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VAT Exemptions, Embedded Tax, and Unintended Consequences

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Abstract

The value-added tax (VAT) has proved to be a highly effective tool at raising revenue in developed and developing countries alike. However, the effective operation of the VAT breaks down in the presence of exemptions. Unlike zero rates, exemptions deny input tax credits, thereby increasing production costs and resulting in VAT being embedded within the prices of goods and services. This paper develops a VAT model based on input-output table and household budget survey data for 29 European countries to examine the effects of VAT exemptions on final prices and to assess the merits of their use. Simulation results show that exemptions suffer from the same targeting problems as reduced VAT rates, but, in addition, they are non-transparent and have unpredictable and counterproductive indirect effects. These effects are in addition to the well-known distortionary impact of exemptions on production decisions, and their creation of incentives to self-supply. The paper concludes that the use of exemptions should be limited to addressing pragmatic concerns, such as the disproportionate compliance costs of small businesses and the practical difficulty in taxing margin-based financial services.

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1 Introduction

The value-added tax (VAT) has proved to be a highly effective tool at raising revenue in developed and developing countries alike, with 175 countries having implemented a VAT as of 2024 (OECD, 2024a).[1] Key to the VAT's design is its staged collection process where businesses charge VAT on their sales but claim credits for the VAT paid on their purchases. This ensures that the VAT acts as a tax on final consumption rather than on production and creates an incentive for businesses to declare transactions.[2] However, the effective operation of the VAT breaks down in the presence of exemptions, which, unlike zero rates, deny input tax credits, thereby increasing production costs and resulting in VAT being embedded within the prices of goods and services. While this phenomenon is well known, there is little research quantifying the degree and spread of the embedded VAT as this depends on the supply and use patterns within an economy. This paper develops a VAT model based on input-output tables for 29 European countries to examine the effects of VAT exemptions on final prices and to assess the merits of their use.

Countries apply VAT exemptions for various reasons. They are often applied for pragmatic reasons: margin-based financial services are usually exempt because the value added on transactions is difficult to accurately quantify, while many countries also exempt small businesses to minimize compliance and administration costs. However, in many countries exemptions are also applied to achieve specific policy goals, often as an alternative to applying a reduced or zero VAT rate. For example, to achieve distributional goals, exemptions are often applied to food (or the agriculture sector more generally), water supply, public healthcare and education. Exemptions may also be applied to products considered to be culturally or socially beneficial (based on merit good or positive externality arguments). Finally, exemptions may be applied to particular products or sectors in order to encourage employment or economic activity in that sector.[3]

Exemptions have a range of negative consequences that can undermine their effectiveness as a policy tool. Previous studies (see, e.g., Ebril et al., 2001) highlight that exemptions distort production decisions, create incentives to self-supply, reduce export competitiveness, and create risk of exemption creep (i.e., businesses unable to reclaim VAT paid on their inputs pressure government to also exempt those inputs). In addition to taking account of these well-known concerns, assessing whether an exemption is an effective and efficient means of achieving its policy goal also requires an understanding of the impact of a VAT exemption on the final prices of goods and services.

Determining the impact of VAT exemptions on final prices is not a simple task because the inability to recover input tax means that exemptions have both direct and indirect effects that must be accounted

[1] The VAT is a particularly crucial revenue source in developing economies, where limited administrative capacity and significant informality can often restrict countries' ability to raise significant tax revenue from income and other direct taxes.

[2] It also limits revenue risk in the event of fraud to just the value-added at the particular stage of the supply chain where the fraud occurred.

[3] Exemptions are often wide ranging, even in high-income countries. For example, OECD (2024a) notes the following as exemptions that are commonly applied in most OECD countries: postal services; transport of sick/injured persons; hospital and medical care; human blood, tissues and organs; dental care; charitable work; education; non-commercial activities of non-profit making organizations; sporting services; cultural services (except radio and television broadcasting); insurance and reinsurance; letting of immovable property; financial services; betting, lotteries and gambling; supply of land and buildings; certain fund-raising events.

for. The direct effect eliminates VAT paid on the exempted good or service. However, the indirect effect may lead to a rise in the pre-tax price of the exempt commodity due to the unrecoverable input tax. This embedded VAT can, in turn, increase the cost of inputs for businesses that use the exempted commodity, and then lead to cascading as VAT is subsequently charged on the embedded VAT. The size of these direct and indirect (embedded and cascaded) effects on prices, which work in opposite directions, is not obvious because they depend on the supply-use relationships within the economy.[4]

To quantify the impact of VAT exemptions on final prices, we construct a VAT model based on input-output (IO) table data for 29 European countries from the OECD's Inter-Country Input-Output database. These IO tables describe, in a standardized manner, the supply and use relationships among 45 different commodities in each economy, as well as quantifying the total output from a sector going to domestic final demand and to exports. When commodities are fully taxable, the model calculates the direct VAT paid by households, non-profit institutions serving households (NPISH) and government (with exports zero-rated). When an exemption is modeled, the unrecoverable VAT embedded in each domestically produced commodity is fully forward shifted, in fixed proportions, to final demand (households, NPISH and government), exports and intermediate use. The VAT allocated to intermediate use is then allocated again to final demand, exports and intermediate use, with this iterative process continuing until all embedded and cascaded VAT has been shifted to either final demand or to exports. The model is also linked to semi-aggregated household budget survey data from Eurostat to enable distributional analysis across expenditure quintiles.

This iterative modeling approach is different to that applied in standard IO models. Typically, IO models adhere to the structure of the tax regime that was in place in the reference year. This means they can capture any embedded tax that existed in the reference year, but they cannot introduce embedded tax that did not previously appear or remove embedded tax that did. As such, while they can scale up and down rates, they cannot, for example, model the introduction of an entirely new exemption. This is the case, for example, with Statistics Canada's Social Policy Simulation Model (SPSM), which models VAT, excise and other commodity taxes (Statistics Canada, 2025). In contrast, our model can capture the changes in direct, embedded and cascaded VAT arising from the introduction of a completely new exemption, or removal of an existing exemption. For example, in our model, when an exemption is introduced, the VAT is removed from final consumption of the exempt commodity and businesses using the exempt commodity now incur unrecoverable VAT (which cascades). This switching of tax liability from final consumption to businesses is a unique feature of our model that does not occur in a standard IO model.

An additional novel feature of our model is its ability to capture the international trade implications of VAT exemptions. Domestic firms incur unrecoverable tax when making an exempt supply, whereas imports arrive tax free. Because our model differentiates between the two, it can generate estimates of

[4] While, like a zero rate, an exemption results in no tax being applied to the sale of the specified good (or service), an exemption also results in the inability to claim input tax on the purchases made to produce the exempted good. This increased cost will typically be passed on in the price of the good, meaning that the effective tax rate on final consumption of an exempted good will still be positive (though less than the standard VAT rate as the value-added at the final stage of production is not being subjected to tax). Meanwhile, where the exempted good is an intermediate input into other goods, a 'cascading' effect occurs where not only is the embedded VAT not able to be reclaimed by the purchaser, but VAT is then charged on the (embedded) VAT, resulting in an effective tax rate on final consumption that is higher than the standard VAT rate.

import bias induced when previously taxable commodities become exempt. Similarly, introducing an exemption embeds VAT in a country's exports that did not previously exist. This is captured in our model, whereas the standard IO methodology keeps relative prices fixed and cannot therefore introduce unrecoverable tax in exports.

Another strength of our approach is its compatibility with IO tables that are either non-square or have non-diagonal supply matrices – the standard format in national accounting systems. Square IO tables with diagonal supply matrices are less detailed and are derived specifically for IO and CGE modeling, which require matrix inversion. While the current analysis uses square IO tables, the ability to work directly with the original non-square or non-diagonal tables enhances the model's flexibility. This is particularly valuable in many developing countries, where data quality may be limited – making it especially important to use the most detailed available tables to reduce aggregation bias.

The Commitment to Equity (CEQ) Institute and World Bank have also used a more conventional IO modeling framework to estimate VAT burdens as part of their fiscal incidence analysis program (see CEQ Data Center on Fiscal Redistribution, 2025).[5] However, the CEQ approach is designed in a static context to examine the overall poverty and distributional impacts of a country's existing fiscal system, rather than to specifically examine the effects of VAT exemptions. Their approach, which also assumes full forward shifting and fixed proportion production, yields direct, indirect and induced effects, characteristic of a classic input-output modeling approach, whereas our model explicitly tracks the direct, embedded and cascaded taxes. As the two approaches seek to answer different questions, in this respect, they can be viewed as complementary.

To draw out policy implications on the use of VAT exemptions, we use our model to run a range of simulations. We do not attempt to model each country's current VAT regime, instead we simulate the same baseline hypothetical VAT system in each country and then examine the impact of introducing exemptions on the goods and services consumed by households in, and exported from, each country. Our baseline scenario applies a single 10% VAT rate on all consumption, with no small business exemption threshold, and no informality. From this baseline, we simulate the introduction of an exemption on each of the 45 commodities in the model, one by one.

Our simulation results highlight the uncertain and non-transparent impact of VAT exemptions. Effective VAT rates on final consumption of an exempted commodity are always below the baseline 10% VAT rate as some value-added is no longer taxed, and they are also always above zero due to the presence of embedded VAT. However, the degree of embedded VAT varies significantly across commodities. Furthermore, the indirect (embedded and cascaded) impact of an exemption on the prices of commodities that use the exempted commodity as an input is shown in some cases to more than fully offset the VAT reduction on the exempted commodity itself. Additional results illustrate the impact of embedded VAT reducing both export competitiveness and the competitiveness of domestic production with imports. Finally, distributional analysis of effective VAT rates across expenditure quintiles shows that exemptions suffer from the same poor targeting as reduced VAT rates, but, in addition, provide a non-transparent level of support due to varying degrees of embedded VAT and by their indirect effects on other

[5] Inchauste and Jellema (2018) provide a summary of this modeling approach, which itself builds on earlier work predominantly focused on the indirect effects of excise taxes and subsidies by Ahmad and Stern (1984) and extended to the VAT by Coady (2008). The same approach was also recently adopted by Warwick et al. (2022).

commodities – with results showing that these indirect effects can, in some cases, remove any progressive effect that an exemption might otherwise have had.

These results imply that exemptions are an inferior policy tool to reduced VAT rates. We therefore conclude that the use of exemptions should be limited solely to addressing pragmatic concerns, such as the disproportionate compliance costs of small businesses and the practical difficulty in taxing margin-based financial services. Notably, exemptions on financial services in practice often extend beyond margin-based services to other fee or commission-based services, so there even remains an opportunity for countries to reduce the extent of exemptions here.

More generally, a hierarchy of policy mechanisms can be established. Direct mechanisms (such as targeted transfers to address distributional concerns) should be preferred to reduced VAT rates, which in turn should be preferred to VAT exemptions. Furthermore, only in cases where targeted transfers are not implementable due to administrative limitations should a reduced VAT rate be considered as a potential policy option.

