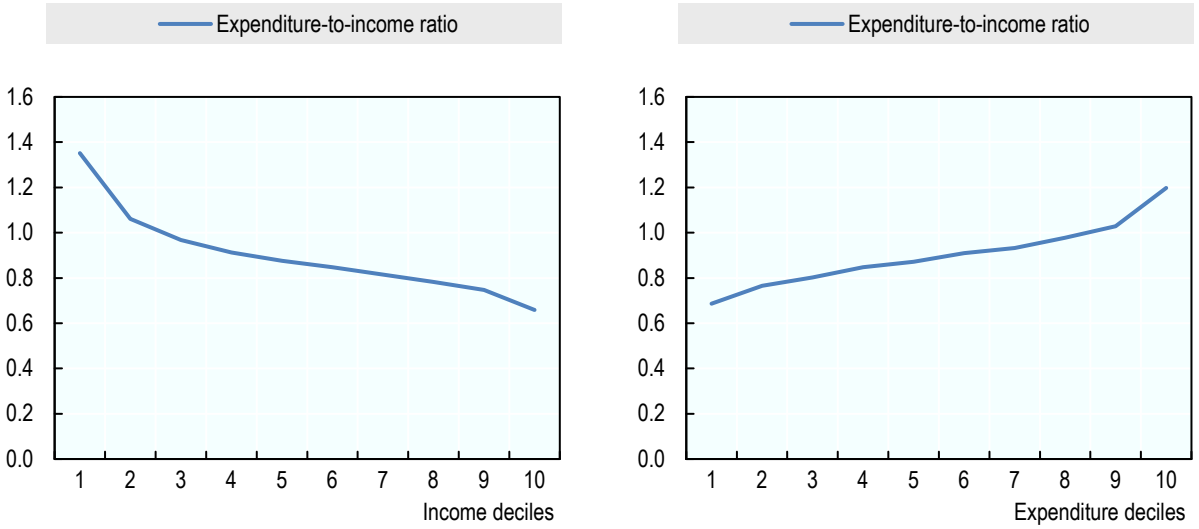


Table 2. Average VAT as a percentage of income across income deciles

	1	2	3	4	5	6	7	8	9	10
AUT	15.3	11.5	10.6	10.3	10.5	10.1	9.7	9.5	8.9	8.5
BEL	11.3	9.4	9.2	9.4	9.2	9.2	8.9	8.3	8.1	6.2
CHE	5.4	4.2	4.0	3.8	3.8	3.6	3.6	3.5	3.4	3.0
CHL	18.1	15.1	12.7	11.5	10.7	11.1	9.9	9.2	8.7	7.4
CZE	11.1	10.8	10.6	10.2	10.3	10.1	9.9	9.4	9.2	8.3
DEU	8.8	8.5	8.5	8.2	8.0	7.8	7.6	7.3	7.0	6.2
DNK	15.9	13.1	12.6	11.6	11.3	10.7	10.2	9.9	9.8	8.2
ESP	11.6	9.4	8.8	8.2	7.9	7.5	7.4	7.2	6.8	6.2
EST	18.8	13.7	12.1	11.7	11.0	11.2	11.7	10.3	10.4	9.8
FIN	11.9	9.6	9.8	9.6	9.9	9.0	9.3	9.4	9.0	7.7
FRA	10.9	7.7	7.2	6.9	6.3	6.2	5.9	6.0	5.6	4.7
GBR	9.3	7.8	7.2	7.2	6.2	6.3	6.3	5.9	5.9	5.4
GRC	13.5	10.6	9.8	9.1	8.8	8.6	7.7	8.1	8.0	7.2
HUN	16.2	14.1	12.9	12.5	11.5	11.2	11.1	10.8	10.1	9.5
IRL	13.8	8.9	8.4	7.8	7.3	7.4	6.6	6.2	6.1	4.9
ITA	-	-	-	-	-	-	-	-	-	-
KOR	6.4	4.4	3.9	3.8	3.7	3.5	3.2	3.0	2.8	2.5
LUX	6.8	5.2	3.2	2.3	2.0	1.8	1.8	1.5	1.4	1.1
LVA	24.1	19.3	16.7	15.8	15.1	14.7	13.2	12.5	11.9	10.3
NLD	13.6	10.2	9.3	8.7	8.8	8.3	8.7	8.4	8.5	7.5
NZL	13.8	10.3	9.2	9.2	8.9	8.6	8.0	7.7	6.9	6.4
POL	12.3	10.5	9.8	9.6	9.4	9.4	9.0	9.1	9.0	8.4
PRT	13.6	11.0	9.8	8.8	9.1	9.2	8.7	8.5	7.8	6.9
SLV	16.8	13.4	11.4	11.7	10.6	10.3	10.9	10.4	10.0	9.5
SVK	14.5	13.1	12.4	12.1	12.1	11.5	11.4	11.1	10.5	9.8
SWE	12.0	8.0	8.1	7.9	7.8	8.0	7.3	7.4	7.1	6.4
TUR	12.5	10.6	10.0	9.5	9.2	8.8	8.7	8.2	7.7	7.2
Average	**13.0**	**10.4**	**9.6**	**9.1**	**8.8**	**8.6**	**8.3**	**8.0**	**7.7**	**6.9**

Note: Income data unavailable for Italy.

Table 3. Average VAT as a percentage of expenditure across income deciles

	1	2	3	4	5	6	7	8	9	10
AUT	10.9	10.8	10.7	10.9	11.1	11.0	11.1	11.3	11.2	11.3
BEL	8.9	9.0	9.2	9.4	9.6	9.7	9.8	9.9	10.1	10.3
CHE	3.8	4.0	4.1	4.2	4.3	4.4	4.4	4.5	4.6	4.7
CHL	9.9	10.2	10.0	10.1	10.1	10.4	10.2	10.0	9.6	9.5
CZE	13.1	13.2	13.4	13.3	13.5	13.5	13.6	13.7	13.7	13.8
DEU	7.8	8.4	8.8	8.9	9.0	9.1	9.2	9.1	9.1	8.9
DNK	13.2	12.9	12.9	14.0	14.1	14.3	14.3	14.4	14.2	14.5
ESP	7.0	7.0	7.1	7.1	7.0	7.1	7.2	7.2	7.2	7.3
EST	13.9	13.7	13.3	13.2	12.9	12.7	13.6	13.3	13.2	13.1
FIN	9.8	10.0	10.3	10.4	10.9	10.7	11.1	11.2	11.3	11.1
FRA	8.3	7.8	7.5	7.5	7.3	7.5	7.5	7.6	7.8	7.9
GBR	8.5	8.6	8.9	9.1	9.1	9.4	9.6	9.4	9.7	9.6
GRC	8.4	8.4	8.5	8.6	8.7	8.9	8.9	9.1	9.2	9.4
HUN	15.7	15.1	14.5	14.4	14.0	13.7	13.8	13.8	13.7	14.0
IRL	7.8	7.6	7.8	7.7	7.8	8.0	8.0	7.9	8.1	8.2
ITA	-	-	-	-	-	-	-	-	-	-
KOR	5.0	5.2	5.3	5.4	5.5	5.6	5.4	5.6	5.6	5.5
LUX	5.8	6.4	6.6	6.4	6.3	6.1	6.1	5.7	5.5	5.0
LVA	13.7	13.8	13.7	13.4	13.4	13.2	13.4	13.2	13.3	13.0
NLD	7.9	8.1	8.1	8.2	8.2	8.4	8.7	8.8	8.9	9.1
NZL	12.4	12.4	12.0	11.8	12.0	11.8	11.6	11.3	11.2	11.3
POL	9.2	9.7	9.9	10.1	10.3	10.4	10.5	10.7	11.0	11.4
PRT	8.6	8.6	8.5	8.7	8.7	8.9	9.1	9.1	9.2	9.5
SLV	9.0	9.3	9.1	9.5	9.4	9.6	9.9	9.8	10.0	10.3
SVK	12.8	13.1	13.0	13.0	13.1	13.1	13.2	13.2	13.2	13.3
SWE	9.2	8.8	9.4	9.9	9.8	10.5	9.9	10.3	10.6	11.3
TUR	8.4	8.7	8.8	8.8	8.8	8.9	8.9	9.0	8.9	9.2
Average	**9.6**	**9.6**	**9.7**	**9.8**	**9.8**	**9.9**	**10.0**	**10.0**	**10.0**	**10.1**

Note: Income data unavailable for Italy.

Table 4. Average VAT as a percentage of income across expenditure deciles

	1	2	3	4	5	6	7	8	9	10
AUT	5.4	6.5	7.6	8.3	9.4	10.2	11.6	12.9	14.1	18.8
BEL	5.5	6.2	6.6	7.4	7.8	8.0	9.0	9.8	11.1	17.8
CHE	2.2	2.8	3.2	3.4	3.7	3.9	4.1	4.4	4.7	5.9
CHL	7.9	9.2	9.7	12.2	11.6	13.9	13.0	13.7	11.9	11.5
CZE	7.4	8.4	9.1	9.6	9.9	9.9	10.4	10.6	11.1	13.2
DEU	6.2	6.6	6.9	7.1	7.2	7.6	7.7	8.1	8.5	12.2
DNK	8.3	9.2	9.7	10.2	10.6	12.0	11.4	12.1	13.0	16.7
ESP	6.0	6.6	6.8	7.2	7.5	8.0	8.5	8.9	9.7	11.7
EST	5.9	8.7	9.4	10.7	10.7	12.4	13.8	14.6	15.7	18.7
FIN	5.8	7.3	7.5	8.4	8.9	9.3	10.1	10.7	12.4	14.7
FRA	4.7	5.5	5.7	6.1	6.2	6.5	7.1	7.3	8.1	10.3
GBR	3.2	4.5	5.2	5.6	6.4	6.8	7.3	7.6	9.1	11.8
GRC	6.0	7.9	8.1	8.2	9.5	9.2	9.8	10.3	10.5	12.0
HUN	10.5	11.1	11.3	10.9	11.7	11.9	11.9	12.6	13.0	15.1
IRL	4.9	6.3	6.5	8.0	7.9	8.3	8.5	8.6	8.9	9.5
ITA	-	-	-	-	-	-	-	-	-	-
KOR	3.3	3.3	3.4	3.5	3.6	3.7	3.8	3.8	4.0	4.8
LUX	2.2	2.5	2.5	2.3	2.4	2.9	3.0	2.8	3.0	3.5
LVA	11.9	12.4	13.3	14.0	15.7	15.9	15.1	17.1	18.8	19.5
NLD	6.3	7.9	7.7	7.6	8.2	9.4	9.4	10.1	11.5	13.8
NZL	4.6	6.8	8.5	8.9	9.4	8.6	9.8	9.3	10.7	12.6
POL	6.8	7.6	8.1	8.5	8.8	9.4	10.1	10.6	11.5	15.2
PRT	4.7	6.4	7.2	8.4	9.3	9.9	10.6	12.1	12.0	12.8
SLV	8.0	8.8	9.4	9.8	10.5	11.0	11.5	13.2	14.3	18.4
SVK	10.1	10.3	10.8	11.3	11.2	11.5	11.7	12.3	12.7	16.7
SWE	5.0	5.4	6.1	7.0	7.1	7.3	7.9	8.9	10.8	14.2
TUR	7.5	8.5	8.8	9.0	9.0	9.2	9.5	9.7	10.2	11.2
Average	**6.2**	**7.2**	**7.7**	**8.2**	**8.6**	**9.1**	**9.5**	**10.1**	**10.8**	**13.2**

Note: Income data unavailable for Italy.

