DISSERTATION

THREE ESSAYS ON PUBLIC POLICIES IN INDONESIA

Submitted by

Devanand Pandapotan Tampubolon

Department of Economics

In partial fulfillment of the requirements

For the Degree of Doctor of Philosophy

Colorado State University

Fort Collins, Colorado

Summer 2023

Doctoral Committee:

Advisor: Anita Alves Pena

Elissa Braunstein
Harvey Cutler
Andrew Seidl

ABSTRACT

THREE ESSAYS ON PUBLIC POLICIES IN INDONESIA

This dissertation studies tax burden, tax compliance, and cooking fuel choice and energy policy in Indonesia. The three papers observe the impact of recent public policy changes in taxation and cooking fuel. The first paper comprehensively analyzes the burden of Value-Added Tax (VAT), focusing on current exemptions. This paper uses expenditure as the proxy of income or welfare to examine the VAT burden. This paper finds that the effective VAT rate is 4.51 percent nationally and weakly progressive. The effective VAT rate is relatively similar to other developing countries, but only half of the developed countries. The VAT burden is lower and more progressive in rural areas than in urban areas. The tax burden on food consumption is lower and regressive, while higher and progressive for nonfood consumption. While households in non-Java islands spend more than households in Java, this paper finds that the effective tax rate in non-Java is less than in Java.

The first paper also simulates the impact of the VAT reform implemented in April 2022. The result shows that if the exempted items are maintained (by only changing nontaxable to taxable but still excused from VAT) and the tax rate increase from 10 percent to 11 percent, the tax burden will increase proportionally to all expenditure deciles by 10 percent. However, the calculations suggest that if all exemptions are excluded, the tax burden will be double that of the previous tax regime and the poorest households will get hit more than the richest.

The second paper studies the impact of the high VAT threshold introduced in 2014 on small firms' reported revenues. The threshold is set to help both the tax authorities and small businesses.

However, the existence of a threshold will be counterproductive in its strength of providing transaction information. Due to a lack of trading information, the tax authority will have more difficulties assessing the tax obligation owed by the taxpayers. This paper utilizes quasi-natural experiments and Difference-in Difference regression to explore the treatment effect. The treatment group is wholesale firms, and the control group is retail firms. This paper finds that wholesale reports lower revenues by 58-70 percent for four years than those in the retail sectors. This paper also finds that the decrease in reported revenues is larger than the reported costs. This may lead us to conclude that the lower reported revenues are due to underreporting revenues.

The third paper studies the determinants of cooking fuel choices and energy policy in Indonesia amid the zero kerosene program. This study finds that government policy is important for the transition to clean energy. One percent increase in the distribution of LPG Kits increases the probability of clean energy usage by 2%. The impact is almost double in urban areas compared to rural areas. All socioeconomic and demographic factors significantly influence the household choice of cooking fuel. Households with higher income and wealth, better house infrastructure, formal education, electric network, and mobile phone are more likely to be clean energy users. On the other hand, working women, household heads working in agriculture, and bigger household sizes are identic to unclean energy. The age and gender of the head have different effects on urban and rural households.

In line with the findings of previous studies, household income is still the main determinant of clean energy. One percent increase in income will impact the probability of clean energy by 10 to 13 percentage points. With steady GDP growth of around 5-6% yearly, Indonesia has a good path to transition to clean energy.

The three essays complement each other to strengthen Indonesia's economic development. Taxation is essential for adequate and sustainable public funding and clean energy is for better living and productivity. Chapter One provides insight into estimates of the VAT burden in society. This will help the government to improve VAT revenue with a less negative impact on society, especially for low-income people. Chapter Two provides insight for government to improve the utilization of information from the VAT system and tax compliance. Adequate and sustainable self-funding through taxation will enable the government to provide sustainable clean cooking fuel, which may help society become healthier and more productive. Chapter Three has the implication that tax policy can be used to promote clean cooking fuel. The current VAT exemption on households that use electric power up to 6600 VA should be maintained to encourage low-income families to use clean cooking fuel.

ACKNOWLEDGEMENTS

First, I would like to thank my wife, Jesly Panjaitan, for her love, support, and belief that I can complete this program. This journey is beyond my imagination. Thank you to my kids, Kayla and Klara Tampubolon, who give me joy and strength to be back on track and finish my work.

I am totally grateful to my supervisor Dr. Anita Pena. This dissertation will not have been accomplished without her guidance, support, and helpful editing. Thank you is not enough for your kindness. I also would like to thank the dissertation committee members: Dr. Harvey Cutler, Dr. Elissa Braunstein, and Dr. Andrew Seidl, for their support and precious feedback. Thank you also to Dr. Daniele Tavani for helping me administratively and academically when you were our graduate coordinator.

I want to thank the financial support from Lembaga Pengelola Dana Pendidikan (LPDP) Indonesia for making this journey possible. I also want to thank my organization, the Directorate General of Taxes, Indonesia, for allowing me to have a different life and pursue my dream.

TABLE OF CONTENTS

Chapter 1 - Value-Added Tax Burden: A Case of Indonesia

1. Introduction

Like many developing countries, Indonesia introduced value-added tax (VAT) as a substitute for sales taxes in 1983 to increase its internal revenue collection and bring transparency to its indirect tax system. Currently, VAT is a significant source of revenue in Indonesia, with more than 30% of revenue collected through VAT, and more importantly, its contribution to the total revenue is increasing (Alm, 2019). However, since the tax is imposed based on consumption regardless of the income level of the households, this kind of tax is perceived as a regressive tax (Creedy, 1998; Caspersen and Metcalf, 1993). It usually results in dissatisfaction as it is considered unfair to lower-income people to pay a higher effective rate than rich people. The former spends all their income to support their living, while the latter can save.

The rise of VAT worldwide has recently been one of the most significant tax developments (Bird, 2007). As of 2020, 170 countries had a VAT (OECD, 2020), with the tax contributing a more significant proportion of total tax revenue in developing countries (Alm and El-Ganainy, 2012). An adequately designed VAT raises more revenue with less administrative and economic cost than other broadly based taxes (Farida and Sarker, 2011). VAT avoids most of the negative features of sales and excise taxes (Le, 2003). It removes cascading, allowing the tax content of any product to be known with greater certainty, thus leading to better resource allocation decisions as investment decisions can be made independent of the tax policies. Furthermore, VAT simplifies tax administration and increases efficiency in resource allocation (Farida and Sarker, 2011).

All goods and services consumption is taxable unless exempted or the rate is otherwise reduced. These treatments are a ubiquitous feature of such systems in many countries. Indonesia

exempts a broader range of goods and services than most countries, making Indonesia's VAT system different from international norms (Marks, 2005; Lewis, 2019). The main reason is to reduce the regressivity effect of VAT on most of the population. Exempting basic needs such as food, education, and health service from VAT will help many low-income people who spend most of their income on these consumptions. However, these numerous exemptions could raise questions about the tax burden and who benefits from this VAT exemption most in Indonesia, the richer or the poorer.

Several studies on VAT burden and regressivity have been conducted prominently in developed countries (Metcalf, 1994; IFS, 2011) and OECD countries (Thomas, 2022). To the best of my knowledge, only a few have been conducted in developing countries (non-OECD countries) such as Tanzania (Mushi, 2009), Bangladesh (Faridy and Sarker, 2011), Ethiopia (Muñoz and Cho (2003), and Lebanon (Salah and Mustafa, 2007). This kind of research has not been conducted yet for a big developing country like Indonesia.

Each country that adopted VAT as a consumption tax has developed its VAT structure by considering their countries' specific features such as, among others, economic development and political condition (Bird, 2015). While research from other developing countries has provided insights into the VAT burden, research specific to Indonesia's case will enrich the literature as the VAT structure is different. Stiglitz (2009) states that the tax policy appropriate to one developing country may differ markedly from that of another.

Information regarding tax burden and progressivity is increasingly important for public policy on taxation and redistribution. Especially in the current situation, all countries worldwide, including Indonesia, face the severe impact of the Covid-19 Pandemic on the national budget. Many economic activities as sources of national revenue had halted to prevent the spread of the

virus. As an impact, public revenue decreases during public expenditure increases because massive subsidies are needed to help poor and vulnerable households, and the government covers all health expenditures related to Covid-19.[1]

While some countries reduce the burden of VAT faced by their people either for some or all types of consumption, Indonesia took a different policy by pushing more collection of tax revenue from VAT.[2] The government of Indonesia (GOI) needs to boost its internal revenue to support many programs, especially in anticipating the impacts of Covid-19 pandemic. Thus, in late 2021, GOI introduced tax reform in all taxes, including VAT. There are two major VAT reforms, such as reclassifying numerous nontaxable goods and services to be taxable but still excused from VAT and the VAT rate increase from 10 percent to 11 percent in April 2022.

The contribution of this paper is to provide a comprehensive analysis of the VAT burden of a unique VAT structure with enormous exemptions implemented in Indonesia. Several questions can be raised about the impact of the unique VAT structure. First, this paper asks about the magnitude of the tax burden caused by VAT and whether it is progressive or regressive. Second, this paper is curious whether the burden is equally borne between households in urban and rural areas, and Java (one of the most populated big islands in the world) and non-Java areas. It is also worth knowing whether the tax burden is different between food and nonfood consumption. All these questions will also lead us to another critical question who benefits from the numerous

[1] Deficit budget increased from 349 trillion IDR (USD24.5 billion) in 2019 to 948 trillion (or USD67 billion) in 2020 (from Audited Central Government Financial Report 2020). Deficit budget was still high in 2021, targeted at 1006 trillion but realized at 775 trillion IDR due to a windfall revenue from commodity price shock like coal and palm oil (Audited Central Government Financial Report 2021).

[2] For examples, United Kingdom (see https://www.gov.uk/guidance/vat-reduced-rate-for-hospitality-holiday-accommodation-and-attractions), Belgium (https://globalvatonline.pwc.com/covid-19-summary).

exemptions in the VAT system? Finally, this paper aims to estimate the possible impact of the current VAT reform on tax incidence.

This paper adds value to VAT incidence literature (Thomas, 2022; Bachas et al., 2020; IFS, 2011; Metcalf, 1994; among others), especially from developing countries perspectives (Farida & Sarker, 2011; Mushi, 2009; Abosedra et al., 2007; Muñoz & Cho, 2003). Countries have different magnitudes of tax burdens regarding effective VAT tax rates due to various VAT systems and economic environments. To my knowledge, this is the first paper that analyzes VAT incidence in Indonesia. In addition, this paper examines tax burden using the household as the unit of analysis and individual levels such as expenditure per capita and equivalence scale expenditure.

This paper also adds value to the discussion of VAT reform, fiscal policy, and economic development literature (like Bird, 2007; Stiglitz, 2009; Alm, 2019; Warwick et al., 2022). Tax incidence analysis is usually conducted to analyze a country or compare one country to another. This paper provides an intra-country analysis by comparing developed and underdeveloped areas. In addition, this paper also includes a universal cash transfer scenario to ease the tax burden on people with low incomes and improve VAT progressivity.

The rest of the paper is organized as follows: Section 2 describes the background and literature, Section 3 discusses the methodology and data, Section 4 explains the results, and Section 5 elaborates on the impact of VAT reform. Finally, Section 6 concludes.

2. Background and Literature

2.1 Value-added Taxes

VAT is a consumption tax levied at multiple production and distribution stages, with taxes on inputs credited against taxes on output (Bird, 2007). It is levied on all sales by registered businesses and collected from consumers at the point of sale (Satterthwaite, 2019). Sellers are required to

charge the tax on all their sales and can claim a credit for taxes that they have been charged on their inputs.

VAT has three critical strengths compared to other consumption taxes, such as sales tax (Satterthwaite, 2019). First, it supports production efficiency. Consumers will bear VAT rather than producers as there is no cascading like sales tax. In the end, tax is borne by the final customers as the accumulation of all values added is on them. The second strength relates to factionalism. Only the tax on the value added is paid at a particular stage. Thirdly, it can deter evasion as the VAT system will provide a paper trail and self-enforcement through the input credit mechanism.

Consider the example of a transaction between firm A, firm B, and final customer C to show how the VAT works and the statutory incidence. The VAT rate for this case is 10%. Firm A produces a chair and sells it to Firm B for $10. Firm A levies $1 for the VAT, and Firm B pays $11 after tax and receives an invoice for the transaction from A. Firm B creates excellent packaging on the chair and sells it for $15 to C. Firm B charges $1.5 of VAT and customer C pays $16.5 after tax. Firm A reports and pays the VAT collected for $1 to the tax authority as it does not have a tax credit from input to produce the chair. Firm B reports $1.5 for VAT collected and $1 for VAT paid for input. Then, Firm B pays $0.5 to the tax authority. So, Firm B only pays tax for the value-added it had created, which is 10% of $5. In this stage, the tax authority will have information on transactions from A and B. If A does not report anything to the tax authority, information from B will be enough to identify a tax evasion conducted by Firm A. Customer C pays VAT for $1.5, which is the tax collected from all values created by Firm A and Firm B, at $10 and $5, respectively. Thus, it can be concluded that VAT is a consumption tax on value-added and is borne by the final customer.

2.2 Progressivity of VAT

The tax base of a VAT is sales. It is often perceived as a regressive tax relative to income tax. A tax is considered regressive if the average tax rate or the ratio of tax liabilities to income decreases with an increase in income, progressive if the average tax rate increases with income and proportional if the average tax rate is flat. In other words, low-income people pay a higher fraction of their income in taxes than wealthier people if the tax is regressive and a lower fraction if the tax is progressive. The low-income people will spend almost all their income (in some circumstances, all or more than their income) to fulfill their basic needs, while high-income people can still save some of their income. Thus, the high proportion of spending to income causes low-income people to bear a higher consumption tax ratio than high-income people.

The impact of VAT on the lifetime rich versus the lifetime poor could be one of the most exciting questions for public finance scholars (IFS, 2011), and analysis based on lifetime income and lifetime expenditure would give similar answers since the two are generally similar (the main difference being bequests made and received). However, the data on lifetime resources are hard to obtain. Most researchers rely on survey data that only provide snapshots of households' income or expenditures at a particular time.

Measuring income and expenditure can differ when looking at snapshots of resources at a particular point in time. Households with low reported current income typically report spending more than their income, while those with high current income typically report spending less (Thomas, 2022; IFS, 2011; Mushi, 2009; Metcalf, 1997). That shows that households could borrow to meet their consumption needs and save if their income exceeds consumption. Unsurprisingly, distributional analysis based on income-based and expenditure bases can provide strikingly different patterns.

It leads to another major question should we use income or expenditure to measure whether a household is rich or poor? If the aim is to gauge a household's lifetime living standards, the question is whether income or expenditure varies less around its long-term average. VAT payments as a percentage of expenditure are more informative than payments as a percentage of income. Without data on lifetime resources, it is likely to be a better guide to the lifetime distributional effects of VAT (Metcalf, 1994; IFS, 2011; Thomas, 2022; Poterba, 1989, 1991).

Specific to developing countries, income data is relatively weak, collected by statistical agencies, and is a less accurate measure of welfare (Bavier, 2008; Fields, 1994; Meyer & Sullivan, 2003). Unlike in developed countries, consumption expenditure is the preferred indicator in measuring welfare or living standards in developing countries because consumption can capture long-run welfare levels more than income (World Bank, 2001). Consumption is less vulnerable to under-reporting bias as income may fluctuate over time due to shocks or lifecycle income. At the same time, consumption may smooth across seasons or years by saving or dissaving or by other consumption smoothing mechanisms. Consumption is a more direct measure of material well-being and a better basis for determining economic status than income (Bavier, 2008; Meyer & Sullivan, 2003).

The progressivity of VAT is often affected by different treatment of rates among goods and services. In practice, not all consumption is taxable, and some goods and services have been imposed VAT with a reduced rate. Basic needs such as raw food, health services, and education are usually reduced, zero-rated, or exempted from VAT. The main reason is that low-income people spend all their income on this consumption. Zero and reduced rates could make VAT more progressive (IFS, 2010). However, while poor households are the biggest gainers from reduced

rates on items such as food in proportional terms, wealthier households gain considerably more in absolute or cash terms (Mushi, 2009; IFS, 2010).

In determining the incidence of VAT on households, there is a critical issue in measuring how much tax households effectively bear or how the VAT passes through into consumer prices. Tax may fully pass through to the end customer, or the producer still bears a part of it, as the feature of VAT is that, in principle, there is no tax in intermediaries' activities. This issue often arises in tax reform situations, such as VAT rate increases or decreases, or exemptions are deleted.

As explained in IHS (2011), the degree to which changes in VAT rates are passed through (shifted) into consumer prices is primarily based on a theoretical point of view. It depends on the competition in the market and demand and supply behavior. The theory states that consumption taxes may be less shifted, or prices rise (fall) less than the amount of VAT increase (cut) or even over shifted or prices rise (fall) by more than the amount of the VAT increase (cut). In a perfect competition setting, only complete or under-shifting should be observed. The degree of shifting is higher if the less responsive demand is to price changes and the more responsive supply is.[3]

In models with imperfect competition, the results can differ. If firms compete by setting prices (Bertrand competition), the results are the same as perfect competition. On the other hand, if firms compete by choosing the level of output (Cournot competition) and prices are determined in the market, VAT can be under, fully, or even over-shifted, depending on the structure of the market as well as demand and supply elasticities (IHS, 2011).

[3] Fullerton and Metcalf (2002) provide the formula: $\tau^{\mathcal{C}} = \frac{\varepsilon^{S}}{\varepsilon^{S} - \varepsilon^{D}}$, where $\tau^{\mathcal{C}}$ is the relative burden of the customer, ε^{S} is the elasticity of supply of the consumption good and ε^{D} is the elasticity of demand for the consumption good. The share $\tau^{\mathcal{C}}$ lies between zero and one and is assigned one if the tax is fully shifted into prices and zero if prices will be unchanged, implying the tax burden is completely held by the producer.

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

2.3 VAT in Developed Countries

Several empirical studies have examined the distributional impact of VAT worldwide. These have typically been conducted using household expenditure survey microdata. The use of microdata enables the fine distinctions present in many countries between categories subject to different VAT rates or exemptions to be accurately modeled. It also provides flexibility regarding how to measure distributional effects. In most cases, average VAT burdens measured as a percentage of income or expenditure are presented across income or expenditure deciles. Whether VAT is regressive or progressive depends on the income or expenditure approach.

Introducing VAT as a substitute for sales tax in the United States, Metcalf (1994) simulates VAT incidence using household expenditure microdata for 1990. He shows simulated VAT incidence as a percentage of gross income and expenditure. He emphasizes that a VAT in the United States would be proportional on a lifetime basis, with expenditure as a proxy for lifetime income, and regressive as a percentage of current income.

IFS (2011) studies VAT tax burden cross-country analysis using expenditure-based approaches. Nine countries with similar microsimulation methodologies are observed, such as the United Kingdom, Spain, Poland, Italy, Hungary, Greece, Germany, France, and Belgium. Depending on the country, they use the household expenditure survey microdata from 2004 to 2009. As the unit of analysis is individual, they create equivalized disposable income and expenditure. While IFS (2011) measures tax burdens as a percentage of both income and expenditure, they highlight that measuring VAT as a percentage of income can drive a misleading impression of the distributional effect of the VAT due to the ability to borrow and save. They conclude that expenditure-based results show a better picture of the distributional impact of VAT. They find VAT to be either proportional or progressive in all countries except Greece and Hungary when measured as a percentage of expenditure across expenditure deciles. On the other hand, they find the VAT regressive in all nine countries when calculated as a percentage of income across income deciles.

Alastair Thomas (2022) studies VAT regressivity in 27 OECD countries using Household Budget Survey (HBS). He uses income or expenditure to assess the competing methodological approaches in previous distributional studies. He provides a simple two-period model showing the distributional impact of VAT utilizing current expenditure. He finds that the effective VAT rates range from 4.3 to 14.3 percent across countries and are roughly proportional or slightly progressive across countries based on the expenditure approach. He also emphasizes that compensation measures for poorer households, such as targeted tax credits or benefit payments, should accompany increased VAT revenue by base-broadening or tax rate increases. In several emerging countries, subsidizing food cannot be justified on equity or efficiency grounds.

2.4 VAT in Developing Countries

Some studies on VAT incidence have also been conducted in developing countries. For example, Muñoz and Cho (2003) examine the progressivity of VAT of Ethiopia for 2002/2003 utilizing the 1999/2000 Household Income, Consumption and Expenditure Survey. They use household consumption as the welfare measure and divide the sample into deciles of total expenditure. To measure the progressivity of VAT, they compare the effective tax rate for each decile and examine the generalized Lorenz curve for expenditure and the concentration curve for VAT. They also extend their tax incidence study to subgroup analyses such as food and nonfood and urban and rural areas. Their study shows that the average effective VAT rate is 4.77 percent. VAT is progressive at the national level, while it is regressive or, at most, neutral in urban areas. VAT on food spending is regressive, while nonfood spending is progressive. VAT is less progressive than the replaced sales tax due to fewer exemptions and one tax rate system. They further emphasize that as the better-off people consume the exempted goods and services more, the exemptions cannot be justified on equity grounds.

Abosedra et al. (2007) studied the regressivity of the VAT in Lebanon by using a 1997 household survey. The unit of analysis is the household, and the primary welfare measure is expenditure. They find that VAT is not regressive. Exemptions on food, education, shelter and health care made the VAT more progressive than the direct income tax. Their estimates of the GINI coefficient using income and expenditure show that using expenditure instead of income would result in a more equitable national product distribution. They also examine the proposal by the government to increase the VAT rate to 16 percent from 10 percent. They find that the distribution of tax burden would be better, and tax revenue would increase significantly while the extra burden on people experiencing poverty is negligible.