The paper proceeds as follows: Section 2 presents the data and the model. Section 3 then presents simulation results for the 29 countries. Section 4 concludes and discusses policy implications.

2 Methodology

2.1 Data

2.1.1 Input-Output Data

The model is built on the OECD's 2021 Input-Output tables for 29 European countries (OECD, 2024b). The OECD IO tables all have the same commodity and industry space, which makes it possible to easily compare results of simulations. The IO tables are the foundation of the model, providing final consumption expenditure, capital investments as well as the production structure of the economy. Final consumption expenditure is disaggregated across households, non-profit institutions serving households (NPISH) and government. Capital investments are disaggregated across gross fixed capital formation (GFCF) and inventories. Finally, the structure of domestic production is provided by the Input and the Output matrices that express the intermediate inputs used in the production of each industry and the output being produced by each industry. The OECD's output matrix is diagonal, which means that each industry outputs only one good. Each of these components is available in two versions: domestic and imported. The domestic matrix reports the use and consumption of domestically produced goods and services while the imported matrix reports the use and consumption of imported goods and services.

2.1.2 Household Consumption Data

The household consumption data by income quintile provides insights into the consumption pattern of households across the income distribution, which makes it possible to gauge the distributional impact of different VAT policies or of informality. The following two series from the household consumption data published by Eurostat are used to estimate the distributional impacts:

- Structure of consumption expenditure by income quintile and COICOP consumption purpose (Eurostat, 2024a).
- Mean consumption expenditure by income quintile (Eurostat, 2024b).

The former provides the share of total consumption spent on each COICOP commodity group for each quintile, while the latter provides the average total consumption of each quintile. The two datasets are combined to derive the share of each commodity's final consumption that is consumed by each quintile. With concordances between the different commodity spaces, these proportions can then be used to disaggregate the household final consumption expenditure (HHFCE) data from the IO tables. Using proportions applied to the HHFCE data from the IO tables makes the disaggregation less sensitive to the concordances and avoids discrepancies between the disaggregated HHFCE and the aggregated HHFCE data that is part of the IO tables.

2.2 Adjustments

2.2.1 Capital Shift

In most countries, capital investments—or Gross Fixed Capital Formation (GFCF) in the IO tables—are subject to VAT and eligible for input tax credits when producing output that is not exempt. Since capital is reported as final consumption in IO tables, it is necessary to shift capital used by businesses to the intermediate use matrix such that it can be taxed appropriately based on whether the industry is eligible for input tax credits—in the case of output that is standard-rated, zero-rated or subject to a reduced rate—or that is not eligible for input tax credits—in the case of output that is exempt. This process is generally done using complementary statistical data, such as a mapping of the use of each capital good by each industry. Since this is not readily available in many countries, capital is allocated to each industry based on the share of that industry's intermediate use of the corresponding goods. The allocation of capital I^K can be described in the following way:

$$I_{c,i}{}^{K,DOM} = K_c{}^{DOM} \times \frac{I_{c,i}{}^{DOM,w/o\,K}}{\sum_i \quad I_{c,i}{}^{DOM,w/o\,K}} \; \forall c, i$$

$$I_{c,i}{}^{K,IMP} = K_c{}^{IMP} \times \frac{I_{c,i}{}^{IMP,w/o\,K}}{\sum_i \quad I_{c,i}{}^{IMP,w/o\,K}} \; \forall c, i$$

Where:

- $K_c{}^{DOM}$ is domestic capital investments of commodity c
- $K_c{}^{IMP}$ is imported capital investments of commodity c
- $I_{c,i}{}^{DOM,w/o\,K}$ is domestic inputs of commodity c in industry i without capital investments
- $I_{c,i}{}^{IMP,w/o\,K}$ is imported inputs of commodity c in industry i without capital investments
- $I_{c,i}{}^{K,DOM}$ is domestic capital inputs of commodity c in industry i
- $I_{c,i}{}^{K,IMP}$ is imported capital inputs of commodity c in industry i

Capital investments are then added to the input matrix to obtain our VAT base for embedded VAT:

$$I_{c,i}{}^{DOM} = I_{c,i}{}^{DOM,w/o\,K} + I_{c,i}{}^{K,DOM} \forall c, i$$

$$I_{c,i}{}^{IMP} = I_{c,i}{}^{IMP,w/o\,K} + I_{c,i}{}^{K,IMP} \forall c, i$$

2.3 Distribution of Informality

Informality is a parameter in the model. It is not calibrated to the data as the objective of the simulation is to isolate the impact of different VAT policies at various levels of informality. Given that the literature on VAT informality shows that the propensity to consume informal goods and services decreases with income, informality is calibrated with two parameters:

1. The average propensity to purchase from the formal economy ξ_c in commodity c
2. The dispersion in propensity to consume from the formal economy α

The parameter α determines the extent to which the propensity to consume from the formal economy differs across income quintiles:

- $\alpha = 0$ is no variation
- $\alpha \to \infty$ infinite variation

The propensity to consume from the formal economy $f_c(x)$ in commodity c is defined as a sigmoid function:

$$f_c(x) \quad = \frac{1}{1+e^{-\alpha(x+\beta_c)+\gamma_c}}$$

where:

- x is the income quintile and $x \in \{1,2,3,4,5\}$
- γ_c is set such that:

$$\gamma_c = ln\left(\frac{1}{\xi_c} - 1\right)$$

- β_c is determined such that:

$$\frac{\sum_{x=1}^{5} \left(FD_c{}^{HH,DOM}(x) \times f_c(x)\right)}{\sum_{x=1}^{5} FD_c{}^{HH,DOM}(x)} = \xi_c$$

where $FD_c{}^{HH,DOM}(x)$ is domestic household final demand of commodity c by quintile x.

The sigmoid function is a well-suited functional form for modeling the relationship between income and the propensity to consume from the formal economy. It offers three key advantages in this context. First, it is naturally bounded between 0 and 1, which aligns with the interpretation of the propensity as a share variable. Second, it is monotonic, ensuring that formality increases with income – a stylized fact widely supported by the empirical literature on informality. Third, it provides a high degree of flexibility: by adjusting the dispersion parameter α, the function can approximate a flat relationship (when α is close to zero) or a sharp income-based transition (as α increases). This makes the sigmoid form suitable for both developing countries with large informal sectors and OECD economies where formality is near-universal but still potentially varies by sector or income level. As noted below, the base calculations in section 3 of this paper assume no informality, but sensitivity analysis is conducted following the above approach.

2.4 Core Tax Component

2.4.1 VAT on Final Demand

Final demand is taxed by applying the applicable tax rates to household, NPISH and government final consumption expenditure.[6] The domestic final consumption of households is weighted by the propensity to consume from the formal economy $f_c(x)$ for each commodity c and quintile x. The domestic final consumption of NPISH and government is weighted by the average propensity to consume from the formal economy ξ_c. The imported final consumption of households, NPISH and government is assumed to be 100% formal as VAT is applied at customs; however, this assumption could be relaxed for specific sectors such as services, where non-compliance may arise. The direct VAT on final demand is hence calculated as:

$$VAT_c{}^{HH,FD}(x) = \left(FD_c{}^{HH,DOM}(x) f_c(x) + FD_c{}^{HH,IMP}(x)\right)(p_c{}^t \times \tau^t)\ \forall c, x \in \{1,2,3,4,5\}$$

$$VAT_c{}^{NPISH,FD} = \left(FD_c{}^{NPISH,DOM} \xi_c + FD_c{}^{NPISH,IMP}\right)(p_c{}^t \times \tau^t)\ \forall c$$

$$VAT_c{}^{GOV,FD} = \left(FD_c{}^{GOV,DOM} \xi_c + FD_c{}^{NPISH,IMP}\right)(p_c{}^t \times \tau^t)\ \forall c$$

Where:

- $VAT_c{}^{HH,FD}(x)$ is direct VAT on household final demand of commodity c by quintile x
- $VAT_c{}^{NPISH,FD}$ is direct VAT on NPISH final demand of commodity c
- $VAT_c{}^{GOV,FD}$ is direct VAT on government final demand of commodity c
- $FD_c{}^{HH,DOM}(x)$ is domestic household final demand of commodity c by quintile x
- $FD_c{}^{HH,IMP}(x)$ is imported household final demand of commodity c by quintile x
- $FD_c{}^{NPISH,DOM}$ is domestic NPISH final demand of commodity c
- $FD_c{}^{NPISH,IMP}$ is imported NPISH final demand of commodity c
- $FD_c{}^{GOV,DOM}$ is domestic government final demand of commodity c
- $FD_c{}^{GOV,IMP}$ is imported government final demand of commodity c
- $p_c{}^t$ is the share of commodity c that is taxable
- τ^t is the tax rate

The rate $(p_c{}^t \times \tau^t)$ is the average effective tax rate applicable to formal supply of commodity c, accounting for exemptions and zero-rating. A reduced-rate could easily be added to the model by adding the reduced-rate and the share of the formal supply of commodity c that is subject to the reduced-rate to the average effective tax rate calculation such that it becomes $(p_c{}^t \times \tau^t + p_c{}^r \times \tau^r)$ where $p_c{}^t$, $p_c{}^r$, τ^t and τ^r are the taxable and reduced-rate proportions and the full and reduced tax rates respectively.

2.4.2 VAT on Intermediate Inputs

VAT also applies to the inputs used in the production of exempt supplies $\left(VAT_i{}^{INPUT,FORMAL}\right)$ or of supplies produced by the informal economy $\left(VAT_i{}^{INPUT,INFORMAL}\right)$ and is imposed on the input matrix:

[6] Imputed rents are excluded from this component, consistent with the structure of the OECD IO tables used in the model. In applications where IO tables include imputed rents, these would typically be treated as VAT-exempt under the benchmark.

$$VAT_i^{INPUT,FORMAL} = \sum_c \quad \xi_i\big(p_i{}^e \times (1 - exp_i)\big)\big(I_{c,i}{}^{DOM}\xi_c + I_{c,i}{}^{IMP}\big)(p_c{}^t \times \tau^t)\ \forall i$$

$$VAT_i^{INPUT,INFORMAL} = \sum_c \quad (1 - \xi_i)\big(I_{c,i}{}^{DOM}\xi_c + I_{c,i}{}^{IMP}\big)(p_c{}^t \times \tau^t)\ \forall i$$

Where:

- $VAT_i^{INPUT,FORMAL}$ is the VAT that applies to intermediate inputs used for the production of exempt supply by the formal economy in industry i
- $VAT_i^{INPUT,INFORMAL}$ is the VAT that applies to intermediate inputs used by the informal economy in industry i
- $p_i{}^e$ is the share of the output produced by industry i that is exempt
- exp_i is the share of the output produced by industry i that is exported
- $I_{c,i}{}^{DOM}$ is the domestic input of commodity c in industry i
- $I_{c,i}{}^{IMP}$ is the imported input of commodity c in industry i
- $p_c{}^t$ is the share of commodity c that is taxable
- τ^t is the tax rate
- ξ_i is the proportion of output by industry i that is formal
- ξ_c is the proportion of domestic supply of commodity c that is formal

The equations can be split into three parts:

- The share of production that is not eligible for input tax credits
  - $\xi_i\big(p_i{}^e \times (1 - exp_i)\big)$ and $(1 - \xi_i)$
- The inputs
  - $\big(I_{c,i}{}^{DOM}\xi_c + I_{c,i}{}^{IMP}\big)$
- The average effective tax rate
  - $(p_c{}^t \times \tau^t)$

2.4.3 Direct Tax

Overall, the direct VAT at the point of imposition is the VAT on final consumers $VAT_c{}^{HH,FD}(x)$, $VAT_c{}^{NPISH,FD}$ and $VAT_c{}^{GOV,FD}$ and the embedded VAT, $VAT_i^{INPUT,FORMAL}$ and $VAT_i^{INPUT,INFORMAL}$. Now to estimate the true impact of VAT policies on exports and final consumers, we will compute the indirect effects by following the path of the embedded VAT in the supply chain iteratively until all the embedded VAT $VAT_i^{INPUT,FORMAL}$ and $VAT_i^{INPUT,INFORMAL}$ has been transferred to exports or final consumers.