Table 5. Average VAT as a percentage of expenditure across expenditure deciles

	1	2	3	4	5	6	7	8	9	10
AUT	9.6	10.1	10.3	10.6	10.8	11.2	11.3	11.8	12.0	12.6
BEL	7.8	8.4	8.6	9.1	9.4	9.6	9.8	10.3	10.8	12.1
CHE	3.6	3.9	4.1	4.2	4.3	4.4	4.4	4.6	4.6	4.9
CHL	9.3	9.9	9.8	10.2	10.1	10.5	10.4	10.1	9.9	9.6
CZE	13.1	13.2	13.3	13.3	13.5	13.4	13.6	13.7	13.8	14.0
DEU	7.6	8.1	8.4	8.7	8.8	9.0	9.0	9.2	9.3	10.2
DNK	12.5	12.6	13.2	13.4	13.6	14.4	14.3	14.4	15.0	15.6
ESP	6.2	6.6	6.8	6.9	7.0	7.1	7.3	7.5	7.6	8.1
EST	13.5	13.0	13.0	12.9	12.8	13.2	13.4	13.6	13.8	13.8
FIN	9.6	9.8	10.2	10.3	10.7	10.9	11.0	11.2	11.5	11.8
FRA	7.5	7.2	7.1	7.2	7.3	7.5	7.7	7.9	8.2	9.0
GBR	7.7	8.2	8.8	8.9	9.5	9.6	9.9	9.6	9.9	9.9
GRC	7.6	8.0	8.2	8.5	8.7	9.1	9.1	9.5	9.4	9.9
HUN	15.4	14.8	14.4	14.1	14.1	14.0	13.7	13.9	13.9	14.3
IRL	7.4	7.6	7.4	8.0	7.9	8.0	8.1	8.1	8.3	8.4
ITA	5.3	5.8	5.9	6.3	6.3	6.5	6.6	6.8	7.0	8.5
KOR	5.3	5.6	5.7	5.6	5.6	5.5	5.4	5.3	5.3	4.7
LUX	5.0	5.4	5.7	5.7	5.9	6.0	6.1	6.5	6.6	6.9
LVA	13.5	13.5	13.4	13.4	13.4	13.5	13.3	13.4	13.6	13.2
NLD	7.2	7.7	7.6	7.9	8.2	8.5	8.8	9.1	9.3	10.0
NZL	12.5	12.5	12.3	12.1	11.9	11.4	11.7	11.3	11.3	11.1
POL	8.6	9.3	9.7	9.9	10.2	10.4	10.7	11.0	11.3	12.2
PRT	7.4	8.2	8.2	8.6	9.0	8.9	9.2	9.6	9.7	9.9
SLV	8.8	8.7	9.0	9.1	9.2	9.6	9.6	10.1	10.4	11.2
SVK	12.8	13.1	13.2	13.1	13.1	13.2	13.0	13.2	13.0	13.5
SWE	8.5	8.8	8.9	9.4	9.4	10.0	10.6	10.5	11.0	12.3
TUR	8.2	8.5	8.8	8.7	9.0	9.0	9.1	9.0	9.0	9.0
Average	**8.9**	**9.2**	**9.3**	**9.5**	**9.6**	**9.8**	**9.9**	**10.0**	**10.2**	**10.6**

Table 6. Expenditure-to-income ratios across income deciles

	1	2	3	4	5	6	7	8	9	10
AUT	1.35	1.03	0.95	0.91	0.91	0.87	0.84	0.81	0.77	0.72
BEL	1.18	0.99	0.97	0.95	0.92	0.90	0.86	0.82	0.77	0.58
CHE	1.37	1.02	0.94	0.88	0.85	0.82	0.80	0.76	0.72	0.63
CHL	1.80	1.47	1.25	1.14	1.05	1.05	0.96	0.90	0.91	0.78
CZE	0.84	0.81	0.79	0.77	0.76	0.74	0.72	0.68	0.67	0.60
DEU	1.11	1.00	0.95	0.90	0.86	0.83	0.81	0.78	0.75	0.67
DNK	1.18	0.99	0.95	0.82	0.79	0.74	0.70	0.67	0.67	0.56
ESP	1.60	1.29	1.20	1.11	1.08	1.03	1.01	0.97	0.92	0.83
EST	1.33	0.99	0.89	0.87	0.83	0.85	0.87	0.77	0.77	0.74
FIN	1.19	0.94	0.94	0.90	0.90	0.82	0.83	0.82	0.78	0.69
FRA	1.31	0.98	0.93	0.87	0.83	0.80	0.76	0.75	0.69	0.57
GBR	1.05	0.86	0.77	0.77	0.65	0.65	0.65	0.62	0.60	0.56
GRC	1.58	1.22	1.11	1.03	0.98	0.94	0.84	0.86	0.86	0.76
HUN	1.04	0.94	0.89	0.87	0.82	0.82	0.80	0.78	0.73	0.67
IRL	1.74	1.17	1.06	1.00	0.93	0.91	0.81	0.77	0.74	0.59
ITA	-	-	-	-	-	-	-	-	-	-
KOR	1.28	0.87	0.76	0.73	0.70	0.64	0.62	0.55	0.52	0.47
LUX	1.11	0.79	0.46	0.34	0.30	0.27	0.27	0.25	0.23	0.20
LVA	1.75	1.40	1.22	1.17	1.12	1.10	0.99	0.95	0.90	0.78
NLD	1.67	1.21	1.12	1.04	1.04	0.98	0.97	0.94	0.92	0.80
NZL	1.11	0.83	0.77	0.79	0.75	0.74	0.70	0.69	0.62	0.57
POL	1.29	1.05	0.96	0.92	0.89	0.88	0.83	0.82	0.80	0.71
PRT	1.52	1.23	1.10	0.97	1.01	0.99	0.94	0.90	0.83	0.71
SLV	1.86	1.42	1.23	1.20	1.10	1.05	1.08	1.02	0.97	0.89
SVK	1.14	1.00	0.96	0.94	0.92	0.88	0.86	0.84	0.79	0.73
SWE	1.25	0.89	0.83	0.78	0.75	0.74	0.70	0.68	0.65	0.55
TUR	1.45	1.20	1.13	1.08	1.04	0.99	0.98	0.92	0.87	0.77
Average	**1.35**	**1.06**	**0.97**	**0.91**	**0.88**	**0.85**	**0.82**	**0.78**	**0.75**	**0.66**

Note: Income data unavailable for Italy. Calculations for Chile, Ireland, Slovenia, Sweden and Turkey include imputed rental expenditure but not imputed rental income (as not reported in the HBS data), potentially biasing upward expenditure-to-income ratios.

Table 7. Expenditure-to-income ratios across expenditure deciles

	1	2	3	4	5	6	7	8	9	10
AUT	0.57	0.63	0.72	0.79	0.84	0.92	0.99	1.09	1.16	1.46
BEL	0.69	0.74	0.76	0.81	0.81	0.84	0.91	0.93	1.03	1.42
CHE	0.62	0.72	0.78	0.82	0.85	0.90	0.93	0.96	1.02	1.20
CHL	0.84	0.93	0.98	1.18	1.13	1.29	1.24	1.35	1.18	1.18
CZE	0.57	0.63	0.69	0.72	0.73	0.74	0.77	0.77	0.82	0.94
DEU	0.81	0.82	0.81	0.82	0.82	0.84	0.85	0.86	0.89	1.12
DNK	0.66	0.74	0.76	0.75	0.79	0.82	0.80	0.83	0.88	1.05
ESP	0.97	0.97	0.99	1.04	1.06	1.08	1.13	1.16	1.23	1.39
EST	0.46	0.67	0.72	0.82	0.85	0.89	1.00	1.06	1.11	1.31
FIN	0.62	0.73	0.77	0.81	0.83	0.88	0.89	0.96	1.06	1.25
FRA	0.64	0.74	0.78	0.80	0.81	0.85	0.90	0.92	0.96	1.10
GBR	0.42	0.53	0.60	0.64	0.67	0.70	0.73	0.83	0.88	1.19
GRC	0.81	0.95	0.96	0.98	1.02	1.04	1.06	1.07	1.11	1.18
HUN	0.70	0.73	0.78	0.77	0.82	0.84	0.86	0.89	0.93	1.04
IRL	0.67	0.84	0.89	0.98	1.02	1.07	1.00	1.09	1.07	1.12
ITA	-	-	-	-	-	-	-	-	-	-
KOR	0.63	0.60	0.61	0.63	0.66	0.70	0.71	0.75	0.79	1.06
LUX	0.46	0.42	0.41	0.38	0.40	0.46	0.41	0.40	0.42	0.45
LVA	0.89	0.92	0.96	1.05	1.16	1.15	1.17	1.26	1.35	1.46
NLD	0.85	1.05	0.98	0.99	0.98	1.10	1.10	1.05	1.24	1.34
NZL	0.37	0.54	0.68	0.75	0.76	0.77	0.83	0.83	0.94	1.13
POL	0.78	0.81	0.84	0.85	0.87	0.90	0.94	0.96	1.01	1.20
PRT	0.63	0.78	0.85	0.97	1.00	1.09	1.15	1.23	1.22	1.27
SLV	0.92	1.02	1.03	1.08	1.14	1.14	1.20	1.30	1.37	1.63
SVK	0.78	0.78	0.82	0.85	0.87	0.87	0.90	0.94	1.00	1.24
SWE	0.57	0.63	0.68	0.76	0.75	0.74	0.75	0.89	0.95	1.12
TUR	0.90	0.99	1.00	1.00	1.00	1.02	1.05	1.06	1.13	1.27
Average	**0.69**	**0.77**	**0.80**	**0.85**	**0.87**	**0.91**	**0.93**	**0.98**	**1.03**	**1.20**

Note: Income data unavailable for Italy. Calculations for Chile, Ireland, Slovenia, Sweden and Turkey include imputed rental expenditure but not imputed rental income (as not reported in the HBS data), potentially biasing upward expenditure-to-income ratios.