Mushi (2009) studies the distribution of the VAT burden in Tanzania based on annual income and current consumption as the proxy of lifetime income using the Household Budget Survey of 2000/2001. She elaborates on the impact of exemptions on government revenue and tax burden. The distributional characteristics approach shows whether exemptions are justifiable on distributional grounds. Like the previous study, VAT looks very regressive when annual income is used to measure welfare. Using expenditure as the proxy of lifetime income makes VAT proportional. VAT becomes progressive when exemptions are incorporated and expenditure is used. However, exemptions pose a negative impact on revenue. Her study shows that the VAT rate could be lower if exemptions are limited to gain the same level of tax revenue.

A similar study has been conducted in Bangladesh. Faridy and Sarker (2011) use the individual as the unit of analysis and income per capita to measure welfare. Consumption per capita is used in the measure of VAT liabilities. The VAT burden is relatively high for people in lower-income groups than those in high-income groups. When the VAT exemptions for certain goods and services are included, they find a significant decrease in the VAT burden for the people of lower-income groups. When the VAT burden is observed based on urban and rural areas, they find the progressivity of VAT changes significantly. Comparing the results with and without VAT exemptions, the authors find that the VAT in Bangladesh is regressive overall. Furthermore, it is more regressive without exemptions than with exemptions. VAT in the rural area is less regressive than at the urban level, both with and without exemptions.

While a specific study of VAT burden and progressivity in Indonesia has yet to be presented in the literature to date, some studies on improving tax revenue highlight the exemptions on VAT. Mark (2005) studies the proposal to exclude several exempted goods of 2004 and its implications for tax revenue. He builds a simulation model using the input-output table of 2000 to measure the

potential tax revenue. He provides examples to show that ending exemptions can either raise or lower VAT revenues. His calculation concludes that the estimated revenue impacts of reducing exemptions on several goods are minor relative to revenue increases from improved administration of the VAT system. Lewis (2019) discusses a more efficient value-added tax that would raise more revenue. She suggests broadening the VAT base by removing exemptions and lowering the threshold for VAT registration. Those changes would harness the efficiency of the VAT and raise more revenue without increasing the rate.

2.5 VAT in Indonesia (Recent and the Reform)

In most developing countries, taxes are the government's primary revenue source. Indonesia is no exception; tax revenue accounts for about 60-70 percent of total government revenue, and the VAT alone accounts for 29-32 percent of total tax revenue from 2007 to 2015, as shown in Figure 1.1. The tax ratio to GDP is still low relative to other countries at similar income levels (Lewis, 2019).[4]

VAT was introduced in Indonesia at the end of 1983 and implemented in April 1985. It replaced the sales tax that had been implemented in 1951. The reform aims to elevate public revenue, support export, and distribute the tax burden evenly. VAT applies as an indirect tax on consumption levied on the value addition of goods and services at each point in the chain of the raw material stage to the final consumption. Firms collect VAT at a standard rate on sales and claim credit for the VAT included in the cost of their purchases of taxable goods and services. Until March 2022, the single VAT rate used is 10 percent. Under the new tax reform, this rate will be 11 percent in April 2022 and 12 percent in 2025.

[4] Indonesia's tax to GDP ratio was 11.6 percent in 2019, far below the Asia and Pacific average of 21 percent and OECD average of 33.8 percent (OECD, 2021).

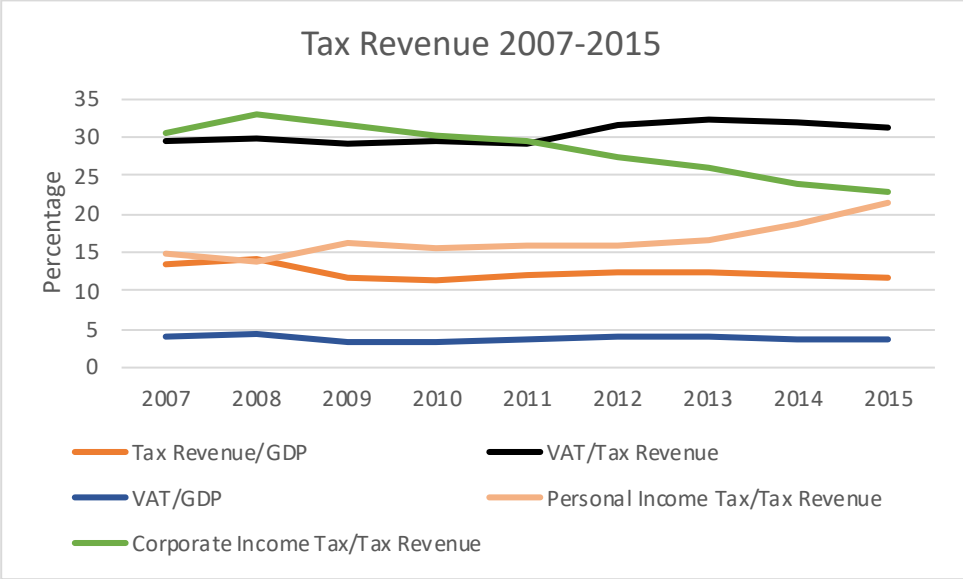

Figure 1.1: All Taxes and VAT revenue
Source: reproduced from Alm (2019).

VAT design in Indonesia follows the worldwide best practice (Mark, 2005). First, VAT on capital goods expenditures is credible against VAT obligations supporting investment activities. Second, as VAT follows the destination principle or where consumption occurs, exports are zero-rated while imports are subject to the standard VAT rate. Third, implementing a credit-invoice system allows auditors to cross-check claims for VAT credit included in input prices with VAT payments by input suppliers. Fourth, a single VAT rate and zero rates for exports are applied. It avoids problems that arise when differentiated rates, creating incentives for misclassifying goods and services. Lastly, the VAT registration threshold is used to reduce the compliance cost of taxpayers and the administration cost of the tax authority.

Currently, the threshold is set to 4.8 billion IDR. Businesses with sales up to the threshold point may choose to become VAT registered. If the firms that have sales below the threshold decide to be registered, they must put VAT over their sales prices and can credit the VAT paid for the cost of production. However, they must spend more on tax compliance costs, like preparing monthly VAT reports. On the contrary, if the firms choose not to be registered, their sales prices

will not include VAT, and they do not have to spend more on compliance costs. By choosing not to be registered, the firms have the incentive to be beyond the radar of the tax authority as it is more likely their transaction will not be known by the tax authority (no counterpart will report their trade in the tax system).

All consumption is taxable. However, some goods and services are treated differently.[5] First, goods and services are classified as non-taxable. Businesses do not impose VAT on sales for this type, and VAT paid from purchases cannot be credited but be accounted for as an additional cost and will impact the sale price. Examples of goods and services in this category are unprocessed food such as rice, meat, vegetables, fruits, and health and education services. Second, goods and services that are taxable but excused from VAT. The treatment is like the nontaxable goods and services in which businesses do not impose VAT, and VAT paid from purchases cannot be credited. Excused goods and services usually are called strategic goods. Examples of this type are fish, piped clean water, and electricity. Third, goods and services are classified as zero-rated. For this kind of goods, firms do not need to collect VAT from sales, but VAT is paid from purchases of goods and services to make the products can be credited. Exported goods and goods produced by firms operating in special economic zones are classified into this type.[6]

[5] See Appendix A for detail on Law Number 42 of 2009.

[6] Types of firms based on the institutional rule (registered and not registered, taxable and nontaxable product) impact the consumer price. Assumed Firm A, a registered and taxable firm, sell a product to several type of firms with sales price of 100 (or value added) and a VAT of 10 (VAT rate is 10%). The price after tax is 110. Firm B, a registered and taxable firm, buys the product and add value of 100. It sells the product with sales price of 200 (100 + 100 of value added) and charge VAT of 20. The sales price after tax is 220. B remits VAT of 10 to government (VAT output of 20 minus VAT input of 10). Firm C, a registered but nontaxable firm due to its product is exempt, also buys A's product and add value of 100. Since C cannot credit the input tax of 10, it adds the input tax on the sale price. C sell its product of 210 without any VAT. The price that a consumer paid is lower if he buys from C. This is also the same if the firm is nonregistered and taxable (due to small firms) or nonregistered and nontaxable. Those firms will also charge 210 to the consumers. However, if the firm is registered and zero rating or exporter, the sale price will be 200 and it can get refund from government for input tax of 10 it had paid to Firm A.

Nontaxable and excused goods and services are called exempted goods and services in VAT literature. Indonesia's VAT system differs from international norms as Indonesia exempts a broader range of goods and services than most developed countries and even many developing countries (Mark, 2005).

Besides VAT, Indonesia applies luxury sales tax (LST) and excise tax. LST differs from VAT as it is only imposed once on the producer or importer of luxury goods. The rates are ranged from 10 percent to 200 percent. Examples of the goods and range of tax rates used could vary depending on government policy, and several goods subject to this tax include cars, motorcycles, aircraft, and watercraft. Goods that are subject to LST are also taxed VAT. Like LST, the excise tax is also charged to producers, such as the excise tax for tobacco and alcoholic drinks. VAT is still imposed on these goods.

Another consumption tax is the sales tax imposed by the local government. This tax is imposed on processed food sales in restaurants, hotel rooms, and entertainment services. VAT is not charged if local tax is imposed.

3. Methodology and Data

3.1 Methodology

This paper follows the methodology used in VAT progressivity literature with household expenditure as a proxy of income (Thomas, 2022; IFS, 2011; Muñoz & Cho, 2003; Abosedra et al., 2007). There are two components of measuring tax burden and progressivity: the effective tax rate and progressivity index. The effective tax rate is calculated by dividing the VAT paid by the total expenditure. The progressivity index used in this paper and described in what follows is The Kakwani Progressivity Index (Kakwani, 1977).

Households are grouped into deciles of total expenditure to estimate the distributional impacts of VAT. Then, the average effective tax rate is calculated per decile to determine the level of the tax burden. If the effective tax rate increases on expenditure, the VAT burden tends to be progressive. On the other hand, VAT is regressive if the effective tax rate decreases on expenditure. To ensure the level of progressivity, the Kakwani index is used. This index is also helpful to indicate progressivity if there is no clear pattern of the effective tax rate on expenditure.

3.1.1 Effective Tax Rate

The effective VAT tax rate is the proxy of VAT burden and is calculated from the proportion of VAT paid to total expenditure. This differs from the statutory tax rate, which only shows the standard VAT rate imposed on sales. It does not show how precisely the burden of VAT is on households' total welfare**.** The effective tax rate is a more accurate representation of the tax burden and is frequently used in tax incidence analysis (Metcalf, 2004; Thomas, 2022; Mushi, 2009).

Several assumptions are implemented in processing the consumption data to get the effective tax rate. First, As shown in the literature (Thomas, 2022; Mushi, 2009; Metcalf, 1994; among others), not all expenditures are considered a proxy for income. Lumpy and infrequent payments, like motor vehicles, marriages, Hajj pilgrimage, and funerals, are excluded. Nevertheless, other durable goods, except motor vehicles, are considered an income (Thomas, 2022). Second, food consumption not purchased by households or categorized as an in-kind transaction (self-production or gift) is treated differently from purchased goods. It is assumed that in-kind trade does not bear VAT (Muñoz & Cho, 2003).

Third, as there is no data on VAT paid by households, calculate the amount paid by each family by applying the VAT rates to the corresponding net expenditure amounts (Thomas, 2022). Consumption data is assumed to be gross (net expenditure plus VAT). Thus, it is like working

backward from gross expenditure to find the tax base (the net expenditure).[7] The tax burden for each household is measured by dividing VAT paid by total expenditure, and these amounts are then weighted up to the population using household survey frequency weights.

Fourth, households are assumed to bear the tax burden, not the individual (Mushi, 2009; Metcalf, 1994). Estimating at the individual level could have a better picture of tax incidence, but it needs other assumptions regarding individuals' different levels of consumption in the households. For example, parents' consumption could differ for kids, or men's consumption could vary for women. Thus, using the household level is more straightforward as the data source used in this paper does not provide individual consumption.

Fifth, this paper assumes that the VAT is fully passed through to the final consumer in prices. It is a standard assumption in the empirical literature (see, for example, IFS, 2011; Mushi, 2009; Decoster et al., 2010; Thomas, 2022). The VAT can be less than or even more than fully passed on to consumers depending on the market structure. Empirical evidence, however, is inconclusive, so full pass-through is assumed without clear guidance to the contrary. In addition, by assuming it completely passed through, the result of this paper could be comparable with the previous studies conducted in many countries (see Thomas, 2022; Mushi, 2009).

Sixth, the issue relates to exempted goods and services. While no VAT is imposed on sale to the final consumer, some VAT may still be embedded in the final price due to the inability of the business to claim input tax credits to produce nontaxable and exempted goods and services. Since exempted goods and services are not imposed tax in the simulation that follows, some underestimation of VAT revenue is expected.

[7] As the VAT rate is 10%, to find the tax base is 10/11 * gross expenditure, or to find VAT is 1/11* gross expenditure).

Overestimation of VAT revenue could rise from goods that fall on another type of consumption tax, like an excise tax on tobacco and alcoholic drinks. Excise tax is applied only once time at the producers or importers. Unlike other goods, VAT on these goods is also applied once, like an excise tax. Thus, VAT calculation using household prices may inflate the VAT revenue. However, for this type of consumption is not dominant in household expenditure, the impact will be relatively minor or, if not negligible, for the VAT burden. Another source of overestimation is that small producers or sellers can opt out of the VAT system if the sales are equal to or lower than the VAT registration threshold. As the VAT threshold was relatively low in 2013 compared to 2014, it may be argued that overestimation will be much lower in 2013 than in succeeding years.

This paper estimates the progressivity of VAT in a particular year, in this case, 2013. While many papers show that consumption could be used as the proxy for lifetime income, this paper does not intend to argue about the lifetime tax burden. Information from a snapshot of the tax burden is also essential and still relevant to show whether VAT is progressive. In addition, tax progressivity could change with time as income and consumption taste could change.

3.1.2 Progressivity Index

In addition to average effective tax rate results to show the VAT burden, this paper uses Kakwani Progressivity Index (Kakwani, 1977). The Kakwani index indicates global progressivity, initially of the income tax, but frequently also used to benefit systems and expenditure programs. The Kakwani index can be adapted to examine VAT with expenditure as the welfare metric (Thomas, 2022). The index can be obtained by calculating the difference between the VAT concentration coefficient with households ranked by the household's expenditure and the Gini coefficient of household's expenditure.

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

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

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

Where C_{VAT}^G is the concentration coefficient for VAT (with households ranked by gross expenditure); G_G is the Gini Coefficient for gross expenditure; $L_G\ (p)$ is the Lorenz curve for gross expenditure, and $L_{VAT}^G(p)$ is the concentration curve for VAT (with households ranked by gross expenditure). In the graphic presentation, if the concentration curve lies below the Lorenz curve, the tax is progressive and regressive otherwise.

This paper also uses this index to determine the consumption progressivity of items provided by the consumption data. The purpose is to determine which consumption of goods and services is progressive. If the consumption is progressive, it is a potential target for a new tax base or an increase in the VAT rate.

3.2 Data

This paper uses the 2013 Indonesia Socioeconomic Survey (Susenas) provided by Statistic Indonesia. The survey was conducted across regions of Indonesia, rural and urban areas in 33 provinces. The survey targeted 75,000 households each quarter, a total of 300,000 households for the year. The agency collected 284,063 households, 121,322 urban households and 162,741 rural

households. Those households consist of 1,094,179 individuals. The survey also provided sample weights of households and individuals.

Susenas provides monthly consumption data consisting of food and nonfood expenditures collected based on the household level, not the individual level. The survey manual explains that total food consumption is derived from purchase and nonpurchase or in-kind transactions for the food consumption section. In-kind transactions can be obtained from self-production and gifts. Households were asked about the amount and food prices consumed within the last week. The weekly consumption is multiplied by 30/7 to get the monthly food consumption. For nonfood consumption, the survey asks households for their consumption three months ago, two months ago, and last month. The sum of three months' consumption is divided by three to get the monthly average of nonfood consumption.

Fourteen subgroups consist of 215 items in food consumption. On the nonfood side, six subgroups comprised 87 items. Thus, 302 consumptions of food and nonfood items are asked of the households. However, while items in the food section are relatively specific to one type of food, items in the nonfood section cover several products or services.[8]

Susenas 2013 also provides income data of households. However, this is not complete income data as the survey only asks for monthly income earned from the main job.[9] There is no direct data on VAT paid by households. In addition, there is no data on producers or retailers where the households purchase their goods and services. Thus, it is impossible to determine whether the seller will impose VAT.

[8] See Appendix A for more detail on food and nonfood consumption.

[9] Part V.C. question number 29 in the VSEN13. K documentation.

As Susenas 2013 provides monthly expenditure data, all the calculations used in this paper are monthly. However, to compare with the data of VAT revenue collected by the tax authority in a year, this paper also provides annual consumption and tax burden calculation, assuming that the monthly consumption will be constant throughout the year.

4. Results

4.1 The Baseline Result (Household as the unit of analysis)

As shown in Figure 1.2, almost 76 percent of consumption is spent by higher-income households (households in the sixth to tenth deciles), and 24 percent is spent by half of the people in the lower-income groups (households in the first to fifth deciles).[10] The lowest income group spends 2.5% of the total households 'consumption, while the highest income group spends 31.4 percent of total consumption. The Gini coefficient derived from this income distribution is at 0.3967, considered adequate inequality or still not in a category of the significant income gap.

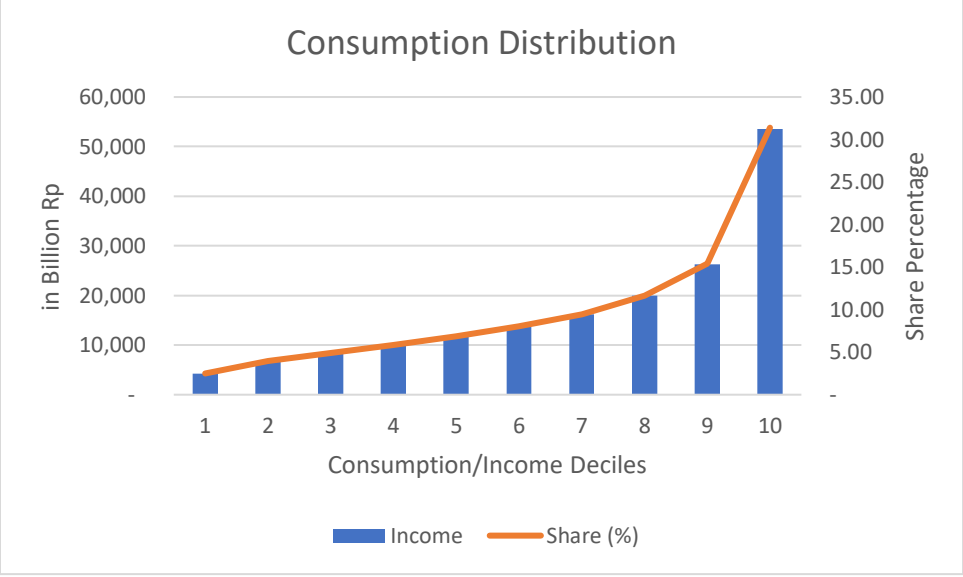

Figure 1.2: Consumption Distribution

[10] From this part, the terms income and consumption/expenditure are used interchangeably.

As a baseline model, Table 1.1 shows the estimates of VAT incidence in terms of effective VAT rate.[11] With an average VAT paid at 123,887 rupiahs (IDR), the national average effective tax rate is 4.51 percent**.** The effective VAT rate is less than 26 OECD countries (Thomas, 2022), Ethiopia (Muñoz & Cho, 2003), 9 European countries (IFS, 2011), and Tanzania (Mushi, 2009). However, it is more than Lebanon (Abosedra et al., 2007) and Switzerland (Thomas, 2022).[12] The effective VAT rate is less than half the standard VAT rate of 10 percent**.** The poorest households face the lowest effective rate of 3.92 percent, while the wealthiest households face an effective rate of 4.77 percent. The ninth decile income group bears the highest effective tax rate of 4.78 percent, just slightly higher than the effective tax rate of the richest. Overall, the results show that the VAT effective rate increases with expenditure. It means that VAT in Indonesia tends to be progressive. It aligns with results from other countries that use expenditure as the proxy for income or welfare, showing that VAT is progressive (Thomas, 2022; Mushi, 2009; Metcalf, 1994).

Figure 1.3 shows income and VAT distribution using the Lorenz and Concentration. The Lorenz curve shows the income distribution of the households. 90% of the population contributes to 68.6 % of total income, while 10% contributes to 31.4%. It aligns with the results shown in Figure 2. The Gini Coefficient obtained is 0.3967. The Concentration Curve shows the VAT distribution using ordered households based on their income. The households bear 67.8% of the total VAT burden up to the ninth income decile, while the richest income decile bears 32.2%. The Concentration Coefficient obtained is 0.4156.

[11] The calculation using items classification in Appendix A, Table A.3, Column Treatment, sub column 2009.

[12] Those studies provide estimates from the ratio of VAT over expenditure and grouping the households based on expenditure except Mushi (2009) and Abosedra et al. (2007) based on income. The 26 OECD countries effective rate ranges from 5.3 to 14.3 percent, Ethiopia is 4.8 percent, 9 European countries ranges from 7 to 17.3 percent, Tanzania ranges from 8.6 to 10.1 percent, Switzerland is 4.3 percent, and Lebanon is 4.3 percent. Mushi (2009) calculate the effective VAT rate using median.

