
Development of an econometric model of alcohol taxation in Vietnam

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Abstract

This paper presents details of a project that uses available data to construct an econometric model of alcohol taxation in Vietnam. The project was developed through a funding agreement between the Asia Pacific International Wine and Spirits Alliance (APIWSA) and the Research Office of Charles Sturt University (CSU). The purpose of such an econometric tax model is that it allows APIWSA to engage with stakeholders using evidence-based assumptions as to the effect on the Vietnamese alcohol market on any possible taxation reform scenarios. These effects include impact on pricing; consumer responses to price changes and consumption levels; and changes to government revenues.

The current alcohol taxation system of Vietnam

Excise tax plays the central role in the system of alcohol taxation and is found within the Law on Excise Tax (Law on Excise 2008 (No 27/2008/QH12) as amended. This law sets out three categories of taxable alcoholic beverage, which currently include ‘beer’, ‘liquor up to 20% alcohol by volume’, and ‘liquor which is 20% alcohol by volume or higher’.

All excise taxes on alcohol are applied on an *ad valorem* or value basis, with current excise tax rates being set through an amendment to the Law on Excise, which was passed in 2014 (Law No 70/2014/QH13 to amend Law No 27/2008/QH12). This 2014 amendment essentially set out a ‘roadmap’ of excise tax rate increases, beginning on 1 January 2016, followed by further rate increases on 1 January 2017 and 2018. These increases are summarised in Table 1 below.

The taxable value for excise purposes within Table 1 was also recently amended, and from 1 January 2016 is based upon a manufacturer’s or an importer’s selling price to a non-affiliated company (Law No 106/2016/QH13). In relation to imports, this would appear to represent an effective excise tax increase, as taxable value rises from that of the landed price being CIF (cost insurance and freight) and relevant import tariffs, to a taxable value that also incorporates the importers value add and margins (Vietnam Customs, 2015), whereas domestic manufacturers only see an excise tax increase if they are distributing through affiliated wholesalers.

Table 1: Existing alcohol excise policy in Vietnam

Product Category	From 1 January 2016	From 1 January 2017	From 1 January 2018
Beer	55%	60%	65%
Liquor 20% alcohol by volume of higher	55%	60%	65%
Liquor up to 20% alcohol by volume	30%	30%	35%

Source: Law No. 70/2014/QH13

Given that the final excise tax rate increase decreed in 2014 took place on 1 January 2018, it is likely that the Vietnamese tax policy makers will soon begin a process of reviewing the existing excise policies for alcohol with a view to making recommendations to the National Legislative Assembly sometime during 2018 or 2019. As such, it is an opportune time to consider the current excise tax policies over alcohol and, where appropriate, review these against the objectives of the Vietnamese government in terms of alcohol taxation and against what are considered the principles of good alcohol tax policy.

In addition to these excise taxes, the importation of alcoholic beverages also attracts the payment of customs import tariffs at rates. These are found in the relevant schedules to the Law on Export and Import Tax (Law on Export and Import Tax 2005 [No 45/2005/QH11] as amended) and are based on the customs classification of the product and its origin should the import qualify for preferential rates.

For analytical purposes only, import tariffs have to be ‘mapped’, or generally aligned with the appropriate excise tax category, so that a single alcohol product can have its import tariff and excise liabilities identified. To assist, Table 2, below, links each of the three excise tax categories to the relevant customs import tariff payable. In this regard, that import tariff has been shown as the most favoured nNation (MFN) rate; however, it is noted that certain preferential rates are in place as at 2017 under free trade agreements (FTAs), with both ASEAN member countries through the ASEAN Trade in Goods Agreement (ATIGA) and with China.

Table 2: Existing alcohol import tariffs in Vietnam

Product Category (Law on Excise)	HS Heading	MFN	ATIGA	China FTA
Beer	2203	35%	5%	5%
Liquor 20% alcohol by volume or higher	2208	45%	5%	20%
Liquor up to 20% alcohol by volume	2204, 2205, 2206	50%	5%	5%

Source: Vietnam Customs, Author

Finally, the value added tax (VAT) is applied to the sale of all alcoholic beverages through the Law on Value-Added Tax (Law on Value-Added Tax [No 13/2008/QH12] as amended). The current general rate for VAT in Vietnam is 10 per cent and, when applied to alcoholic beverages, taxable value will include any excise taxes that have been paid and, in the case of imported product, any customs duties that were similarly paid.

Is it time to transition from an *ad valorem* alcohol taxation system?

Vietnam possesses a fully *ad valorem* – based alcohol tax system. Alcohol taxation based upon a product's value may be considered a more progressive approach given that higher tax burdens will fall on products of a premium nature and more likely consumed by those with greater means. However, excise taxation policy, in general, has been moving away from the taxation of products on the basis of their perceived luxurious nature, instead adopting the Pigouvian approach of aligning the excise tax with the external costs associated with harm from consumption of the product (Cnossen, 2007, pp. 6–7). As such, the taxation of alcohol within an excise tax system is more appropriate if it is more closely related to the quantity of alcohol consumed rather than being taxed according to its production and distribution costs.

Specific-rate taxation, or taxation based on quantity, meets this criterion for alcoholic beverages in that the rates applied to beverages will relate directly to the quantity of alcohol that will be consumed (Smith, 2005). There are two possible approaches to consider: an excise rate based on the volume of the product, such as litres of beer, litres of wine or litres of distilled spirits; or an excise rate based on the alcohol content within the product, expressed as litres of actual or 'pure' alcohol in one of those products.

The first option of an amount-per-litre specific rate, whilst being the simplest, does not fully reflect the various external costs associated with consumption of alcohol. To address this, a complex banded or tiered excise tax structure is required under which products of a higher strength are taxed at a higher rate. Without such a complex structure, a one-litre bottle of beer, at say four per cent alcohol by volume, would attract the same excise tax as a one-litre beer that was six per cent alcohol by volume, despite the fact it contains 50 per cent less alcohol for consumption (Preece, 2017).

The second option for specific-rate taxation are tax rates that are based on a 'per litre of pure alcohol' (LPA) measure. This option better reflects the externalities associated with alcohol consumption and overcomes the issues raised above in terms of a per litre rate. The effect of an LPA rate is that the excise tax is being levied upon the actual alcohol content and, as such, the tax liability for the product rises in line with the alcohol content of the beverage. The result is that LPA rates increase the price of higher strength alcoholic beverages relative to lower strength products. Returning to the beer illustrations above, the one-litre beer, which was six per cent alcohol by volume, would be paying 50 per cent more excise than the one-litre beer of four per cent and is thus more likely to result in its retail price being higher when consumers are making a choice of beverage.

Specific excise taxation based on alcohol content is also favoured by experts, particularly those in public health policy. The World Health Organisation (WHO) has publicly advocated for specific taxation of alcohol based on alcohol content as part of its 'global strategy to reduce harmful consumption' (WHO, 2010a, p. 16). In its strategy outline, the WHO recommends that national governments, in setting alcohol tax policy, should:

...establish a system for specific domestic taxation on alcohol accompanied by an effective enforcement system, which may take into account, as appropriate, the alcoholic content of the beverage...

The WHO adds that this approach to taxation of alcohol is most appropriate due to its impact on pricing, where the pricing of products to consumers is key in the strategy to reducing harmful levels of drinking. Where alcohol tax policy is a part of government policy in relation to harmful levels of consumption, academics such as Cnossen (2013, p. 606) and Bird and Wallace (2010, pp. 6–7) agree with the approach, believing that specific rates of alcohol excise tax best work in terms of price signals and correction of the negative externalities arising from excessive consumption; however, they do recognise the regressive nature of specific-rate taxation and thus understand why *ad valorem* rates are still used, particularly in developing economies.

To address this perceived regression to specific-rate alcohol taxation, it may be necessary to include ‘mixed’ or ‘composite’ alcohol excise tariff structures that include both a specific and *ad valorem* excise rate. For low- and middle-income countries, a mixed specific and *ad valorem* taxation is considered more appropriate. This mixed tax design is expected to reduce harmful and excessive drinking and prevent drinking initiation among young people by putting a floor price on alcohol beverages (Sornpaisarn, Shield, Osterberg & Rehm, 2017, p. XI). Such an approach has been adopted by both Thailand, the Philippines and Malaysia as a way to transition away from *ad valorem* excises on alcohol and towards policy objectives that see alcohol taxed on a per litre of pure alcohol basis and, thus, are better aligned with externalities being taxed (World Bank, 2015, pp. 12–16). Malaysia has now finished its progression to a fully specific excise tax system for alcohol (Excise Duty Order [Amendment] 2016 taking effect 1 March 2016).

With a potential alcohol tax policy review in mind, this study starts from the point of the policy questions, raised in the discussion above, that Vietnam could consider in the context of the current taxation arrangements. These questions could include:

- Is it still appropriate to retain a full *ad valorem* – based excise tax base?
- What would be the impact of replacing this current structure with either a fully specific system or a mixed or hybrid system?
- What would be the basis of a specific system – the quantity of product or on the actual alcohol content?
- What would be the impact of the relatively high MFN import tariff rates, which then feed into the taxable value for excise, with consideration of some form of possible tariff reduction policy? This would include consideration of the extent to which the current tariffs act as a driver to smuggling or other forms of illicit trade.