5.2. Summary measures of progressivity and redistribution

This section presents three summary indicators of progressivity and redistribution to complement the decile averages presented in the previous section. These summary indicators enable clearer judgements to be drawn on the distributional impact of a VAT and for comparisons to be made that are not always possible from the analysis of simple decile averages – such as when non-monotonic patterns arise.

Table 8 presents Kakwani progressivity index, Reynolds-Smolensky redistribution index, and (change in) Atkinson inequality index results for 26 of the 27 countries. Results for Korea were unable to be calculated due to data access restrictions. Kakwani index results are all low, ranging from 0.0822 in Italy to -0.0188 in New Zealand. In 22 of 26 countries the results are positive, showing the VAT to have a small (but statistically significant) progressive effect. In four countries (Chile, Hungary, Latvia and New Zealand) the results are negative (though not statistically significantly different from zero in Latvia), showing the VAT has a small regressive effect.[26] The Kakwani results are consistent with the decile average results in Table 5, which pointed to Chile, Hungary, Korea, Latvia and New Zealand as having the least progressive or potentially regressive VAT.

The slightly regressive results in Chile, Hungary, Latvia and New Zealand provide two interesting insights: first, low spending households in these countries do not benefit significantly from reduced VAT rates. On close consideration, this result is not surprising: Chile and New Zealand both have very few, if any, reduced rates in comparison to the majority of countries covered in this study. Hungary and Latvia also have relatively few reduced rates, and importantly the vast majority of food products (which make up a substantial proportion of total household expenditure) are subject to the standard rate.[27] Second, higher spending households in these – and presumably other – countries spend a greater proportion of their total expenditure on items that are either untaxed or exempt from tax (for example, financial services, international air travel).

Even the most progressive countries in Table 8 exhibit only a low degree of progressivity. This can be seen when compared to typical Kakwani results for the personal income tax. For example, Joumard et al. (2012) found Kakwani indices of between 0.05 and 0.25 for personal income taxes (including

[26] Furthermore, sensitivity analysis (see Appendix 1) shows that if a higher degree of economies of scale was applied in the equivalence scale, then the slightly regressive results for Hungary and Latvia could change to slightly progressive.

[27] Note that while Latvia applied the standard VAT rate to all food products except baby food in 2010 (the year modelled), it now also applies a reduced VAT rate to some fresh fruit and vegetables. Hungary also now applies a reduced VAT rate to a wider range of basic food products than in 2010.

employee social security contributions) in 27 of 30 OECD countries examined. More recently, Causa and Hermansen (2017) found Kakwani indices of between 0.1 and 0.25 for personal income taxes in 13 of 15 OECD countries examined. In contrast, the Kakwani index for VAT in Table 8 is at most 0.08 (in Italy), and only reaches above 0.05 in another four countries (Belgium, the Netherlands, Poland and Switzerland). These countries all make extensive use of reduced rates and exemptions, but even then this creates only limited progressivity.

Table 8. Summary indicators of progressivity and redistribution

	Kakwani	Reynolds-Smolensky	$\frac{t}{1-t}$	Change in Atkinson		
				ε=0.2	ε=0.7	ε=1.2
AUT	0.0428	0.0056	0.1300	0.0010	0.0032	0.0051
BEL	0.0738	0.0082	0.1117	0.0015	0.0045	0.0069
CHE	0.0419	0.0020	0.0469	0.0003	0.0011	0.0018
CHL	-0.0080	-0.0009	0.1099	-0.0004	-0.0009	-0.0007
CZE	0.0114	0.0018	0.1572	0.0002	0.0007	0.0012
DEU	0.0477	0.0049	0.1017	0.0010	0.0029	0.0043
DNK	0.0382	0.0064	0.1665	0.0008	0.0028	0.0045
ESP	0.0401	0.0032	0.0799	0.0006	0.0018	0.0029
EST	0.0153	0.0024	0.1558	0.0004	0.0012	0.0013
FIN	0.0346	0.0043	0.1237	0.0007	0.0022	0.0034
FRA	0.0457	0.0040	0.0867	0.0007	0.0021	0.0030
GBR	0.0277	0.0029	0.1059	0.0006	0.0022	0.0037
GRC	0.0394	0.0040	0.1010	0.0007	0.0024	0.0038
HUN	-0.0059	-0.0010	0.1651	-0.0002	-0.0008	-0.0016
IRL	0.0215	0.0019	0.0876	0.0002	0.0008	0.0014
ITA	0.0822	0.0063	0.0766	0.0016	0.0043	0.0060
LUX	0.0464	0.0031	0.0667	0.0005	0.0018	0.0028
LVA	-0.0007	-0.0001	0.1550	0.0000	-0.0002	-0.0003
NLD	0.0561	0.0054	0.0961	0.0007	0.0024	0.0038
NZL	-0.0188	-0.0025	0.1301	-0.0006	-0.0019	-0.0031
POL	0.0562	0.0069	0.1228	0.0014	0.0042	0.0064
PRT	0.0378	0.0039	0.1026	0.0008	0.0026	0.0042
SLV	0.0478	0.0053	0.1103	0.0009	0.0027	0.0041
SVK	0.0067	0.0010	0.1520	0.0002	0.0006	0.0008
SWE	0.0631	0.0074	0.1175	0.0011	0.0034	0.0049
TUR	0.0106	0.0010	0.0988	0.0003	0.0009	0.0014
Average	**0.0328**	**0.0034**	**0.1138**	**0.0006**	**0.0018**	**0.0028**

Turning to the Reynolds-Smolensky results, it follows logically that the 22 countries with a positive Kakwani index, also have a positive Reynolds-Smolensky redistribution index – showing that inequality has fallen in these countries. Conversely, the four countries with a negative Kakwani index, also have a negative Reynolds-Smolensky index – indicating an increase in inequality. However, in all cases the redistributive effect is very low, ranging from 0.0082 in Belgium to -0.0025 in New Zealand. (For comparison, Joumard et al. (2012) and Causa and Hermansen (2017) found Reynolds-Smolensky indices greater than 0.01 for personal income taxes in 28 of 30 countries, and 14 of 15 countries, respectively). Redistribution is low despite average tax rates typically being above 11%, further emphasising the very low degree of progressivity (or regressivity) in the VAT. This highlights that even in the countries with the most extensive use of reduced rates and exemptions, there is very little impact the VAT can have on redistribution.

The (change in) Atkinson index results support the above findings. Inequality falls in the same 22 countries as with the Reynolds-Smolensky results, and rises in the same four. The largest reduction in inequality is again in Belgium (for medium and high levels of inequality aversion, but in Italy for a low level of inequality aversion), while the largest increase is again in New Zealand. The magnitudes are once again very low, indicating minimal redistribution through the VAT. A higher degree of inequality aversion increases the magnitude of the redistributive effect, though again it remains small, while country rankings remain very similar.

Overall, the results in this section allow us to nuance the conclusions from the average tax rate results to say that the VAT systems in most countries are indeed slightly progressive, but only to a very limited extent and consequently provide very limited redistribution despite significant average tax rates being imposed. Meanwhile, the results for Chile, Hungary, Latvia and New Zealand highlight that broad-based VAT systems that have few reduced VAT rates or exemptions can still produce a small degree of regressivity.

5.3. Poverty effects of the VAT

The conclusion that the VAT is generally not regressive does not mean that policy makers should not be concerned about its impact on the poor. Assuming diminishing marginal utility of consumption, a proportional VAT will still have a greater negative impact on the wellbeing of the poor than of the rich. At the extreme, it may reduce the consumption of necessities by the poor, but merely the consumption of luxuries by the rich.

This section presents three Foster-Greer-Thorbecke (FGT) poverty measures: the "poverty headcount", "poverty gap", and "squared poverty gap" indices. A relative poverty line equal to 50% of median equivalised gross expenditure is adopted in the analysis. Table 9 presents results for the 26 countries for which data were available for the analysis. Looking first at the poverty headcount results, in each country the imposition of the VAT is shown to increase the proportion of individuals below the poverty line. The increase ranges from 1.2 percentage points in the Netherlands, to 5.8 percentage points in Hungary. On average, the imposition of the VAT increases the poverty headcount by three percentage points, from 8.1% to 11.1%.[28]

Some caution needs to be taken in comparing the results for the Czech Republic, New Zealand, Switzerland and the United Kingdom with other countries. Analysis for these four countries excludes housing expenditure due to the unavailability of imputed rental expenditure data. Sensitivity analysis (presented in Appendix 1) shows that the inclusion of housing expenditure has an equalising effect, lowering the net poverty headcount in all 22 countries where housing data was available, and the gross headcount in 20 of 22 countries. It also shows the change in the poverty headcount to be lower (but still positive) in all 22 countries when housing expenditure is included. As such, the results for the Czech Republic, New Zealand, Switzerland and the United Kingdom can be expected to be overstated, though the overall conclusion that the VAT increases the poverty headcount stands.