2.5 Iterative Component

The iterative component takes the results of the core tax component in which VAT was applied on intermediate inputs—i.e. $VAT_{c,i}{}^{INPUT,FORMAL}$ and $VAT_{c,i}{}^{INPUT,INFORMAL}$—to transfer this embedded tax to exports and final consumption. With every iteration, a portion of the embedded tax returns to intermediate inputs such that the process needs to be repeated until the amount remaining in intermediate inputs is negligible. On the first iteration $j = 1$:

$$VAT_c{}^{HH,FD,EMB}(x)^{j=1} = VAT_{i=c}{}^{INPUT,FORMAL} \times \frac{FD_c{}^{HH,DOM}(x) f_c(x)}{Supply_c \xi_c}$$

$$+VAT_{i=c}{}^{INPUT,INFORMAL} \times \frac{FD_c{}^{HH,DOM}(x)(1-f_c(x))}{Supply_c(1-\xi_c)} \; \forall c, x \in \{1,2,3,4,5\}$$

$$VAT_c{}^{NPISH,FD,EMB,j=1} = \left(VAT_{i=c}{}^{INPUT,FORMAL} + VAT_{i=c}{}^{INPUT,INFORMAL}\right) \times \frac{FD_c{}^{NPISH,DOM}}{Supply_c} \quad \forall c$$

$$VAT_c{}^{GOV,FD,EMB,j=1} = \left(VAT_{i=c}{}^{INPUT,FORMAL} + VAT_{i=c}{}^{INPUT,INFORMAL}\right) \times \frac{FD_c{}^{GOV,DOM}}{Supply_c} \quad \forall c$$

$$VAT_c{}^{EXPORTS,EMB,j=1} = \left(VAT_{i=c}{}^{INPUT,FORMAL} + VAT_{i=c}{}^{INPUT,INFORMAL}\right) \times \frac{EXP_c{}^{DOM}}{Supply_c} \quad \forall c$$

$$VAT_{c,i}{}^{INPUT,EMB,j=1} = \left(VAT_{i=c}{}^{INPUT,FORMAL} + VAT_{i=c}{}^{INPUT,INFORMAL}\right) \times \frac{I_{c,i}{}^{DOM}}{Supply_c} \quad \forall c, i$$

A share of the embedded tax was transferred to household, NPISH and government final consumption expenditure as well as exports in proportion to their respective share of domestic supply. The remaining embedded tax flows back to intermediate inputs—in $VAT_{c,i}{}^{INPUT,EMB,j=1}$—as the exempt or informal goods and services containing embedded tax are used downstream in the supply chain in the production of other goods and services. In future iterations $j \geq 2$:

$$VAT_c{}^{HH,FD,EMB}(x)^j = VAT_c{}^{HH,FD,EMB}(x)^{j-1} + VAT_{c,i}{}^{INPUT,EMB,j-1} \times \frac{FD_c{}^{HH,DOM}(x)}{Supply_c}$$

$$\forall c, x \in \{1,2,3,4,5\}$$

$$VAT_c{}^{NPISH,FD,EMB,j} = VAT_c{}^{NPISH,FD,EMB,j-1} + VAT_{c,i}{}^{INPUT,EMB,j-1} \times \frac{FD_c{}^{NPISH,DOM}}{Supply_c} \; \forall c$$

$$VAT_c{}^{GOV,FD,EMB,j} = VAT_c{}^{GOV,FD,EMB,j-1} + VAT_{c,i}{}^{INPUT,EMB,j-1} \times \frac{FD_c{}^{GOV,DOM}}{Supply_c} \quad \forall c$$

$$VAT_c{}^{EXPORTS,EMB,j} = VAT_c{}^{EXPORTS,EMB,j-1} + VAT_{c,i}{}^{INPUT,EMB,j-1} \times \frac{EXP_c{}^{DOM}}{Supply_c} \quad \forall c$$

$$VAT_{c,i}{}^{INPUT,EMB,j} = VAT_{c,i}{}^{INPUT,EMB,j-1} \times \frac{I_{c,i}{}^{DOM}}{Supply_c} \quad \forall c$$

The process is repeated iteratively up to the value of $j = J$ such that $VAT_{c,i}{}^{INPUT,EMB,j} \approx 0$ and therefore that all the embedded VAT has been shifted to final consumption or exports. At this point, all the embedded VAT has been transferred to final consumers and exports. It is contained within the following variables:

- Households
  - Direct: $VAT_c{}^{HH,FD}(x) \; \forall c, x \in \{1,2,3,4,5\}$
  - Indirect (embedded tax): $VAT_c{}^{HH,FD,EMB}(x)^J \; \forall c, x \in \{1,2,3,4,5\}$
- NPISH
  - Direct: $VAT_c{}^{NPISH,FD} \; \forall c$
  - Indirect (embedded tax): $VAT_c{}^{NPISH,FD,EMB,J} \; \forall c$

- Government
  - Direct: ${VAT_c}^{GOV,FD}\ \forall c$
  - Indirect (embedded tax): ${VAT_c}^{GOV,FD,EMB,J}\ \forall c$
- Exports
  - Indirect (embedded tax): ${VAT_c}^{EXPORTS,EMB,J}\ \forall c$

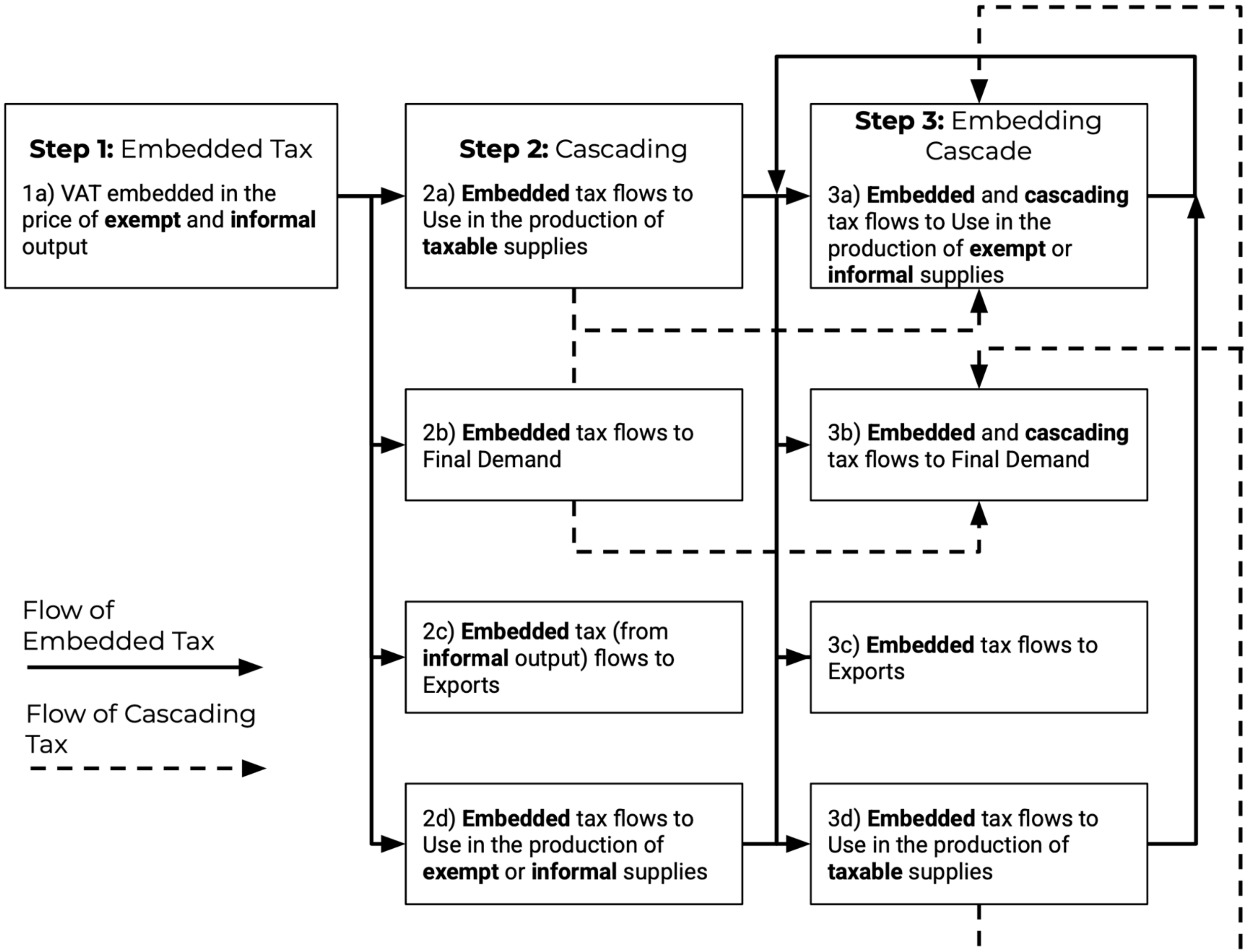
While this approach to shifting embedded tax from the input matrix to final demand is functionally equivalent to the matrix inversion method in traditional IO models, it is more flexible as it can be used with non-square IO tables or square IO tables with non-diagonal supply matrices. It also lets us properly account for tax cascading along the iterative process, which depends on whether the embedded tax is flowing out of and into exempt, informal or taxable production as shown below.

2.6 Cascading

Embedded tax cascades primarily because once a good or service contains uncredited VAT—arising from an exemption or informal production—it is carried forward into subsequent stages of production. When such an input is utilized in the production of a taxable output, an additional layer of VAT is levied on a cost base that already includes the embedded VAT. Consequently, VAT is effectively imposed on a tax-inclusive price, generating a compounding effect known as cascading taxation. This process is illustrated in Chart 1 at Step 2, where the embedded VAT is transmitted into the production of taxable supplies, thereby subjecting it to an additional VAT charge.