Table 1.1: Tax Incidence of VAT by expenditure deciles

Deciles	Income(Rp)		VAT (Rp)		Effective Rate (%)		Exempted Ratio (%)		VAT Exempted (Rp)	
	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.
1	666,566	1,323	26,523	84	3.92	0.008	54.95	0.09	36,322	85
2	1,055,014	658	44,984	90	4.26	0.008	51.99	0.08	54,803	92
3	1,309,670	584	57,320	104	4.38	0.008	50.83	0.08	66,563	111
4	1,554,577	611	69,323	124	4.46	0.008	50.02	0.08	77,748	130
5	1,823,167	701	82,550	142	4.53	0.008	49.30	0.08	89,860	151
6	2,138,556	869	98,079	171	4.59	0.008	48.77	0.08	104,283	182
7	2,539,926	1,163	118,348	205	4.66	0.008	48.07	0.08	122,097	223
8	3,112,433	1,769	147,040	268	4.72	0.008	47.42	0.09	147,536	286
9	4,105,851	3,594	196,263	400	4.78	0.009	46.90	0.09	192,478	427
10	8,382,518	51,302	398,477	3,000	4.77	0.011	47.14	0.12	396,619	2,745
Average	2,668,739	8,067	123,887	428	4.51	0.00	49.54	0.03	128,827	405

Note: This table reports average expenditure, the share of exempted consumption, VAT exempted, VAT liabilities, and effective tax rates by decile (one is for the poorest and 10 is for the richest) for expenditure as the proxy of income or welfare. Income is the average expenditure of households in each decile. The share of exempted is the share of nontaxable expenditure to total expenditure. Exempted VAT is avoidable due to VAT exemption computed as 10% of exempted expenditure. VAT paid is calculated as 10% of taxable expenditure. Effective tax rates are computed as the ratio of VAT liability to expenditure. Households are sorted by total expenditure. There are 284.063 samples of households, and all calculations produced in this table use sampling weights given in the Susenas 2013.

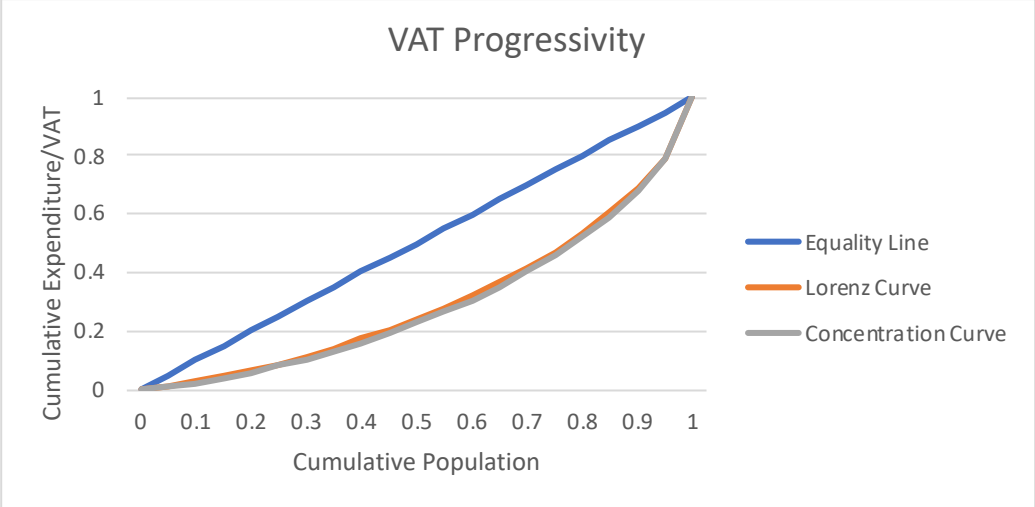

Figure 1.3: VAT Progressivity

Note: The Lorenz Curve plots cumulative expenditure (Y-axis) against the cumulative population (X-axis). The Concentration Curve plots VAT expenditure against population share with the population ordered by expenditure level.

The Kakwani Progressivity Index is 0.0189 (Concentration Coefficient minus Gini Coefficient). The index is positive, which means the VAT burden is progressive. However, the level of progressivity is low or close to proportional. Figure 3 also shows that the Concentration Curve is below but relatively close to the Lorenz Curve. It shows that the progressivity of VAT is low or relatively proportional.

Consumptions of exempted items play significant roles in the estimated tax burden and progressivity of the VAT. All households spend much of their income on exempted goods and services, around half of their consumption. The poorest households spend 55 percent on these items, while the wealthiest households spend only 47 percent. The share of exempted goods and services is generally falling on income. While the effective tax rate is higher for the wealthier income groups in terms of the effective VAT rate, in terms of cash, the more affluent groups could save a lot more from the consumption of exempted goods and services. Table 1.1 shows that the wealthiest income group can save VAT of 396,619 IDR monthly, or eleven times that of the poorest income group, which can only save 36,322 IDR.

In addition to exempted items, this paper assumes that no VAT is imposed on in-kind expenditure. Figure 1.4 shows the proportion of in-kind transactions by expenditure deciles. The higher the income, the lower the share of the in-kind trade. The lower effective tax rate of the wealthiest group to the ninth deciles could be explained by the higher share of exempted goods, not the share of the in-kind transaction.

Table 1.2 shows the estimated VAT revenue based on this paper's calculation in 2013. The monthly VAT tax payment is calculated at 7.92 trillion IDR or about 95 trillion IDR in 2013. The estimated VAT exempted by the households is about 99 trillion IDR, larger than the estimated VAT collected from household consumption. It is a significant finding for the tax authority. There

is a space to increase the tax revenue by taking out some exemptions enjoyed chiefly by higher-income households.

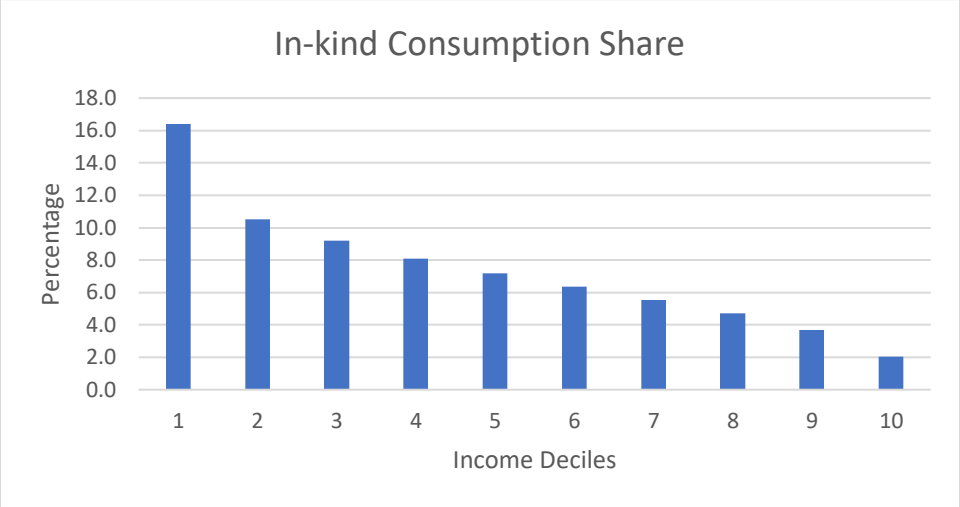

Figure 1.4: Share of In-kind Transaction by Deciles

It is worth noticing that the estimated VAT payment from household consumption is only one-fourth of the VAT collected by the tax authority (DGT) in 2013. DGT was able to collect about 384.71 trillion IDR. Several reasons could contribute to this discrepancy. First, VAT collected by the government is from all economic consumption. It is not only from household expenditure but also from government and firm consumption. Second, the calculation in this paper excluded the expensive and infrequent buying such as vehicles (motorcycles and cars) and housing (the survey does not provide or ask for this expenditure). Third, households can underreport their expenditures. Fourth, this paper treats exempted goods and services at zero rates. On the contrary, fraud is not simulated in the models. It may result in an overestimation of VAT revenue from the survey data.

Table 1.2: Comparison of VAT Revenue and Exemption

	VAT 2013 (in trillion Rp)	Ratio to VAT payment
VAT payment (estimated)	95.04	1.00
VAT Exempted (estimated)	98.88	1.04
VAT Collected by Tax Authority	384.71	4.05

4.2 Robustness Check: Individuals as Unit of Analysis

In this part, this paper provides a robustness check of previous results using individuals as the unit of analysis. One of the possible weaknesses of tax incidence measurement of using the household as the unit of analysis is the heterogeneity of households in terms of the number of household members. It could be problematic for welfare analysis. For example, the welfare of a one-person household was given as much weight as that of a large household with many individuals. Two approaches will be used: equivalence scale expenditure and expenditure per capita.

4.2.1 Equivalence Expenditure

The critical issue in applying the individual as the unit of analysis is that expenditure data are provided on a household basis. Thus, to adjust the unit of analysis to the individual, it is necessary to multiply household survey weights by household size. Implicit in this approach is the assumption of equal sharing of resources within a family so that the measured welfare of each household member is identical (see Thomas, 2022).

Another critical consideration is that family members' consumption may be different. For example, an adult will require more food to maintain the same welfare level as a child. In addition, households can be expected to benefit from the economics of scale. For example, additional cooling costs associated with a second occupant of a house will be reasonably lower than for the first occupant. Following Thomas (2022), the equivalence scale is measured using the parametric equivalence as follows:

$$\boldsymbol{E_i} = \left(\boldsymbol{n_{a,i}} + \Theta \boldsymbol{n_{k,i}}\right)^{\boldsymbol{\alpha}}$$

Where E_i is the equivalent size of household i, Θ measures the degree of need of children relative to adults, α specifies economies of scale in consumption, $n_{a,i}$ is the number of adults in the household I, $n_{k,i}$ is the number of children in household i.

As mentioned by Creedy and Sleeman (2006), this parametric scale was used first by Cutler and Katz (1992) and is an extension of the simpler n_i^{α} form used by Buhmann et al. (1998) and Coulter et al. (1992). The scale explicitly allows for adjustment of need between adults and children and economies of scale with increases in need-adjusted household size. Households can be expected to benefit from economies of scale. For example, additional heating costs associated with a house's second occupant will be significantly lower than for the first occupant (Thomas, 2022).

The parameters adopted in this paper follow Thomas (2022), which adopts Θ=0.5 and α =0.7. This paper defines a child as any family member under 15 years old. This classification aligns with Statistic Indonesia (BPS), which measures the labor force from age 15. This paper assumes an adult person is a person who is eligible for the labor force.

Table 1.3 shows tax incidence for the individual as the unit of analysis and its comparison with household as the unit of analysis. The effective tax rates are relatively like the basic model using the household as the unit of analysis. In general, the effective tax rates increase with expenditure. The effective VAT rate is 4.5 percent, less than half of the statutory VAT rate of 10 percent, and very close to the basic model average effective tax rate. Kakwani's progressivity index is 0.0263, and as shown in Figure 1.5, the Concentration Curve is below the Lorenz Curve. It means that VAT is more progressive than the basic model but still has a low level of progressivity.

Table 1.3: Tax incidence using equivalence expenditure

Deciles	Expenditure		VAT		Effective VAT Rate	
	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.
1	381,332	470	15,031	37	3.92	0.01
2	508,171	251	21,306	41	4.19	0.01
3	602,003	239	26,089	48	4.33	0.01
4	699,171	277	30,943	55	4.42	0.01
5	811,519	314	36,738	65	4.53	0.01
6	945,552	391	43,349	77	4.58	0.01
7	1,118,561	518	52,064	91	4.65	0.01
8	1,368,806	816	65,041	121	4.75	0.01
9	1,799,823	1,592	86,702	180	4.82	0.01
10	3,515,850	20,345	168,226	1,236	4.79	0.01
Average	1,175,031	3,409	54,547	183	4.50	0.00

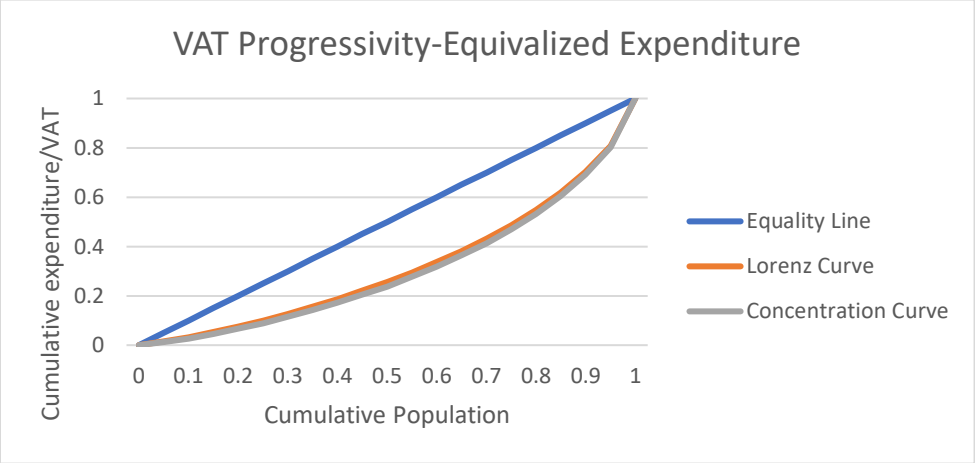

Figure 1.5: VAT Progressivity-Equivalence Expenditure

4.2.2 Expenditure per Capita

This paper also simulates the tax burden and progressivity using expenditure per capita as shown in Table 1.4. The calculation assumes that every individual in the household will have the same consumption portion without differentiating between adults and kids. Like the equivalized expenditure, the effective tax rate also increases on expenditure per capita. The effective tax rate is lower than the basic model, 4.48 percent compared to 4.51 percent. Thus, it is also less than half of the standard VAT rate. Kakwani's progressivity index is 0.025, and as shown in Figure 1.6, the

Concentration Curve is below the Lorenz Curve. It means that VAT is more progressive than the basic model but still has a low level of progressivity.

Table 1.4: Tax incidence using expenditure per capita

Deciles	Expenditure		VAT		Effective VAT Rate	
	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.
1	215,485	318	8,309	24	3.83	0.01
2	285,126	155	11,939	25	4.18	0.01
3	337,010	151	14,575	29	4.32	0.01
4	393,134	170	17,406	33	4.43	0.01
5	460,011	198	20,736	38	4.51	0.01
6	541,615	250	24,829	45	4.58	0.01
7	645,681	317	30,057	54	4.65	0.01
8	797,689	486	37,734	69	4.73	0.01
9	1,065,292	1,006	51,240	110	4.81	0.01
10	2,127,290	11,564	102,011	712	4.80	0.01
Average	686,829	2,028	31,884	109	4.48	0.00

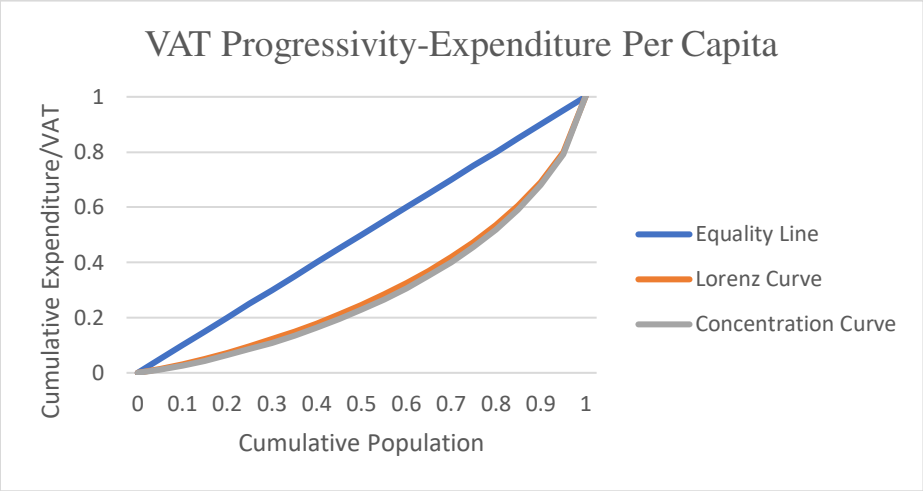

Figure 1.6: VAT Progressivity-Income Per Capita

4.3 Disaggregated Results

4.3.1 Food and Nonfood

In this section, this paper separately observes tax incidence on food and nonfood consumption. The tax incidence analysis for food and nonfood items is shown separately in Table 1.5. The share of food expenditure is high, at 59 percent of total expenditure on average. The percentage of food

expenditure is decreasing on the level of expenditure. The poorest households spend much higher on food expenditure than the average, at 66 percent, while the richest households spend less than the average, at 41 percent of total expenditure. This condition contributes to the tax burden of VAT.

On average, the effective tax rate for food consumption is 3.26 percent. The poorest households bear the lowest effective tax rate of 2.77 percent, while the wealthiest households face not the highest VAT burden. Their VAT burden is slightly higher than the average, 3.27 percent of the effective tax rate. It shows that the poorest and the wealthiest benefit from VAT exemption on food.

Due to in-kind expenditures on food and the large variety of exempted food items, the effective VAT rates on food are much lower, almost half of the nonfood effective VAT rates. The effective tax rate for food expenditure increases until the eighth decile but decreases for the last two richest income groups. Nonfood expenditure shows a similar trend as exempted nonfood items are also numerous. On average, the effective tax rate for nonfood expenditure is 6.31 percent. It is higher than the effective tax rate the richest and the poorest people face. The richest income group bears the lowest VAT tax burden on nonfood expenditure. They face a 5.90 percent effective VAT rate compared to the 6.08 percent of the poorest income group. The richest income group in Indonesia benefits more from the VAT exemption on nonfood expenditures than the lower income deciles.

Figure 1.7 shows that the Lorenz Curve is clearly different from Concentration Curve. The VAT of food spending is more concentrated in lower-income than higher-income households. In every income decile, the cumulative VAT ratio is larger in food than nonfood spending. Households up to the ninth income decile contribute to 77.6 % of the total VAT in food spending while 62% in nonfood spending. The income distribution of 90% of the population is between

those ratios, at 68.6%. The Kakwani Progressivity Index for food consumption is -0.088, while for nonfood consumption is 0.171. The Concentration Curve for food consumption is above the Lorenz curve, which means that the VAT burden for food is regressive. On the other hand, the Concentration Curve for nonfood consumption is below the Lorenz Curve, which means that the nonfood VAT burden is progressive.

Table 1.5: Tax Incidence of VAT by Deciles-Food and Nonfood

Deciles	Food							
	Expenditure		Food Ratio (%)		VAT		Effective Rate	
	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.
1	435,813	986	65.57	0.08	12,364	57	2.77	0.01
2	681,755	890	64.65	0.08	21,664	74	3.16	0.01
3	838,730	1,102	64.06	0.08	27,539	88	3.27	0.01
4	978,490	1,353	62.95	0.08	32,500	105	3.30	0.01
5	1,127,888	1,646	61.88	0.09	37,934	122	3.34	0.01
6	1,298,153	2,085	60.73	0.10	43,964	144	3.36	0.01
7	1,495,731	2,527	58.92	0.10	50,940	173	3.37	0.01
8	1,757,979	3,354	56.53	0.10	60,046	211	3.38	0.01
9	2,149,126	4,798	52.51	0.11	73,542	286	3.37	0.01
10	3,133,450	12,039	41.12	0.13	103,809	548	3.27	0.01
Average	1,389,689	2,545	58.89	0.04	46,429	102	3.26	0.00

Deciles	Nonfood							
	Expenditure		NonFood Ratio (%)		VAT		Effective Rate	
	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.
1	230,754	724	34.43	0.08	14,159	55	6.08	0.01
2	373,258	847	35.35	0.08	23,320	71	6.21	0.01
3	470,940	1,072	35.94	0.08	29,781	90	6.30	0.01
4	576,087	1,331	37.05	0.08	36,823	111	6.37	0.01
5	695,279	1,631	38.12	0.09	44,616	131	6.42	0.01
6	840,403	2,089	39.27	0.10	54,115	161	6.47	0.01
7	1,044,196	2,530	41.08	0.10	67,409	197	6.49	0.01
8	1,354,454	3,396	43.47	0.10	86,994	262	6.48	0.01
9	1,956,725	5,107	47.49	0.11	122,721	383	6.37	0.01
10	5,249,068	45,860	58.88	0.13	294,668	2,853	5.90	0.02
Average	1,279,050	6,240	41.11	0.04	294,668	2,853	6.31	0.00

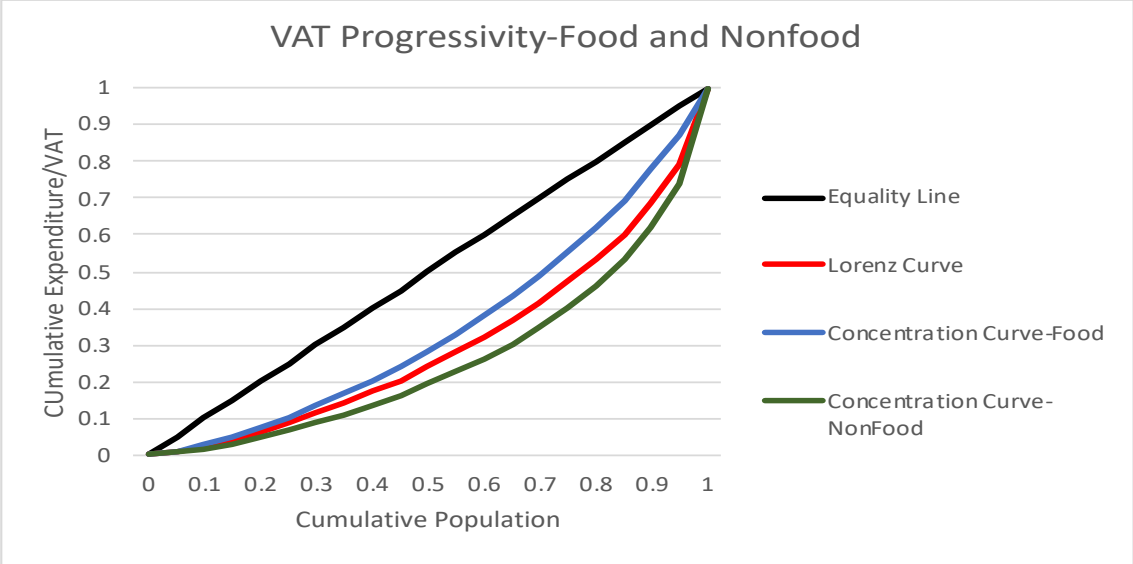

Figure 1.7: VAT Progressivity for Food and Nonfood
Note: The Lorenz Curve plots cumulative expenditure (Y-axis) against the cumulative population (X-axis), while Concentration Curve plots VAT expenditure against population share with the population ordered by expenditure level.