To assist in the evaluation of these types of alcohol tax policy questions, the bulk of the research in this project was dedicated to the construction of an econometric model into which various tax policy options could be tested. The basis of this concept is that it seeks to better inform tax policy development by providing capability to predict the effect of future tax policies, based on both an understanding and a measurement of how the alcohol market responds to price changes, such as those that would occur under an amended tax policy.

The proposed model supporting this study needed the flexibility to incorporate new policies, such as use of specific-rate excise taxation, on either a ‘per litre’ or ‘per litre of alcohol’ basis. In addition, there also needed to be the ability to test a ‘mixed’ excise tax system. Finally, it needed to be able to forecast several years forward. This allows for the model to track transition of current tax policies to any new tax policies, as well as predicting the effect of any proposed new ‘5-year road map’ announced by Vietnam. The actual methodology involved in constructing the econometric model is outlined in Annex A.

Approach

Developing an econometric model for Vietnam’s alcohol market proved to be a significant challenge, particularly in relation to a lack of transparency in official data relating to clearances into the market and to tax collections. This meant that other sources of information on the market were required and that certain testing of the ‘base-line’ revenue projections of the model could not be completed. Following is an outline of the model’s construction:

Market data collection

One of the major issues to manage was that of a lack of official published tax data in relation to either the level of clearances into the market of products within each of the three tax categories or of any data for excise tax collections for each of these three tax categories. There was not even officially reported data at the 'total alcohol excise' collections level. Therefore, no official data was available to:

- assist in calculating own price and cross price elasticities
- use as inputs to the model as baseline consumption
- confirm the accuracy of the outputs of the model by comparing baseline consumption in 2016 against excise tax collections for the same period.

This resulted in the need to source alcohol market data from a number of market research entities who primarily use an industry-based survey approach to estimate the size, value and overall make-up of the Vietnamese alcohol market by various product categories rather than by clearances related to tax categories (See Annex A re IWSR and Euromonitor Reports). In this regard, two market analysis reports were selected to ensure full coverage of all aspects of the market, namely IWSR and Euromonitor, and products were classified and sorted into the three excise tax categories.

Elasticity calculations

Consistent with past studies of alcoholic beverage markets that assume that demand for alcoholic beverages is dependent upon the price of the beverage, the price of other alcoholic beverages and household expenditure, this study uses the same approach. The estimation of price elasticities was conducted using the Almost Ideal Demand System (AIDS) with the full methodology employed outlined in Annex A. The AIDS model is also confirmed in the literature as an appropriate approach, taking into account other factors in demand such as trends in terms of changes in consumer tastes and preferences over time.

Based on household expenditure, the consumption of beer, spirits and wine has been disaggregated as follows for modelling:

- Beer: Premium priced, mid-priced and economy priced
- Spirits: Vodka, whisky, brandy and 'other spirits'
- Wine: Premium priced, mid-priced and economy priced.

The complicating factor in the calculations was the significant market in untaxed products that had been smuggled through the border or had under-stated their excise tax payable. One market research report was able to offer estimates as to the extent of the untaxed market, and as a result the elasticity calculations were also made with a correction factor for untaxed product. As the study progressed, the question as to the extent of 'smuggling' of imported products resulted in a more thorough investigation and an attempt at quantification; this will be the subject of further analysis later in the paper.

The study calculated both 'own price' and 'cross price' elasticities for the 10 product categories listed above (the full final factors can be found at Annex A). However, as a brief overview, brandy, as well as premium and mid-priced wines and beers, were the most price-sensitive products, with signs of some consumers trading down to lower priced beverages of choice as well as some small substitution between wine and spirits.

Representative products

Within the 10 product categories, a number of representatives were identified and were largely based on the largest selling products in each category. The main objectives in identifying such representative products are:

- To establish alcohol strength so that calculations could be made to estimate the litres of alcohol in the product and in the tax categories and, from this, begin to look at possible specific-rate tax scenario proposals based on alcohol content. In many cases, two or more products were identified in each category, in which case a weighted average alcohol strength was determined.
- To start creating 'cost builds' for these representative products with a view to again building a 'weighted average' cost build for each product category. This weighted average cost build will form part of the final model and will be subject to simulation in which proposed tax scenarios impact the tax components of the product and influence the retail price.

For beer, 14 products were identified: three from the low-cost segment; five from the mid-priced beer segment; and six from the premium-priced segment, of which two were imported. For liquor products up to 20 per cent a/v, 15 products were identified: seven from the low-priced segment, of which there was one local product and six imported products; five from the mid-price segment, all of which were imports; and three from the premium-price segment, all of which were imports.

Finally, for liquor products over 20 per cent a/v, 13 products were selected: for whisky, six products were selected, including a local whisky brand; brandy had two products, both of which were imported; vodka had three products, two of which were local brands; and in the 'other spirits' segment, two were imported brands.

The 42 representative products selected represent almost 90 per cent of the taxable volume of sales.

Cost builds

The development of cost builds is an important aspect of modelling as the relationship between pricing and tax must be properly understood, especially in an *ad valorem* tax system such as that in Vietnam. The tax components of the prices must be identified as it is these components that will change with any proposed alcohol tax policy change, such as customs tariffs (for imports), excise or VAT.

Cost builds became a significant issue for the project for several reasons. Commercially, owners of products keep information on key pricing components confidential, such as CIF values (for importers), manufacturing costs and profit margins. These margins and other costs can vary from product to product, or from customer to customer.

Further, as mentioned above, significant volumes of smuggled and tax-avoided product has entered the regular distribution channels and become one with like tax paid product. In some cases, it appears that prices set by wholesalers may have been calculated by 'averaging out' their tax paid and non-tax paid product to offer a single price to retailers or other wholesalers.

As such, no exact cost build could be developed. Rather, a number of assumptions had to be made from the use of other data sources to produce a number of 'generic' cost builds. These sources include:

- Market research reporting of estimates of the ratio of cost components as a percentage of retail price such as 'manufacturing costs and margins', 'wholesale margins' and 'taxes'
- UN trade data for average CIFs per HS code for beer, wines, brandy, whisky, vodka and 'other'

- Market research reports that include surveys for retail pricing, supported in many cases by actual visitations to premises selling alcohol
- VAT being 1/11th of retail price using the 10 per cent rate.

There were also a number of complexities in relation to distribution that needed to be understood and addressed. The distribution of alcoholic beverages has a direct impact on the cost builds of products as each layer of distribution will add to these costs, and the taxable value for excise can move to differing points along the supply chain, dependent on whether product is sold to affiliates or whether the margins of on-sellers is sufficient. In terms of importers, the excise calculation is further complicated by the fact that excise is levied twice: once upon importation of the product, and a second time when the product is sold to a non-affiliated entity (with a compensating credit from the excise paid at import). To overcome these further complexities, the generic cost builds have had to assume manufacturers and importers have not sold to affiliates and that importers have received full credit on the excise paid on customs clearance at import.

Unrecorded alcohol

Unrecorded alcohol also emerged as a significant issue, with two areas impacting on the consumption of alcohol. First is that of ‘small scale’ non-commercial alcohol produced free of the need of formal licensing and tax payments – usually found in the villages of Vietnam – provided the distilling operation is registered with local authorities (see Article 6 of Circular 39/2012/TT-BCT of December 20, 2012, detailing a number of articles of the Government’s Decree No. 94/2012/ND-CP of November 12, 2012, on liquor production and trading). Few attempts have been made to quantify this production, the most comprehensive perhaps being that of Luu et al. (2014) who conducted interviews in three provinces in rural Vietnam, and further cited the work of both Lam (2008) and Lachenmeier (2009) to assist this study quantify both volumes and importantly alcohol strength of non-commercial alcohol.

Based on these studies, non-commercial alcohol has been captured in the modelling as a separate worksheet, as at this stage there is no data to allow for the relationship between non-commercial and commercial alcohol to be understood. Notwithstanding this, Luu et al. (2008, p. 12) suggest that non-commercial production is in decline as new generations of drinking age populations are moving to the cities to find work, or are preferring commercial products, particularly branded beer, that is moving into rural communities.

The last recorded estimates of non-commercial alcohol are almost 10 years old and put total production at approximately 250 million litres. Alcohol strength and sales values have been updated for 2014 and see average alcohol strength of 38 per cent alcohol by volume (a/v) of these products whilst sales values will vary dependent upon the raw materials being fermented, but on average is around VND 20,000 per litre.

The second area of unrecorded alcohol is that of smuggling. An attempt was made to identify the potential extent of this problem using UN trade data statistics (provided by a third-party service). This data is reported by HS classification code in two formats: ‘direct data’, as reported by Vietnam in its trade reporting systems; and ‘mirror data’, being reported by the trading partners exporting to Vietnam. When comparing direct and mirror data, a significant anomaly was observed. When comparisons were made between Vietnam’s reported ‘direct data’ for alcohol imports, with ‘mirror’ trade data, only 6–7 per cent of ‘mirror data’ has been reported as imported into Vietnam (Trademap, n.d.). The implication is that the gap represented smuggled alcohol. However, further investigation revealed that certain alcohol products sent to Vietnam as a ‘hub’ are intended for onward export to markets like China. Therefore, adjustments were made to mirror data, which reduced the potential ‘smuggling’ figure from Vietnam less those exports of locally produced Vietnamese beer and liquors (see General Statistics Office of Vietnam, n.d., for details by industry).