Following this cascading process, the accumulated tax flows into various economic channels, including final consumption, exports, and intermediate production (whether exempt or informal). When a taxable product is exported by a VAT-registered entity benefiting from zero-rating, only the new VAT paid at the most recent production stage can be reclaimed through an input tax credit. However, any previously embedded VAT originating from informal or uncredited sources remains embedded in the cost structure of the exported product.

Chart 1: Flow of Embedded and Cascading Tax



Similarly, when the taxed product is further utilized in the production of exempt or informal goods or services, the newly added VAT cannot be credited, resulting in a compounding of the tax burden. In Step 3, this mechanism leads to a further accumulation of VAT within the production chain, which may re-enter taxable production at a later stage, triggering subsequent rounds of cascading taxation.

2.7 Assumptions and Limitations

The analysis in this paper is based on an input-output (IO) framework that uses fixed-coefficient production functions, with no allowance for substitution of inputs in response to VAT policy changes. In other words, each sector's technology is held constant, and producers are assumed to maintain the same input mix irrespective of any adjustments in the VAT treatment of their inputs or outputs. This fixed-proportions assumption is standard in IO-based modeling but necessarily limits the model's capacity to capture dynamic behavioral responses: real-world producers may alter their production processes if an exemption, rate change, or other policy measure significantly alters relative input prices.

A second key assumption is that all taxes are fully passed forward to the purchasers of goods and services. Thus, whenever unrecoverable VAT arises (e.g., because a firm is exempt or operating informally), the resultant "tax wedge" is assumed to be reflected entirely in the price that either the next stage of production or final consumers pay. The model does not allow for partial absorption of the tax by producers, nor does it consider demand elasticity effects (e.g., the possibility that producers might lower margins in response to changing consumer demand). This simplifies the analysis but overstates the extent to which consumer prices might change in real markets, especially in highly competitive or highly regulated sectors.

Third, the model treats exports and imports in a stylized, destination-based manner. Exports of taxable commodities are zero-rated, but any embedded VAT from exempt or informal upstream production remains in the final export price. Likewise, imports face no "trailing" domestic VAT if they enter the country as exempt commodities. This generates the import-bias results discussed in the paper. The IO framework also imposes fixed trade shares for each commodity, so there is no allowance for import substitution or changes in export competitiveness beyond the pass-through of embedded VAT.

Finally, the baseline scenario assumes a single uniform VAT rate (10% in our simulations) and no small supplier threshold or informality—unless these elements are explicitly introduced. In practice, countries have myriad additional VAT features (multiple rates, partial exemptions, hybrid financial-services rules, special regimes for agriculture or tourism, etc.). Incorporating these requires further country-specific data and refinements to the model's structure, potentially introducing interaction effects among exemptions, thresholds, and informality that can alter the net outcome. The simulations presented here are thus illustrative rather than predictive, highlighting the mechanisms of embedded and cascaded VAT while recognizing that real-world outcomes will depend on the specific legal, administrative, and behavioral context in each country.

3 Simulation Results

This section presents simulation results from the model designed to illustrate the different impacts of VAT exemptions. To do this, a baseline hypothetical VAT system is simulated for each country where a single 10% VAT rate is imposed on all consumption, with no small business exemption threshold and no informality. From this baseline model, we then simulate the introduction of exemptions on the different goods and services produced in each country. We first compare the impact of exemptions on different goods and services by simulating the introduction of an exemption on each of the 45 commodity groups in the model. After this, we focus on two specific commodities to examine in more detail the different impacts that exemptions can have, and then briefly consider interaction effects between multiple exemptions. Finally, we incorporate HBS data into the model to examine the distributional impact of exemptions.

3.1 Effective Tax Rates across Commodities

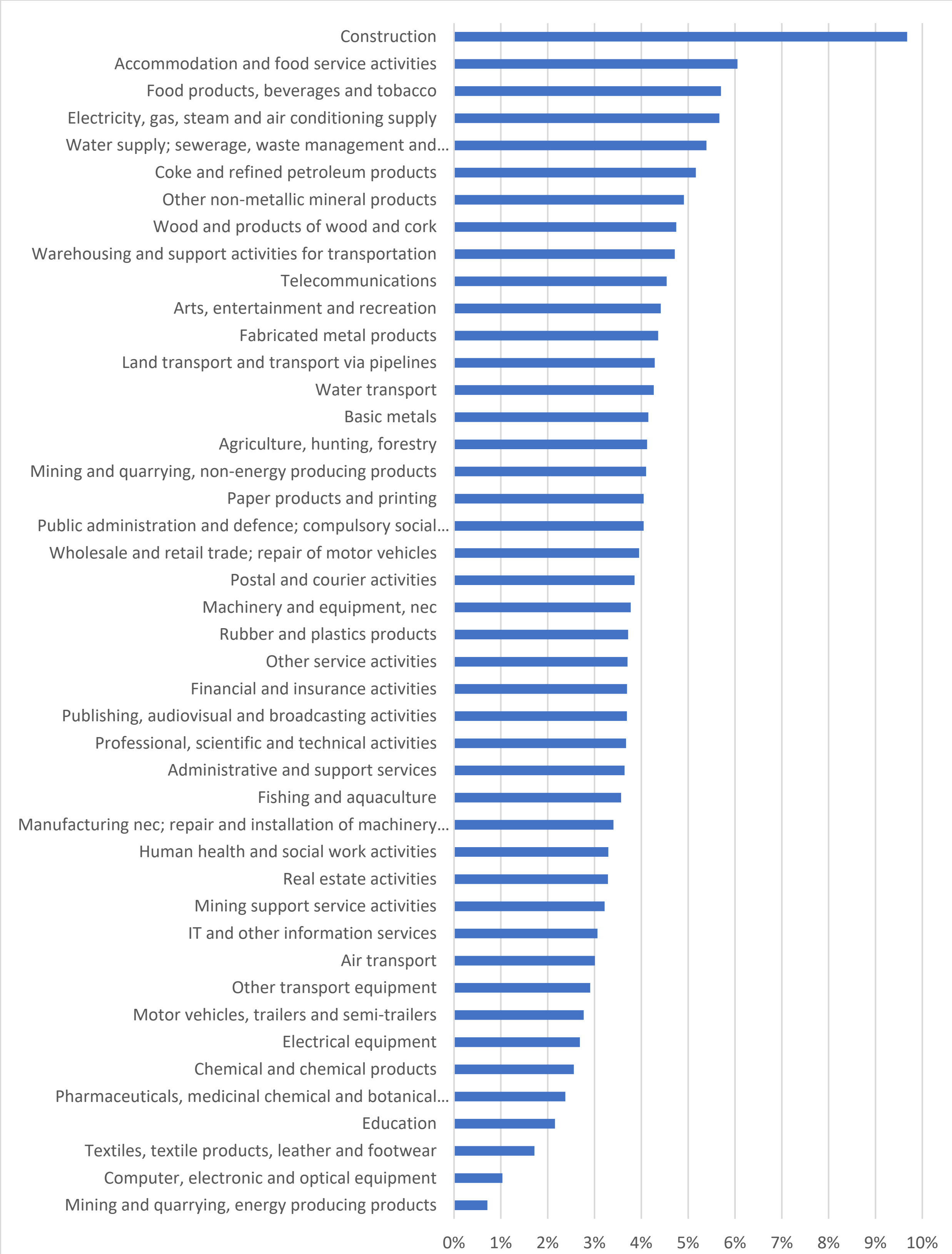
This section compares the impact of exempting each of the commodity groups in the input-output tables. To eliminate interaction effects, we simulate the introduction of an exemption on each commodity one at a time. This requires 1,305 simulations to be run (45 commodities times 29 countries), but for presentational purposes only the weighted 29-country averages are presented for the exemption to each of the 45 commodities. To quantify the 'direct' effect of an exemption on the exempt commodity, we calculate effective tax rates (ETRs) on (domestic) household consumption of just the exempt commodity. To quantify the total effect of an exemption, including the indirect effect on other commodities, we also calculate ETRs on *total* (domestic) household consumption of all commodities.

Figure 1 shows the 29-country weighted average of the ETR on household consumption of each exempted commodity. No VAT is charged on the exempt commodity, so these ETRs measure the amount of embedded (and cascaded) VAT in the final sale price. If no exemption was in place, the ETR would be 10%. However, for all sectors, the ETR is below 10% – because at least some value-added at the final retail stage has not been taxed. Equally, the ETR is always above zero – because there is at least some embedded VAT earlier in the supply chain. Within this range, results vary widely across commodities – from 9.7% for construction to just 0.7% for mining and quarrying of energy related products. That said, ETRs for 29 of 45 commodities are between 3% and 5%.

The variation in results is influenced by a range of factors. In particular, commodities that have a larger proportion of value-added in the final (retail) stage of production have lower ETRs as the value-added from that final stage is untaxed, whereas commodities that have most value-added earlier in the supply chain have higher ETRs. Additionally, commodities produced using imports as inputs have lower ETRs as imports are assumed to carry no VAT due to their zero rating in the exporting country.[7] Finally, commodities produced using inputs from within the same commodity grouping also face lower ETRs because those inputs are also exempt in our simulations and therefore carry less embedded VAT than other fully-taxed inputs. This, for example, is the case with agriculture for which a significant proportion of inputs are either from domestic agriculture or from imports. The very low ETR for mining and quarrying of energy related products is because this is predominantly imported in EU countries. Meanwhile, the very high ETR for construction is driven heavily by the fact that it is predominantly used as an intermediate input and a significant amount of the products that use construction as an input (and hence incur embedded and cascaded tax) are themselves then used in construction.

[7] The ETR estimates are for domestic VAT. As we will see later, exemptions in the exporting country could result in some positive VAT being embedded in the price of imports. Nevertheless, the domestic exemption does not result in any domestic VAT being embedded in the price of imports.

Figure 1: 29-country average ETR on final household consumption of an exempted commodity



It is important to recall that the simulations assume no other exemptions, no exemption threshold for small businesses, and no informality, whereas in practice this will not be the case. Purchases from exempt or informal businesses, or of exempt goods and services, will include less embedded VAT in their own prices as a result, thereby reducing the amount of VAT embedded in the prices of the exempt commodities using them as inputs presented in Figure 1. For example, additional simulations show that if 30% of inputs were informal across all sectors, then the ETR on construction would fall slightly from 9.7% to 9.4%, and the ETR on mining and quarrying of energy related products would fall from 0.7% to 0.1%. In this sense, the results in Figure 1 can be seen as upper bound estimates of the ETR.

Nevertheless, the degree of variation both across commodities and across countries highlights a major concern regarding the use of exemptions – their lack of transparency. While they do lower the ETR below the standard VAT rate, the extent to which they do so can be seen to depend on the (country-specific) supply-use patterns, as well as other factors such as the extent of other exemptions, degree of informality and use of imports. If a specific tax concession is desired, a reduced VAT rate would more accurately and transparently target the concession (although even then the tax saving may not be fully passed on to the consumer). If policy makers want to completely relieve the VAT on a given commodity, zero-rating would be a better option than granting an exemption.