Turning to the poverty gap calculations, these also increase with the imposition of the VAT in every country. On average, the poverty gap is 1.8% of the poverty line for gross expenditure, but 2.5% for net expenditure. Similarly, the squared poverty gap index increases on average from 0.7% to 0.9%. While these figures may not appear substantial, it should be recalled that they are weighted down by the majority of individuals that are above the poverty line (and hence have a poverty gap of zero).

When comparing results across the three indices, there is generally very little variation in terms of where countries rank. However, a small number of countries exhibit more significant changes. Greece has the 11th highest (net) poverty headcount, but when also taking account of the depth of poverty, it falls four places to 15th (poverty gap index), and a further two places to 17th when also accounting for the degree of inequality amongst the poor (squared poverty gap index). Similarly, Luxembourg drops from 16th (headcount) to 19th (squared poverty gap). In contrast, the Czech Republic increases from 21st

[28] Sensitivity analysis (see Appendix 1) was again undertaken by applying different equivalence scale parameters, with results showing a small degree of variation in the poverty headcount for both net and gross expenditure. However, as with the results presented in the main text, the poverty headcount was always larger for net expenditure than gross expenditure with the difference between the two measures relatively consistent.

(headcount) to 18th (squared poverty gap). Sweden has the 21st highest poverty gap index but the 12th highest squared poverty gap index, highlighting the impact of the VAT on inequality amongst the poor. These variations illustrate the importance of considering broader aspects of poverty than just frequency alone.

Table 9. Poverty indices

Poverty line = 50% of median gross expenditure

	Poverty headcount			Poverty gap			Squared poverty gap		
	gross	**net**	**diff**	**gross**	**net**	**diff**	**gross**	**net**	**diff**
AUT	8.8	12.3	**3.5**	1.9	2.8	**0.8**	0.7	1.0	**0.3**
BEL	7.1	9.2	**2.0**	1.4	2.0	**0.5**	0.4	0.6	**0.2**
CHE	7.4	8.7	**1.3**	1.3	1.6	**0.2**	0.4	0.4	**0.1**
CHL	14.7	19.2	**4.5**	3.7	5.0	**1.3**	1.4	2.0	**0.5**
CZE	4.2	7.3	**3.1**	0.9	1.5	**0.6**	0.3	0.5	**0.2**
DEU	4.2	6.5	**2.3**	0.5	0.9	**0.4**	0.1	0.2	**0.1**
DNK	3.8	7.4	**3.7**	0.5	1.1	**0.6**	0.1	0.3	**0.2**
ESP	8.4	10.6	**2.2**	1.8	2.3	**0.5**	0.6	0.8	**0.2**
EST	13.7	19.5	**5.7**	3.6	5.3	**1.7**	1.5	2.2	**0.7**
FIN	7.2	10.4	**3.2**	1.4	2.1	**0.7**	0.4	0.7	**0.3**
FRA	9.5	11.7	**2.2**	2.3	2.9	**0.6**	0.9	1.1	**0.3**
GBR	12.8	15.8	**3.0**	3.5	4.4	**0.9**	1.4	1.8	**0.4**
GRC	7.7	11.1	**3.3**	1.3	2.0	**0.6**	0.4	0.5	**0.2**
HUN	5.7	11.6	**5.8**	1.0	2.2	**1.2**	0.3	0.6	**0.4**
IRL	6.9	10.0	**3.1**	1.4	1.9	**0.5**	0.5	0.6	**0.2**
ITA	8.4	10.4	**2.0**	1.7	2.2	**0.4**	0.6	0.7	**0.1**
LUX	7.4	9.6	**2.1**	1.3	1.7	**0.4**	0.4	0.5	**0.1**
LVA	10.1	14.5	**4.3**	2.4	3.7	**1.3**	0.9	1.4	**0.5**
NLD	2.9	4.1	**1.2**	0.4	0.6	**0.2**	0.1	0.1	**0.1**
NZL	15.7	20.3	**4.7**	5.0	6.7	**1.7**	2.3	3.1	**0.8**
POL	5.7	8.6	**2.9**	0.9	1.4	**0.5**	0.2	0.4	**0.1**
PRT	11.4	14.7	**3.3**	2.9	3.7	**0.8**	1.1	1.4	**0.3**
SLV	4.2	6.9	**2.7**	0.7	1.1	**0.4**	0.2	0.3	**0.1**
SVK	3.1	6.3	**3.2**	0.5	1.0	**0.5**	0.1	0.3	**0.1**
SWE	4.4	6.5	**2.0**	0.9	1.4	**0.4**	0.5	0.7	**0.2**
TUR	14.2	16.9	**2.7**	3.9	4.9	**1.0**	1.6	2.0	**0.4**
Average	**8.1**	**11.1**	**3.1**	**1.8**	**2.5**	**0.7**	**0.7**	**0.9**	**0.3**

Note: Poverty indices expressed as percentages; gross = gross expenditure; net = net expenditure; diff = percentage point difference.

6. Conclusion

This paper has used a household expenditure microdata set of unprecedented size to examine the distributional effects of the VAT in 27 OECD countries. It has followed a consistent microsimulation methodology across countries to ensure comparability of results.

Average tax rate results presented across disposable income and expenditure deciles broadly confirm the dichotomous results from previous smaller-scale studies: the VAT appears to be regressive when measured as a percentage of current income in all 27 countries, but appears generally either proportional or slightly progressive when measured as a percentage of current expenditure. The paper has illustrated the distorting effect of savings behaviour on results when measured as a percentage of income, showing that expenditure-based results are likely to provide a more meaningful estimate of the distributional effect of the VAT.

Using equivalised expenditure as the welfare metric, these results are then confirmed by calculations of summary indicators of progressivity and redistributive effect. Kakwani progressivity index results show a low degree of progressivity in almost all countries, often extremely close to proportionality. The exceptions are Chile, Hungary, Latvia and New Zealand where a very small degree of regressivity is found. Reynolds-Smolensky and (change in) Atkinson index results show the VAT to have minimal redistributive effect – driven by the very low degree of progressivity and despite significant average tax rates being applied.

The paper also examines the effect of the VAT on the poor by calculating a range of Foster-Greer-Thorbecke poverty indices. Based on a relative poverty line of 50% of median equivalised gross expenditure, results show that the imposition of VAT increases the number of individuals below the poverty line (the poverty headcount) by three percentage points, on average, from 8.1% to 11.1%. Poverty gap and squared poverty gap index calculations also show similar increases.

Overall, the paper finds that the VAT is generally either roughly proportional or slightly progressive, with this progressivity driven by the presence of reduced VAT rates and exemptions. This strongly contrasts with the general public perception that VAT systems are regressive. Nevertheless, the results for Chile, Hungary, Latvia and New Zealand highlight that broad-based VAT systems that have few reduced VAT rates or exemptions can still produce a small degree of regressivity.

Furthermore, the results clearly show that even a roughly proportional VAT can have significant equity implications for the poor. This emphasises the importance of ensuring the progressivity of the tax/benefit system as a whole in order to compensate poor households for the loss in purchasing power from paying VAT.

REFERENCES

Atkinson, A. (1970), "On the Measurement of Inequality", *Journal of Economic Theory*, 2, 244–263.

Bachas, P., L. Gadenne and A. Jensen (2020), "Informality, Consumption Taxes and Redistribution", Paper presented at the annual meeting of the Allied Social Science Associations, San Diego.

Barreix, A., M. Bes and J. Roca (2009), "Equidad fiscal en Centroamérica, Panamá y República Dominicana", Banco Interamericano de Desarrollo, Washington, DC.

Benedek, D., R. De Mooij, M. Keen and P. Wingender (2019), "Varieties of VAT Pass Through", *International Tax and Public Finance*, Published online on 13 November 2019, https://doi.org/10.1007/s10797-019-09566-5

Benzarti, Y., D. Carloni, J. Harju and T. Kosonen (2020), "What Goes Up May Not Come Down: Asymmetric Incidence of Value-Added Taxes", *Journal of Political Economy* (forthcoming).

Bird, R. and M. Smart (2016), "Taxing Consumption in Canada: Rates, Revenues, and Redistribution", *Canadian Tax Journal*, 64(2), 417–42.

Bover, O., J. Casado, E. García-Miralles, J. Labeaga and R. Ramos (2017), "Microsimulation Tools for the Evaluation of Fiscal Policy Reforms at the Banco de Espana", *Documentos Ocasionales*, No. 1707, Banco de Espana.

Bozio, A., R. Dauvergne, B. Fabre, J. Goupille and O. Meslin (2012), "Fiscalité et redistribution en France", Institut des Politiques Publiques.

Brashares, E., J. Speyrer and G. Carlson (1988), "Distributional Aspects of a Federal Value-Added Tax", *National Tax Journal*, 41(2), 155-74.

Buhmann, B., L. Rainwater, G. Schmaus and T. Smeeding (1988), "Equivalence Scales, Well-Being, Inequality, and Poverty: Sensitivity Estimates Across Ten Countries using the Luxembourg Income Study (LIS) Database", *Review of Income and Wealth*, 34, 115–142.

Campbell, J. and G. Mankiw (1990), "Permanent Income, Current Income and Consumption", *Journal of Business and Economic Statistics*, 8(3), 265–279.

Campbell, J. and G. Mankiw (1989), "Consumption, Income, and Interest Rates: Reinterpreting the Time Series Evidence", in O. Blanchard and S. Fischer (eds.), *NBER Macroeconomics Annual*, Cambridge, MA, MIT Press.

Carbonnier, C. (2007), "Who Pays Sales Taxes? Evidence from the French VAT Reforms, 1987–1999", *Journal of Public Economics*, 91, 1219–29.

Caspersen, E., and G. Metcalf (1994), "Is a Value Added Tax Regressive? Annual versus Lifetime Incidence Measures", *National Tax Journal*, 47, 731–746.

Causa, O. and M. Hermansen (2017), "Income Redistribution Through Taxes and Transfers Across OECD Countries", *OECD Economics Department Working Papers*, No. 1453.