4.3.1.1 Distribution of Food and Nonfood

The analysis of the VAT burden on food and nonfood can be extended to more detailed consumption per item as the way different items are shared in the society determines the distribution of the tax burden. This section reclassifies the 14 subgroups of food consumption into five subgroups. The six subgroups 6 of nonfood consumption are reclassified into 10 subgroups.

Table 1.6 provides the expenditure pattern by income group. The expenditures on grains, tubers, vegetables, legumes, and fruits decrease with income. On the contrary, the consumption of school expenses, fuel and vehicle maintenance, public transport and entertainment, clothing, footwear, headwear, furniture and equipment, insurance, tax, excise, and party and ceremonial increase in income. Most of the remaining items have no consistent pattern.

Using the same approach as Kakwani Progressivity Index, the consumption progressivity of each item is shown in Figure 1.8. The curve above the Lorenz Curve indicates regressive consumption, while the curve below indicates progressive consumption. All consumptions of food

but subgroups of fish, meat, egg, and milk are regressive. It means that the more income, the less share of consumption on these items. The concentration curve for fish, meat, egg, and milk intersects the Lorenz curve, but the Kakwani Progressivity index is positive at 0.01. The share of expenditure on fish, meat, egg, and milk will be higher if income increases. All consumptions on a subgroup of nonfood are progressive. It means that households tend to consume more if their income is higher. Based on this result, if the government wants to increase tax revenue with less adverse impact on the poor, it can target progressive consumption. Besides nonfood consumption, the government can target fish, meat, egg, and milk.

Table 1.6: Consumption Pattern by Income Groups

Items	Average Consumption Ratio per Deciles (%)									
	1	2	3	4	5	6	7	8	9	10
Grains and Tubers	17.75	16.94	15.54	14.14	12.89	11.57	10.25	8.81	7.21	4.38
Fish, Meat, Egg, and Milk	7.40	8.05	8.64	9.06	9.38	9.84	10.24	10.42	10.44	9.50
Vegetables, Legumes, and Fruits	12.67	11.41	10.73	10.18	9.78	9.39	9.00	8.37	7.72	5.94
Prepared Food, Beverages, and others	23.17	21.08	21.18	21.33	21.36	21.40	21.10	21.06	20.05	16.96
Tobacco and Betel Leaf	4.69	7.28	8.06	8.38	8.59	8.61	8.46	8.03	7.29	4.56
Housing and Household facilities	22.23	19.43	18.76	18.75	18.75	19.10	19.40	20.17	21.17	23.33
Variety Goods and Services	3.59	3.49	3.35	3.31	3.32	3.34	3.32	3.40	3.59	4.90
Health and Medical Expenses	1.70	1.55	1.56	1.61	1.78	1.88	2.02	2.37	2.97	4.94
School Expenses	1.17	2.46	2.85	3.02	3.15	3.27	3.50	3.67	4.19	5.52
Fuel and Vehicle Maintenances	1.48	3.28	3.89	4.32	4.60	4.83	5.11	5.24	5.44	6.09
Public Transport. and Entertainment	1.34	1.45	1.52	1.65	1.74	1.88	2.01	2.25	2.53	3.63
Clothing, Footware, and Headware	1.71	2.09	2.31	2.44	2.65	2.75	3.08	3.19	3.44	3.67
Furniture and Equipment	0.42	0.58	0.66	0.79	0.96	1.04	1.29	1.65	2.27	3.70
Insurance,Tax, Excise	0.64	0.85	0.90	0.95	0.98	1.04	1.13	1.25	1.51	2.58
Party and Ceremonial	0.04	0.05	0.05	0.06	0.07	0.07	0.10	0.13	0.18	0.30
Total	100	100	100	100	100	100	100	100	100	100

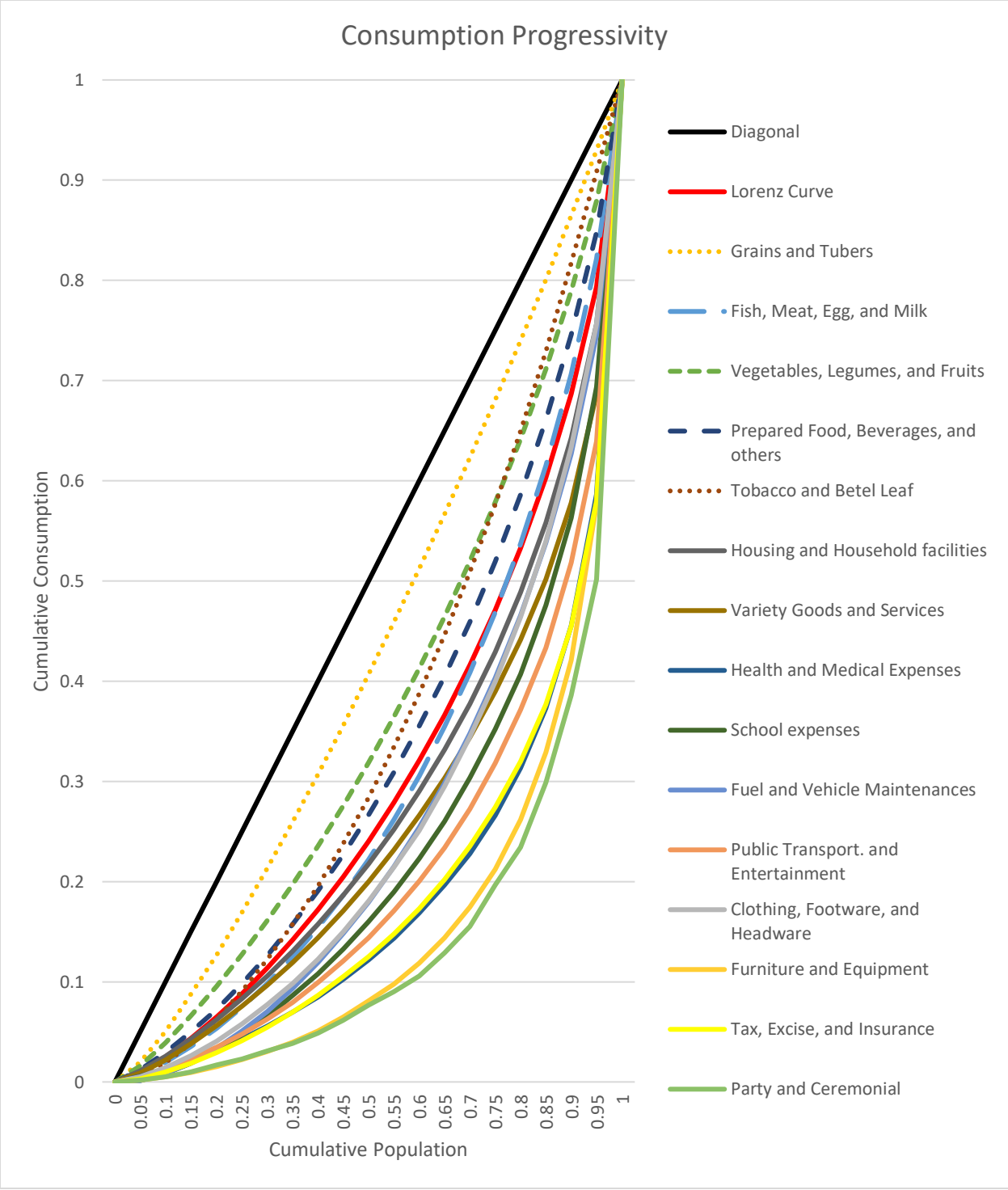

Figure 1.8: Consumption Progressivity Per Items

Note: The Lorenz Curve plots cumulative total expenditure (Y-axis) against the cumulative population (X-axis). The Concentration Curve plots each expenditure against population share with the population ordered by total expenditure.

4.3.1.2 Distribution of Exemption Items

In this part, the analysis goes further on the distribution of exemptions items. As shown in Table 1.1, the tax burden and progressivity level are due to exempted items. This analysis is needed to determine whether exemptions are justifiable on equity grounds and what could be taxed or untaxed. For the study, the exempted items are classified into 11 subgroups: two subgroups from food expenditures, unprocessed food and prepared food (restaurants), and nine groups from nonfood expenditures.

The consumption pattern of exempted items can be shown in Table 1.7. In line with the distribution of more detailed food subgroups in Table 1.6, unprocessed food decreases with income. However, there is no clear pattern in foods bought from restaurants. Expenditures on water, health, medical expenses, school expenses, public transportation, hotel, cinema, recreation, financial services, insurance, and postal items are increasing on income. While expenditures on fuelwood decrease on income and expenditures on electricity have no apparent pattern. The latter decreases until the fourth income group and increases from the fifth.

Using the same approach with VAT progressivity, this paper also measures the consumption of exempted items progressivity, as shown in Figure 1.9. Expenditures on unprocessed food and fuelwood are regressive. Expenditure on prepared food (restaurants) is also regressive or relatively proportional even though its concentration curve is not decisive. Other expenditures are progressive. Based on these results, exempted items such as water, health and medical expenses, school expenses, public transportation, financial services, insurance, postal items and others can be reevaluated from exemptions.

Some Concentration Curves are crossing each other, for example, the financial services curve and hotel, cinema, and recreation. This is because of the drastic change in the cumulative spending

ratio when the income decile is higher. Until the eighth income decile, the cumulative ratio of spending on financial services is lower than that of spending on hotels, cinema, and recreation (18.14% to 19.47%, respectively). However, the cumulative ratio of both spending changes in the ninth income decile (33.77% to 29.92%, respectively). Households in the ninth decile spend 15.63% on financial services, while they spend 10.45% on hotels, cinema, and recreation. This specific information could not be learned from the aggregate analysis but can be studied using the disaggregated version.

Table 1.7: Consumption pattern of exempted items

Items	Average Consumption Ratio per Deciles (%)									
	1	2	3	4	5	6	7	8	9	10
Unprocessed food	33.42	32.18	30.77	29.33	28.14	26.89	25.59	23.65	21.42	16.11
Prepared Food (Restaurants)	10.44	8.90	9.29	9.86	10.15	10.62	10.77	11.25	11.08	9.84
Electricity	3.11	2.68	2.57	2.55	2.57	2.59	2.61	2.64	2.72	2.93
Water	0.25	0.25	0.25	0.28	0.30	0.35	0.39	0.44	0.51	0.58
Health and Medical Expenses	1.04	1.04	1.06	1.12	1.28	1.36	1.49	1.80	2.34	4.11
School expenses	1.09	2.30	2.67	2.84	2.95	3.07	3.29	3.46	4.00	5.33
Public Transportation	1.28	1.36	1.43	1.54	1.61	1.74	1.84	2.01	2.26	2.92
Hotel, Cinema, Recreation	0.07	0.08	0.09	0.11	0.12	0.14	0.16	0.23	0.27	0.68
Financial services	0.00	0.01	0.01	0.01	0.02	0.02	0.04	0.05	0.08	0.15
Insurance, Postal items and others	0.65	0.87	0.92	0.99	1.04	1.13	1.26	1.46	1.97	4.40
Fuelwood	3.61	2.32	1.78	1.39	1.13	0.86	0.64	0.42	0.25	0.07
Total	54.95	51.99	50.83	50.02	49.30	48.77	48.07	47.42	46.90	47.14

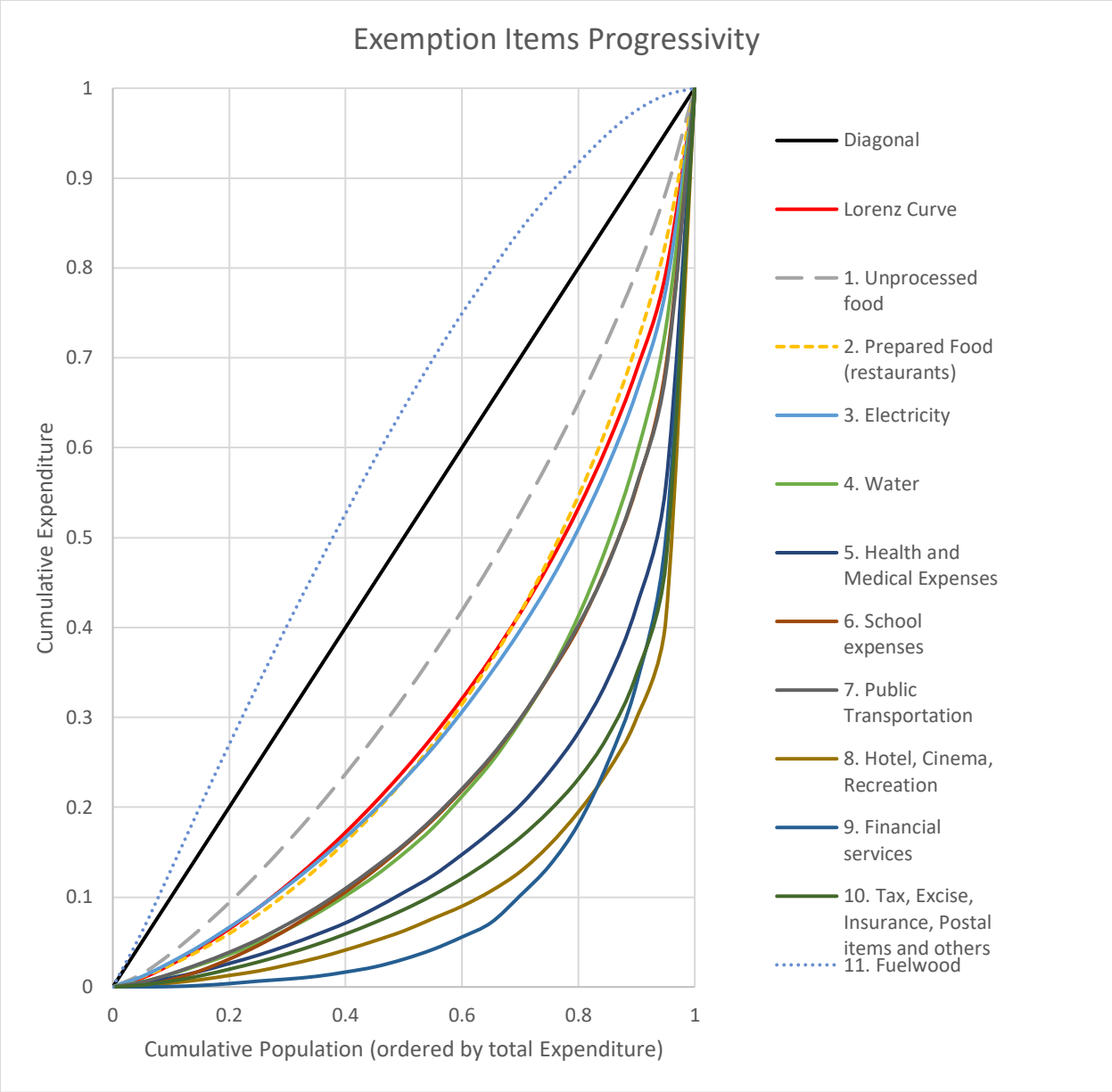

Figure 1.9. Consumption of exempted item progressivity

Note: The Lorenz Curve plots cumulative total expenditure (Y-axis) against the cumulative population (X-axis). The Concentration Curve plots each expenditure against population share with the population ordered by total expenditure.

4.3.2 Rural and Urban

This section examines the VAT burden on a regional decomposition basis in urban and rural areas. It is estimated that 32,07 million households (50,16 percent of total households) live in rural areas and 31,87 million (49.84 percent of total households) in urban areas. It is almost similar composition. It shows that Indonesia has experienced a vast migration flow into urban areas. In

2000 there was still 58% of the population lived in rural areas.[13] The tax incidence on urban households could differ from that on rural households. There are several reasons to support that argument: (1) income levels are higher in urban areas, (2) the share of in-kind expenditures is larger in rural areas, and (3) the amount of registered VAT firms is much higher in the urban areas due to firms in urban areas tend to be more formal than of rural areas (Bachas et al., 2020).

Table 1.8 shows the tax incidence of VAT in urban and rural areas. As expected, households' average expenditure in urban areas is higher than in rural areas, at about 3.38 million to 1.96 million IDR. The wealthiest group in urban areas spends twice higher as the richest group in rural areas. Households in both areas consume a relatively high proportion of exempted expenditure. As an impact, VAT exempted is larger than VAT liabilities.

The urban population bears a higher effective tax rate at all expenditure group levels than the rural population. The urban population faces an effective VAT rate of 4.68 percent, while rural dwellers face 4.34 percent. In the rural area, the effective tax rate increases on expenditure level and urban areas show a similar trend except for the wealthiest income group. The lower tax burden in a rural area can be explained by a higher share of exempted expenditure in a rural area than in an urban area, at 51 percent at 48 percent, respectively. Another reason is that rural households tend to purchase a more significant portion of goods and services from the informal retail sector, where the goods are either not taxed or are more lightly taxed (Bachas, 2020; Faridy and Sarker, 2011). The result also shows that the richest urban households in Indonesia heavily use exempted goods. A similar result was found in Ethiopia and Bangladesh.

While the VAT burden in rural populations is lower than in urban populations, VAT is relatively more progressive in rural areas than in urban areas. The Kakwani Progressivity index in

[13] Based on data from World Development Indicator.

rural areas is higher than in urban areas. The indexes are 0.0271 and 0.0065, respectively. It means that in both areas, VAT is progressive but relatively at a low level or proportional. The lower Gini coefficient could explain the higher level of progressivity in a rural area in a rural area compared to an urban area. The coefficients are 0.32 and 0.41, respectively. Income is relatively more equal in rural areas than in urban areas.

Table 1.8: Tax Incidence of VAT by deciles-Urban and Rural

Deciles	Urban									
	Expenditure		VAT		Effective VAT Rate		Exempted Ratio (%)		VAT Exempted	
	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.
1	808,443	2,483	35,086	160	4.28	0.01	51.45	0.13	41,165	153
2	1,269,210	1,243	58,176	155	4.58	0.01	48.76	0.12	61,882	165
3	1,586,426	1,151	73,219	188	4.61	0.01	48.51	0.12	76,943	197
4	1,907,526	1,252	89,286	218	4.68	0.01	47.88	0.12	91,332	238
5	2,261,752	1,429	106,669	270	4.72	0.01	47.62	0.12	107,684	288
6	2,684,901	1,829	127,457	320	4.75	0.01	47.32	0.12	127,069	349
7	3,223,494	2,384	153,851	394	4.77	0.01	47.06	0.13	151,662	423
8	3,997,151	3,698	192,365	534	4.81	0.01	46.73	0.14	186,756	567
9	5,347,884	7,121	257,245	776	4.81	0.01	46.79	0.14	250,313	850
10	10,700,000	89,412	509,156	5,404	4.74	0.02	47.60	0.17	512,679	4,852
Average	3,383,390	14,902	160,249	794	4.68	0.00	47.97	0.04	160,746	753

Deciles	Rural									
	Expenditure		VAT		Effective VAT Rate		Exempted Ratio (%)		VAT Exempted	
	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.
1	587,131	1,549	22,307	95	3.76	0.01	56.18	0.11	32,785	103
2	926,867	776	37,596	105	4.05	0.01	53.69	0.11	49,735	108
3	1,140,667	629	47,863	121	4.20	0.01	52.37	0.11	59,727	128
4	1,333,250	627	56,819	142	4.26	0.01	51.77	0.11	69,022	151
5	1,534,153	673	66,695	164	4.35	0.01	50.92	0.11	78,102	172
6	1,760,519	801	77,394	184	4.40	0.01	50.53	0.11	88,931	194
7	2,033,217	987	90,973	217	4.47	0.01	49.72	0.11	101,091	231
8	2,396,343	1,359	108,555	262	4.53	0.01	49.19	0.11	117,861	279
9	2,970,572	2,389	137,756	339	4.64	0.01	48.17	0.12	143,051	364
10	4,903,360	23,010	231,585	1,415	4.73	0.01	47.37	0.15	232,627	1,651
Average	1,958,593	4,677	87,754	246	4.34	0.00	50.99	0.04	97,292	261

4.3.3 Java and Other Islands

In this part, this paper examines the tax burden based on a geographic area such as Java and other islands (non-Java). Indonesia is an archipelago country that has more than 17.000 islands. There are five big islands such as Java, Sumatra, Kalimantan, Sulawesi, and Papua, among those islands. This paper classifies islands other than Java as non-Java. There are six provinces on Java Island and 28 provinces out of Java.

The main reason for examining the tax incidence between those regions is the imbalance in economic development. About two-thirds of the population of Indonesia live in Java, the center of the regional economy (Nasution, 2016). Manufacturing activities are concentrated on this island. Indonesia's provinces depend on Java Island provinces for many processed goods and services. Thus, it is reasonable to think that the price of goods and services will be higher outside Java as additional costs are needed to distribute the goods or provide services across the sea.

Figure 10 shows the contribution of regions to the National GDP. In 2019, the Java economy contributed about 58.55 percent of the national GDP, Sumatra at 21.49 percent, Kalimantan at 8.04 percent, Sulawesi at 6.55 percent, Bali and Nusa Tenggara at 3 percent, and finally Papua and Maluku at 2.37 percent. This condition is interesting to examine whether the difference in geographic and socioeconomic characteristics across regions in Indonesia relates to the level of VAT burden. One important thing to consider is that the VAT rate is the same across the region in Indonesia, with 10 percent of consumption.