The commodity-specific impact of an exemption is, however, only part of the story. Figure 2 shows the 29-country weighted average ETRs on *total* household consumption when each commodity is exempted. The figure shows the combined impact of the direct effect on the exempted commodity and indirect (embedded and cascading) effect on other commodities. If all commodities were fully taxable the total ETR would be 10% in every instance. However, because of the exemptions the direct effect (blue) is always less than 10%. The indirect effect mutes the tax saving from the exemption, increasing the total ETR. For several commodities, the indirect effect can be seen to outweigh the direct effect and push the overall ETR above 10%. This is most clearly the case for the construction sector, where the ETR rises to 10.7%, but the ETR increases slightly above 10% for 16 of the 45 commodities. In these cases, the exemption increases ETRs on taxpayers rather than reducing them. Though not presented in Figure 2, there is also a moderate degree of variation across countries. For example, the ETR on construction ranges from 10.2% to 11.2%, while the ETR on agriculture ranges from 9.7% to 10.1% (see Figures 4 and 5, below).

The largest indirect effects, contributing more than 0.4 percentage points to the total effective tax rate, are for: "Wholesale and retail trade; repair of motor vehicles", "Real estate activities", "Construction"; "Food products, beverages and tobacco"; and "Accommodation and food service activities". In each case, a significant proportion of these commodities are used as intermediate inputs into the production of other commodities. The "real estate activities" commodity group has the lowest total ETR despite having one of the largest indirect effects. This is because housing accounts for the largest single expenditure in a household's budget.

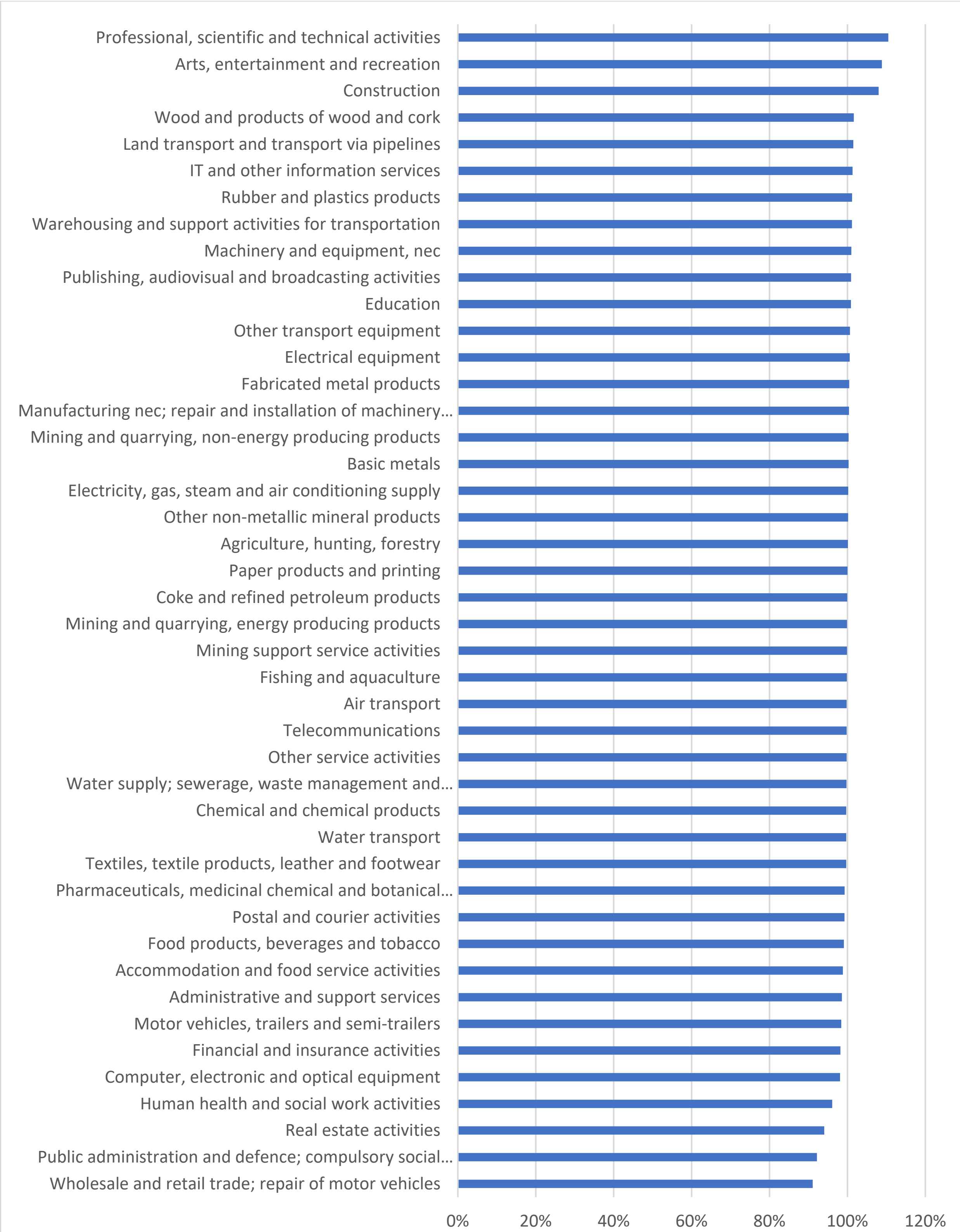
Two clear points come from the results in Figure 2. First, the indirect effect counteracts the reductions highlighted in Figure 1, weakening further the case for use of exemptions to address policy goals, and potentially entirely counteracting the direct reductions – as highlighted by the 16 commodities with total ETRs above 10%. Second, the overall impact of exemptions, even when reducing the ETR, is small – with ETRs for exemptions on 43 of the 45 commodities above 9.7%. This suggests that the tax reduction from a single exemption is simply not large enough to have a significant impact on overall VAT burdens.

Figure 2: 29-country average ETR on total household consumption from exempting a commodity

Figure 3 now examines the revenue impact of exempting each of the 45 commodities. Because our modeling is based on hypothetical scenarios rather than on each country's actual VAT rules, results are presented as a percentage of total VAT revenue, rather than as a percentage of GDP. More specifically, Figure 3 presents the VAT revenue generated after exempting each commodity, as a percentage of total VAT revenue in the absence of any exemption. A result above 100% therefore reflects a revenue gain, and below 100% a revenue loss from exempting the particular commodity.

Results range from 110% for professional, scientific and technical activities, to 91% for wholesale and retail trade. Perhaps most interestingly, for 21 of 45 commodities, an exemption results in a revenue increase, albeit in most cases only a slight increase. This is greater than the 16 commodities for which an exemption increased the ETR above 10% in Figure 2. This is because, whereas the ETR results in Figure 2 considered only the impact of an exemption on domestic households, the revenue results in Figure 3 also account for the VAT paid by government, NPISH and exports. While not shown in Figure 3, there is also some variation across countries. For example, while exempting construction increases revenue in all 29 countries, exempting agriculture increases revenue in 16 countries and reduces revenue in the remaining 13 countries.

Figure 3: 29-country average of VAT revenue from exempting a commodity as a share of total revenue in the absence of any exemption



3.2 Intermediate Inputs versus Final Consumption

To examine in more detail the mechanics behind the results in Figures 1 and 2, we now focus specifically on two sectors: construction and agriculture. The former is used as an example of an exemption applying predominantly (but not entirely) to intermediate inputs, while the latter is illustrative of an exemption applying predominantly (but not entirely) to final consumption. By focusing on these two commodities, we can illustrate a number of key impacts of VAT exemptions.

Figures 4 and 5 show the total ETRs arising from exempting each commodity for each of the 29 countries. Figure 4 shows that the total ETR from exempting construction is greater than 10% for every country, whereas Figure 5 shows that the total ETR from exempting agriculture is less than 10% for every country. These results illustrate that an exemption on an intermediate input, like construction, increases households' overall VAT burden (raising VAT revenue). Exempting commodities consumed primarily by households reduces households' VAT burden (lowering VAT revenue). While results vary across countries, the degree of variation remains relatively small given that we are examining the impact of the exemption of a single sector relative to total household consumption. Interestingly, the lowest ETRs from the exemption for agriculture are predominantly for countries with lower incomes, where agriculture forms a greater proportion of total consumption than in higher income countries.

Figure 6 contrasts the spread of VAT across commodities from exemptions for construction and agriculture. It presents the 29-country average of the embedded (and cascaded) VAT from an exemption of construction (blue bars) and agriculture (orange bars) across selected commodities. Looking first at the construction exemption, we see the embedded tax on final consumption of construction is 9.7% – the same result presented in Figure 1. However, we now see the wide-ranging impact of this exemption on other commodities that use construction services as inputs. Real estate activities unsurprisingly suffer the largest tax increase, with the ETR on final consumption increasing by more than 1.5 percentage points. However, ETRs also increase by more than half a percentage point for another six commodities. In total, 44 of the 45 commodities in the model face at least some increase in ETR due to the exemption on construction, with their combined impact pushing the total ETR above 10% (as shown in Figure 2).

In contrast, the agriculture exemption results in a far more limited spread of embedded (and cascaded) VAT. The ETR on final consumption of agriculture is 4.1% – as was shown in Figure 1. However, ETRs now only increase for another three commodities. Agricultural outputs are unsurprisingly used as an intermediate input in the 'food products, beverages and tobacco' and 'accommodation and food service activities' commodity groupings, resulting in increases in their ETRs. Additionally, as the agriculture commodity group includes forestry, there is a resulting increase in the ETR for 'wood and products of wood and cork'. However, this spread is far more limited than was the case for the construction exemption, resulting in the reduction in tax paid on final consumption of agriculture still outweighing these indirect effects and hence the total ETR remaining below 10% (as shown in Figure 2).