Coulter, A., F. Cowell and S. Jenkins (1992), "Equivalence Scale Relativities and the Extent of Inequality and Poverty", *Economic Journal*, 102, 1067–1082.

Creedy, J. (1998), "Are Consumption Taxes Regressive?", *Australian Economic Review*, 31(2), 107–116.

Creedy, J. and C. Sleeman (2006), *The Distributional Effects of Indirect Taxes: Models and Applications from New Zealand*, Edward Elgar, Cheltenham.

Cutler, D. and L. Katz (1992), "Rising Inequality? Changes in the Distribution of Income and Consumption in the 1980's", *American Economic Review: Papers and Proceedings*, 82(2), 546–551.

Decoster, A., J. Loughrey, C. O'Donoghue and D. Verwerft (2010), "How Regressive are Indirect Taxes?", *Journal of Policy Analysis and Management*, 29(2), 326–350.

Department of Finance, Ireland (2018), "Review of the 9% VAT Rate", Report prepared by the Economic Division, Department of Finance.

Eurostat (2015), "Household Budget Survey 2010 Wave EU Quality Report", HBS/2015/01/EN, Rev 1.

Eurostat (2018), "Glossary: At-Risk-of-Poverty Rate", available at: http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:At-risk-of-poverty_rate

European Commission (2004-12), "VAT Rates Applied in the Member States of the European Union", DG TAXUD (various editions).

Figari, F. and A. Paulus (2012), "The Redistributive Impact of Indirect Taxes and Imputed Rent on Inequality: A Comparison with Cash Transfers and Direct Taxes in Five EU Countries", *GINI Discussion Papers*, No. 28.

Flavin, M. (1981), "The Adjustment of Consumption to Changing Expectations About Future Income", *Journal of Political Economy*, 89, 974–1009.

Foster, J., J. Greer and E. Thorbecke (1984), "A Class of Decomposable Poverty Measures", *Econometrica*, 52(3), 761–766.

Gaarder, I. (2018), "Incidence and Distributional Effects of Value Added Taxes", *Economic Journal*, 129, 853–876.

Hurst, E., G. Li and B. Pugsley (2014), "Are Household Surveys Like Tax Forms: Evidence from Income Underreporting of the Self Employed", *Review of Economics and Statistics*, 96(1), 19–33.

IFS (2011), "Quantitative Analysis of VAT Rate Structures" in IFS et al., *A retrospective evaluation of elements of the EU VAT system*, Report prepared for the European Commission, TAXUD/2010/DE/328.

IHS (2011), "The Effect of VAT on Price-Setting Behaviour" in IFS et al., *A retrospective evaluation of elements of the EU VAT system*, Report prepared for the European Commission, TAXUD/2010/DE/328.

IHS, CPB, CAPP, CASE and IFS (2015), *A Study on the Economic Effects of the Current VAT Rates Structure*, Report prepared for the European Commission, TAXUD/2012/DE/323. (Completed 2013; publicly released 2015).

Jenkins, G., H. Jenkins and C. Kuo (2006), "Is the Value Added Tax Naturally Progressive?", *Queen's Economics Department Working Papers*, No. 1059.

Joumard, I., M. Pisu and D. Bloch (2012), "Tackling Income Inequality: The Role of Taxes and Transfers", *OECD Journal: Economic Studies*, 2012/1, 37–70.

Kakwani, N. (1977), "Measurement of Tax Progressivity: An International Comparison", *Economic Journal*, 87, 71–80.

Leahy, E., S. Lyons and R. Tol (2011), "The Distributional Effects of Value Added Tax in Ireland", *The Economic and Social Review*, 42(2), 213–235.

Metcalf, G. (1994), "Life Cycle versus Annual Perspectives on the Incidence of a Value Added Tax", *Tax Policy and the Economy*, 8, 45–64.

Meyer, B. and J. Sullivan (2003), "Measuring the Well-Being of the Poor Using Income and Consumption", *Journal of Human Resources*, 38, 1180–1220.

O'Donoghue, C., M. Baldini and D. Mantovani (2004), "Modelling the Redistributive Impact of Indirect Taxes in Europe: An Application of EUROMOD", *EUROMOD working paper*s, No. EM7/01.

OECD (2006-16), *Consumption Tax Trends*, OECD Publishing, Paris (various editions).

OECD (2016), "Income Inequality Update", available at: http://www.oecd.org/social/OECD2016-Income-Inequality-Update.pdf

OECD (2018), "Terms of Reference OECD Project on the Distribution of Household Incomes", http://www.oecd.org/els/soc/IDD-ToR.pdf

OECD/KIPF (2014), *The Distributional Effects of Consumption Taxes in OECD Countries*, OECD Tax Policy Studies, No. 23, OECD Publishing, Paris.

ONS (2019), "Effects of Taxes and Benefits on UK Household Income: Financial Year Ending 2018", Statistical bulletin, Office for National Statistics, United Kingdom.

Reynolds, M. and E. Smolensky (1977), *Public Expenditures, Taxes, and the Distribution of Income: The United States, 1950, 1961, 1970*, New York, Academic Press.

Ruiz, N. and A. Trannoy (2008), "Le caractère régressif des taxes indirectes : les enseignements d'un modèle de microsimulation", *Economie et Statistique*, 413, 21–46.

Warren, N. (2008), "A Review of Studies on the Distributional Impact of Consumption Taxes in OECD Countries", *OECD Social, Employment and Migration Working Papers*, No. 64.

APPENDIX 1. SENSITIVITY ANALYSIS

A1.1. Introduction

This appendix provides sensitivity analysis regarding a number of assumptions and key modelling decisions made in the paper. It considers: the choice of parameters in the equivalence scale; the impact of the inclusion/exclusion of actual and imputed housing costs; and the choice of poverty line.

A1.2. Equivalence scale

Recall the parametric equivalence scale adopted in the analysis:

$$m_i = \left(n_{a,i} + \theta n_{c,i}\right)^{\alpha}$$

where m_i is the equivalent size of household i, θ measures the degree of need of children relative to adults; α specifies economies of scale in consumption; $n_{a,i}$ is the number of adults in household i and $n_{c,i}$ is the number of children.

The parameters adopted in the paper are: $\theta = 0.5$ and $\alpha = 0.7$. These parameter settings closely approximate the commonly used "OECD modified" scale, but provide for additional economies of scale at greater household sizes. This section examines how variation in these parameters affects the Kakwani and poverty headcount index results.

A1.2.1. Kakwani index

Figure A1.1 presents the average across 26 countries for the Kakwani progressivity index results presented in Table 8, for values of α between 0.05 and 1, for four different values of θ.[29] This provides broad coverage of the feasible range of values of α and θ: α must be positive and less than one if economies of scale are considered to exist (with lower values indicating greater economies of scale); θ must be positive and less than one if a child is considered to need less consumption than an adult to attain the same level of wellbeing (with lower values indicating less need for children relative to adults).

The results show, on average, a very slight rise in the Kakwani index as α initially increases, before a larger fall at higher levels of α. The fall at higher levels of α is greater for higher values of θ. However, the total variation in the index is relatively low, ranging from a minimum of 0.024 to a maximum of 0.037.

[29] This presentational approach follows that of Creedy and Sleeman (2006). Results for Korea were unable to be calculated due to data access restrictions.

These overall averages do mask a small degree of variation across countries. Some countries (e.g. the Czech Republic, Estonia, Switzerland and the United Kingdom) exhibit a greater increase in the Kakwani index before it begins to fall. In contrast, several countries show a continuous fall in the Kakwani index (e.g. Hungary, Italy, Latvia, the Slovak Republic and Turkey). In general, there is very little variation in results for different values of θ, though any differences are greatest at high levels of α.

Overall, the results do not vary significantly enough to alter the broad conclusion in the paper that the VAT is generally roughly proportional or slightly progressive. However, in three out of 25 countries, where Kakwani index results are very close to zero, a change in parameter can alter the exact conclusion for that country. In Hungary and Latvia, results change from slightly positive to slightly negative as α increases. As such, if greater economies of scale are considered to exist than is assumed in the main text ($\alpha = 0.7$) then this may lead to a conclusion of slight progressivity in these two countries. That said, the range of variation in the Kakwani index is very low in Latvia (a range of 0.005 – even less than the range of 0.013 for the overall average), though larger for Hungary (0.031). Additionally, in the Slovak Republic, while the Kakwani index is almost always positive, it is negative at one extreme of α (no economies of scale) for high values of θ. The other two regressive results (for Chile and New Zealand) hold for all feasible values of α and θ.

The variation in the Kakwani index exhibited in Figure A1.1 is driven by variation in the underlying inequality measures that it compares – the Gini index of expenditure and the concentration index of VAT. These are shown – again for the 26 country average – in Figure A1.2. Patterns are almost identical for different values of θ, so for ease of presentation only the results for $\theta = 0.6$ are presented.

Both the Gini and concentration index follow a U-shaped pattern, with inequality first falling before rising again. As highlighted by Coulter et al. (1992) and Creedy and Sleeman (2006), two opposing effects drive this pattern: a concentration effect and a re-ranking effect. As α starts to increase, economies of scale fall thereby reducing the equivalised expenditure of larger households. As larger households tend to have higher expenditure, the expenditure distribution becomes more concentrated. As α increases further, though, the reduction in equivalised expenditure of larger households starts to change the ranking of households, acting to increase inequality. At low values of α the concentration effect dominates the re-ranking effect, whereas the opposite is true at higher values of α. Though not illustrated in Figure A1.2, higher values of θ increase the re-ranking effect. The greater variation in the Gini index of expenditure than in the concentration index of VAT results in the slight n-shaped pattern of the Kakwani index.