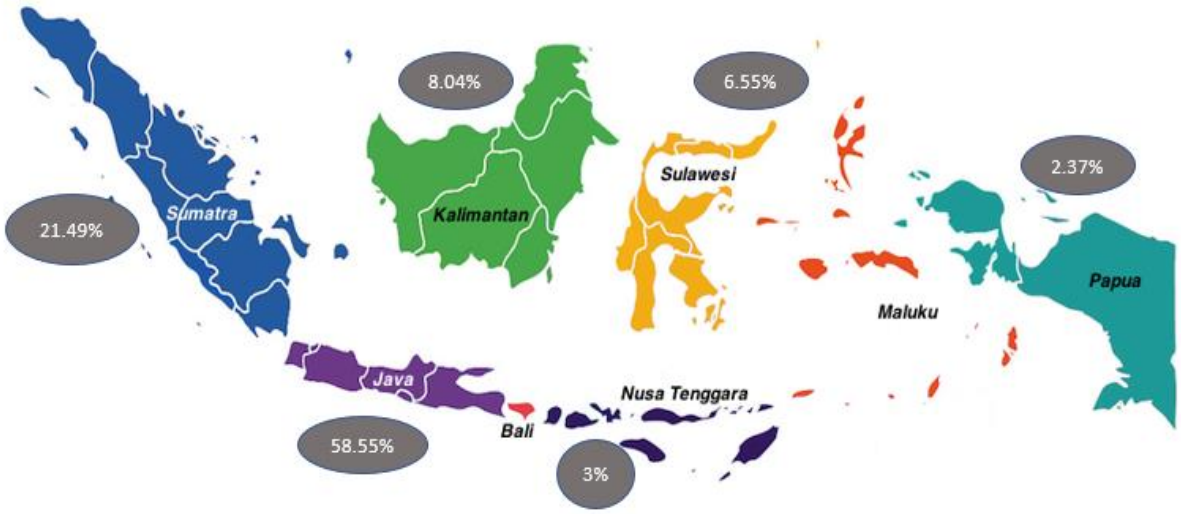

Figure 1.10. Islands' Contribution to National GDP
Source: Statistic Indonesia of 2020

Table 1.9 shows the tax incidence of VAT borne by households in Java and non-Java. About 38 million households (59 percent) live in Java and 26 million (41 percent) in non-Java. The expenditure level of households outside Java is higher than households in Java. On average, households outside Java spend 2.8 million IDR, while households in Java spend 2.6 million IDR. This result supports the argument that households in Java bear lower prices of goods and services than those outside Java, as it is the center of production of many goods and services. As an impact, household VAT liabilities outside Java are higher than households in Java. On average, VAT liabilities borne by households outside Java are 129 thousand IDR, while households in Java pay 120 thousand IDR. However, looking into expenditure deciles, the richest decile in Java has a different pattern from other deciles. The wealthiest households on Java Island spend and pay VAT more than the most affluent households outside Java.

While households non-Java pay more VAT than Java, the VAT burden borne by households in non-Java is lower than that of Java. On average, the effective VAT rate in non-Java is 4.44 percent. It is lower than the VAT effective rate in Java, which is 4.55 percent. Households in any

income group in non-Java except the richest one bears a lower VAT burden. Households outside Java benefit more from consuming exempted goods and services than their Java counterparts. Households in Non-Java spend 50 percent of their consumption on exempted goods and services, while households in Java spend slightly lower, 49 percent of total consumption. The poorest households in non-Java spend 56 percent of their total consumption on exempted while the poorest households in Java spend a lower proportion, at 54 percent of their total consumption. On the other hand, the richest in Java spend more on exempted goods and services than the richest in non-Java.

Table 1.9: Tax Incidence of VAT by deciles- Java and Non-Java

Deciles	Java									
	Expenditure (Rp)		VAT (Rp)		VAT Rate (%)		Exempted Share (%)		VAT Exempted (Rp)	
	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.
1	611,985	1,728	24,718	109	3.97	0.01	54.21	0.12	32,833	110
2	988,382	895	43,218	116	4.37	0.01	50.79	0.11	50,154	119
3	1,227,237	791	54,994	138	4.48	0.01	49.70	0.12	60,986	146
4	1,452,114	824	65,722	164	4.53	0.01	49.34	0.12	71,627	175
5	1,699,831	989	77,956	193	4.59	0.01	48.73	0.12	82,813	201
6	2,000,022	1,257	92,439	233	4.62	0.01	48.41	0.12	96,806	249
7	2,384,400	1,713	111,700	301	4.68	0.01	47.83	0.13	114,010	316
8	2,957,287	2,757	139,885	384	4.73	0.01	47.49	0.13	140,379	408
9	3,967,107	5,672	189,837	592	4.79	0.01	46.98	0.14	186,434	642
10	8,535,555	81,608	404,321	4,806	4.74	0.02	47.63	0.18	407,339	4,316
Average	2,582,319	12,489	120,476	667	4.55	0.00	49.11	0.04	124,335	626

Deciles	Nonjava									
	Expenditure (Rp)		VAT (Rp)		VAT Rate (%)		Exempted Share (%)		VAT Exempted (Rp)	
	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.
1	770,605	1,594	29,078	103	3.74	0.01	56.36	0.10	43,220	112
2	1,174,962	813	47,828	122	4.07	0.01	53.55	0.10	62,869	124
3	1,455,468	736	61,849	145	4.25	0.01	51.94	0.10	75,556	151
4	1,722,747	765	75,388	169	4.37	0.01	50.75	0.10	87,409	177
5	2,005,005	862	90,287	193	4.50	0.01	49.48	0.10	99,188	205
6	2,333,675	1,034	106,669	218	4.57	0.01	48.87	0.10	114,030	231
7	2,742,223	1,319	127,154	266	4.64	0.01	48.25	0.10	132,281	284
8	3,305,478	1,977	155,686	328	4.71	0.01	47.53	0.10	157,051	346
9	4,279,044	4,040	204,442	479	4.78	0.01	46.93	0.11	200,753	509
10	8,148,351	43,636	389,799	2,387	4.82	0.01	46.64	0.13	383,180	2,760
Average	2,794,073	7,955	128,834	408	4.44	0.00	50.03	0.03	135,568	422

The effective tax rate is increasing with expenditure in both Java and Non-Java. This result shows that VAT is progressive in both areas. However, Java's wealthiest income group does not bear the highest effective tax rate. In all expenditure deciles except for the most affluent group, the effective VAT rates are higher in Java than non-Java. The Kakwani indexes support progressivity as indexes for Java and Non-Java are 0.0145 and 0.0264, respectively. The degree of progressivity is higher in non-Java than on Java Island. The main reason is the higher proportion of spending on exempted goods and services, and income is relatively more equal in non-Java. The Gini coefficient is 0.37 in non-Java and 0.41 in Java.

This result brings on to a discussion of the single VAT rate that applies to parts of the regions. There is a question about whether the VAT rate could be differentiated between Java and non-Java, and whether households in non-Java should have a lower VAT rate to compensate for lower economic development and higher cost of living. The result shows that while the cost of living is higher, a lower VAT rate seems unnecessary for households living outside Java, as the tax burden is lower than in Java.

4.4 Main/Working Income

The Susenas 2013 does not provide complete information on households' income. Still, it has information on households' working income.[14] The survey asks how much income (money and goods) they typically earn from their primary job for a month.[15] Not all households have income from a primary or working job. Thus, there is a lot of zero income from the survey.

Households with zero or very low income are excluded from this analysis to have a meaningful result. Also, households with a primary income of fewer than 100 thousand IDR are excluded. The

[14] In this section income and expenditure are not the same.

[15] In the manual of KOR survey part V, question 29 of Susenas 2013.

reference for this treatment is based on Statistic Indonesia, which measures Indonesia's poverty line as a monthly expenditure of up to 273,468 IDR.[16] With this arrangement, the unit of analysis to be observed is estimated to be 224.416 samples of households.

Table 1.10 shows the variety of households grouped based on income and expenditure. Only 43.10 percent of households in the lowest decile of income group are also in the lowest decile of expenditure. Meanwhile, 0.19 percent of households in the richest income group are classified as the lowest decile expenditure group. On the other hand, only 58.58 percent of households with the richest income are also ranked in the largest expenditure group. Based on this result, a household may spend more than its primary income or much less than its main income.

About 60 percent of households spend more than their primary income, and the left spend equal to or less than their primary income. Until the sixth income decile, households that spend more than their primary income are larger than households that spend equal to or less than their primary income. From the seventh income to the richest group, households that spend more than their primary income dominate. Spending more than their primary income is possible as households may have other sources of income. Alternatively, those households use their previous savings or take loans to finance their needs.

Table 1.11 shows the tax incidence based on income and expenditure deciles. Based on primary income, VAT looks regressive, while based on expenditure, VAT looks progressive. This result seems unsurprising if we compare it with other countries based on the literature. Based on income, the poorest income group bears an effective VAT rate of 16.15 percent, while the richest group bears an effective VAT rate of 4.02 percent. The poorest income group is taxed four times higher than the richest. If we see the result based on the expenditure, the VAT is slightly progressive as

[16] Source Url: https://www.bps.go.id/indicator/23/195/5/garis-kemiskinan-rupiah-kapita-bulan-menurut-provinsi-dan-daerah-.html.

the lowest group of households faces a 4.12 percent effective VAT rate. The highest group bears the highest effective VAT rate of 4.77 percent.

Based on this result, VAT payments as a percentage of expenditure are more informative than payments as income. A tax burden much larger than its standard VAT rate seems problematic to explain. Expenditure is a better welfare measure when using a snapshot or short period of tax incidence (Metcalf, 1994, IFS, 2011, Thomas, 2022, Poterba, 1989, 1991).

Table 1.10: Income and Expenditure Deciles Group

	Expenditure Deciles									
Income Deciles	1	2	3	4	5	6	7	8	9	10
1	43.10	17.15	11.80	8.70	6.63	4.67	2.95	2.44	1.60	0.95
2	28.26	23.13	15.43	10.92	7.52	6.11	3.80	2.40	1.60	0.83
3	13.66	22.36	18.93	13.62	10.32	7.85	5.99	3.78	2.19	1.29
4	6.57	16.34	18.91	16.85	14.27	10.06	7.42	5.01	3.03	1.54
5	3.71	9.52	15.50	19.39	17.37	13.83	9.24	6.57	3.67	1.21
6	1.74	5.76	9.11	13.50	17.93	18.01	14.82	10.31	5.96	2.85
7	1.13	2.78	5.33	8.88	12.99	18.01	20.54	16.62	9.92	3.81
8	0.55	1.34	2.83	5.06	7.98	12.51	18.85	23.06	19.18	8.64
9	0.29	0.56	1.36	2.42	3.95	7.06	12.18	20.96	30.77	20.44
10	0.19	0.40	0.51	0.90	1.36	2.23	4.41	9.11	22.30	58.58

Table 1.11: Tax Incidence Based on Income and Expenditure Deciles

Decile	Main Income			Expenditure		
	Income (Rp)	VAT paid (Rp)	Effective Rate (%)	Expenditure (Rp)	VAT paid (Rp)	Effective Rate (%)
1	414,027	57,125	**16.15**	772,962	32,125	**4.12**
2	798,207	66,191	**8.37**	1,158,095	50,710	**4.38**
3	1,096,114	78,052	**7.16**	1,418,642	63,358	**4.46**
4	1,407,586	87,526	**6.21**	1,673,661	75,734	**4.52**
5	1,705,797	94,801	**5.56**	1,955,419	89,797	**4.59**
6	2,059,927	113,138	**5.50**	2,286,774	106,330	**4.65**
7	2,543,130	130,140	**5.12**	2,710,815	127,570	**4.70**
8	3,209,968	158,684	**4.95**	3,313,710	157,723	**4.76**
9	4,390,498	200,830	**4.58**	4,365,694	210,039	**4.81**
10	9,341,822	351,539	**4.02**	8,874,730	422,684	**4.77**
Average	2,690,240	133,605	**6.78**	2,853,006	133,605	4.58

5. The Impact of VAT Reform 2021 on Tax Incidence

The Covid-19 Pandemic has struck all countries globally and caused a massive problem to the national budget, especially in developing countries such as Indonesia. An enormous amount of money is needed to tackle the pandemic's impact. At the same time, public revenues decrease since many economic activities that contribute to revenues are prohibited. As a result, the government of Indonesia (GOI) faces a huge budget deficit. This condition has pushed GOI to reconsider how to collect revenues to support the national budget.

One of the quick options to boost revenue is to reform the VAT. The VAT rate in Indonesia is still considered at a low level compared to many countries (Alm, 2019), and it still has enormous exemptions items that could not be right on the equity ground. Increasing the VAT rate and deleting many exemptions could bring more revenue to the government faster than income tax. VAT collection is straightforward, based on consumption or sales, and fast due to monthly input and output VAT calculations. It does not involve a complex calculation like income tax.

In October 2021, GOI implemented tax reform by issuing Law Number 7 on Tax Law Harmonization. The new tax law covers reform in many types of taxes, including VAT. There are two significant changes in VAT. First, The VAT rate increases from 10 percent to 11 percent in April 2022 and 11 percent to 12 percent in 2025. Second, many goods and services that were previously nontaxable become taxable but still excused from VAT.[17]

GOI maintains the exemption and only changes the classification of goods and services from nontaxable to taxable but still excused from VAT. Staple goods and services that people mostly need are now taxable but excused from VAT. Among those things are raw food, health and education services. This change does not impact the VAT burden as the two categories of

[17] The comparison of old VAT and new VAT law is available in Appendix A.

nontaxable and taxable but excused from VAT are still classified as exempted items. Thus, there is no VAT imposed on sales. However, for the government, this reform gives them some flexibility to define strategic goods and services in the future without needing approval from the House of Representatives. As there is no new government regulation yet to regulate those items, thus it is assumed that the old government regulation that regulates strategic items still applies. The change impacts sellers that previously sold or produced nontaxable goods and services. They will be required to register as VAT-registered even though they will not collect VAT from sales as the goods and services are now subject to VAT but excused.

This paper attempts to simulate the distributional impact of VAT tax reform using the 2013 household data. The static approach is taken, and only a hike in the VAT rate will impact the tax burden as the government maintains the exemption. This simulation neglects the change of spending composition on goods and services due to price changes as the VAT rate increases. It is better to use the latest survey data, for example, Susenas 2021. Some distribution and the level of expenditure may have changed. However, those data are not free and expensive.[18]

In this simulation, the new VAT rate used is 11 percent. It is straightforward to estimate that the hike in rate will proportionally affect all expenditure deciles at a 10 percent increase, as shown in Table 1.12.[19]

As shown in several studies (for example, in Mushi, 2019), it is interesting to find the tax burden and progressivity if all exemptions are excluded or, in other words, a broad base approach as all goods and services are taxable. In the future, GOI can select which consumption will be out of strategic or exempted goods without changing the VAT Law, which will take a long

[18] The price of the data of Susenas 2021 is 60,083,115 IDR (or USD4,060, exchange rate 1USD=14800 IDR).

[19] The calculation using items classification in Appendix A, Table A.3, Column Treatment, sub column 2022-part New VAT Law.

administration process. Thus, this paper attempts to simulate the VAT burden without an exemption to find the upper bound side of tax revenue.

Table 1.12: Tax incidence based on the New VAT Law

Expenditure Deciles	New Law With Exemption				Former Law				Change (%)
	VAT		Effective VAT Rate		VAT		Effective VAT Rate		
	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.	
1	29,175	92	4.32	0.01	26,523	84	3.92	0.008	10
2	49,483	99	4.69	0.01	44,984	90	4.26	0.008	10
3	63,053	115	4.81	0.01	57,320	104	4.38	0.008	10
4	76,256	136	4.90	0.01	69,323	124	4.46	0.008	10
5	90,805	157	4.98	0.01	82,550	142	4.53	0.008	10
6	107,887	189	5.04	0.01	98,079	171	4.59	0.008	10
7	130,183	226	5.13	0.01	118,348	205	4.66	0.008	10
8	161,744	294	5.19	0.01	147,040	268	4.72	0.008	10
9	215,890	440	5.26	0.01	196,263	400	4.78	0.009	10
10	438,325	3,300	5.25	0.01	398,477	3,000	4.77	0.011	10
Average	136,275	471	4.96	0.00	123,887	428	4.51	0.00	10

Note: This table reports average VAT, tax rates, and change of tax incidence by decile for expenditure as the proxy of income or welfare based on regulation in the old (2009) and new (2021) VAT laws. All data from Susenas 2013 is assumed constant and the same with 2022. VAT liabilities are computed as 10% of taxable expenditure. Tax rates are computed as the ratio of VAT liability to expenditure. Change is computed as an increase (+) or decrease (-) of VAT liabilities due to VAT Reform.

The simulation of VAT burden without exemptions is the same except for the tax base. The tax base of goods and services exempted by former VAT law is the expenditure itself, as this paper assumes that there is no VAT on those expenditures. The tax base of taxable items is the same as the treatment of the old law, which is the net expenditure (gross expenditure minus VAT), as this paper assumes that taxable expenditure from the survey includes VAT.[20] In this simulation, the new VAT rate used is 11 percent.

Table 1.13 shows the simulated tax burden of the new VAT law without exemptions.[21] Since the broad exemption on goods and services becomes taxable, and the VAT rate increases by 1

[20] The net expenditure is calculated by 10/11 of gross expenditure (expenditure data from the survey).

[21] The Calculation using items classification in Appendix A, Table A.3, Column Treatment, sub column 2022, part Upper Bound.

percent, the VAT burden increases in all expenditure deciles. The effective tax rate increases from 4.51 percent to 9.53 percent. The VAT burden rises more than double the former tax burden. The poorest expenditure decile gets hit more than other expenditure deciles. The poorest households face a 121 percent hike in VAT burden, while the wealthiest households face only 108 percent. The VAT still looks slightly progressive, using expenditure as an income proxy under the new VAT Law. The Kakwani Progressivity Index also supports it. The index shows a positive number at 0.0117. It is lower than the Kakwani index for the old VAT Law, 0.0189. The index indicates that VAT in Indonesia is less progressive if all exemptions are excluded.

Table 1.13: VAT burden under new VAT Law for expenditure as the proxy of income

Expenditure Deciles	VAT Without Exemption (Broadbase)				Former Law				Change (%)
	VAT		Effective VAT Rate		VAT		Effective VAT Rate		
	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.	
1	58,512	164	8.68	0.01	26,523	84	3.92	0.008	121.04
2	97,777	131	9.26	0.01	44,984	90	4.26	0.008	117.46
3	122,983	142	9.39	0.01	57,320	104	4.38	0.008	114.55
4	147,620	155	9.49	0.01	69,323	124	4.46	0.008	112.96
5	174,657	171	9.58	0.01	82,550	142	4.53	0.008	111.62
6	206,578	193	9.66	0.01	98,079	171	4.59	0.008	110.63
7	247,124	223	9.73	0.01	118,348	205	4.66	0.008	108.80
8	304,795	286	9.79	0.01	147,040	268	4.72	0.008	107.34
9	404,780	454	9.86	0.01	196,263	400	4.78	0.009	106.28
10	827,951	5,029	9.90	0.01	398,477	3,000	4.77	0.011	107.53
Average	259,269	801	9.53	0.00	123,887	428	4.51	0.00	111.57

Note: This table reports average VAT, tax rates, and change of tax incidence by decile for expenditure as the proxy of income or welfare based on regulation in the old (2009) and new (2021) VAT laws if all exemptions are excluded. All data from Susenas 2013 is assumed constant and the same with 2022. VAT liabilities are computed as 10% of taxable expenditure. Tax rates are calculated as the ratio of VAT liability to spending as a proxy of income or welfare. Change is computed as an increase (+) or decrease (-) of VAT liabilities due to VAT Reform. Households are sorted by total expenditure.

The estimated impact of VAT law without exemptions to VAT revenue is significant and in line with the prediction of an increase in tax burden. Table 1.14 shows that GOI will collect VAT revenue under the new VAT regime more than twice of the former VAT regime. VAT revenue will get extra by 104 trillion IDR or a 109 percent increase. Thus, taking out the exemptions will

boost the tax revenue much more than changing nontaxable to taxable but still excused from VAT. However, it impacts households' tax burden, especially the poorest income groups.

Table 1.14: Estimated revenue of broad base VAT

	2013	2022	Change (amount)	Change(%)
VAT payment (estimated in trillion Rp)	95.04	199.2	104.16	109.60

Note: estimated VAT payment in 2022 using 2013 price**.**

Cash transfers or subsidies to poor households could reduce the impact of broad base VAT on their purchasing power. If administrating people with low incomes is problematic (deciding who is poor or not poor), the universal transfer approach could be an alternative policy (Warwick et al., 2022). In this approach, all households will be given a certain amount to compensate for excluding all exemptions. Assume each family will be given 50,000 rupiah monthly or 600,000 IDR yearly. Then the tax burden will be much more progressive, as shown in Table 1.15. The lowest income group will only bear a net effective tax rate of 0.4% of their consumption, and the highest income group will have a tax burden of 9.2%. The average effective tax rate is also lower, from 9.53% to 6.46%. The total cash transfer needed to fund this policy for a year is 38.4 trillion IDR. As the GOI is estimated to get 104.16 trillion IDR to exclude all exemptions, the additional net revenue will be collected by 65.76 trillion IDR. Two purposes can be achieved with this universal transfer; the VAT will become highly progressive, and at the same time, the burden on vulnerable income groups will be eased.

Table 1.15: Tax Burden with Universal Transfer

Expenditure Deciles	VAT New (No exemptions) with Universal transfer						
	VAT		Transfer	VAT-Transfer		Tax Burden	
	Mean	Std. Err.		Mean	Std. Err.	Mean	Std. Err.
1	58,512	164	50,000	8,512	164	0.40	0.00
2	97,777	131	50,000	47,777	131	4.50	0.00
3	122,983	142	50,000	72,983	142	5.56	0.00
4	147,620	155	50,000	97,620	155	6.27	0.00
5	174,657	171	50,000	124,657	171	6.83	0.00
6	206,578	193	50,000	156,578	193	7.32	0.00
7	247,124	223	50,000	197,124	223	7.75	0.00
8	304,795	286	50,000	254,795	286	8.18	0.00
9	404,780	454	50,000	354,780	454	8.63	0.00
10	827,951	5,029	50,000	777,951	5029	9.20	0.00
Average	259,269	801	50,000	209,269	801	6.46	0.01

Note: This is a simulation for a broad base and single-rate VAT. Every household is given 50,000 IDR monthly to compensate for the higher tax burden.