Figure 4: Average ETR on total household consumption from exempting construction

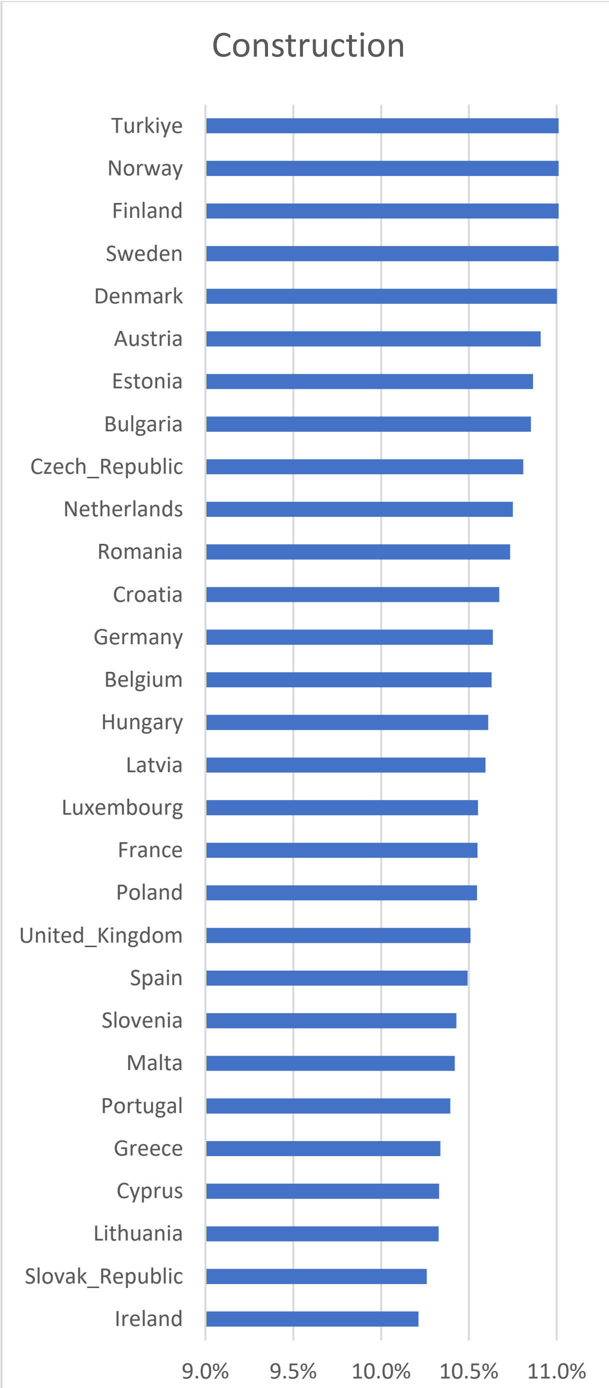


Figure 5: Average ETR on total household consumption from exempting agriculture

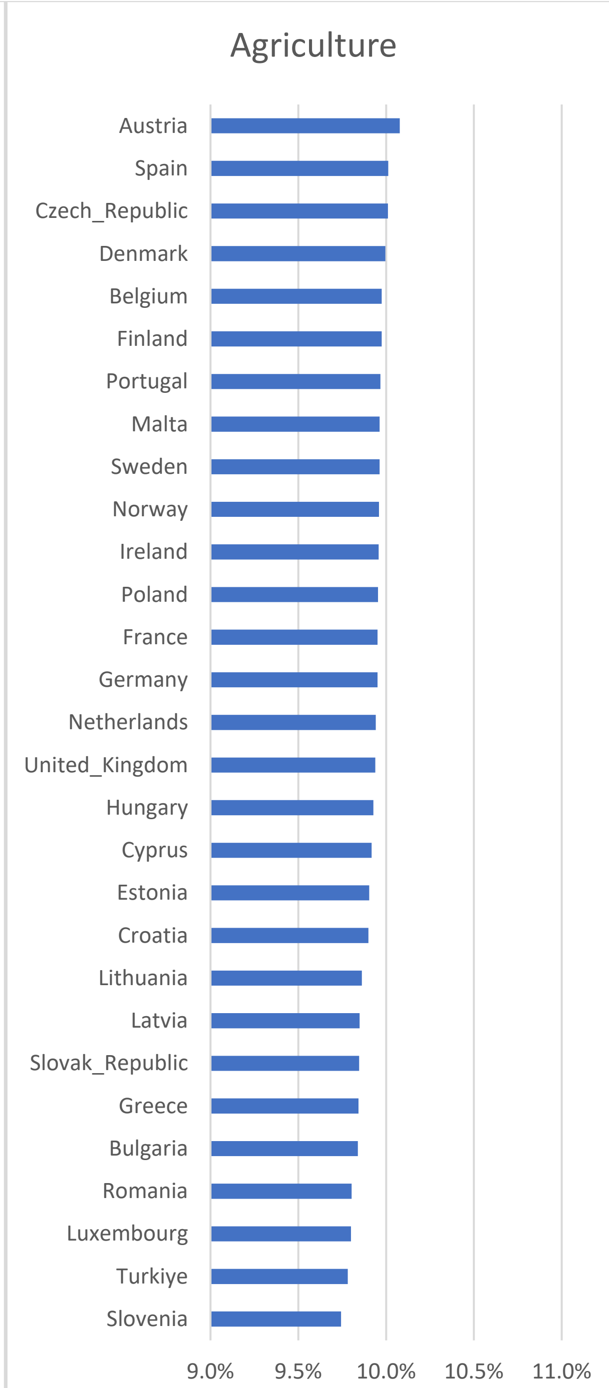
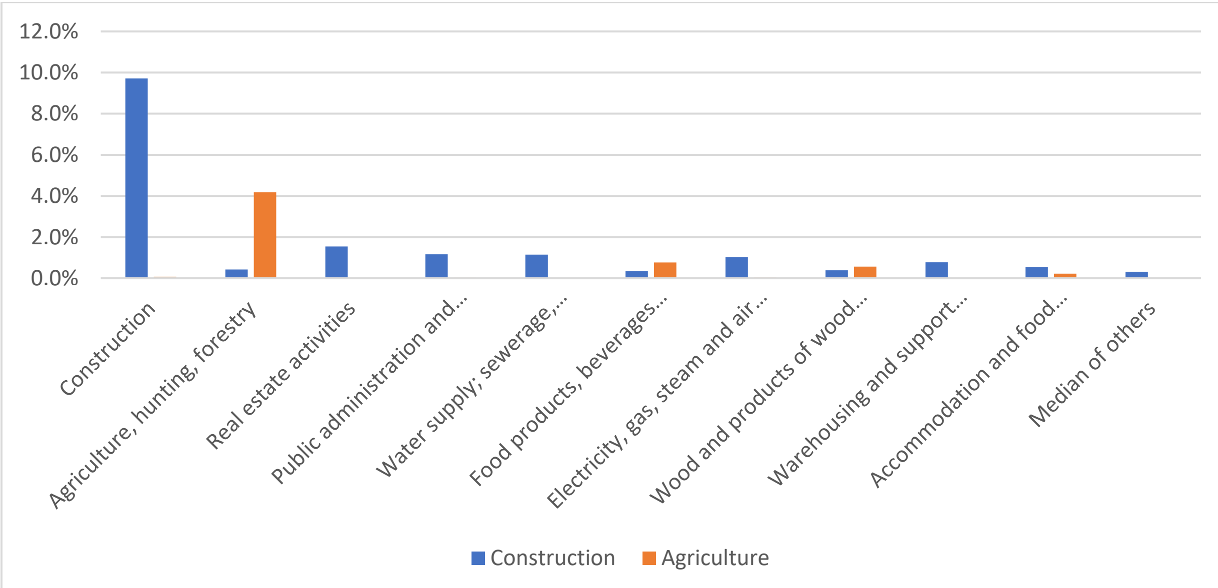


Figure 6: 29-country average embedded VAT rate from exempting construction and agriculture (selected commodities)



3.3 Impacts on Trade Competitiveness

Exemptions impose embedded and cascaded VAT on domestic production, putting them at a disadvantage compared to imports. To illustrate this, Figure 7 reproduces Figure 6, but solely for domestic production. The results in Figure 7 highlight the especially large disadvantage faced by producers of the exempted commodity – with final consumption of exempted domestic construction services facing an ETR of 9.7%, whereas imported construction services would face an ETR of zero (as they would also be exempt, as well as zero-rated in the exporting country).[8] Exempted domestic agriculture faces an ETR of 5.3%, while imports again face an ETR of zero. Furthermore, the impact is not limited just to the exempt commodities, but spreads widely across other commodities for construction, increasing ETRs above the 10% standard rate, though with more limited spread for agriculture.

Exemptions also put domestic exports at a competitive disadvantage on the international market, even when firms can claim full input tax credits on the exempt supplies they export. Figure 8 shows the amount of embedded (and cascaded) VAT in exports when construction and agriculture are exempted. Figure 8 shows that exports of construction[9] carry an ETR of 4.8%, and agriculture an ETR of 0.6%. These rates are tempered by their zero rating on export and hence deductibility of input tax. However, for construction the ETR is still large as the construction sector is the largest purchaser of its own outputs. Hence, there is embedded VAT crystalized in the price of construction inputs into construction that cannot be removed, even when zero-rated for export. This is less the case for agriculture. The exemptions for construction and

[8] While zero-rated in the exporting country, there may, of course, be some foreign VAT embedded in the price of imports due to VAT exemptions in the exporting country. However, that potential competitive disadvantage created by the exporting country does not change the fact that, irrespective of the import price, the domestic price will be higher, and hence less competitive with imports, as a result of embedded VAT due to domestic exemptions.

[9] Exports of construction include construction materials and construction services (e.g. engineering, architecture).

agriculture can again be seen to penalize exports of other commodities as the spread of embedded VAT is once again wide for construction, though more limited for agriculture.

Figure 7: 29-country average embedded VAT rate on domestic production from exempting construction and agriculture (selected commodities)