Figure A1.1. Kakwani index

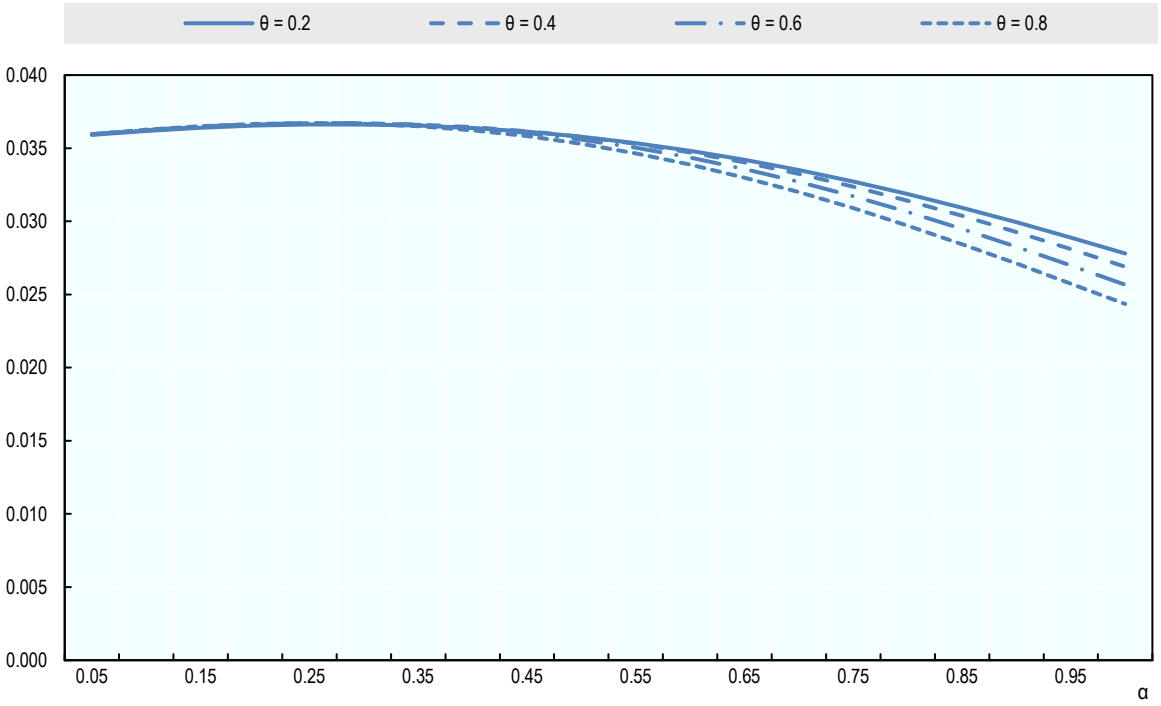
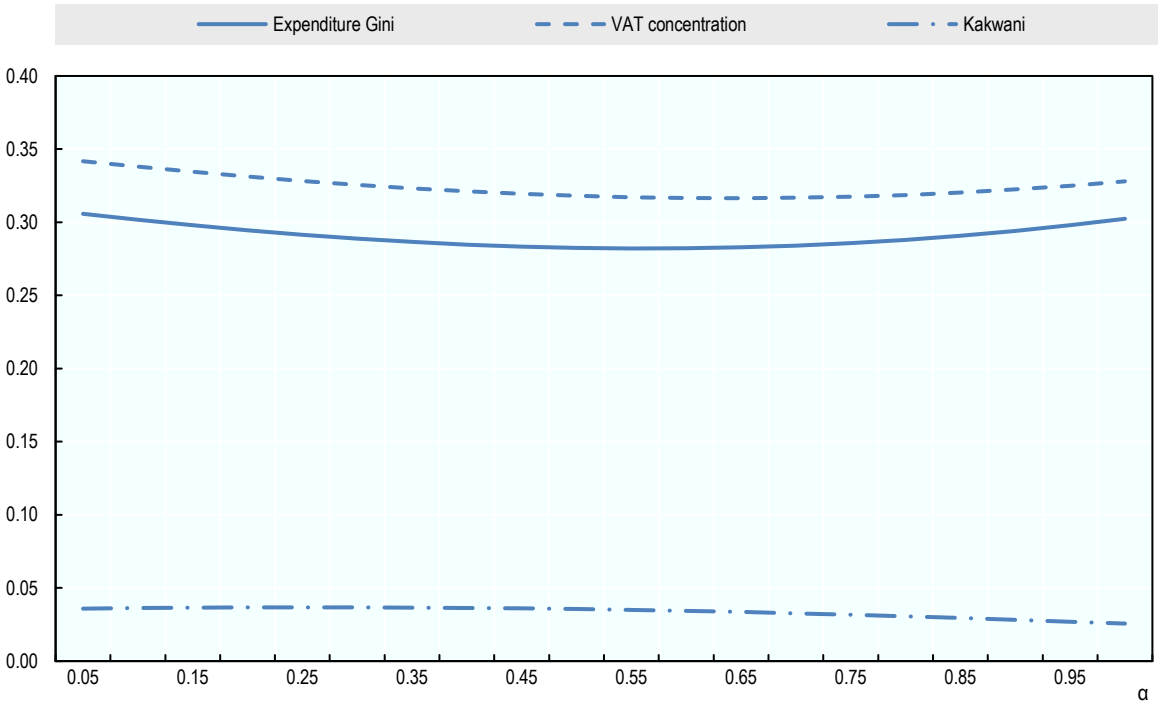


Figure A1.2. Kakwani index (decomposition)

$\theta = 0.6$.



A1.2.2. Poverty headcount

Figure A1.3 presents the average across 26 countries of the difference in poverty headcount results (between gross and net expenditure) initially presented in Table 9, for the same range of α and θ as in Figure A1.1. The results show very little change in the difference in poverty headcount, ranging from 2.9 to 3.3 percentage points, with a very small dip at mid-range values of α, and no clear pattern across values of θ.

Results are similar for individual countries, with minimal variation across the range of α and θ. In some countries (e.g. Greece, Hungary, Poland) there is a slight increasing pattern as α increases; while in several others (e.g. the Czech Republic, Denmark, the Netherlands) there is a slight decreasing pattern. However, results are always positive, and variation is always small, emphasising the robustness of the conclusion that the VAT increases the poverty headcount.

The broad consistency in the difference in the poverty headcount is explained by the consistent pattern in the underlying headcount measures, as illustrated in Figure A1.4. As above, patterns are broadly consistent across values of results for θ, hence only results for $\theta = 0.6$ are presented.

For both gross and net expenditure, the poverty headcount falls as α initially increases, before rising at higher levels of α. The variation in the poverty headcount measures are also driven by the concentration and re-ranking effects noted above. Initially, the concentration effect leads to median expenditure falling to a greater extent than the expenditure of poorer households, thereby lifting households above the relative poverty line. However, at higher levels of α, re-ranking of households results in the median falling to a lesser extent than the expenditure of poorer households, and hence to an increase in relative poverty.

Figure A1.3. Percentage point change in poverty headcount

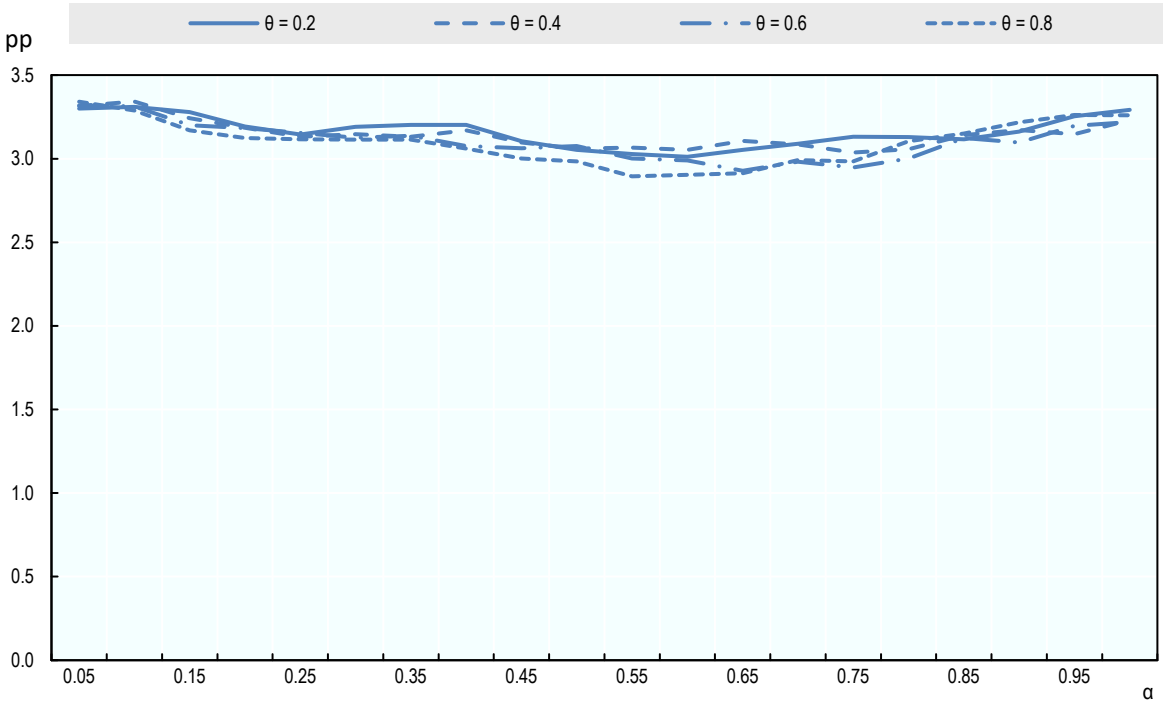
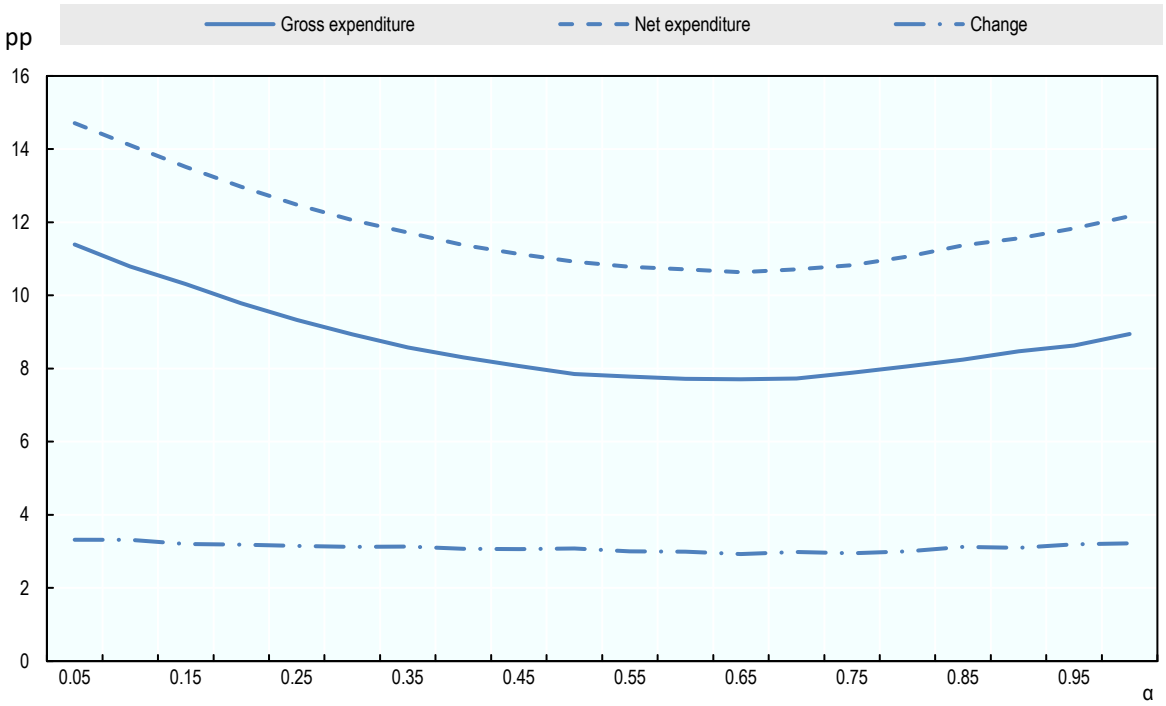