Table 3 provides a summary of the data as reviewed by the study and indicates gaps between direct data (for 2015) as reported as mirror data (for 2016) as adjusted for re-exports of mirror data products and indicates the potential quantity of smuggled product in Vietnam. Indicated by the UN mirror data for 2016, total CIF value of wine and spirit reaches 1.37 billion USD in total. However, UN direct data for 2015 shows total landed value at 78.68 million USD. After the adjustment of re-export figures, tariff revenue loss is estimated at 534.32 million USD. If reasonable, this now suggests only around 16 per cent of imported wines and spirits in the market had tax paid for them – a figure not inconsistent with reports of raids by the Market Surveillance Authority before 2018 Tet holidays, suggesting that only 20 per cent of wine products were found to be properly labelled with import stamps only (Vietnam New Agency, 2018; Market Surveillance Agency, 2018).

Table 3: Direct and mirror trade data by HS code – alcohol imports to Vietnam in US Dollars

	Direct and Mirror trade data by HS code - alcohol imports to VN (in Million USD)							Adjustments		Potential revenue pool (in Million USD)	
	CIF: UN Mirror Data 2016	MFN	Tariff revenue	CIF: UN Direct Data 2015	MFN	Tariff revenue	Tax paid as % of total	Re-exports	Duty acquitted	CIF of smuggled goods	Tariff revenue lost
Beer 2203	34.25	0.35	11.99	7.52	0.35	2.63	22%	26.73	9.35	0.00	0.00
Wine 2204	94.46	0.5	47.23	23.00	0.5	11.50	24%	0	0	71.47	35.73
Wine 2205	1.33	0.5	0.67	0.02	0.5	0.01	2%	0	0	1.31	0.66
Wine 2206	6.99	0.5	3.50	4.50	0.5	2.25	64%	2.49	1.25	0.00	0.00
Brandy 22082	805.68	0.45	382.55	31.68	0.45	14.25	4%	92.71	41.72	681.31	306.59
Whisky 22083	130.65	0.45	58.79	13.15	0.45	5.32	10%	2.73	1.23	114.77	51.65
Vodka 22086	61.29	0.45	27.58	5.73	0.45	2.58	9%	0.79	0.36	54.77	24.65
Other 2208 (ex 22082, 22083, 22086)	266.71	0.45	120.02	0.63	0.45	0.28	0.2%	10.41	4.68	255.66	115.05
Totals	1401.36		632.33	86.20		39.41	6%	136	58.59	1179.30	534.32

Source: Trademap.org, GSO & author

The third-party service provider does issue certain caveats on the data indicating the potential for trading partners to be capturing or reporting inaccuracies and that some reporting times between Vietnam and its trading partners are not aligned. Notwithstanding, figures that suggest only 16 per cent of the CIF value of all alcoholic beverages sent to Vietnam being reported, supported by market raids suggesting only 20 per cent compliance from import tax stamps, there is a real issue for Vietnam in the area of under-reporting, of valuations, or non-reporting or under-reporting of quantities, or a combination of each of these. Smuggling on this potential scale should be part of future alcohol tax policy discussion as current policies may be contributing to incentives to smuggle, or indeed future tax policies may require increased enforcement support to Customs.

Economic model

The purpose of this study was not to dictate alcohol tax policy to Vietnam, but to highlight options. In this regard, the best place to start identifying options is with the government’s likely intentions for alcohol tax, which are best captured by press reporting on the 2014 amendments to the Law on Excise Taxation (Vietnam Briefing, 2014):

The taxes on alcohol are also in response to what the government sees as the increasing harm caused by excessive drinking throughout the country – Vietnam consumes the third largest amount of beer in Asia, behind only China and Japan. An additional reason for the tax is to help boost state budget income.

This statement suggests that alcohol tax policy thinking is starting to place a higher priority on the potential harm from unsafe levels of consumption, although growing the revenue contribution to the national budget remains important. In this context, it is time to question the on-going sustainability of a fully *ad valorem* alcohol tax system and introduce an element of, or transition to, a specific rate of excise.

The economic modelling tool allows for this sort of question to be analysed. Looking at Figure 1, users can, in relation to excise tax, select in the ‘scenario’ field for each of 2017–2020 a new *ad valorem* rate, and or create specific rates as either ‘Dong per litre’ or ‘Dong per LPA’ or a combination of these tax bases for each of ‘beer’, ‘liquor up to 20% a/v’ and ‘liquor above 20% a/v’.

Figure 1: Input screen for economic model

Tax Assumption		2017		2018		2019		2020	
		Baseline	Scenario	Baseline	Scenario	Baseline	Scenario	Baseline	Scenario
Tariff (%)	Beer	35%	35%	35%	35%	35%	35%	35%	35%
	Liquor & wine up 20% abv	50%	50%	50%	50%	50%	50%	50%	50%
	Liquor above 20% abv	45%	45%	45%	45%	45%	45%	45%	45%
Excise (% Ad Valorem)	Beer	60%	60%	65%	65%	65%	65%	65%	65%
	Liquor & wine up 20% abv	30%	30%	35%	35%	35%	35%	35%	35%
	Liquor above 20% abv	60%	60%	65%	65%	65%	65%	65%	65%
Excise (Dong per litre)	Beer		0		0		0		0
	Liquor up 20% abv		0		0		0		0
	Liquor above 20% abv		0		0		0		0
Excise (Dong per LPA)	Beer		0		0		0		0
	Liquor & wine up 20% abv		0		0		0		0
	Liquor above 20% abv		0		0		0		0

In addition to proposing changes to excise taxation in terms of current *ad valorem* rates or introducing elements of specific rate tax per litre or per LPA, the model also allows for users to propose changes to MFN import tariffs. As with excise taxation, the options to propose tariff changes is against ‘beer’, ‘liquor up to 20% a/v’ and ‘liquor above 20% a/v’. To assist users, the baseline MFN and excise rates remain in place, with users required to change the MFN or excise rates in the ‘Scenario’ columns.

How does the model report output from proposed scenarios?

The amendment of any alcohol tax policy has an instant or real time output report in relation to:

- price changing per litre of product categories, in actual VND and percentage changes against the baseline pricing
- consumption in litres (and 000s of 9-litre case equivalents) for product categories and percentage changes against the baseline consumption
- government revenue in VND per product category and percentage changes against the baseline tax revenues for
 - MFN tariffs
 - excise
 - VAT
 - total tax revenue being a sum of MFN, excise and VAT.

Each of these outputs are considered important in terms of analysing potential tax policy scenarios. Pricing, as well as driving the consumer response measurements in the model, is also a factor in discussions of areas such as affordability. The concept of affordability becomes an issue for government revenue in that, where affordability for a great mass of the population decreases so too will tax revenue. This is due to both the consumer not purchasing and therefore not contributing tax, as well as the greater likelihood that smuggling and other forms of tax evasion will become more attractive, offering product on which tax is not collected.

Understanding changes in consumption is also important. Alcohol tax policy should not drive an increase in total consumption, in particular it should not be driving consumption from lower strength alcohols into cheap higher strength products, or to cheaper alcohols of equal strength. Rather, alcohol tax policy scenarios should be designed with a view to reducing overall consumption, or at least maintaining consumption at acceptable non-risky levels. This would include seeing consumers move to more premium products, and in addition seeing lower alcohol strength products remaining equally or more affordable than high strength products.

Tax revenue as a measure would likely be held at a neutral position overall in any alcohol tax reform, even if it is achieved at the end of a transition period. It is unlikely that a sustained tax revenue loss to the government would see the government keen to listen and consider such a policy proposal.

The output of each of price, quantity and government revenue as outlined above, is available in the model for display in both tabular and graphic formats.

Using the model: Looking at some revenue neutral policies

To assist in outlining how to put the model to use, a number of simple scenarios have been developed and the ‘input screens’ included in this report. As an interesting starting point, and in line with the statement on ‘alcohol taxes and excessive drinking’ cited above, a ‘high level’ analysis was performed with the model to look at replacing the existing set of *ad valorem* excise rates with specific based excise rates.

In this regard, there are the two options as outlined and shown in Figure 2: a rate based on a per LPA basis and another on a per litre basis. The rate being sought in each case is that which provides the government with a revenue-neutral (or as close as can be measured) outcome across the entire alcohol tax system.

To achieve this for an LPA rate, Year 1 is selected as a ‘test year’ and a manual process is undertaken of resetting the current *ad valorem* rates to 0 per cent, and inserting a rate in each of the three tax categories until a rate per LPA is found that results in a government revenue change of 0 per cent. The result of this process is that a single LPA rate for all three categories of VND 353,000 per LPA as shown in Figure 2 gives a tax revenue neutral outcome.

Of interest in such a scenario is that the expected price changes occur with tax increase and therefore price increases to lower end products, offset by slight falls in tax and price at the premium end. However, overall consumption does not change from the baseline, the main observation is a ‘trading up’ with consumers simply changing to better quality product rather changing consumption amounts.