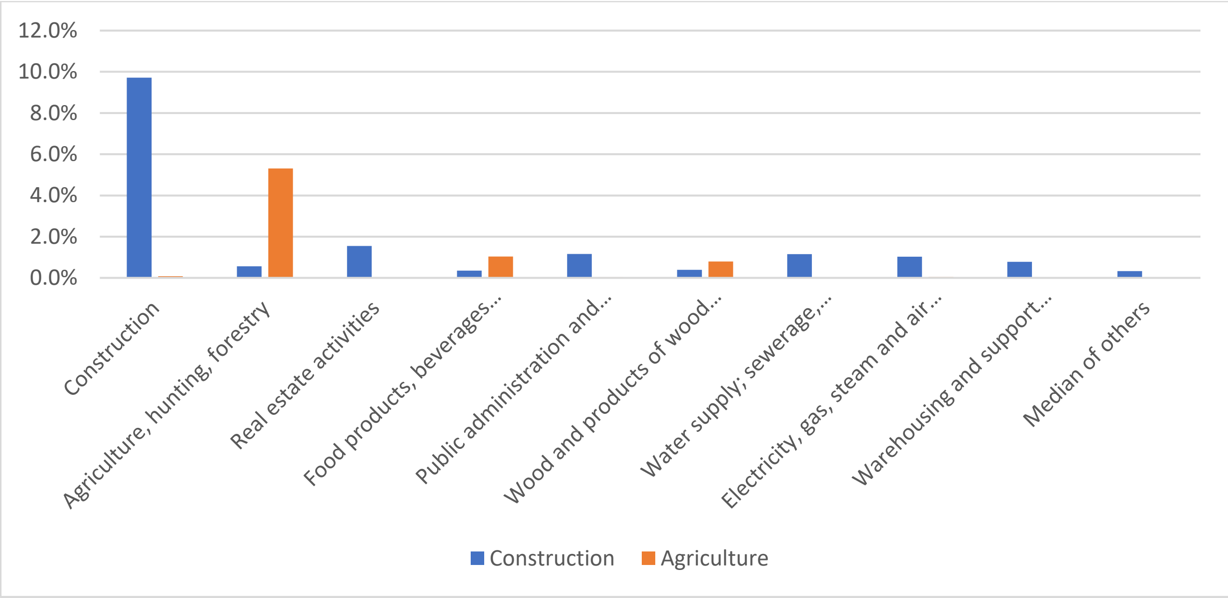
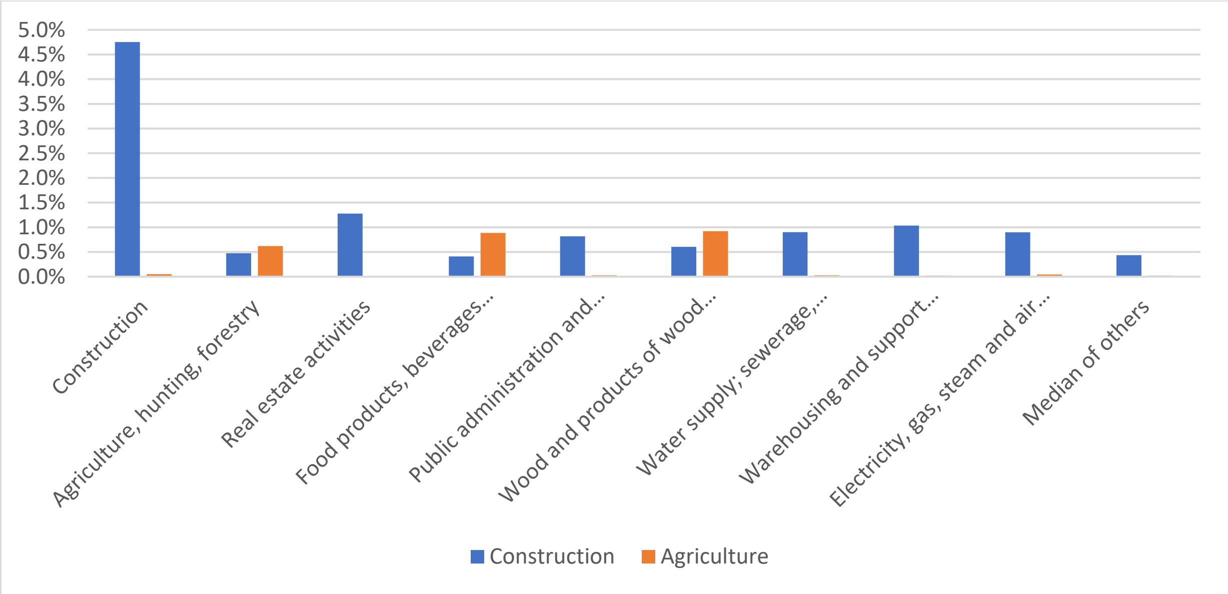


Figure 8: 29-country average embedded VAT rate on exports from exempting construction and agriculture (selected commodities)



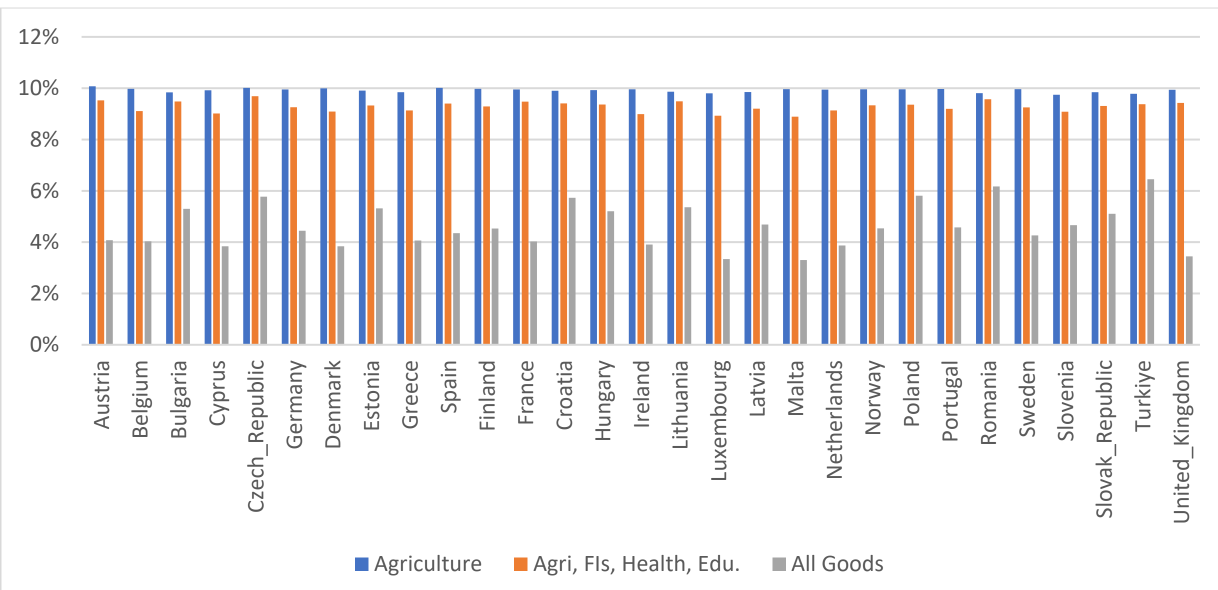
3.4 Interaction Effects

The above results are for simulations where commodities are exempted one at a time. In practice, countries typically apply multiple exemptions simultaneously, the most common being for financial services, healthcare and education.[10] Additionally, small business thresholds apply in most countries, and there is significant informality in most low- and middle-income countries and some high-income ones as well. These multiple exemptions can interact and can reduce effective tax rates on exempt commodities.

Figure 9 shows the impact of interaction effects on effective tax rates for three scenarios. The blue bars are the overall weighted average total effective rates for all commodities combined when only agriculture is exempted. The orange bars are the overall weighted average total effective rates for all commodities combined when agriculture, financial institutions, healthcare and education are all exempted. The grey bars are the overall weighted average total effective rates for all commodities combined when all goods (but not services) are exempted. As expected, the more commodities that are exempted, the lower the effective tax rates become. The ranking is clear and consistent among commodities; the effective tax rates are highest when only agricultural commodities are exempt.

Figure 9 shows that, even in the presence of the three most common exemptions (financial institutions, healthcare and education), the reduction from exempting agriculture remains low, with a median average effective tax rate of 9.3%. Latvia has the largest reduction in this scenario, even there, the overall effective tax rate only falls by 1.1 percentage points.

Figure 9: 29-country average ETRs for multiple exemption scenarios



[10] While countries commonly exempt health care and education, there are instances where some portion of these could be fully taxable or zero-rated. Exports of all services, even financial services, are often zero-rated, while banks may also make fully taxable supplies. Some elements of health care, like cosmetic surgery, may also be fully taxable. Depending on the definition of education, countries may exempt and charge VAT on this sector. Public schools may be exempt, but training offered by software vendors on their products could be fully taxable.

3.5 Distributional Effects of VAT Exemptions

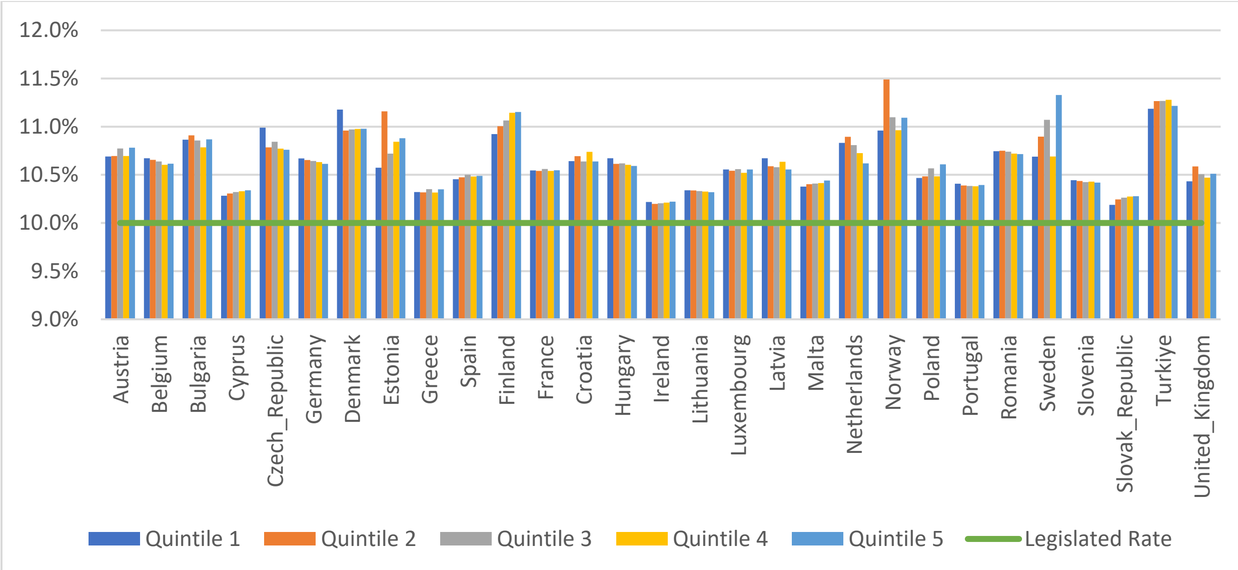
Finally, we extend the analysis to consider the distributional impact of exemptions by linking the household consumption categories in the input-output data to consumption categories in household budget survey data from Eurostat. Given the wide output in the model, we again focus on results for construction and agriculture. Agriculture is a prime example of an exemption aimed at supporting poorer households.[11, 12] While OECD countries tend to provide reduced rates rather than exemptions for food products, a number of low- and middle-income countries apply exemptions to food or agricultural products. For example, Indonesia provides an exemption for fresh agricultural goods; the Arab Republic of Egypt provides an exemption for a wide range of food products. In contrast, an exemption on construction is unlikely to be introduced to address distributional goals, but it will still have a distributional impact that should be considered when assessing the merits of applying the exemption.

Figure 10 presents total ETR results for each of the 29 countries, broken down by expenditure quintile for an exemption to construction, while Figure 11 presents the same results for an exemption to agriculture. These graphs break into quintiles the ETR results previously presented in Figures 4 and 5. Figure 10 shows the ETR from exempting construction to be above 10% in all quintiles in all countries, consistent with Figure 4 and showing that all households face a tax increase. However, the extent of the increase varies across quintile and country, with no clear pattern to the results. The results for Cyprus, Finland, Malta and the Slovak Republic appear marginally progressive across quintiles, while Germany appears very marginally regressive. In most cases, though, the results show some ambiguity due to non-monotonic patterns across quintiles. For example, in Estonia, Norway and the United Kingdom, the total ETR on the second quintile is higher than for any other quintile. In Latvia, an otherwise regressive pattern is interrupted by a rising ETR at the 4^{th} quintile, while in Sweden, an otherwise progressive pattern is interrupted by a drop in ETR at the 4^{th} quintile. The degree of variation and lack of clear patterns underscores the uncertainty in outcomes from VAT exemptions.