Figure A1.4. Percentage point change in poverty headcount (decomposition)

$\theta = 0.6$.



A1.3. Housing costs

While actual rental expenditure data are available in the household budget surveys (HBSs) for all 27 countries covered by this paper, imputed rental expenditure data are only available for 23 countries. This raises concern about the comparability of results between renters and homeowners in countries where imputed rental data are unavailable. For this reason, where both rental and imputed rental expenditure are available for a country, both are included in the modelling. However, for countries where only actual rental expenditure is available, this is excluded from the modelling.

This section examines how results differ depending on whether housing costs (defined as actual plus imputed rental expenditure) are included in the analysis. As above, the Kakwani and poverty headcount index results are focused on. The analysis covers 22 countries. The Czech Republic, New Zealand, Switzerland and the United Kingdom are excluded as imputed rental expenditure data are not available in the HBSs, while Korea is excluded due to data access restrictions.

A1.3.1. Kakwani index

Figure A1.5 presents results for the Kakwani index initially presented in Table 8, with and without housing costs. In all countries except Hungary, the Kakwani index is lower when housing costs are excluded. In two countries, Estonia and the Slovak Republic, results change from slightly progressive to slightly regressive, increasing the number of countries with (slightly) regressive results from three to five.

The reduction in the Kakwani index on exclusion of housing costs is due to the more equal distribution of (equivalised) housing expenditure than (equivalised) non-housing expenditure (with the exception of Hungary). While richer households spend more on housing in aggregate terms than poorer households, they spend less in relative terms. Inclusion of housing costs therefore acts as an equalising factor lowering the Gini index of gross expenditure. Meanwhile, there is minimal change in the VAT concentration index as no VAT is imposed on housing costs in any of the countries (so there is only a re-ranking effect based on gross expenditure), so the difference – the Kakwani index – falls.[30]

The reductions in the Kakwani index are generally significant in proportionate terms – falling by more than 50% in 13 of 22 countries. However, the reductions (as with the levels) are small in aggregate terms, with results still indicating a low degree of progressivity in most countries, often extremely close

[30] There may potentially be some VAT capitalised into rental expenditure as a result of the imposition of VAT on new house purchases, however this is not able to be captured in the analysis.

to proportionality. An overall conclusion drawn on the basis of the "exclusive of housing costs" results would therefore remain consistent with the broad conclusion that the VAT is generally either roughly proportional or slightly progressive.

A1.3.2. Poverty headcount

Figures A1.6-A1.8 present the poverty headcount results initially presented in Table 9, with and without housing costs. Figure A1.6 presents the change in poverty headcount results. It shows that, in every country, the increase in the poverty headcount on imposition of VAT is greater when housing costs are excluded than when included. Underlying this result is an increase in the poverty headcount for all countries for net expenditure when excluding housing costs (Figure A1.7), and a similar increase – though to a smaller extent – in the poverty headcount for 20 out of 22 countries for gross expenditure when excluding housing costs (Figure A1.8).

As with the change in the Kakwani index, the increase in poverty headcount is driven by the equalising effect of housing costs. Including housing costs increases the expenditure of poorer households proportionately more than richer households. While median expenditure (and hence the relative poverty line) increases, more people are lifted above the poverty line. The poverty headcount for gross expenditure increases by less than for net expenditure as housing expenditure makes up a smaller proportion of gross expenditure than net expenditure and hence has a smaller impact on the overall gross expenditure distribution.

These results highlight that the poverty index results presented for the Czech Republic, Switzerland, New Zealand and the United Kingdom are likely to be overstated as a result of the exclusion of housing costs. Nevertheless, the overall conclusion that the VAT increases the poverty headcount appears robust.

Figure A1.5. Kakwani index, with and without housing

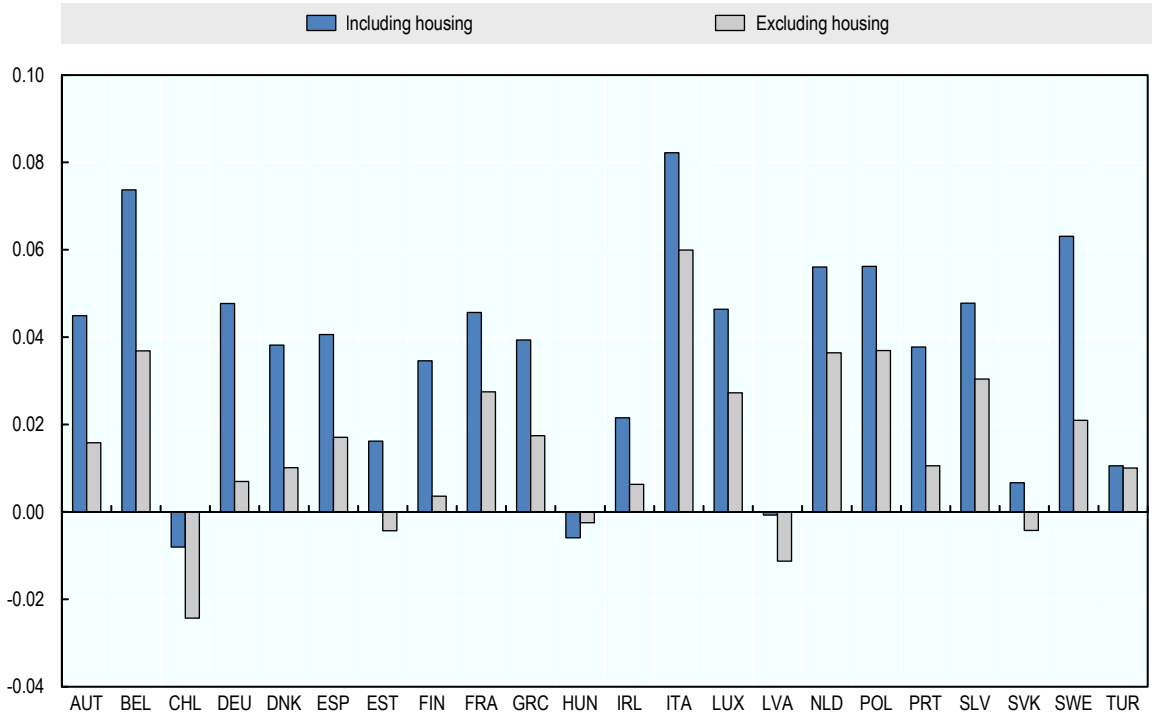


Figure A1.6. Percentage point change in poverty headcount, with and without housing