Figure 2: Input screen for revenue neutral single LPA rate

		Year 1	
		Baseline	Scenario
Tariff (%)	Beer	35%	35%
	Liquor & wine up 20% abv	50%	50%
	Liquor above 20% abv	45%	45%
Excise (% Ad Valorem)	Beer	60%	0%
	Liquor & wine up 20% abv	30%	0%
	Liquor above 20% abv	60%	0%
Excise (Dong per litre)	Beer		0
	Liquor up 20% abv		0
	Liquor above 20% abv		0
Excise (Dong per LPA)	Beer		353,000
	Liquor & wine up 20% abv		353,000
	Liquor above 20% abv		353,000

The other specific rate option available to policy makers is that of a ‘per litre’ approach. Following the same manual approach of re-setting all *ad valorem* excise rates in year 1 to 0 per cent and looking for a ‘revenue neutral’ single per litre rate across all products. This rate was found to be tax revenue neutral when the model was set at VND 17,575 per litre in all three tax categories. Figure 3 shows the relevant input screen. Also of note is that this single per litre rate set at VND 17,575 results in beer consumption falling by 0.1 per cent. Other outputs are as expected, with lower end products increasing in price, particular low-priced beers, and falls in price for premium beers, wines and spirits.

Figure 3: Input screen for revenue neutral single per litre rate

		Year 1	
		Baseline	Scenario
Tariff (%)	Beer	35%	35%
	Liquor & wine up 20% abv	50%	50%
	Liquor above 20% abv	45%	45%
Excise (% Ad Valorem)	Beer	60%	0%
	Liquor & wine up 20% abv	30%	0%
	Liquor above 20% abv	60%	0%
Excise (Dong per litre)	Beer		17,575
	Liquor up 20% abv		17,575
	Liquor above 20% abv		17,575
Excise (Dong per LPA)	Beer		0
	Liquor & wine up 20% abv		0
	Liquor above 20% abv		0

To further illustrate the capability of the model, users are also able to simulate a transition of a policy over several years of implementation. A significant policy move from, say, *ad valorem* to specific rate taxation and its impact on lower end products could, for example, be transitioned over a four-year period. In this regard, another policy scenario was input to the tax model relating to customs import tariffs and a possible pathway to tariff reduction.

The tax model contains MFN tariff rates, which for wines and spirits could be considered ‘high’ by international comparison. In Figure 4 below, over a four-year period the MFN tariff rates for wines and spirits were reduced by 5 per cent each year until they met the 35 per cent MFN tariff that currently applies to imports of beer.

This is achieved by replacing the current MFN tariff rates over the four years of the model with rates that reduce for wines and spirits by 5 per cent each year until they reach 35 per cent. This was achieved in Year 3 for wine and in Year 2 for spirits. The effect of this gradual reduction is very interesting from an academic perspective, in that total government revenue from total alcohol tax in Year 1 only falls by 0.05 per cent, and further, the overall policy is virtually fully tax revenue neutral by Year 4. The model is suggesting that the fall in duties from a cut in import tariffs for wines and spirits is offset by a switch to imports of premium wine and spirits by consumers.

Figure 4: Four-year phase in of MFN tariffs to 35%

		Year 1		Year 2		Year 3		Year 4	
		Baseline	Scenario	Baseline	Scenario	Baseline	Scenario	Baseline	Scenario
Tariff (%)	Beer	35%	35%	35%	35%	35%	35%	35%	35%
	Liquor & wine up 20% abv	50%	45%	50%	40%	50%	35%	50%	35%
	Liquor above 20% abv	45%	40%	45%	35%	45%	35%	45%	35%
Excise (% Ad Valorem)	Beer	60%	60%	65%	65%	65%	65%	65%	65%
	Liquor & wine up 20% abv	30%	30%	35%	35%	35%	35%	35%	35%
	Liquor above 20% abv	60%	60%	65%	65%	65%	65%	65%	65%
Excise (Dong per litre)	Beer	0	0	0	0	0	0	0	0
	Liquor up 20% abv	0	0	0	0	0	0	0	0
	Liquor above 20% abv	0	0	0	0	0	0	0	0
Excise (Dong per LPA)	Beer	0	0	0	0	0	0	0	0
	Liquor & wine up 20% abv	0	0	0	0	0	0	0	0
	Liquor above 20% abv	0	0	0	0	0	0	0	0

Transparency

As a cautionary note, as with any model, the output of this model is reliant on the accuracy of the data going into the model during its construction. This means that the quality of the output as it relates to revenue and consumption relies on the level of accuracy of the input data, including: the sales data sourced from the market research entities; the closeness of the generic representative cost builds to actual cost builds; the closeness of alcohol strengths in representative products to actual products; and the unknown impact of such a substantial amount of non-taxed paid product in the market.

Unfortunately, the actual accuracy of the model was unable to be tested, as Vietnam has decided not to publish relevant data, such as clearances or indeed tax collections, to a level that could be used to test the baseline data in the model. An offer to have the model reviewed by the Vietnamese tax policy makers was declined. This lack of transparency is of concern and is not conducive to good tax policy development process as those stakeholders outside the government are unable to develop evidence-based submissions to future tax policy design.

Notwithstanding, this study believes that it has generally been able to capture the impact of various tax policy changes on the Vietnamese alcoholic beverage market and including that on pricing, consumers’ responses to price changes, changes in sales volumes and, from these, changes to government revenues in relation to import tariffs, excise and VAT.

Tax model calculations

The final aspect of this report is the technical methodology employed in establishing the various factors that are the basis of the model's calculations and simulations of alcohol tax policy proposals. Annex A is a step-by-step account of this process and supports the underlying credibility of the model.

In short, whenever the model is being demonstrated or output of the model is being used to present a policy position, and there are questions on how the model is constructed, and the extent to which it can be relied upon (including limitations and assumptions), Annex A provides this detail.

Annex A should be read in conjunction with any use of the model, or by any person looking to independently review the model.

Conclusion

The outputs of this project do not include any proposals for specific reforms to the Vietnamese alcohol tax policy—that is a role for the APIWSA membership, working with its local stakeholders in Vietnam, to determine what policies should be taken forward for debate. The project does, however, consider that 'best practice' alcohol taxation includes the use of alcohol content as the basis for taxation, and that efforts should be made to address the illicit market. In this regard, the alcohol tax model allows simulation of a move away from value-based excise taxes to taxes based on alcohol content, and attempts to quantify the untaxed alcohol market simulations' effect on future tax policy proposals on this untaxed market.

Whilst this project has focused on excise taxation, the alcohol tax model can also simulate reforms to customs import tariff policy on imported alcohol and capture the impact of any proposed tax scenarios on the Value Added Tax (VAT) collections.

It is anticipated that Vietnam will commence consideration of its next 5-year plan for excise taxes, including alcohol, sometime in late 2018 or 2019. It is therefore hoped that this alcohol tax model can enable stakeholders to run various policy scenarios through the model with a degree of confidence, and that the output results will add credibility to the debate on potential tax reforms.

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Annex A: Method

Demand modelling of the Vietnam alcohol market

The standard approach in applied economics to empirically model demand behaviour in alcohol markets is to estimate a demand system. Demand systems are theoretically motivated equations that assume that demand for various alcohol types depends on their own prices, prices of the other alcohol types and household expenditure per capita. Additionally, trends to capture taste behaviour changes over time and lagged variables to capture habit persistence are also often examined. There appears to be no systematic studies conducted for most south-east Asian countries, including Vietnam. In part, the absence of studies for south-east Asian countries results from the paucity of accurate and lengthy time-series data sets.

Demand system modelling

For the estimation of elasticities, we employ the AIDS framework. The AIDS model is flexible and theoretically consistent in the sense that it provides a first-order approximation to any demand system based on utility maximising behaviour; it is derived from the second order approximation of any utility function and satisfies conditions for consistent aggregation across consumers (Deaton & Muellbauer, 1980). Fogarty's (2010) survey of the demand for alcohol literature indicates that at least 18 studies up until 2006 have employed the AIDS framework or its variants. Given the nature and short time span of the data, we employed the simplified 'linear approximate' version of the model (LAIDS). Further, the results from Unit Root tests indicate that the use of a first difference formulation is suitable.

In developing models, various approaches to combining the prices of individual products were employed. Consumer theory consistent indexes, such as the ideal Fisher index (Diewert, 1998) and average unit values (AUV), were considered. Theoretically consistent results were gained with normalised AUVs.

Multi-stage demand budgeting

A common assumption made in demand estimation is weak separability, see Edgerton (1997), Carpentier and Guyomard (2001), Klonairs and Hallam (2003), Gustavsen and Rickertsen (2003) and Mergenthaler, Weinberger and Qaim (2009) for food demand analysis in Vietnam. The approach assumes that commodities can be partitioned into separate groups and that consumers employ a multi-stage choice process, first allocating expenditure between groups of commodities and then within each individual group. Estimates from within group analyses are termed conditional estimates, conditional on the budget allocated to the group. These conditional estimates can then be combined with estimates from across group analyses to produce unconditional demand estimates which capture the total effects of price and expenditure changes on demand. The approximate relation between conditional and unconditional uncompensated price and expenditure elasticities has been developed by Edgerton (1997) and refined by Carpentier and Guyomard (2001).