6. Conclusion and recommendation

This paper examines the VAT burden in Indonesia using National Socioeconomic Survey 2013 data and expenditure as the proxy of income or welfare. The study finds that nationally the effective VAT rate is 4.51 percent, or less than half of the standard VAT rate of 10 percent. The effective VAT rate is relatively close to other developing countries estimates, like Lebanon (4.3%) and Ethiopia (4.77%), but it is half of the average of 27 OECD countries' estimates (9.73%). The poorest households face an effective rate of 3.92 percent, while the wealthiest families face a rate of 4.77 percent. Kakwani Progressivity Index shows that VAT in Indonesia is weakly progressive. This paper also finds that measuring VAT burden using expenditure as a welfare measure is more informative than income as the latter will yield effective tax rates much higher than the standard VAT for low-income people. This finding supports similar results from previous researchers (Metcalf, 1994; IFS, 2011; Thomas, 2022).

This paper also decomposes the analysis of VAT burden by comparing households in urban and rural areas, two groups of expenditure, such as food and nonfood, and islands, such as Java

and Non-Java. This paper finds that the tax burden is lower and more progressive in rural areas than urban areas. The tax burden on food consumption is lower and regressive, while higher and progressive for nonfood consumption. While households in non-Java spend more than households in Java, this paper finds that the effective tax rate in non-Java is less than in Java. The main reason is the larger share of exempted goods and services consumption. However, in absolute (cash) terms, the wealthiest households benefit more from consuming exempted goods and services and, in several cases, are not the people who bear the highest effective VAT rate.

This paper also simulates the impact of the VAT reform implemented in April 2022. The result shows that if the exempted items are maintained by only changing nontaxable to taxable but still excused from VAT and the tax rate increase from 10 percent to 11 percent, the tax burden will increase proportionally to all expenditure deciles by 10 percent or become 4.93%. However, if all exemptions are excluded, the tax burden will be 9.53 percent or double that of the previous tax regime, and notably, the poorest households will get hit more than the richest.

This paper suggests some critical considerations and possible policy recommendations for the VAT system in Indonesia. The first consideration is the standard VAT rate and the level of tax burden. Compared to the standard VAT rates of other developing countries like Lebanon (11%), Ethiopia (15%), Tanzania (18%), or OECD countries (19.2%), Indonesia's current VAT rate is assumed at a low rate.[22] The tax burden estimate due to the current VAT reform is still close to the developing countries with around 4 to 5% effective VAT rate. One critical point is that even though the VAT rate is relatively low, the effective VAT rate is similar to several developing countries

[22] See https://www.oecd.org/tax/tax-policy/tax-database-update-note.pdf for OECD countries, https://taxsummaries.pwc.com/lebanon/corporate/other-taxes for Lebanon, and https://www.globalvatcompliance.com/globalvatnews/world-countries-vat-rates-2020/ for other countries.

that apply higher standard VAT rates. An increase in the VAT rate (from 11% to 12% in 2025) will make the VAT burden higher than the average of developing countries.

The second consideration is about removing exemptions. The average effective VAT rate of 27 OECD countries (Thomas, 2022) is 9.7 percent which is close to the estimate of the effective VAT rate if Indonesia takes out all exemptions. However, OECD countries or high-income countries tend to have a higher tax burden and tax revenue to GDP ratio than developing countries and relatively have the required capacities to maintain it (Besley & Persson,2014). Indonesia's current GDP per capita (2021) is USD 4,333, and those 27 OECD countries' average GDP per capita is USD 44,297.[23] It is a huge gap in income or economic development. Even compared to Chile (the lowest GDP per capita among those countries) with USD16,265 of GDP per capita, the GDP per capita of Indonesia is still around one-fourth of Chile. Hence, this paper assumes that Indonesia will have severe problems if all exemptions are removed, as Indonesia is not developed enough.

One obvious problem is that inflation is caused by increasing prices of goods and services due to tax and possible social unrest that typically follows high inflation. Most OECD countries are still using various reduced rates and exemptions. Indonesia's GDP per capita is very close to Lebanon and fourth time of Tanzania, and Ethiopia. Thus, this paper assumes that the government has conducted a prudent way to increase public revenues by gradually increasing the VAT rate and still maintaining exemptions in the uncertain economic situation due to the Covid-19 pandemic and the ongoing war of Russia-Ukraine that interrupts many goods distribution.[24]

---

[23] See https://data.worldbank.org/indicator/NY.GDP.PCAP.CD

[24] The monthly inflation rate from April 2022 (the VAT reform started) to March 2023 is 4.9%. The monthly inflation rate before the Covid-19 Pandemic (2015-2019) is 4% (see https://www.bi.go.id/en/statistik/indikator/data-inflasi.aspx).

The current VAT law enables the government to exclude goods and services through exemptions. This paper shows that removing all exemptions (becoming a broad base VAT system) by itself does not increase the progressivity of VAT. Suppose the government intends to increase progressivity for equity or redistribution reasons. It can differentiate tax treatment between goods and services consumed by high-income and low-income people. For example, imported high-quality food or produce from other countries typically sold in modern stores can be taxed. Another approach is to reevaluate spending on exemptions that increase with income, like fish, meat, egg, and milk. The exemptions on water, health and medical expenses, school expenses, public transportation, financial services, insurance, and postal items can be reevaluated from the nonfood consumption. The government can target those goods selectively to improve the progressivity of VAT.

The other way is to maintain the VAT threshold to exclude small sellers based on turnover from the VAT system. Low-income and high-income people may have different preferences for shopping places. The low-income people tend to purchase goods and services from small sellers as they can provide affordable products. The high-income people can shop in modern stores that add VAT to their selling price for convenience and quality. Allowing small firms not to impose VAT on selling prices will reduce low-income people's tax burden and make the VAT more progressive.

The progressivity of VAT is not the only matter of a good VAT design. Economic efficiency, administrative efficacy, and adequate tax revenue to finance public spending are also critical components (Mirrless et al., 2011; Faridy & Sanker, 2011). If the government decides to tax exempted goods and services to increase tax revenue, they need to consider several findings in this paper. Low-income people will be the most vulnerable as their consumption proportion of

exempted items is much larger than that of more affluent people. Specifically, the government should pay more attention to low-income people in rural areas and people who live outside Java. The ratio of exempted items consumed by the five lowest-income groups in the rural area is higher or close to the lowest-income group in urban areas. The ratios of exempted items consumed by the five lowest-income groups in Nonjava are much higher than those in Java. A universal cash transfer could help low-income people and make VAT progressive. If the cash transfer for all people seems unreasonable, cash transfer for households in the lower income groups should be appropriate.

This paper also finds that differentiation of VAT rate for households outside Java seems unnecessary as they face a lower tax burden. The cheaper transportation cost of goods from Java to other islands in Indonesia may be more critical and administratively less complex than VAT rate differentiation due to an imbalance in economic development. Promoting industrial areas outside Java Islands is feasible to reduce the high price disparity between Java and Non-Java.

This paper highlights a snapshot of the VAT burden in the year 2013. The tax burden could change intertemporally due to economic development. Stiglitz (2009) states that VAT is collected more extensively in the urban sector than in rural areas. The more households move to urban areas, or the development of rural areas into urban areas can change the level of the tax burden. The economic activities tend to be more formal as the economy develops. Bachas et al. (2020) also highlight that the tax burden and progressivity of VAT depend on the sellers' formality. Formal sellers or modern stores typically charge VAT on their invoices.

Another factor that could change the level of the tax burden is the VAT registration threshold, in which the sellers could opt out as VAT collectors and not put VAT on the sales prices. In 2013, sellers should be registered if their sales were over 600 million IDR. However, since 2014 the

threshold was increased eight times to 4.8 billion IDR. This change will probably reduce the number of registered sellers and the tax burden.

This paper has a possible limitation regarding its treatment of exempted goods and services. While no VAT is imposed on sale to the final consumer, some VAT may still be embedded in the final price due to the inability of the business to claim input tax credits to produce nontaxable and exempted goods and services. Input-output tables could estimate this embedded tax separately (Warren, 2008; Mark, 2005; Warwick et al., 2022). However, it is beyond the scope of this paper. Instead, exempted goods and services are not imposed tax in the simulation. This assumption, however, is likely to result in some underestimation of VAT revenue in the simulations.

If the data is available, a dynamic approach could be made to measure the impact of a VAT rate hike on demand and supply, prices, and tax burden. The analysis could also examine whether the VAT is fully passed through. This kind of paper has been conducted in other countries, and the result from Indonesia will enrich the literature. In addition, if the data of places or sellers where households buy goods and services are available, research following Bachas et al. (2020) could be conducted to understand the tax burden and progressivity even better.

Chapter 2 – Does the Indonesian VAT Registration Threshold Reduce Reported Revenues?

1. Introduction

Many countries worldwide have adopted a value-added tax (VAT) system to generate their public revenue to finance public expenditures. As of 2020, 170 countries had a VAT (OECD,2020). More often, revenue from VAT contributes a more significant proportion of tax revenue than other kinds of taxes, especially in developing countries (Alm & El-Ganainy, 2012).

VAT has three critical strengths compared to other consumption taxes, such as sales tax (Satterthwaite, 2019). First, it supports production efficiency. Consumers will bear VAT rather than producers as there is no cascading like sales tax.[25] In the end, tax is borne by the final customers as the accumulation of all values added is on them. Second, it is factionalism. Only the tax on the value added is paid at a particular stage. Thirdly, it can deter evasion as the VAT system will provide a paper trail and self-enforcement through the input credit mechanism. This last feature is vital for the tax authorities as it provides information to reduce tax noncompliance. As stated by Pomeranz (2015), it is hard to enforce tax compliance if the information is unavailable.

One of the general features of a VAT system implemented in most countries is a VAT registration threshold in which not all firms are required to collect the VAT on their sales.[26] The main reason for implementing the VAT threshold is to reduce the tax administration cost of tax authorities and the compliance cost of the business taxpayer, in this case, small firms (Keen & Mintz, 2004). The tax authority will forgo tax revenue to save administration costs (Ebrill et al.,

[25] Tax is calculated at each production stage without adjustment via input credits. Thus, the position of the transaction in the supply chain will affect the sale price (Satterthwaite, 2018).

[26] There are some countries do not have registration threshold, like Chile, Colombia, and Mexico (see Table 2.1).

2001). The compliance cost will significantly burden small companies and could inhibit them from growing.

While the VAT threshold looks to provide a mutual benefit for the tax authority and small firms, it will provide an uneven treatment among firms and impact firms' behavior. Research on the impact of VAT threshold on firms' behavior is growing. For example, to avoid VAT obligations, In Finland, firms bunch below the threshold to avoid the VAT obligation (Harju et al., 2019). Due to a high threshold in Japan, firms can squeeze into several smaller firms (Onji, 2009). However, none of those studies specifically observe the firms' sales or revenues underreporting activities due to the registration threshold.

The threshold could become a contradiction to the strength of the VAT. It will tend to reduce the information that could be given through trading networks, as many small businesses may opt out of the system. Information from VAT is essential not only for VAT revenue but also for business income tax information. The VAT system will provide revenue and cost information. The higher the threshold, the more possible it will be for many businesses out of the system.

This paper aims to observe the impact of the VAT threshold on reported sales or revenues in Indonesia. In 2014 The government of Indonesia (GOI) increased the VAT registration threshold from 600 million rupiahs (US$42.259) to 4.8 billion rupiahs (US$338.076).[27] This threshold puts Indonesia at one of the highest VAT thresholds in the world (see Table 1). Firms with annual turnover above this new threshold are legally required to register as VAT collectors if their products are not exempted from VAT. In contrast, firms with revenue below the threshold could still register or choose to be out of the system.

[27] Central Bank of Indonesia exchange rate for 31 December 2021.

This paper asks whether the high threshold will induce businesses to decrease reported revenues. There has yet to be a study on this question. The high threshold will tend to reduce the information provided by the VAT system from the paper trail and self-enforcement. The higher the threshold, the lower the paper trail available and self-enforcement information. This threshold will examine whether firms that previously had revenue over the old threshold but below the new threshold will underreport sales. Small firms are relatively under-monitored as many authorities focus more on large firms by forming special tasks or tax offices (Bachas et al., 2019; Basri et al., 2019).

This paper adds value to the growing literature on VAT and registration thresholds (Keen & Mintz, 2004; Bird, 2007; Onji, 2019; Liu et al., 2021, among others) and tax compliance (Slemrod, 2019; many others). Keen and Mintz (2004) set a threshold model incorporating the trade-off between compliance and administration costs. Their basic model concludes that the threshold should be very high. Their model does not incorporate tax evasion. Thus, this paper intends to fill the research gap by empirically showing whether firms will be incentivized to underreport sales when the registration threshold is high. The result could be used to reconsider whether the existing threshold needs to be lowered to maximize VAT revenue.

This paper also adds value to the growing literature on VAT and transaction information (Naritomi, 2019; Pomeranz, 2015; Kleven et al., 2009). Pomeranz (2015) shows the empirical proof of the strength of information from VAT. This paper will, on the contrary, show that the threshold will reduce the power of VAT for tax compliance. Naritomi (2019) shows that retail sectors increase reported sales when the final customers are rewarded for reporting their purchases to the authority. She uses wholesale as the control group in her method using Difference in

Difference regression (DD). This paper, though, uses wholesale as the treatment group to show that a very high threshold will induce a wholesaler to act like a retailer.

This paper adds value to the growing literature that uses tax administration data (Liu et al., 2021; Naritomi, 2019; Harju et al., 2019; Pomeranz, 2015, among others). Using the microdata of taxpayers will provide better results and understanding of how taxpayers react to tax policy than using other data, such as survey data, as the proxy of taxpayers. This paper also contributes to the literature on tax administration reform, particularly in firm size enforcement (Bachas et al., 2019; Basri et al., 2019, among others). This paper shows that small firms that are less monitored by authorities tend to evade tax compared to medium or large businesses.

The rest of the paper is organized as follows: Sections 2 and 3 describe the background and literature, respectively. Section 4 discusses the methodology and data, and Section 5 explains the results and robustness check. Finally, Section 6 concludes.

2. VAT, Registration Threshold, and Tax Administration in Indonesia

2.1 Background on the VAT and Registration Threshold

Most countries worldwide have a VAT, and for many developing countries, it represents the largest source of tax revenue. In Indonesia, VAT accounts for about a third of tax revenue (Alm, 2019). Indonesia has a single 10% VAT rate, paid and reported monthly. Businesses collect VAT from customers and remit VAT on the difference between total sales and total input costs to the tax authority. The overall tax base-total value added in the production chain- is therefore equivalent to that of a sales tax, which is paid on the entire final value at the retail stage.[28]

As shown in Figure 2.1, VAT revenue grew positively high in 2018 but then negatively in 2009. The US subprime mortgage crisis in 2008-2009 might have impacted Indonesian economics

[28] This equivalence holds when the VAT has a uniform rate and no exemptions.

and countries worldwide. The growth of VAT revenue started to increase in 2010 until 2012 but then decreased from 2013 to 2015. The increase of the VAT threshold could impact the decreasing growth as the authority forgoes VAT revenue to save administration costs and help small firms with compliance costs.

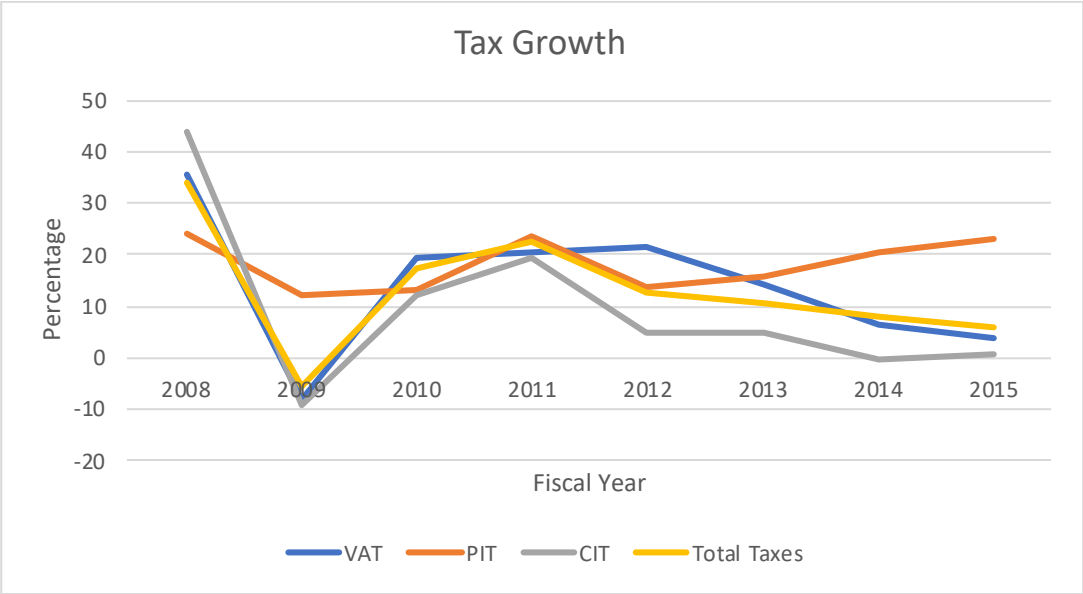

Figure 2.1: Tax Revenue Growth
Source: reproduced from Alm (2019).

Indonesia applies the invoice method for businesses to declare sales amounts and other revenue sources (tax debit) and input costs (tax credit). Firms must keep and maintain these invoices, especially the tax credit, to reduce their tax liability. If the tax debit exceeds the tax credit for a given month, the firm must remit the difference to the tax authority. If the tax credit is larger than the tax debit, the difference can be carried over to the following month as a credit. A firm can opt to claim a refund, but only some do so as it triggers an automatic audit, and it is time-consuming to prepare the report and address the tax audit (Pomeranz, 2015).

Firms must keep and maintain the invoices, especially the tax credit, to reduce their tax liability. This provides the third-party paper trail along the production chain or trading network. The information from the buyer/the firm through its tax credit claim will inform the authority about

its suppliers' sales. The tax authority then cross-checks the two firms 'records against each other through its administration system. This enables the authority to find whether the suppliers have reported their VAT returns correctly.

This mechanism only applies to VAT-registered companies that require them to report monthly VAT returns with complete seller and buyer information. This will work in business-to-business (B2B) transactions where parties register VAT. However, it will not work if one of the parties is not VAT registered. Neither this mechanism will work in business-to-customer (B2C) as the final customer is not interested in reporting their purchases to the authority.

There is a different treatment between B2B and B2C regulation, in this case, the retail sectors. Other than retail, VAT-registered businesses should issue an invoice with complete information about the buyers. Thus, the retailer can escape from the strength of VAT in giving information as the counterparty is not available or will not be known by the authority.

2.2 VAT Threshold in Indonesia

As shown in Table 2.1, it is not uncommon for countries that adopted a VAT system set a turnover threshold for VAT registered. The threshold is set to exclude small firms from VAT compliance costs and to allow the tax authority to exclude tax administration costs to monitor the small firms. The other consideration is majorly VAT revenue remitted by large firms (Stiglitz, 2009). So, the limited capacity of the tax authority in most developing countries can be devoted more to large businesses.

Indonesia has applied VAT threshold regulation since the very beginning of adopting VAT in 1984. The threshold has changed several times, as shown in Table 2.2. In the early inception of the VAT system in 1984, the threshold was set to 60 million Indonesian Rupiah (IDR) for producing goods and services. The threshold was later changed between the manufacturing and

services sectors several times. The threshold for firms was set higher than the services sectors. One consideration may be due to the difference in value-added between the manufacturing and services sectors. Services are perceived to have higher value-added (profit margin) than manufacturing firms. Thus, the threshold should be lower (Ebrill, 2001; Keen & Mintz, 2004).

Table 2.1: OECD Countries and Indonesia VAT Threshold 2021

Countries	National Currency	General Treshold		Countries	National Currency	General Treshold	
		Currency	USD			Currency	USD
Indonesia	RP	4800 000 000	338,076	Korea	KRW	30 000 000	34,520
U.K.	GBP	85 000	118,671	Belgium	EUR	25 000	33,155
France	EUR	85 800	115,864	Germany	EUR	22 000	29,543
Poland	PLN	200 000	110,427	Israel	ILS	100 491	27,263
Lithuania	EUR	45 000	99,946	Netherlands	EUR	20 000	25,161
Italy	EUR	65 000	97,158	Canada	CAD	30 000	25,040
Japan	JPY	10 000 000	96,701	Portugal	EUR	12 500	21,769
Slovak Rep.	EUR	49 790	93,374	Greece	EUR	10 000	18,330
Ireland	EUR	75 000	91,910	Iceland	ISK	2 000 000	13,878
Slovenia	EUR	50 000	87,962	Finland	EUR	10 000	11,702
Switzerland	CHF	100 000	87,425	Denmark	DKK	40 000	7,507
Hungary	HUF	12 000 000	82,384	Norway	NOK	50 000	5,375
Latvia	EUR	40 000	81,312	Sweden	SEK	30 000	3,370
Czech Rep.	CZK	40 000	77,860	Chile	CLP	None	
Estonia	EUR	40 000	75,061	Colombia	COP	None	
Australia	AUD	75 000	51,314	Mexico	MXN	None	
Austria	EUR	35 000	46,055	Spain	EUR	None	
New Zealand	NZD	60 000	41,121	Turkey	TRY	None	
Luxembourg	EUR	30 000	34,715				

Source: https://www.oecd.org/ctp/tax-policy/tax-database for OECD countries. Indonesia data is based on the author's calculation.