[11] Note that the agriculture commodity group in the IO data, and hence our simulations, also includes fishing and forestry, which are less likely to be exempted in practice than agricultural products.

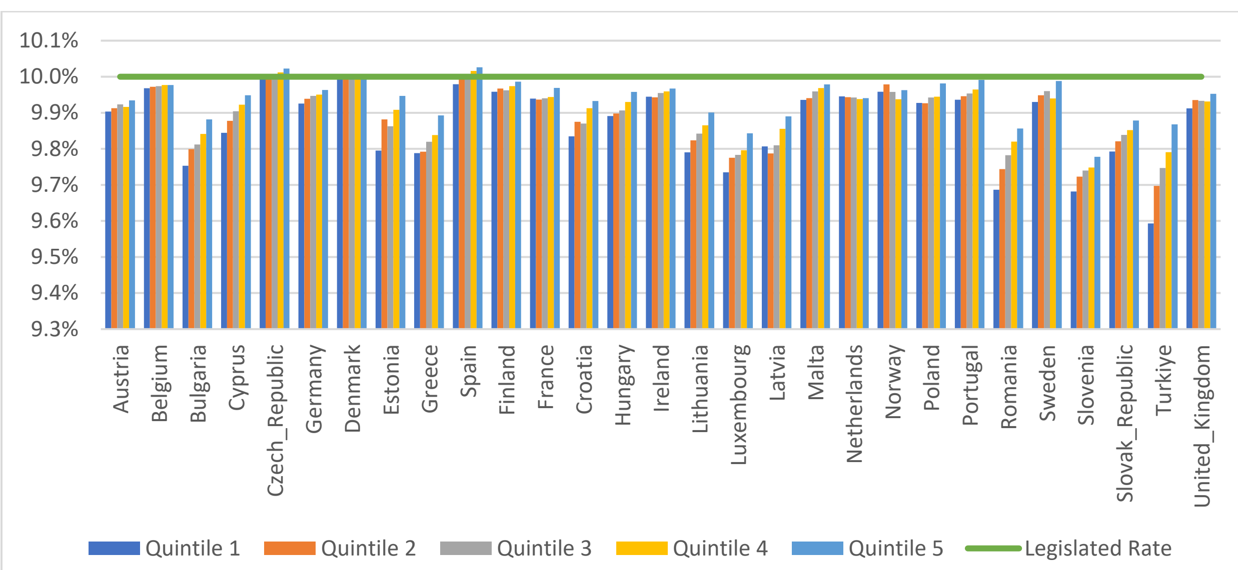
[12] Typically, the rationale for exempting agriculture is to make food, a necessity, less expensive and improve the progressivity of the tax system. These exemptions may also be designed to help the agriculture sector, but because farmers are unable to recover their VAT, these exemptions actually increase their production costs. This is why many countries also exempt inputs into agriculture, which can further undermine the policy's effectiveness.

Figure 10: Average ETR on total household consumption by quintile from exempting construction



Clearer patterns emerge in the results for exempting agriculture in Figure 11. In most countries, results are progressive, with a monotonic increasing pattern of ETRs across quintiles in 15 countries, and close to monotonic increasing patterns in most other countries. These progressive patterns are unsurprising, given the typically greater share of agricultural products (especially basic food products) in the total consumption of poorer households as compared to richer households. The largest ETR reductions, and most progressive patterns, tend to appear in comparatively poorer countries in our sample, where these budget share patterns are most pronounced, such as Bulgaria, Romania, Slovenia and Türkiye. Interestingly, Luxembourg also exhibits a comparatively large reduction. Nevertheless, the total differences in ETRs across quintiles remain small, highlighting the very limited impact of an exemption on a single commodity relative to total consumption.

Figure 11: Average ETR on total household consumption by quintile from exempting agriculture



Furthermore, progressivity is not guaranteed. In Denmark, the Netherlands and arguably Norway, a roughly proportional pattern emerges. These results highlight that even for an expenditure type typically disproportionally consumed by the poor, the indirect impact of an exemption can still push the overall impact away from progressivity. The Czech Republic and Spain illustrate further the unpredictability of an exemption, with the overall ETR increasing slightly above 10% for the third, fourth and fifth quintiles. This result is again driven by the indirect impact of the exemption, with the impact of the embedded and cascaded VAT on consumption of processed food products and restaurant food appearing to outweigh the reduction from these quintiles' direct consumption of agricultural products.

These results also highlight that, even when an exemption has a progressive impact, exemptions are still a badly targeted way to support poor households. Aside from the Czech Republic and Spain, in all other countries, all quintiles – including the richest – benefit from a reduction in VAT below the 10% standard rate due to the agriculture exemption. This is the same result as occurs for reduced rates (see, e.g., OECD/KIPF, 2014), leading to the strong conclusion that directly targeted mechanisms such as targeted tax credits or cash transfers, where implementable, will be better tools to address distributional concerns than reduced rates. The results here show that this argument holds also for exemptions, with the further concerns on top that the extent of the reductions is not transparent, and that there is also potential for the indirect effects of an exemption to counter any progressivity achieved.

As discussed previously, these ETR results should be considered as upper bounds given that they assume no informality and no small business threshold. In practice, we can expect some inputs into agriculture to be from unregistered businesses or informal businesses, lowering, at least slightly, the total ETRs. Informal consumption of non-exempt products may also lower ETRs. Furthermore, if informal consumption occurs disproportionately among poorer households then this can have a progressive impact in of itself (Bachas et al., 2024; Jenkins et al., 2006).

While our results do not examine the potential of differing levels of informality in final consumption across quintiles, they do still provide some insights regarding the impact of informality. First, informal consumption will not result in a zero rate. As results in Figure 1 show, as long as some inputs into production of the informally purchased product are from formal businesses, then there will be some embedded VAT in the purchase price. Second, as Thomas (2024) notes, a zero rate could have a regressive impact where the poor consume informally (and so pay positive embedded VAT) but the rich consume formally (and so pay no VAT). Our positive ETR results confirm this possibility. Country-specific analysis drawing on estimates of informality would be required to delve further into these impacts. This, however, is left for future work.

4 Conclusion

This paper has developed a model based on input-output tables and household budget survey data for 29 European countries to examine the effects of VAT exemptions and to assess the merits of their use. The model follows a novel iterative approach to capture changes in direct, embedded and cascaded VAT arising from the introduction of an exemption, under the standard assumption of full forward shifting into prices.

To draw out policy implications on the use of VAT exemptions, we have simulated the same baseline hypothetical VAT system in each of the 29 countries, and then examined the impact of introducing exemptions on each of the 45 commodities in the model, one by one. Our baseline scenario assumes a single 10% VAT rate on all consumption, with no small business exemption threshold, and no informality. To quantify the 'direct' effect of an exemption on the exempt commodity, we have calculated effective tax rates (ETRs) on domestic household consumption of just the exempt commodity. To quantify the total effect of an exemption, including the indirect effect on other commodities, we also calculated ETRs on *total* domestic household consumption of all commodities.

Considering first the direct effect, we find that ETRs on household consumption of each exempted commodity in each country are positive, but are below the 10% standard VAT rate that would have applied absent the exemption. ETRs are below 10% because, at a minimum, the value-added at the final retail stage is now not taxed, but they are always greater than zero because there is always some embedded VAT from earlier in the supply chain. Within this range, though, results vary widely across commodities – from a weighted 29-country average of 9.7% for construction to just 0.7% for mining and quarrying of energy related products. That said, ETRs for 29 of 45 commodities are between 3% and 5%. As the simulations assume no other exemptions, no small business threshold and no informality, these results should be seen as an upper bound on the respective ETRs. That said, additional simulations that assume 25% of inputs are exempt (or informal) show only a small drop in ETRs. For example, the average ETR on exempted agriculture drops from 3.5% to 3.4%.

This direct effect also lowers ETRs on *total* household consumption slightly below 10%. However, the indirect (embedded and cascaded) effect of the exemption on the prices of other commodities acts in the opposite direction, raising the ETRs on *total* household consumption back towards 10% and in some cases above 10%. This is most clearly the case for construction, where the 29-country weighted average total ETR rises from 9.5% to 10.7%, but the ETR also increases slightly above 10% for 16 of the 45 commodities. In these cases, the exemption actually increases total VAT revenue.

Additional results illustrate the impact of embedded VAT reducing both export competitiveness and the competitiveness of domestic production with imports. Finally, distributional analysis of effective VAT rates across expenditure quintiles shows that exemptions suffer from the same poor targeting as reduced VAT rates, but, in addition, provide a non-transparent level of support due to varying degrees of embedded VAT and by their indirect effects on other commodities – with results showing that these indirect effects can, in some cases, remove any progressive effect that an exemption might otherwise have had.

These results have significant policy implications, and build on top of the extensive existing literature examining the use of reduced and zero VAT rates (hereafter "reduced rates"). That literature shows reduced rates to be a very poor tool for achieving distributional goals because they provide greater aggregate benefit to higher income households than poorer households, sometimes to such an extent that they actually have a regressive impact (see, e.g., Thomas, 2024, for a summary of this literature). Reduced rates are also found to be a poor tool for achieving merit good and other policy goals due, again, to their poor targeting. This includes the inability to target specific groups for which positive externalities may exist, their *ad valorem* nature resulting in a greater tax reduction being provided for more expensive products, their inability to target businesses, and potential regressivity as higher-income groups often spend significantly more on some goods commonly subject to reduced rates (e.g. cultural activities, restaurant food, hotel accommodation).

Our results show that exemptions suffer from the same targeting problems as reduced rates, but in addition, they are non-transparent and have unpredictable and counterproductive indirect effects. These effects are in addition to the well-known distortionary impact of exemptions on production decisions, and their creation of incentives to self-supply. As such, exemptions can be seen as an inferior policy tool to reduced rates. We therefore conclude that the use of exemptions should be limited solely to addressing pragmatic concerns, such as the disproportionate compliance costs of small businesses and the practical difficulty in taxing margin-based financial services. Notably, exemptions on financial services in practice often extend beyond margin-based services to other fee or commission-based services, so there even remains significant potential for countries to reduce the extent of exemptions here.

More generally, and while some exemptions will have stronger negative impacts than others, a hierarchy of policy mechanisms can be established. Direct mechanisms (such as targeted transfers to address distributional concerns) should be preferred to reduced rates, which in turn should be preferred to VAT exemptions. Furthermore, only in cases where targeted transfers are not implementable due to administrative limitations, should a reduced VAT rate be considered as a potential policy option.

The results shown in this paper are only a small illustration of the model's capabilities. For example, future work will examine in more detail the impacts of informality and small business registration thresholds. Additionally, when using more detailed country-specific data, as opposed to standardized IO tables, our model can be tailored to delve into the implication of each country's tax system and unique set of circumstances.

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