Forecasting

Kastens and Brester (1996) and Gustavsen and Rickertsen (2003) analysed the abilities of theory constrained demand system models to produce accurate out-of-sample forecasts. In general, forecasts can be developed either through the direct statistically estimated equations or through derived elasticities with multi-stage budgeting. Both studies indicate the superior performance of elasticity-based forecasts. Using estimated elasticities and assuming values for prices, population and total expenditure, forecasts for quantities can be made.

Vietnamese alcohol data

Due to the absence of official statistics on alcohol consumption and prices, two research companies were enlisted to provide data. Euromontior was employed for beer data and the International Wine and Spirits Record (IWSR) for wine and spirits data. Data coverage is limited and relates to annual observations. Euromontior reported only tax-paid statistics for beer. In contrast, IWSR reported total volumes that include both the tax-paid and imported illicit markets for wine and spirits. Estimates of the tax-paid segments of the markets were obtained from IWSR and these varied between wine and spirits and among the various quality segments. The data and analysis were performed on the *estimated tax-paid segments* of the markets. The data for beer covers the period 2002–2016; for spirits, 2000–2016; and for wine, 2005–2016. For wine, the absence of price data for the still wine category prior to 2005 limits its duration. As a consequence, the analysis at the three broad alcohol levels relates to the period 2005–2016. The shortness of time-series and estimates of the tax-paid segments suggests that the results should be treated with caution.

We employed a three-stage budgeting process:

Stage 1: Household consumption expenditure allocates to: (1) Alcohol and (2) Other goods

Stage 2: Alcohol allocates to: (1) Beer, (2) Spirits and (3) Wine

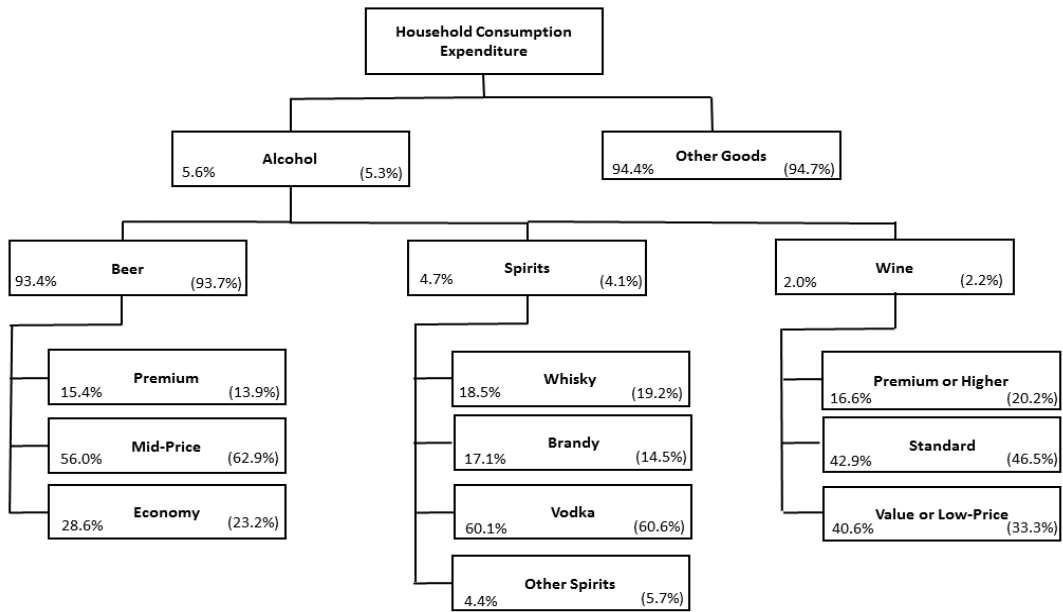
Stage 3: Beer allocates to: (1) Premium, (2) Mid-Priced and (3) Economy

Spirits allocates to: (1) Whisky, (2) Brandy, (3) Vodka and (4) Other siritis

Wine allocates to: (1) Value or Low-price, (2) Standard and (3) Premium or Higher

These groupings reflect natural products differences and are also driven by data availability and estimation results. For wine, the division between still, sparkling and other wine was initially considered. Estimates from this grouping produced theoretically inconsistent results, which, in part, appears to be due to the dominant still wine share of the group, averaging approximately 90 per cent throughout the sample. The expenditure budget shares of the product groupings in the various stages are presented in Figure 1. The figures for final household consumption expenditure and population (15 years or older) are sourced from World Bank (2017).

Figure 1: Alcohol budget shares – Vietnam



Notes: Budget shares based on sample means, 2016 shares presented in parentheses.

Alcohol accounts for approximately 5 per cent of household expenditure and this appears to be slightly higher than estimates from the General Statistics Office of Vietnam (2016) Living Standard Survey (VLSS). The VLSS estimates that the wine and beer percentage share of household consumption per capita monthly expenditure varies from 1.0 per cent to 1.2 per cent over the period 2002 to 2014. Selvanathan and Selvanathan (2006) calculated alcohol expenditure budget shares for over 40 countries and found that average alcohol budget shares are 3.1 per cent for developed countries and 3.3 per cent for developing countries. For some South-East Asian countries, average alcohol budget shares were: Philippines, 2.3 per cent; Sri Lanka, 2.8 per cent; Taiwan, 3.3 per cent; and Thailand, 3.9 per cent. It appears that Vietnam's budget share is slightly higher than other related countries.

Figure 1 clearly indicates that in value terms the market is dominated by beer (93% of market share) followed by spirits (5%) and wine (2%). The beer market is dominated by mid-price beers (63%). The spirits market is dominated by vodka (60%) and whisky (20%), followed by brandy (15%). Standard quality wines dominate the wine market (47%), followed by value/low-price wines (33%) and premium wines (20%).

The Vietnamese beer market

The summary statistics for the beer market are presented in Table 1. Some notable features include:

- the average unit value of premium beer almost doubles that of economy beer
- on average the AUV of mid-price beer is 3,000 VND higher than economy beer
- average per-capita expenditure on beer is approximately 1,100,000 VND per annum over the sample, which at AUVs implies that if only mid-price beer is purchased 34 litres are consumed per annum.

Table 1: Beer: Summary statistics

	Mean	Std Dev	Min	Max
Budget share: Premium	0.154	0.008	0.139	0.170
Budget share: Mid-priced	0.560	0.037	0.497	0.629
Budget share: Economy	0.286	0.033	0.232	0.345
Average unit value: Premium	53.490	10.837	38.729	69.334
Average unit value: Mid-priced	32.311	4.744	24.569	39.604
Average unit value: Economy	29.054	2.857	25.282	34.019
Expenditure per-capita	1109.9	563.1	412.95	2064.3

Notes: $N = 15$, annual data 2002–2016. AUV per litre and expenditure in 1,000 VND.

The LAIDS estimates based on first differences, with imposed restrictions for beer, are provided in Table 2. Some notable features include:

- an increasing time trend in mid-priced beer increasing the budget share by 0.012 per year, mainly at the expense of premium beer with a falling budget share of 0.007 per year
- a strong degree of habit persistence is apparent in the market with the budget share reflecting 0.45 of the previous budget share.

Table 2: Beer: Demand system estimates first difference model

	Budget share		
	Premium	Mid-priced	Economy
Log price: Premium	0.0411 (0.96)	-0.0859* (-1.86)	0.0447 (1.28)
Log price: Mid-priced	-0.0859* (-1.86)	0.2234* (1.91)	-0.1375 (-1.38)
Log price: Economy	0.0447 (1.28)	-0.1375 (-1.38)	0.0928 (0.96)
Log expenditure per-capita	0.0774* (3.70)	-0.0464 (-0.79)	-0.0310 (-0.57)
Time trend	-0.0074* (-4.08)	0.0121* (2.33)	-0.0047 (-0.98)
Habit persistence	0.4466* (7.82)	0.4466* (7.82)	0.4466* (7.82)
R2	0.856	0.595	0.624

Notes: * denotes statistically significant at the 10% level. t -ratios presented in parentheses. $N = 13$.

The elasticity estimates at both mean and 2016 values stemming from Table 2 are provided in Table 3. Interestingly, in terms of own price elasticities, premium beer is largest with -0.81 , followed by economy beer (-0.63) and mid-priced beer (-0.56). In terms of cross-price elasticities, premium and mid-priced beers are complements with negative elasticities, while premium and economy beers are substitutes with positive elasticities. Mid-priced and economy beers are complements. The most important of these elasticities appear to be for premium volume and mid-priced beer price (-0.84) and economy beer volume and mid-price beer price (-0.43). In terms of expenditure elasticities, premium beer is classified as a luxury with a value greater than unity (1.5), with mid-priced and economy beer being approximately 0.9 . Compared to other studies, the own-price and expenditure elasticity are higher than other averages however, they do fall within the range of previous estimates. In part, the higher elasticity values may reflect the dominance of the beer market in Vietnam.

Table 3: Beer: Conditional elasticities

	Premium price	Mid-priced price	Economy price	Expenditure
Premium beer	-0.8104 (-0.7898)	-0.8406 (-0.9693)	0.1538 (0.1961)	1.4972 (1.5481)
Mid-priced beer	-0.1384 (-0.1264)	-0.5613 (-0.6030)	-0.2195 (-0.2022)	0.9192 (0.9272)
Economy beer	0.1790 (0.2112)	-0.4340 (-0.5094)	-0.6339 (-0.5643)	0.8888 (0.8683)

Notes: Evaluated at the means of the data, 2016 values in parentheses. Own price elasticities are in bold.