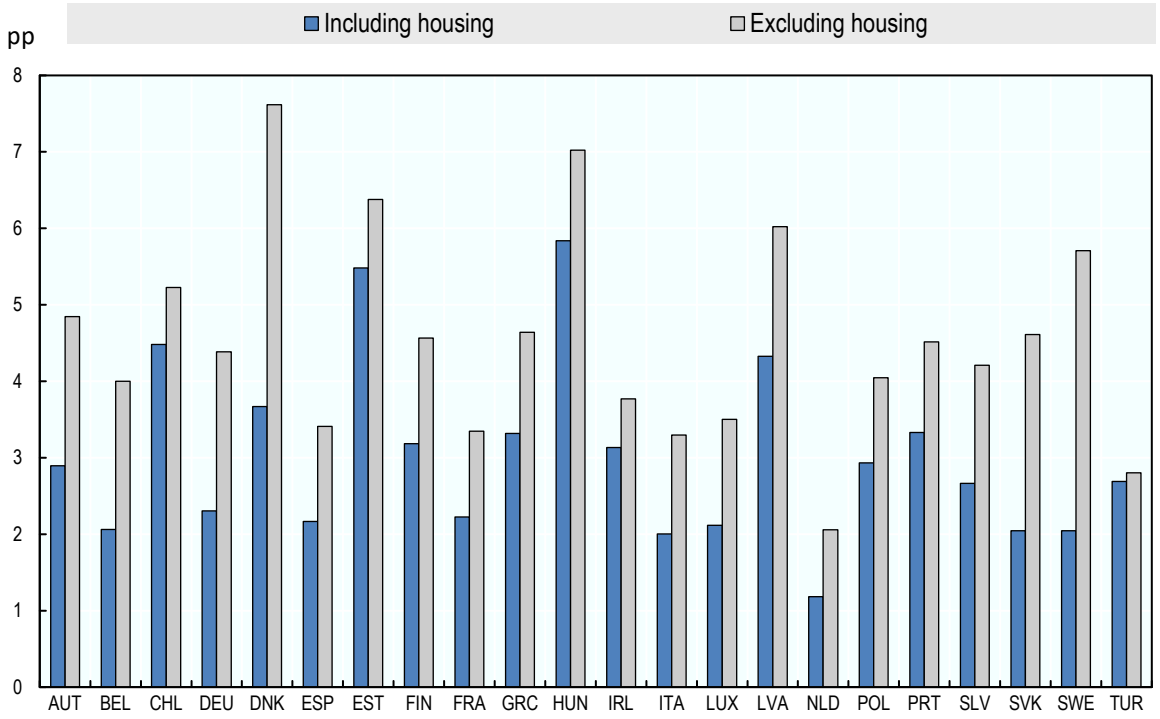


Figure A1.7. Net expenditure poverty headcount, with and without housing

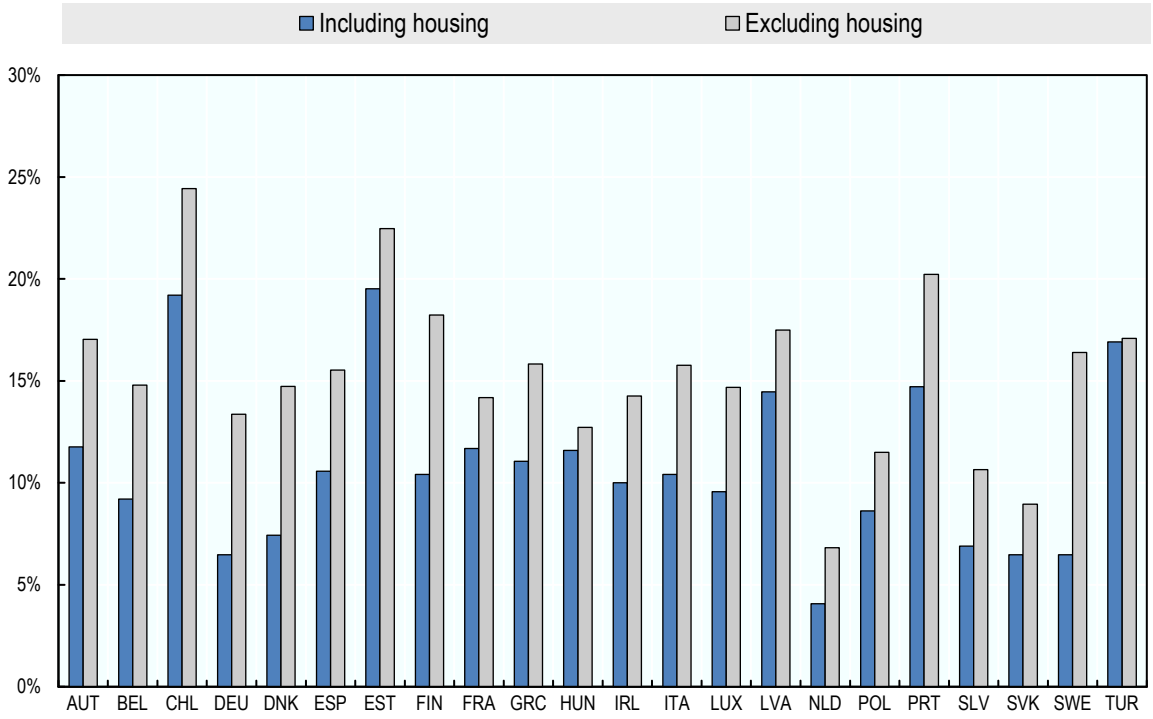
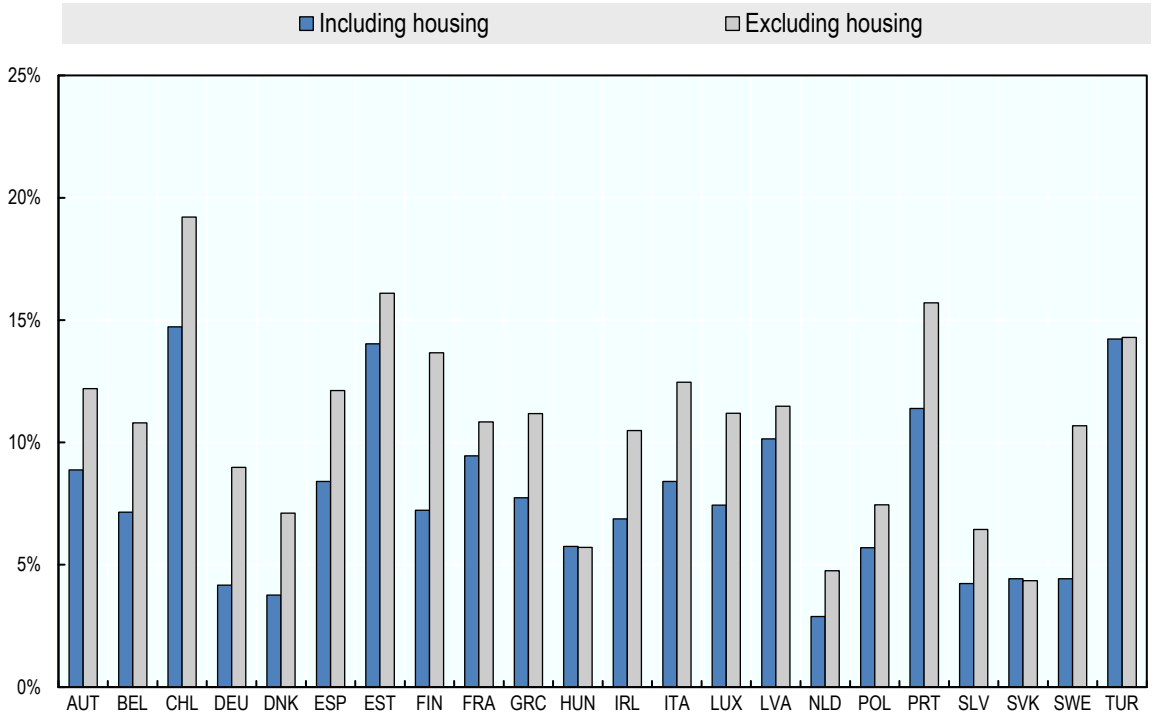


Figure A1.8. Gross expenditure poverty headcount, with and without housing

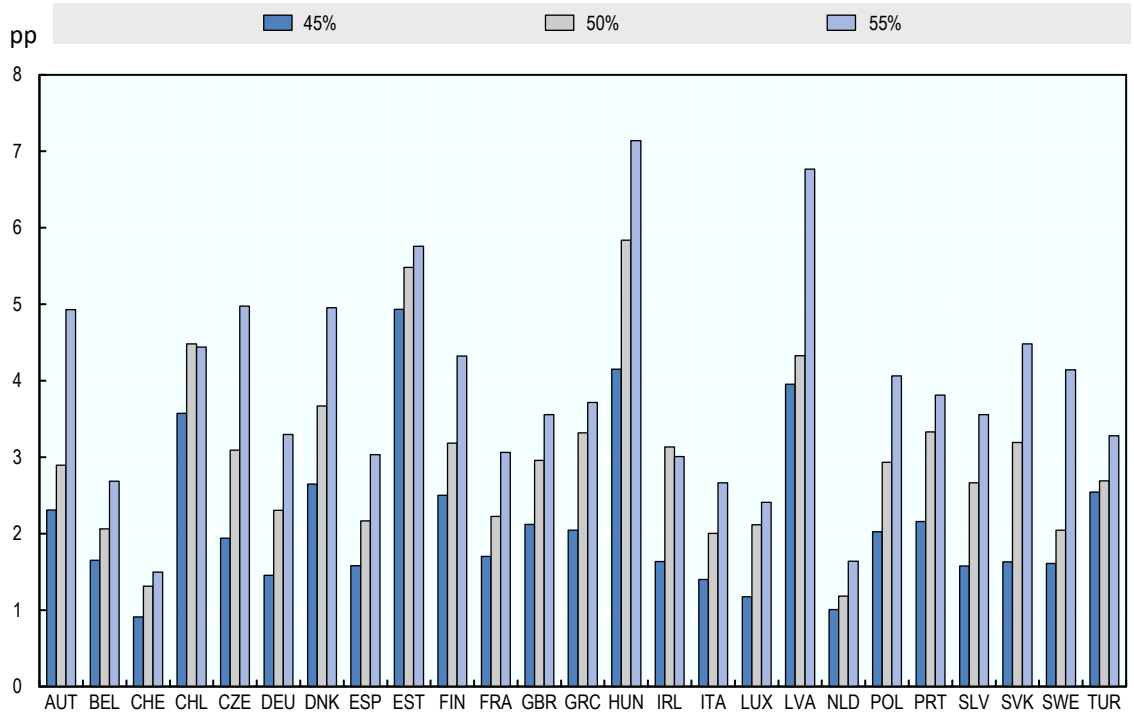


A1.4. Poverty line

Poverty index results are also sensitive to the choice of poverty line. The focus of analysis in the paper has therefore been on changes in the poverty indices, rather than their underlying values. Nevertheless, this section illustrates the sensitivity of the underlying poverty index values to the choice of poverty line. Again, poverty headcount results from Table 9 are focused on.

Figure A1.9 shows the percentage point change in poverty headcount results (from gross to net expenditure) for 25 countries for a poverty line of 45%, 50% and 55% of median gross expenditure.[31] In 23 of 25 countries, the poverty headcount increases as the poverty line increases. In two countries (Chile and Ireland) the difference increases as the poverty line moves from 45% to 50% of median gross expenditure, but falls slightly as the poverty line moves from 50% to 55%. However, the difference is always positive – emphasising the robustness of the conclusion that the VAT increases the poverty headcount.

Figure A1.9. Percentage point change in poverty headcount, for differing poverty lines



[31] Results for Korea and New Zealand were unable to be calculated due to data access restrictions.