In 2004 the threshold for goods and services was 600 million IDR, which continued until 2013. The threshold was increased to 4.8 billion IDR in 2014. The current threshold puts Indonesia considered a high VAT threshold country, if not the highest among countries that adopt VAT in their tax system. Businesses that have revenues below the threshold are still eligible to register. As most of the firm's revenue is below this threshold, many firms will be qualified to opt out of the VAT system. Thus, the strength of the paper trail or self-enforcement feature of VAT will weaken.

Table 2.2: Indonesian VAT Registration Threshold over Time

Year	Threshold (IDR)	Type
1984	60,000,000	for taxable good and services
1989	60,000,000	for taxable goods
	30,000,000	for taxable services
1992	120,000,000	for taxable goods
	60,000,000	for taxable services
1995	240,000,000	for taxable goods
	120,000,000	for taxable services
2001	360,000,000	for taxable goods
	180,000,000	for taxable services
2004	600,000,000	for taxable good and services
2010	600,000,000	for taxable good and services
2014-Current	4,800,000,000	for taxable good and services

Source: 1. Minister of Finance Decision (MFD) Number 430/KMK.04/1984, 2. MFD Number 303/KMK.04/1989, 3. MFD Number 1288/KMK.04/1991, 4. MFD Number 648/KMK.04/1994, 5. MFD Number 552/KMK.04/2000, 6. MFD Number 571/KMK.03/2003, 7. Minister of Finance Regulation (MFR) Number 68/PMK.03/2010, 8. MFR Number 197/PMK.03/2013.

3. Literature Review

This paper aims to observe the impact of the VAT threshold on reported revenue or sales. This paper contributes to the literature on several tax issues, mainly on the impact of VAT threshold, tax compliance, business information, and firm size enforcement. As a common feature of the VAT system, the registration threshold separates small firms from VAT obligations. The main reason is to reduce the compliance cost of small firms and the administration cost of the tax authority (Keen & Mintz, 2004). The authority may forgo tax revenues from these small businesses to save the administration cost needed to monitor them. The VAT revenue is more concentrated in large firms (Keen & Smith, 2006). Ebrill et al. (2001) assessed that 90 percent of VAT revenue comes from 10 percent of registered businesses.

There is no consensus on the right level of VAT threshold among countries as it is very heterogeneous. To help this out, Keen and Mintz (2004) provide a simple formula for optimal or

efficiency maximizing VAT threshold. The central idea in choosing the threshold is to trade off the lost tax revenue by raising the threshold against the administrative cost saved by tax authorities and the compliance cost saved by taxpayers. In this formula, entrepreneurs' decisions about how big to grow their firms are made independent of firm-size distortions. The optimal threshold (z*) will be higher if administration cost (A) and compliance cost (C) are higher and the marginal cost of public funds (δ), ratios of value-added to sales (v (z)), and VAT rate (t) are lower.

$$z^* = \frac{\delta A + C}{(\delta - 1)tv(z)}$$

Keen and Mintz (2004) also developed a model considering that the registration threshold may influence entrepreneurs' decisions about firm size. This concerns potential distortions arising from differential treatment of those above and below the threshold. The endogenous firm size model shows that firms with lower productivity will choose a firm size beneath the VAT registration threshold. The optimal firm size for firms with higher productivity will be more than the VAT registration threshold. Furthermore, the firm will bunch just below the threshold for intermediate productivity. Their simulation of the model using Canadian data shows that a high threshold tends to be efficiency maximizing. However, their model does not consider tax evasion. They also do not consider the type of transaction, such as B2B or B2C.

Liu et al. (2021) observe administrative tax records for U.K. businesses and find both bunching in annual turnover below the VAT registration threshold and voluntary registration by almost half of the firms below the threshold. They develop a conceptual framework for studying voluntary registration and bunching. They also incorporate the trading network in their models, such as B2B and B2C. They show that a firm is more likely to voluntarily register if the cost of inputs relative to sales is high, there is lower product-market competition, and when the proportion of B2C sales

by the firm is low. On the contrary, firms are more likely to bunch as their share of sales made to VAT-unregistered consumers rises and less likely to bunch as their taxable inputs to sales ratio rise. They also find that the VAT threshold tends to be higher with higher compliance and administration costs and less direct selling to consumers (B2C). However, they do not discuss the compliance effect of the threshold.

An emerging body of empirical evidence shows that firm size can be affected by various tax and regulatory thresholds. One of the earliest examples was conducted in Japan by Onji (2009). He examines the introduction of a VAT in Japan in 1989 with a high threshold. The new VAT system applied preferential treatment for small firms, with a cutoff for eligibility of 500 million yen (US$ 3.3 million) in sales. To identify the overall influence of a policy threshold would be to examine the size distribution of businesses in the neighborhood of the threshold. He implements kernel density estimation and compares the corporate size distributions in 1988 and 1990 using Affiliated Company Data, an annual survey of publicly traded companies that collect information on their domestic subsidiaries.

Onji (2009) finds a clustering of firms just below the threshold following the reform by comparing the corporate size distributions before and after the policy. Furthermore, he observes a decline in densities in a range above the threshold. The tax policy incentivizes a large firm to masquerade into several small firms by separately incorporating business segments.

Unlike Onji (2009), who observed the tax avoidance behavior of big firms, Harju et al. (2015) observed VAT threshold impacts on small firms in Finland. Any firm with a turnover below 8,500 euros is exempted but can voluntarily register. Finland introduces a VAT relief scheme for annual sales below 20,000 euros in 2004 and 22,500 euros in the following year. After the reform, firms can apply for a VAT relief that gradually decreases with the increase in sales from above 8,500

euros. The incentive given by this new policy is that firms above 8500 euros but below 22,500 will remit the VAT rate at 2.5% on average compared to 22%. Harju et al. (2015) use a firm's data from tax administration from 2000 to 2011. They find that the firm's bunch is actively just below the threshold, which implies significant efficiency implications. Changing tax incentives at the threshold does not significantly decrease the effect, implying compliance costs are essential to explain the observed behavior. No clear evidence of tax avoidance or evasion suggests that firms respond in actual economic activity. They find that bunching behavior is relatively permanent, which implies that the threshold decreases the growth of small businesses over the longer run.

Continuing their previous research, Harju et al. (2019) provide the mechanism of their findings from Harju et al. (2015). They can assess estimates for both the number of compliance costs and the rate elasticity. They find that the tax elasticity estimate is minimal, 0.016, and the amount of compliance costs is significant, as much as 19 percent of the value added at the threshold, translating into 1300 euros per year. As Liu et al. (2021) noted, compliance cost becomes a significant force due to the low VAT threshold.

This paper also highlights the strength of VAT in providing information to deter tax evasion. Liu et al. (2021) suggest that the threshold should be lower when firms have more B2C or VAT non-registered customers. Trading with unregistered consumers or businesses will provide less information to the tax authority, and this will weaken the effectiveness of the self-enforcement feature of VAT.

Pomeranz (2015) shows that firms that sell to final customers can underreport their sales. She analyzes the role of third-party information for VAT enforcement through two randomized experiments among over 400,000 Chilean firms. The First experiment is called the large-scale Letter Message Experiment. In this experiment, the Chilean Tax Authority sent letters indicating

an increased audit probability to over 100 thousand randomly selected firms. She finds that announcing additional monitoring fewer impacts transactions subject to a paper trail. However, firms mostly selling their products to final customers indicate increased reported sales. This shows the paper trail's preventive deterrence effect.

In the second experiment, she examines the self-enforcement hypothesis of the VAT system. It is called the Spillover Experiment. Increased tax enforcement on one firm generates spillovers to its trading partners up the VAT chain. She chooses 5600 small firms that tend to do evasion scheduled for an audit. Half received a pre-announcement that they would be audited in a certain period (the treatment group), and half were not (the control group). The spillover measurement is whether there is a difference in VAT declared by suppliers and clients of the treatment group compared to the control group before and after the audit pre-announcement was sent out. She finds that trading partners of treated firms increase their declared VAT compared to trading partners of control firms.

Naritomi (2019) also observes B2B and B2C trading as perfect examples of how information determines tax compliance and tax revenue. Third-party information from end customers, if available, could be used to check whether the registered firms have reported sales correctly. To observe that, she utilizes the anti-tax evasion program that rewards the consumers for ensuring that firms report sales and establishes a verification system to aid whistle-blowing consumers in Sao Paolo, Brazil. As the program will impact the retail most, she uses the retail (B2C) as the treatment group and the wholesale (B2B) as the control group. She finds that the retail sector reported sales increased by at least 21 percent over four years due to the program. However, firms also increased reported expenses. Thus, the tax revenue net of rewards increased by 9.3 percent.

This paper is also related to firm-size tax enforcement. As explained by Kleven et al. (2016) and shown by Pomeranz (2015), small firms tend to evade tax more than large firms. Firm size can be used as a signal of the deterrence effect of tax evasion. The propensity of small firms to do tax evasion is supported by a condition that the possibility of the firms being audited by tax officers is relatively lower than the large firms. The reason could be that the tax revenue expected from auditing the small firm is small as the tax base is relatively small compared to large firms.[29] Due to the low capacity to do an audit, many developing countries put more resources into monitoring large taxpayers. Reliance on size-dependent tax enforcement has increased as international institutions encouraged tax administration to segment taxpayers (Kanbur & Keen, 2014). Over the past 20 years, more than 70 countries adopted special enforcement units for large taxpayers (Bachas et al., 2019). Bachas et al. (2019) find that tax enforcement and compliance increase with firm size using data from firms from 140 countries.

Since 2002, Indonesia has modernized its tax offices based on taxpayer size. There are three types of tax offices: small, medium, and large. Basri et al. (2019) studied the impact of tax administration reform in Indonesia that segmented the taxpayers based on their size. They particularly highlighted the performance of the medium tax office in which the top firms in each region or province in Indonesia. They found that with a much higher staff-to-taxpayer ratio, the tax offices more than doubled tax revenue from affected firms over six years, with increasing impacts over time. With this, it can be assumed that firms' compliance is relatively increasing if medium and large tax offices monitor the firms.

[29] In Indonesia, tax offices are assigned a specific target of tax revenues yearly. This condition forces the tax offices to manage wisely their limited capacity to do tax enforcement to achieve their target.

4. Data and Methodology

4.1. Data

This study uses data from the Directorate General of Taxes of the Ministry of Finance of the Republic of Indonesia. The data used is firm data from the corporate tax return data (Form 1771).[30] It is annual data. As this paper uses the sales data of the firms, the annual sales data from corporate tax return data will be the same as accumulated monthly sales data of VAT tax return in a year or fiscal year. Any concern regarding the time difference of sale recognition can be avoided as the data used is multiple years. Any time difference in sales data will be temporary as it will be balanced off if multiple years of data are used.

To my knowledge, monthly or annual data of firms for various business sectors is not available in Indonesia. Badan Pusat Statistic Indonesia (Statistics Indonesia), the government agency that collects statistics data, does provide an annual report of micro and small firms freely but only related to specific industries and aggregated data by provinces.

The firms' or taxpayers' identity is confidential. Thus, the taxpayers' identity number is de-identified to conceal their identity. The data is available from 2007 to 2017. It provides much information on income statements like sales, cost of goods sold, salary, taxable profit, etc. It also provides nonfinancial data such as business sectors, tax offices, and provinces.

The primary variable used in this paper is the business sector. Designation of what business sector of a firm depends on the firm itself when it registers as a taxpayer and is supported by legal documentation of firm establishment. Sectors are defined according to a five-digit code of the Directorate General of Taxes Classification of Business Sectors.[31] The wholesale sectors are all

[30] Ideally, this paper should use the monthly VAT tax return data (Form 1111). However, it is not available.

[31] Based on the Decision of Director General of Taxes Number KEP-321/PJ/2012 on 10 July 2012.

sectors that start with 46 plus motor vehicle wholesale under sectors that start with 45. Retail is defined by all sectors that start with 47, plus motor vehicle retail under sectors that start with 45. The sector definition is very detailed. For instance, 465 is wholesale machinery, tools, and equipment, 4651 is wholesale computer, computer equipment, and software, and 46511 is wholesale computer and computer equipment. Throughout the paper, sector refers to the 5-digit definition.

There are 188 retail and 83 wholesale sectors. However, not all sectors are taxable. Some are exempted from VAT, like wholesalers and retailers selling plantation products. There are 22 retail sectors, and ten wholesale sectors are exempted from VAT. Thus, this paper will use 162 retail sectors and 73 wholesales sector for the primary analysis.

4.2. Methodology

I employ a quasi-experimental difference-in-difference strategy following Naritomi (2019) to show whether the high VAT threshold will make firms underreport sales. I will compare the pre-reform and post-reform revenue of firms affected by the policy to the unaffected control group of firms. The specification will be as follows:

$$\ln R_{ispt} = \eta_i + \gamma_t + \alpha_p + \beta Treat_s . Post_t + \varepsilon_{ispt} \qquad (2.1)$$

Where lnR_{ispt} is the log of reported sales or revenue of firm *i* in sector *s* time *t* and province *p*; η_i is a firm fixed effect; γ_t is a year fixed effect; α_p is a province fixed effect; β is the parameter interest, which captures the effect of threshold on treatment group after the new threshold has gone into effect. $Treat_s$ is a dummy variable for the treatment group, 1 for the wholesale sector and 0 for the control group, the retail sector. $Post_t$ is a dummy variable of the period of the new threshold applied, 1 for 2014-2017, and 0 for the period 2010-2013. ε_{ispt} is clustered by sector.

Equation (2.1) will be utilized to show the impact of the VAT threshold using balanced panel data (all firms report tax returns every year in the period 2010-2017).[32] This approach is similar to Naritomi's (2019) identification approach but in a different way of treatment and control group identification. Naritomi (2019) uses retailers as the treatment group and wholesalers as the control group. The main reason is that the program used where final customers can report their sales to the tax authority and get chances to win the lottery will impact the retail sector, not the wholesale sector. On the contrary, this paper uses the wholesale sector for the treatment group.

The retailers are assumed not to have been impacted by the new policy as there is no change in how they conduct business regarding how they issue invoices and how the customers will use them. Their customers will not report their purchases to claim VAT input before and after the new policy. Furthermore, legally the retailer can issue an invoice without any complete information about the buyers, only quantity sold, prices, and VAT.

The policy will impact the wholesale sector. Due to the very high threshold, the probability that the customers of small wholesale firms are also small businesses that are not VAT registered is more significant than under the old VAT threshold. Because the buyers are not VAT registered, they do not need to report their transactions to the tax authority to claim VAT input. Thus, there is a bigger chance for the wholesalers to cheat due to the potential increased undetected sales transaction from the tax authority. In addition, the high VAT threshold could make the small wholesalers opt to be non-VAT registered, and their sales become more undetected and act like the retail sectors.

[32] See Appendix for estimation using unbalanced panel data (repeated cross-section).

Not all firms are included in the main specification. In the basic specification, only the small firms with sales of up to 4.8 billion rupiahs before and after the new policy was implemented (period 2010-2017). Those firms are administrated in small tax offices with less capacity to monitor and audit (Bachas et al., 2019; Basri et al., 2019). This institutional difference may be related to tax evasion, like underreporting sales (Kleven & Smith, 2006; Pomeranz, 2015). Larger firms administrated in medium and large tax offices are more tax compliant (Bachas et al., 2019; Basri et al., 2019). The other reason is that limiting the revenues up to the threshold even after the policy ensures that the wholesale group can opt out of the VAT registration. This will enable us to see whether the wholesale will act like the retail as they do not have any counterpart information available to the tax authority.

The corporate tax return data does not have information on whether the firm is VAT registered. Thus, to identify that the firm is qualified for VAT registration, small firms that never had sales above 600 million rupiahs in any year from 2010 to 2013 (before the new threshold was applied) are excluded. Hence, firms in this basic specification should be registered as VAT collectors by law.

Following Naritomi (2019), this paper also runs firm-level regression in a two-period DD, for which the *t* is collapsed by *pre* and *post*. The pre-period is between 2010 and 2013, and the post-period is between 2014 and 2017. This strategy avoids a log of zero values in firms' annual data and helps address serial correlation issues when computing standard errors (Bertrand, Duflo, and Mullainathan 2004). The specification is as follows:

$$\ln R_{ispt} = \eta_i + \gamma Post_t + \beta Treat_s . Post_t + \varepsilon_{ispt} \qquad (2.2)$$

When firms increase their capacity to earn more revenue, their cost will increase simultaneously to show a real economic response. It should also be the case when the firms are in a downturn. A

lower reported sales will be followed by lower direct costs (for example, cost of goods sold). However, as noted by Pomeranz (2015), in the case of tax evasion, sales underreporting must be greater than cost underreporting.[33] To highlight this condition, the cost of goods sold is used as the dependent variable with the exact specification with equation (2.1).

5. Result

5.1. Descriptive Data and Parallel Trend

Table 2.3 describes the data of the firms used in this paper. The qualified firms are the firm that exists or reports corporate tax returns every year before (period 2010-2013) and after (period 2014-2017) the new policy. The total observation for the main specification with the balanced panel is 33,784 observations from 4,223 firms.[34] The mean sales of wholesale firms (the treatment group) increased from 2010 to 2012 and decreased from 2013 to 2017. The mean sale of retail firms (control group) also increased from 2010 to 2012 but decreased only from 2013 to 2015. It increases again from 2016 to 2017.

Figure 2.2 shows the revenue trend in log revenue. The estimates of DD regression will be valid if there is a parallel trend in sales between wholesale and retail before the new threshold takes place. This condition is needed to ensure that the change in the difference in log revenue between the two groups is due to the new policy. From Figure 2.2, it can be interpreted that the two groups have a parallel pre-treatment trajectory. They started to be different trajectories when the VAT

[33] An intuition is also given by Naritomi (2019). Let value added be VA= Y - C, where Y is reported revenue and C is reported costs, and let $\partial^x = \Delta x/x$ be the change in variable x. $\partial^{VA} = \frac{\partial^Y Y - \partial^C C}{Y - C}$. If $\partial^Y = \partial^C = \bar{\partial}$, $\partial^{VA} = \bar{\partial}$. Also, if $\partial^Y < \partial^C, \partial^{VA} < \partial^Y$. The interpretation is that a firm should reports more decrease in revenues than the costs to get a benefit in term of lower VAT liability or profit as a base of income tax calculation.

[34] For the unbalanced panel, in which not all firms report tax returns yearly, the number of observations becomes higher by 42,670 observations from 5,269 firms. The tax return compliance was around 50% to 60% based on Annual Report of Directorate General Taxes of Ministry of Finance of Republic of Indonesia 2016.

threshold changed in 2014. In 2016 both groups had another different slope, further examined later in the paper.

Table 2.3: Descriptive Statistics

	Observations	Mean (Million IDR)	SD	Year
Wholesales Firms				
Reported Revenue	2,902	1,630	895	2010
Reported Revenue	2,902	1,840	954	2011
Reported Revenue	2,902	1,930	958	2012
Reported Revenue	2,902	1,910	1,000	2013
Reported Revenue	2,902	1,740	1,140	2014
Reported Revenue	2,902	1,640	1,190	2015
Reported Revenue	2,902	1,570	1,230	2016
Reported Revenue	2,902	1,530	1,330	2017
Retail Firms				
Reported Revenue	1,321	1,640	896	2010
Reported Revenue	1,321	1,840	909	2011
Reported Revenue	1,321	1,960	958	2012
Reported Revenue	1,321	1,880	949	2013
Reported Revenue	1,321	1,810	1,070	2014
Reported Revenue	1,321	1,790	1,180	2015
Reported Revenue	1,321	1,850	1,260	2016
Reported Revenue	1,321	1,840	1,390	2017
	33,784	1,750	1,100	

Figure 2.2: Log Revenue Trend: Wholesale vs Retail

As in Naritomi (2019), the reported revenues move together until the policy change. To ensure the pretreatment trajectories are parallel, this study tests the linear-trends model coefficient that shows the differences in the trends between treated and controls. If the pretreatment trends are linear in both groups, then the coefficient will be 0 because there are no differences in the slopes between the two groups.[35] Hence, by testing this coefficient against 0, we have a test of the null hypothesis that the pretreatment period trajectories are parallel. This paper finds that the F-test for this parallel trend is statistically insignificant. It means that the null hypothesis cannot be rejected.[36] The data are consistent with a pretreatment parallel trend which is confirmed visibly in Figure 2.2.

This paper also examines whether there is a treatment effect in anticipation of the treatment that can contaminate the parallel-trends assumption. To test this assumption, this paper fits a Granger causality model, which augments the model with dummies that indicate future treatment status for each period before the treatment. A joint test of the coefficients on these dummies against 0 can be used to test the null hypothesis that no anticipatory effects have occurred. This paper finds that the F-test for this anticipation of treatment is statistically insignificant. [37] Thus, there is no effect in anticipation of a significant VAT threshold increase in 2014.[38] The regulation was signed and released in mid-December of 2013 and implemented on the first day of 2014. Hence, it is assumed that the two groups have a limited time to anticipate the new policy.

---

[35] Treatment effect manual in Stata 17.

[36] The parallel trend test shows F (1,155) = 0.03 and Prob>F = 0.8718. It means the null hypothesis that the linear trends are parallel cannot be rejected.

[37] Granger causality test in Stata 17 using command *estat granger*. It shows F (3,155) =1.42 with P>F = 0.2395. It means that the null hypothesis (no effect in anticipation of treatment) cannot be rejected.

[38] Regulation of Minister of Finance of The Republic of Indonesia Number 197/PMK.03/2013 on Amendment of Regulation of Minister of Finance of The Republic of Indonesia Number 68/PMK.03/2010 on Small Entrepreneur Threshold of Value Added Tax.