The Vietnamese spirits market

The summary statistics for the spirits market are presented in Table 4. Some notable features include:

- the average unit value of brandy is nearly 800,000 VND over the sample, and at the other extreme the AUV of vodka is approximately 90,000 VND which predominately reflects very cheap locally produced product sold in large volumes.
- at the means, the AUV of brandy is nearly double that of other spirits.
- the average per-capita expenditure on spirits is approximately 50,000 VND per annum over the sample, which implies that if only vodka is purchased then approximately only one half of litre is consumed per annum.

Table 4: Spirits: Summary statistics

	Mean	Std Dev	Min	Max
Budget share: Whisky	0.185	0.021	0.149	0.215
Budget share: Brandy	0.171	0.024	0.131	0.209
Budget share: Vodka	0.601	0.043	0.536	0.659
Budget share: Other spirits	0.044	0.010	0.032	0.060
Average unit value: Whisky	454.7	201.5	232.3	787.5
Average unit value: Brandy	794.1	394.9	378.6	1404.4
Average unit value: Vodka	91.39	15.09	66.31	112.50
Average unit value: Other spirits	300.6	73.11	215.6	407.1
Expenditure per-capita	50.13	27.86	16.73	91.93

Notes: $N = 17$, annual data 2000–2016. AUV per litre and expenditure in 1,000 VND.

The LAIDS estimates for spirits are provided in Table 5. Some notable features include:

- an increasing time trend for vodka increasing the budget share by 0.010 per year, mainly at the expense of brandy, with a falling budget share of 0.011 per year.
- a strong degree of habit persistence is apparent in the market, with the budget share reflecting 0.53 of the previous budget share, which is similar to the beer market.

Table 5: Spirits: Demand system estimates first difference model

	Budget share			
	Whisky	Brandy	Vodka	Other spirits
Log price: Whisky	0.0528* (2.26)	0.0397* (1.95)	-0.0754* (-4.18)	-0.0175* (-1.86)
Log price: Brandy	0.0397* (1.95)	0.0018 (0.07)	-0.0381 (-1.43)	-0.0035 (-0.38)
Log price: Vodka	-0.0754* (-4.18)	-0.0381 (-1.43)	0.1343* (4.01)	-0.0209 (-1.44)
Log price: Other spirits	-0.0172* (-1.86)	-0.0035 (-0.38)	-0.0209 (-1.44)	0.0415* (1.76)
Log expenditure per-capita	-0.0394 (-0.94)	0.1554* (2.45)	-0.1267* (-1.85)	0.0107 (0.55)
Time trend	-0.0006 (-0.18)	-0.0105* (-2.32)	0.0095* (1.90)	0.0016 (1.26)
Habit persistence	0.5305* (5.18)	0.5305* (5.18)	0.5305* (5.18)	0.5305* (5.18)
R2	0.804	0.452	0.622	0.373

Notes: * denotes statistically significant at the 10% level. t-ratios presented in parentheses. N = 15.

The elasticity estimates at both mean and 2016 values stemming from Table 5 are provided in Table 6. In terms of own price elasticities, brandy is largest with -1.15, followed by whisky (-0.67), vodka (-0.66) and other spirits (-0.08). The high elasticity for brandy is expected as it is the most expensive spirit, while both vodka and other spirits have relatively low elasticities due to their relatively cheap nature. In terms of cross-price elasticities, the majority of products are complements with negative estimated elasticities. The most important elasticities appear to be: brandy volume and vodka price (-0.71); other spirits volume and vodka price (-0.60); and other spirits volume and whisky price (-0.43). In terms of expenditure elasticities, brandy has the highest value (1.86), followed other spirits (1.23), with whisky and vodka having similar elasticities (0.79). Compared to other studies, the own price and expenditure elasticities are within the range of other estimates. The major differences from the average of other estimates are the low own-price elasticity for the residual other spirits category and the high expenditure elasticity for brandy.

Table 6: Spirits: Conditional elasticities

	Price				
	Whisky	Brandy	Vodka	Other	Expenditure
Whisky	-0.673 (-0.678)	0.252 (0.239)	-0.288 (-0.292)	-0.084 (-0.080)	0.794 (0.811)
Brandy	0.049 (0.030)	-1.148 (-1.154)	-0.707 (-0.789)	-0.055 (-0.073)	1.860 (1.986)
Vodka	-0.084 (-0.077)	-0.026 (-0.030)	-0.656 (-0.675)	-0.027 (-0.025)	0.793 (0.808)
Other spirits	-0.431 (-0.344)	-0.121 (-0.091)	-0.597 (-0.458)	-0.084 (-0.281)	1.233 (1.173)

Notes: Evaluated at the means of the data, 2016 values in parentheses. Own price elasticities are in bold.

The Vietnamese wine market

The summary statistics for the wine market are presented in Table 7. Some notable features include:

- the average unit value of premium wines is double that of standard wines, which in turn is nearly double that of value/low price wines.
- the average per-capita expenditure on wine is approximately 29,000 VND per annum over the sample, which implies that if only value/low-price wine is purchased then approximately only one fifth of a litre is consumed per annum.

Table 7: Wine: Summary statistics

	Mean	Std Dev	Min	Max
Budget share: Value/low-price	0.406	0.079	0.312	0.536
Budget share: Standard	0.430	0.049	0.353	0.487
Budget share: Premium/higher	0.166	0.031	0.109	0.208
Average unit value: Value/low-price	156.3	5.644	149.0	168.5
Average unit value: Standard	289.6	37.10	241.8	347.0
Average unit value: Premium/higher	577.6	88.50	468.3	699.4
Expenditure per-capita	29.05	15.24	8.61	48.60

Notes: $N = 12$, annual data 2005–2016. AUV per litre and expenditure in 1,000 VND.

The LAIDS estimates for wine are provided in Table 8. Some notable features include:

- increasing time trends for both premium (0.012 per year) and standard wines (0.006) at the expense of value/low-price wines (-0.018), which is consistent with the absolute falling budget share of low-price/value wines (Figure 12).
- the degree of habit persistence is weaker for the wine market than the other markets, with the budget share reflecting 0.15 of the previous budget share.

Table 8: Wine: Demand system estimates first difference model

	Budget share		
	Value/low-price	Standard	Premium/higher
Log price: Value/low-price	-0.0875 (-0.65)	-0.0720 (0.89)	0.0154 (0.23)
Log price: Standard	0.0720 (0.89)	-0.0887 (-0.90)	0.0167 (0.22)
Log price: Premium/higher	0.0154 (0.23)	0.0167 (0.22)	-0.0321 (-0.48)
Log expenditure per-capita	-0.0391 (-0.58)	0.0591 (1.52)	-0.0200 (-0.60)
Time trend	-0.0180* (-1.89)	0.0062 (1.11)	0.0117* (2.48)
Habit persistence	0.1506* (3.19)	0.1506* (3.19)	0.1506* (3.19)
R2	0.335	0.434	0.384

Notes: * denotes statistically significant at the 10% level. t-ratios presented in parentheses. N = 10.

The elasticity estimates at both mean and 2016 values stemming from Table 8 are provided in Table 9. The own-price elasticities for all wine types are similar, being between -1.1 and -1.3. In terms of cross-price elasticities, all estimates are positive but small, indicating some weak substitutability. The most important elasticities appear to be value/low-price wines volume and standard wine price (0.23), and premium wine volume and standard wine price (0.14). In terms of expenditure elasticities, standard wine is 1.1, which is slightly higher than that for both premium and value wines at 0.89. Compared to other studies, the own price elasticities are slightly higher than the average of other studies but still within the range of other estimates. The expenditure elasticities for all three wine types are very similar to averages from other studies.

Table 9: Wine: Conditional elasticities

	Price			
	Value/low-price	Standard	Premium/higher	Expenditure
Value/low-price	-1.189 (-1.216)	0.233 (0.268)	0.058 (0.068)	0.898 (0.884)
Standard	0.110 (0.110)	-1.257 (-1.245)	0.0148 (0.011)	1.132 (1.126)
Premium/higher	0.133 (0.112)	0.144 (0.127)	-1.164 (-1.142)	0.887 (0.902)

Notes: Evaluated at the means of the data, 2016 values in parentheses. Own price elasticities are in bold.

The Vietnamese alcohol market

We now turn to stage two of the multi-budgeting process and consider the analysis of the three broad alcohol segments: beer, spirits and wine. The summary statistics for the broad alcohol market are presented in Table 10. Some noteworthy features include:

- the average unit value of wine is highest followed by spirits
- the AUV of spirits is approximately five times higher than beer.
- Effectively, the high prices for brandy are mitigated by the low prices of vodka to reduce the average values for spirits to be lower to those for wine
- the average per-capita expenditure on alcohol is approximately 1,300,000 VND per annum over the sample, which implies that if only beer is purchased then approximately 40 litres are consumed per annum.

Table 10: Alcohol: Summary statistics

	Mean	Std Dev	Min	Max
Budget share: Beer	0.934	0.0045	0.928	0.942
Budget share: Spirits	0.046	0.0026	0.041	0.051
Budget share: Wine	0.020	0.0040	0.013	0.024
Average unit value: Beer	34.754	3.890	29.567	40.478
Average unit value: Spirits	153.13	21.98	112.96	176.09
Average unit value: Wine	231.94	28.61	190.42	277.17
Expenditure per-capita	1364.8	545.6	645.96	2203.5

Notes: $N = 12$, annual data 2005–2016. AUV per litre and expenditure in 1,000 VND.

The LAIDS estimates for the three broad alcohol groups are provided in Table 11. There is little evidence of any preference changes over time. The degree of habit persistence is similar to the beer and spirits markets, with the budget share reflecting 0.49 of the previous budget share.

Table 11: Alcohol: Demand system estimates first difference model

	Budget share		
	Beer	Spirits	Wine
Log price: Beer	0.0339* (2.24)	-0.0216 (-1.54)	-0.0123 (-1.34)
Log price: Spirits	-0.0216 (-1.54)	0.0138 (1.16)	0.0077 (1.18)
Log price: Wine	-0.0123 (-1.34)	0.0077 (1.18)	0.0046 (0.42)
Log expenditure per-capita	-0.0206* (-1.14)	0.0037 (0.24)	0.0170 (1.63)
Time trend	0.0011 (0.70)	-0.0005 (-0.40)	-0.0006 (-0.62)
Habit persistence	0.4926* (4.48)	0.4926* (4.48)	0.4926* (4.48)
R2	0.731	0.690	0.760

Notes: * denotes statistically significant at the 10% level. t-ratios presented in parentheses. N = 10.

The elasticity estimates at both mean and 2016 values stemming from Table 11 are provided in Table 12. The own-price elasticities are reasonably similar across all three groups: beer is largest (-0.94), followed by wine (-0.80) and spirits (-0.71). In terms of cross-price elasticities, wine and spirits appear to be substitutes with positive elasticities, while beer is a complement with both spirits and wine. The most important elasticities appear to be wine volume and beer price (-1.32), and spirits volume and beer price (-0.53). In terms of expenditure elasticity estimates, wine (1.80) is largest, followed by spirits (1.08) and beer (0.98). Compared to other studies, the own price elasticities again fall with the range of previous estimates, however, beer appears to be somewhat larger than the average of other estimates. In general, the expenditure elasticity estimates are slightly larger than the average of other studies for wine and beer.

Table 12: Alcohol: Conditional elasticities

	Price			
	Beer	Spirits	Wine	Expenditure
Beer	-0.943 (-0.943)	-0.022 (-0.022)	-0.013 (-0.013)	0.978 (0.978)
Spirits	-0.533 (-0.607)	-0.708 (-0.668)	0.163 (0.186)	1.078 (1.089)
Wine	-1.319 (-1.278)	0.323 (0.317)	-0.801 (-0.808)	1.797 (1.769)

Notes: Evaluated at the means of the data, 2016 values in parentheses. Own price elasticities are in bold

The Vietnamese household goods market

We now turn to stage one of the multi-budgeting process and consider the analysis of alcohol as a single category and how it compares to the consumption of other household goods. Unfortunately, it appears that no thorough systematic study has been conducted for Vietnam that has isolated the separate impact of alcohol in a household expenditure study. As a consequence, we model the choice between alcohol and all other goods. This analysis serves only as an approximation to the substitutability between alcohol and other goods, given limited data availability. For other goods we employed the general consumer price index as prices and deducted total alcohol expenditure from final household consumption expenditure to represent expenditure on other goods.

The summary statistics for the goods market are presented in Table 13. The budget shares are relatively stable given the small size of the alcohol market in all goods. The average per-capita expenditure on all goods is approximately 25,000,000 VND per annum.

Table 13: All goods: Summary statistics

	Mean	Std Dev	Min	Max
Budget share: Alcohol	0.0559	0.0053	0.0501	0.0662
Budget share: Other goods	0.9441	0.0053	0.9338	0.9498
Average unit value: Alcohol	36.70	4.183	30.92	42.61
CPI: Other goods	180.22	55.89	100.0	249.6
Expenditure per-capita	25.106	11.131	9.761	41.755

Notes: $N = 12$, annual data 2005–2016. AUV per litre in 1,000 VND and expenditure in 1,000,000 VND.

Initial attempts at modelling the goods market using the methodology applied to other stages proved unsuccessful, with counter intuitive estimated elasticities. In part, the volatile nature of final household consumption expenditure posed problems – in particular, changes due to the global financial crisis (GFC). For example, the growth in total expenditure per capita fell from 32.6 per cent in 2008 to only 3.5 per cent in 2009. To recognise this structural change, the time trend in the LAIDS model was permitted to change as a result of GFC. The estimates incorporating this modification are presented in Table 14. The estimates indicate how the decreasing time trend has been reversed for the alcohol budget share as a result of recognising the GFC. The habit persistence impact is still present and only slightly lower than the markets for the separate alcohol categories.

The estimated elasticities stemming from Table 14 are presented in Table 15. The alcohol own-price elasticity is -0.61 and expenditure elasticity is 1.10 . These estimates are very similar to other estimates in the literature. Selvanathan and Selvanathan (2006) estimated alcohol elasticities accounting for other household goods for over 40 countries. For the developing countries in the sample, the average own-price uncompensated alcohol elasticity was -0.61 and the expenditure elasticity 1.13 .

Table 14: All goods: Demand system estimates first difference model

	Budget share	
	Alcohol	Other goods
Log price: Alcohol	0.0213* (1.81)	-0.0213* (-1.81)
Log price: Other goods	-0.0213* (-1.81)	0.0213* (1.81)
Log expenditure per-capita	0.0053* (0.13)	-0.0053 (-0.13)
Time trend	-0.0042 (-0.93)	0.0042 (0.93)
Time trend * (2009–2016)	0.0047* (1.74)	-0.0047* (-1.74)
Habit persistence	0.4073 (1.62)	0.4073 (1.62)
R2	0.883	0.883

Notes: * denotes statistically significant at the 10% level. t-ratios presented in parentheses. N = 10.

Table 15: All goods: Conditional elasticities

	Price		
	Alcohol	Other goods	Expenditure
Alcohol	-0.610 (-0.601)	-0.488 (-0.499)	1.098 (1.101)
Other goods	-0.022 (-0.022)	-0.972 (-0.972)	0.994 (0.994)

Notes: Evaluated at the means of the data, 2016 values in parentheses. Own price elasticities are in bold.

Unconditional elasticities

The elasticity estimates in Tables 3, 6, 9, 12 and 15 are conditional estimates, conditional on the expenditure group employed. These elasticities can to be combined with budget share information to estimate unconditional elasticities. Effectively, the unconditional elasticities capture the entire three-stage budgeting process through a single set of estimates. The unconditional estimates based on mean values are presented in Table 16 and estimates based on 2016 values in Table 17.

Table 16: Unconditional elasticities mean values: Three-stage budgeting

	Price										Expenditure
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	
1. Wine: Value/low-price	-1.088	0.268	0.101	0.046	0.101	0.150	0.017	-0.126	-0.301	-0.150	1.772
2. Wine: Standard	0.238	-1.213	0.069	0.058	0.127	0.189	0.021	-0.159	-0.380	-0.189	2.235
3. Wine: Premium/higher	0.233	0.179	-1.121	0.046	0.100	0.148	0.017	-0.125	-0.298	-0.148	1.750
4. Whisky	0.047	0.063	0.019	-0.607	0.214	-0.073	-0.079	-0.020	-0.054	-0.027	0.940
5. Brandy	0.110	0.147	0.044	0.205	-1.238	-0.202	-0.043	-0.046	-0.128	-0.064	2.203
6. Vodka	0.047	0.062	0.019	-0.018	-0.064	-0.440	-0.022	-0.020	-0.054	-0.027	0.938
7. Other spirits	0.073	0.097	0.029	-0.328	-0.180	-0.262	-0.076	-0.031	-0.085	-0.042	1.460
8. Beer: Premium	-0.008	-0.010	-0.003	-0.002	-0.002	-0.005	-0.001	-0.772	-0.449	0.360	1.608
9. Beer: Mid-price	-0.005	-0.006	-0.002	-0.001	-0.001	-0.003	-0.001	-0.115	-0.321	-0.093	0.987
10. Beer: Economy	-0.004	-0.006	-0.002	-0.001	-0.001	-0.003	-0.001	0.202	-0.202	-0.511	0.955

Notes: Own price elasticities are in bold.

Table 17: Unconditional elasticities 2016 values: Three-stage budgeting

	Price										Expenditure
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	
1. Wine: Value/low-price	-1.132	0.305	0.116	0.047	0.088	0.148	0.02	-0.107	-0.311	-0.109	1.720
2. Wine: Standard	0.217	-1.197	0.072	0.060	0.112	0.188	0.026	-0.137	-0.397	-0.139	2.192
3. Wine: Premium/higher	0.197	0.164	-1.093	0.048	0.089	0.151	0.021	-0.109	-0.318	-0.111	1.756
4. Whisky	0.044	0.079	0.027	-0.605	0.204	-0.059	-0.069	-0.029	-0.091	-0.032	0.972
5. Brandy	0.108	0.193	0.067	0.209	-1.238	-0.220	-0.046	-0.072	-0.223	-0.079	2.380
6. Vodka	0.044	0.078	0.027	-0.004	-0.065	-0.444	-0.014	-0.029	-0.091	-0.032	0.968
7. Other Spirits	0.064	0.114	0.039	-0.238	-0.140	-0.122	-0.265	-0.042	-0.132	-0.047	1.406
8. Beer: Premium	-0.006	-0.011	-0.004	-0.002	-0.003	-0.006	-0.001	-0.757	-0.512	0.376	1.666
9. Beer: Mid-price	-0.004	-0.006	-0.002	-0.001	-0.002	-0.004	-0.001	-0.107	-0.329	-0.094	0.998
10. Beer: Economy	-0.003	-0.006	-0.002	-0.001	-0.002	-0.004	-0.001	0.229	-0.253	-0.463	0.935

Notes: Own price elasticities are in bold.

In general, the unconditional own-price elasticity estimates tend to be only slightly smaller than their conditional counterparts. The cross-price unconditional elasticities are similar to their conditional equivalents within stage three groups, but relatively small across groups. The main cross-price effects occur within stage three groupings. The largest across stage three cross-price elasticities occur for wine volumes and beer prices. In general, all beer types are mainly complements with all other products, while some slight substitution occurs between spirits and wine. In most cases, the unconditional expenditure elasticities are much larger than their conditional counterparts. In part, this is due to the relatively high conditional expenditure elasticities. This is most evident for brandy and standard wine where the high conditional expenditure elasticities (Tables 6 and 9) combine with the relatively high wine and spirits expenditure elasticities (Table 12).

Forecasting performance

A number of decision choices need to be made in making forecasts. Kastens and Brester (1996) employed elasticities at mean values for forecasting, while Gustavsen and Rickertsen (2003) found that elasticities based on most recent values do not necessarily perform better for forecasting than using mean values. Also, Gustavsen and Rickertsen (2003) found that the use of conditional elasticities performed better than unconditional elasticities for forecasting. This latter finding may be due to either the inadequacy of the separability assumption for the market and/or the uncertainty of estimates may carry across sub-systems. The latter may be the case with our data given the very small sample sizes used for analysis and the three-stage budgeting approach.

To generate forecasts we also need to evaluate trend and habit persistence elasticities. These estimates are provided in Tables 18 and 19. The trend elasticities are not large. On the other hand, even though the conditional habit elasticities appear feasible the use of relatively large expenditure elasticities produces seemingly large unconditional habit elasticities and given the dynamic nature of forecasting this may significantly impact forecasts. Fundamentally, the use of three-stage budgeting appears to amplify the large expenditure effects throughout the system.

Table 18: Trend and habit rlasticities: Mean values

Product	Unconditional trend	Unconditional habit	Conditional trend	Conditional habit
Wine: Value or low-price	-166.61	1.250	-89.25	0.151
Wine: Standard	-68.51	1.537	29.06	0.151
Wine: Premium or higher	65.73	1.236	142.13	0.151
Whisky	-35.98	1.270	-6.51	0.531
Brandy	-192.59	2.264	-123.52	0.531
Vodka	2.33	1.269	31.76	0.531
Other spirits	27.92	1.679	73.69	0.531
Beer: Premium	-113.81	1.780	-96.29	0.447
Beer: Mid-price	32.65	1.266	43.41	0.447
Beer: Economy	-43.45	1.238	-33.05	0.447

Table 19: Trend and habit elasticities: 2016 values

Product	Unconditional trend	Unconditional habit	Conditional trend	Conditional habit
Wine: Value or low-price	-181.12	1.223	-108.88	0.141
Wine: Standard	-65.17	1.534	26.88	0.155
Wine: Premium or higher	43.23	1.259	116.94	0.155
Whisky	-39.68	1.378	-6.29	0.579
Brandy	-227.72	2.512	-145.99	0.558
Vodka	-1.61	1.304	31.62	0.509
Other Spirits	8.20	1.673	56.49	0.518
Beer: Premium	-126.55	1.825	-107.10	0.462
Beer: Mid-price	27.15	1.252	38.81	0.436
Beer: Economy	-51.74	1.231	-40.82	0.467

To examine the choices for forecasting we made in-sample forecasts for the years 2014–2016 using mean and 2016 elasticity values and various combinations of conditional and unconditional elasticities. For cross-price elasticities, unconditional values are employed to allow for non-zero cross price elasticities across the stage three groupings. Mean absolute percentage errors (MPAE) are presented in Tables 20 and 21 for various in-sample forecasts. It appears that the use of unconditional elasticities performs worst with significant over prediction. This mainly results from the large unconditional habit elasticities. In general, forecasts based on 2016 values perform slightly better than those based on mean values. In terms of MAPE, wine is most difficult to forecast, followed by spirits, with beer forecasts being most accurate. Of all the forecasts it appears the use of 2016 elasticities using conditional habit and expenditure elasticities, with unconditional elasticities for trend and cross-price appears to work best. The associated forecast errors are 6.4 per cent (wine), 4.7 per cent (spirits) and 1.8 per cent (beer) for 2014–2016.

Table 20: Mean absolute percentage eError: Mean elasticities 2014–2016 forecasts

Product	Unconditional	Habit Conditional	Habit & trend Conditional	Habit & expenditure Conditional	Habit, trend & expenditure Conditional
Wine: Value or low-price	6.57	5.41	4.23	7.87	5.89
Wine: Standard	17.60	9.27	13.35	5.85	7.47
Wine: Premium or higher	19.17	9.83	13.44	5.27	7.43
Wine average	14.45	8.17	10.34	6.33	6.93
Whisky	6.01	5.24	6.74	4.14	5.64
Brandy	1.68	7.90	11.57	5.21	8.88
Vodka	7.14	4.30	4.80	3.99	4.49
Other spirits	12.71	9.32	11.56	7.68	9.92
Spirits average	6.88	6.69	8.67	5.25	7.23
Beer: Premium	9.01	2.65	3.50	2.16	2.71
Beer: Mid-price	9.29	2.72	3.21	2.26	2.75
Beer: Economy	3.57	2.30	2.81	1.83	2.34
Beer average	7.29	2.56	3.17	2.08	2.60

Table 21: Mean absolute percentage error: 2016 elasticities 2014–2016 forecasts

Product	Unconditional	Habit Conditional	Habit & trend Conditional	Habit & expenditure Conditional	Habit, trend & expenditure Conditional
Wine: Value or low-price	6.70	5.56	4.43	8.60	6.05
Wine: Standard	17.50	9.02	13.03	5.70	7.24
Wine: Premium or higher	18.29	8.79	12.27	4.81	6.32
Wine average	14.16	7.79	9.91	6.37	6.54
Whisky	6.18	5.35	7.05	4.13	5.83
Brandy	2.58	7.24	11.59	4.15	8.49
Vodka	7.18	4.13	4.69	3.78	4.35
Other spirits	11.81	8.40	10.77	6.72	9.09
Spirits average	6.94	6.28	8.53	4.70	6.94
Beer: Premium	9.06	2.42	3.36	2.05	2.52
Beer: Mid-price	9.00	2.45	2.98	2.01	2.50
Beer: Economy	2.85	1.85	2.38	1.37	1.90
Beer average	6.97	2.24	2.91	1.81	2.31

Baseline forecasting

To generate forecasts, predictions for the exogenous prices and per capita household expenditure are needed. These predictions are based on autoregressive integrated moving average (ARIMA) models. This is a common approach used to generate forecasts and was employed by Gustavsen and Rickertsen (2003). ARIMA models performed better than predictions based on various smoothing models. To choose the best ARIMA model Akaike’s Information Criterion (AIC) was employed. The best fitting ARIMA models, correlations between actual and in-sample predictions and the relative forecasts for the next three years are provided in Table 22. All predictions appear to work well except for the price of value/low-price wines.

Table 22: Forecasting prices and per-capita household expenditure

Product Price	ARIMA Model	Correlation actual and predicted	Forecast relative change 2017	Forecast relative change 2018	Forecast relative change 2019	Forecast relative change 2020
Wine: Value or low-price	(2, 1, 1)	0.286	-0.037	0.019	0.015	-0.021
Wine: Standard	(0, 1, 1)	0.985	0.024	0.028	0.028	0.027
Wine: Premium or higher	(0, 1, 2)	0.984	0.046	0.042	0.031	0.030
Whisky	(1, 1, 1)	0.977	0.041	0.040	0.039	0.038
Brandy	(0, 1, 1)	0.988	0.046	0.041	0.040	0.038
Vodka	(2, 1, 0)	0.991	0.062	0.035	0.002	0.026
Other Spirits	(0, 1, 1)	0.984	0.018	0.028	0.027	0.027
Beer: Premium	(1, 1, 0)	0.986	0.028	0.028	0.028	0.027
Beer: Mid-price	(0, 1, 1)	0.979	0.027	0.026	0.025	0.024
Beer: Economy	(0, 1, 2)	0.987	-0.011	0.027	0.016	0.016
Per capita expenditure	(0, 1, 1)	0.993	0.079	0.068	0.064	0.060

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