5.2. Main Result

Table 2.4 shows the regression result using DD specification for the new VAT threshold. All interest estimates show that the new policy program will tend to reduce reported sales for four years. Column 2 shows the DD coefficient from estimating equation (2.1), and column 3 shows the coefficients from estimating equation (2.2). Columns 1 and 2 show that wholesale sales are 58 percent lower compared to retail firms for four years period the policy was implemented. If the data collapse before and after the policy, as shown in column 3, the wholesale group reports fewer sales at 21 percent than the retail group.[39] The decrease is sizable and shows that the high threshold motivates the firms to lower sales.

Table 2.4: VAT Threshold Effect-Wholesale versus Retail

	Log Reported Revenue		
	(1)	(2)	(3)
DD (Post 2014 x Wholesale)	-0.5811***	-0.5819***	-0.2149
	(0.1592)	(0.1591)	(0.1505)
Firm Fixed Effect	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes
Provinces Fixed Effect	No	Yes	No
Observation	33,784	33,784	8,446
Firms	4,223	4,223	4,223
Sector	156	156	156

Standard errors in parenthesis cluster at the sector level. * p<0.1, ** p<0.05, *** p<0.01.

5.3. Other Programs Effect

5.3.1. Turnover Income Taxes for Small Firms in Mid-2013

In July 2013, the authority released a new regulation called a turnover tax in which firms with revenues up to 4.8 billion IDR (the same threshold for VAT registered) in a year can calculate their

[39] The wholesale reports lower revenues by 57-58 percent and by 29 percent if the data are collapsed into two periods using unbalanced panel data. Appendix B provides estimates using unbalanced panel data.

income tax liabilities using revenue only.[40] The tax rate is 1 percent of the revenue reported and paid monthly. The firms will report the aggregated 12 months' revenues and tax payments in the yearly income tax return (Form 1771). The presumptive tax policy is intended to help micro and small businesses to comply with income tax liability by providing a simple calculation and a low tax rate. Even though their obligation to provide income statements is still the same, their concentration will be entirely on reported revenues. The tax is final, meaning there is no recalculation or adjustment for income tax liability due to tax credits or other fiscal adjustments in income tax reporting. If a qualified firm does not want to use the turnover tax, it can still use the standard corporate income tax with a 25 percent income tax rate on net income.

Several studies observe the impact of this policy on firms' behavior. At first impression, the turnover tax rate seems low enough to induce the firms to use it. However, Nurfauzi et al. (2019) find that firms with revenues around the threshold tend to stay above the threshold. It is the opposite result in developed countries (Nurfauzi et al., 2019).

Himawan (2021) studies the behavioral responses to implementing the turnover tax in 2013 and the expansion of the VAT registration threshold in 2014. His findings are similar to Nurfauzi et al. (2019), that the firms bunch just above the threshold in 2013 to avoid the turnover tax regime. However, for the VAT threshold in 2014, firms in the turnover regime bunch just below the threshold to avoid the VAT registration threshold. He further emphasized that in 2013, firms proportionally increased direct input as they increased output to avoid falling into the turnover tax regime. In 2014, firms in the turnover tax regime disproportionately decreased direct input and thus got higher profit margins as they reduced output to avoid the VAT system (Himawan, 2021).

[40] Regulation of Government of The Republic of Indonesia Number 44 of 2013 on Income Tax on Business Earned by Taxpayer with Certain Turnover.

Both studies find that the effective income tax rate for firms around the threshold is below 1%. Hence, a turnover tax rate of 1% is too high for small firms.[41] It can be inferred from their finding that firms in Indonesia will not reduce their capacity or revenue to qualify for the turnover tax regime as the tax burden is higher. Thus, the turnover tax regime is assumed not to impact the reported revenue.

Figure 2.2 also supports this assumption as the slope of the mean of log-reported revenue does not decline in 2013 but in 2014. The turnover tax will also not impact the firms because, in this part, this paper has already cut down the number of firms based on the revenue up to the turnover tax threshold. Both groups are firms from 2010 to 2013 with revenue above 600 million IDR up to 4.8 billion IDR. Thus, it could be expected that the firms stay away from the behavior impact of the new income tax policy as there is no need to reduce sales to be eligible in the turnover tax regime.

However, the turnover tax regime will impact the firms in another way. It could be the case that small firms misreport their revenues.[42] Some firms report zero revenues in their tax return even though they have paid the turnover taxes. Thus, this paper aims to adjust or recalculate the revenues reported by some firms.[43]

Figure 2.3 shows the trend for adjusted revenues of balanced panel data. The difference between the two groups is wider with adjusted reported revenues, and the down-sloping trend posttreatment is smoother than using the non-adjusted reported revenues. In Figure 2.2, we find a

[41] In mid-2018, the authority changes the turnover tax rate to 0.5%.

[42] It may be intentional or unintentional.

[43] If a firm reported zero revenue but paid a turnover tax, for example, 1 million IDR, the correct revenue it has to report is 100 million IDR (1 million/1%). Small firms may misunderstand how to report income tax returns if they use the turnover tax. As the turnover tax is final, it could be the case that they consider not reporting any revenues in the tax return as their tax liability is done.

clear difference in the trend line in the year 2016 for both groups. However, in Figure 2.3, it is still seen but less clear than in the previous graph. Hence, we still need to address that in the later section to show whether another policy occurred in that period.

Table 2.5 shows the DD estimates for adjusted revenues reported. Column 1 shows the DD coefficient from estimating equation (2.1) and column 2 for equation (2.2). As shown in column 1, the VAT threshold policy will decrease sales reported by wholesale firms by 70 percent for four years. The impact is much more significant than the previous result shown in Table 4 (58 percent). If the data is collapsed into two periods, the impact of the policy shows that the wholesale group reported fewer revenues by 27 percent than the retail, larger than the previous estimates (21 percent).[44]

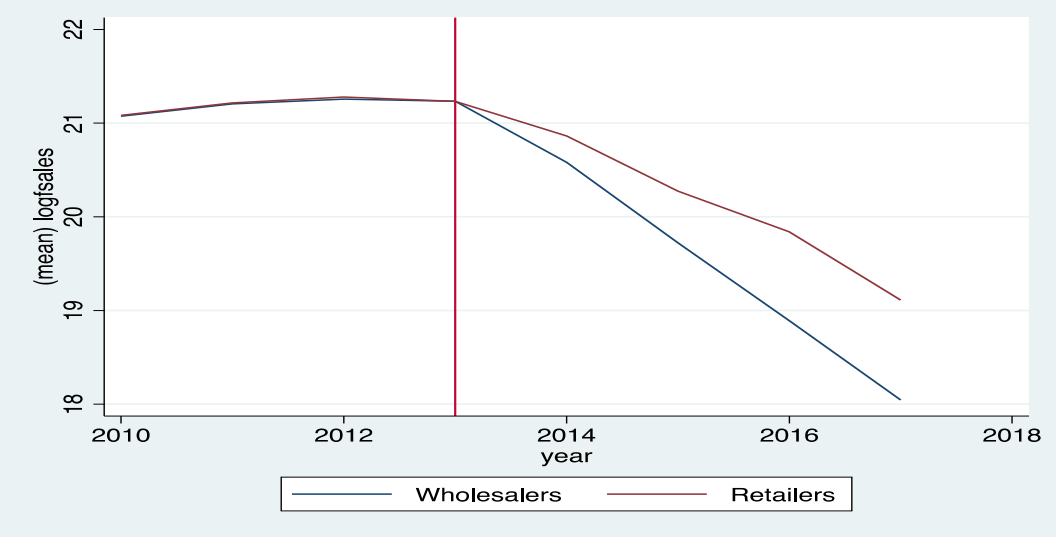

Figure 2.3: Reported Adjusted Revenues: Wholesale and Retail

[44] The wholesale reports lower revenues by 71 percent and by 35 percent if the data is collapsed into two periods using unbalanced panel data.

Table 2.5: VAT Threshold Effect-Wholesale versus Retail (Adjusted Revenues)

	Log Reported Revenue	
	(1)	(2)
DD (Post 2014 x Wholesale)	-0.7018***	-0.2728*
	(0.1612)	(0.1438)
Firm Fixed Effect	Yes	Yes
Time Fixed Effect	Yes	Yes
Provinces Fixed Effect	Yes	No
Recalculated Revenue	Yes	Yes
Observation	33,784	8,446
Observation Recalculated	421	421
Firms	4,223	4,223
Sector	156	156

Standard errors in parenthesis cluster at the sector level. * p<0.1, ** p<0.05, *** p<0.01.

5.3.2. E-Invoice (Staggered Program)

In mid-2014, The government introduced a new regulation on digital invoices (e-invoices).[45] The purpose of digital invoices is to ease the tax authority to monitor trading transactions in real time. The new system will strengthen and automate compliance checks. Formerly, firms issued invoices manually and reported their transaction monthly. Then, the old system in DGT record and match the reported input and output invoices. This raises problems in tax administration as the number of taxpayers and transactions increases. Meanwhile, DGT faced many fictitious or duplicated invoices that caused revenue loss.[46]

The new regulation requires firms to make invoices using an application or electronic system provided by DGT. The implementation of this policy is staggered with three phases. In the first phase, 45 firms were chosen from Large, Special, and Medium Tax Offices to implement e-invoices in July 2014. In the second phase, e-invoices were implemented in Java and Bali islands

[45] Regulation of Directorate General of Taxes Number 17/PJ/2014.

[46] There were 100 cases of fictitious invoices identified by DGT that caused tax revenue loss of 1.5 trillion IDR in 2008-2013.

in July 2015. Finally, all registered firms in Indonesia must use e-invoices in July 2016. Based on those phases, it can be assumed that the new policy will ultimately impact small firms in 2016.

The impact of e-invoices on reported revenues still needs to be determined on their effectiveness on tax compliance. E-invoices enable a massive, efficient, timely cross-check (Ebrill et al., 2001). Bellon et al. (2022) show that small firms increase reported revenues due to e-invoices. However, the impact of massive cross-checking depends on credible enforcement and follow-up efforts (Carillo et al., 2017). The overall effect is conditional on the taxpayer's perception of detection probability and capacity to make an offsetting adjustment on other margins (Slemrod, 2019; Scholz & Pinney, 1995; Nevarez, 2016; Carillo et al., 2017).

Figure 2.2 shows a clear difference in the slope of reported revenues from both groups using unadjusted reported revenue. On the other hand, using adjusted reported revenue, it is less evident in Figure 2.3. However, both still show a downward trend of reported revenues from both groups until 2017. It is a unique observation as it is reasonable to think that in any technology introduced for better administration, the firms may perceive that the authority increases its tax evasion detection capacity. As an impact, they may report the reported revenue correctly in the short term. However, this policy may have an insignificant or less impact on the retail group as they still do not have counterpart information in DGT's system. Neither do the wholesale firms if their customers are nonregistered businesses or they choose to be out of the VAT system.

To fulfill our curiosity, this paper examines the impact of e-invoices on reported revenues using DD regression. Thus, we need to do DD regression with two policies in 2014 and 2016 as follows:

$$\ln R_{ispt} = \eta_i + \gamma_t + \alpha_p + \beta_1 Treat_s . Post_{t1} + \beta_2 Treat_s . Post_{t2} + \varepsilon_{ispt} \qquad (2.3)$$

Where $Post_{t1}$ takes a value of 1 if 2014≤ t < 2016 and 0 otherwise and $Post_{t2}$ takes a value of 1 if t ≥ 2016 and 0 otherwise. This specification makes it possible to differentiate between the effect of the new VAT threshold and e-invoices on reported revenues. β_1 gives the effect of the former, β_2 the latter. The explanation for other variables is similar to equation (2.1).

The results from estimating equation (2.3) are shown in Table 2.6. The coefficient in columns 1 and 2 indicates that the magnitude of the negative effect of the new VAT threshold on reported revenues is smaller than the effect estimated in column 2 of Table 2.4 and column 1 of Table 2.5, respectively. The coefficient on ($Treat_s.Post_{t2}$) indicates that the difference in reported revenues between the treated and control groups was increasing in the post-e-invoices period 2016-2017. The result can be interpreted that the impact of the new VAT Threshold on lower reported revenues is more substantial even in the e-invoices policy for the wholesale group. As a result, the next part of this paper will only consider the impact of the VAT threshold on reported revenues.[47]

Table 2.6: Two Policies Effects: Wholesale versus Retail

	Log Reported Revenue	
	(1)	(2)
DD (Post 2014-2015 x Wholesale)	-0.0022**	-0.1959
	(0.1312)	(0.1235)
DD (Post 2016 X Wholesale)	-0.6606***	-0.7263***
	(0.2014)	(0.2001)
Firm Fixed Effect	Yes	Yes
Time Fixed Effect	Yes	Yes
Provinces Fixed Effect	Yes	Yes
Recalculated Revenues	No	Yes
Observation	33,784	33,784
Observation Recalculated	No	421
Firms	4,223	4,223
Sector	156	156

Standard errors in parenthesis cluster at the sector level. * p<0.1, ** p<0.05, *** p<0.01.

[47] Similar results and conclusions are obtained using unbalanced panel data.

6. Robustness Check

6.1 Firms with Revenue above 600 Million up to 4.8 Billion IDR Every Year in 2010-2013

In the basic specification, we restrict the sample before and after treatment with revenue above 600 million IDR and up to 4.8 billion IDR to ensure the firms should be VAT registered before the VAT threshold new policy and are eligible to be out of the VAT system after the policy. In this section, we lose the restriction post-treatment by allowing both groups can grow above the threshold. This approach aims to observe whether the firms still in the VAT system also act like in the basic specification. The wholesale group can reduce reported sales if most buyers are non-registered businesses. There is no impact on the retail group as there is still no information available for tax authorities about their buyers.

The number of observations increases in this identification. There are 44,824 observations from 5,603 firms for balanced panel data. Figure 2.4 shows a similar trend with the basic specification. The two groups started to make a different trend in 2014. The null hypothesis of linear trends is parallel for balanced panel data is satisfied.[48]

Table 2.7 shows the estimates of the VAT threshold effects for both groups. Columns 1 and 2 show the DD coefficient from estimating equation (2.1), and column 3 for equation (2.2). All estimates show that the wholesale group reported fewer revenues than the retail group for years since the new policy was implemented. The wholesale reports lower revenues by 46 to 55 percent and by 21 percent if the data is collapsed into two periods.[49]

[48] The parallel trend test shows F (1,164) = 0.05 with Prob > F = 0.8264. It means the null hypothesis that linear trends are parallel cannot be rejected.

[49] The wholesale reports lower revenues by 47 to 57 percent and by 28 percent if the data are collapsed into two periods using unbalanced panel data.

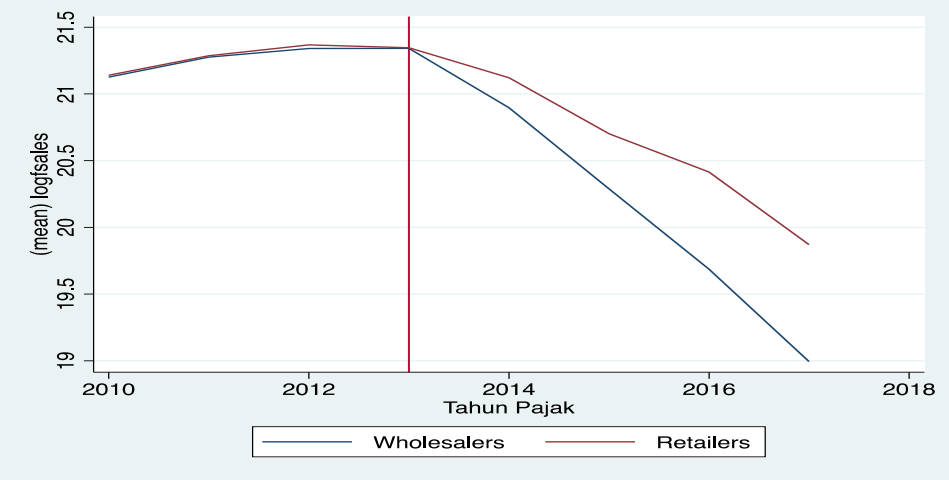

Figure 2.4: Trend Log Reported Revenue (Adjusted) of firms with Revenue above 600 million up to 4.8 billion IDR Every Year in 2010-2013

Table 2.7: VAT Threshold Effect of Firms with Revenue above 600 Million up to 4.8 Billion IDR Every Year in 2010-2013

	Log Reported Revenue		
	(1)	(2)	(3)
DD (Post 2014 x Wholesale)	-0.4556***	-0.5454***	-0.2086*
	(0.1620)	(0.1443)	(0.1114)
Firm Fixed Effect	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes
Provinces Fixed Effect	Yes	Yes	No
Recalculated Revenue	No	Yes	Yes
Observation	44,824	44,824	11,206
Observation Recalculated	No	481	481
Firms	5,603	5,603	5,603
Sector	165	165	165

Standard errors in parenthesis cluster at the sector level. * p<0.1, ** p<0.05, *** p<0.01.

6.2 Firms with Revenue above 600 million IDR Every Year in 2010-2013

This section aims to increase the sample of the firms. All firms reported revenues above 600 million IDR yearly before the new policy is qualified. The firms should be registered businesses by law before the new policy. This section observes whether including larger firms administrated in small firms will change the result obtained in the main specification. Larger firms are more monitored than small firms in the small tax offices, as every tax office has a yearly tax revenue

target to achieve. Larger firms could also see an opportunity to report less revenue as more firms could be out of the VAT system.

The observations are 135,152 from 16,894 firms for balanced panel data. Figure 2.5 shows the trends of revenues (adjusted) for both groups. The two groups started to make a different trend in 2014. The null hypothesis of linear trends is parallel is satisfied.[50] Table 2.8 estimates the VAT threshold effect on reported sales. All estimates show that the wholesale group reports fewer revenues for four years. The estimates of the balanced panel data show that the wholesale groups reported lower revenue than the retail group by 37 to 42 percent for four years. [51] If the data are collapsed into two periods (column 3), the estimates are lower than those in the previous section. The wholesale reported lower revenues by 18 percent than the retail. These estimates support the argument that a high VAT threshold affects the wholesale group reporting fewer revenues. In addition, introducing larger firms tends to reduce the negative impacts of the new VAT threshold.

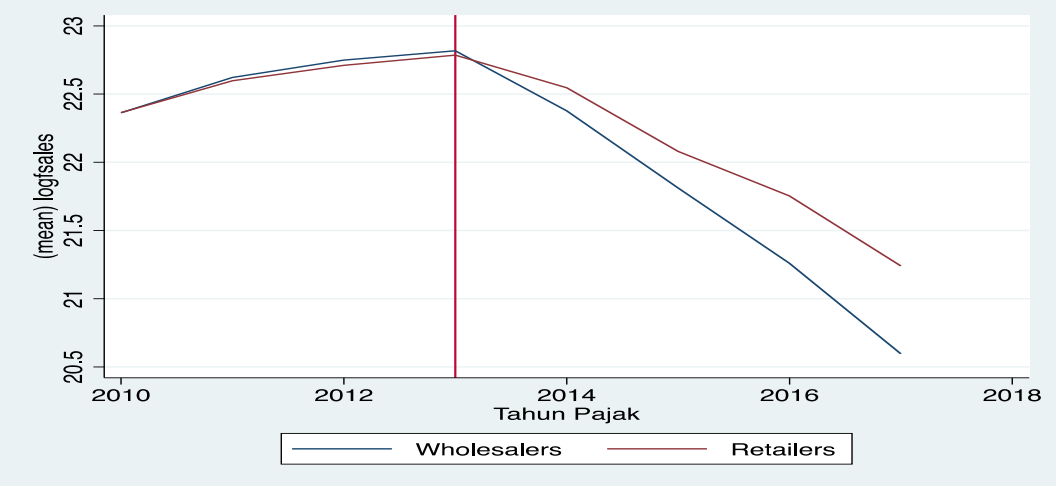

Figure 2.5: Trend Log Revenue (Adjusted) of Firms with Revenue above 600 million IDR Every Year in 2010-2013

[50] The parallel trend test shows F (1,186) = 0.89, Prob > F = 0.3465. It means the null hypothesis that the linear trend is parallel cannot be rejected.

[51] The wholesale reports lower revenues by 32 to 37 percent and by 19 percent if the data are collapsed into two periods using unbalanced panel data.

Table 2.8: VAT Threshold Effect for Firms with Revenue above 600 million IDR Every Year in 2010-2013

	Log Reported Revenue		
	(1)	(2)	(3)
DD (Post 2014 x Wholesale)	-0.3715**	-0.4206***	-0.1803**
	(0.1695)	(0.1549)	(0.0900)
Firm Fixed Effect	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes
Provinces Fixed Effect	Yes	Yes	No
Recalculated Revenue	No	Yes	Yes
Panel	Balanced	Balanced	Balanced
Observation	135,152	135,152	33,788
Observation Recalculated	No	644	644
Firms	16,894	16,894	16,894
Sector	187	187	187

Standard errors in parenthesis, cluster at the sector level. * p<0.1, ** p<0.05, *** p<0.01.

6.3 Firms with Revenue above 600 million IDR Any Year in 2010-2013

This study aims to observe more of the impact of the new threshold on both groups' reported revenues. In this section, the firms do not need to report 600 million IDR every year before the policy was implemented but just in any year before the policy. Thus, the firms could be considered registered businesses by law. By this category, smaller firms can be qualified.

The number of observations and firms increases significantly for balanced panel data into 233,032 observations from 29,129 firms. Figure 2.6 shows the trend of reported revenues (adjusted) for the two groups. The mean log reported revenues are lower than the previous identifications due to more firms with revenues lower than 600 million IDR before the policy was implemented being included. Figure 2.6 shows a different trend from other previous figures. There is a clear gap and slightly different slopes before the policy implementation for both groups in this category, while the previous trends are always close and similar. Especially both groups have

slightly different slopes in 2012 and 2013. The parallel trends can be statistically rejected for balanced panel data.[52]

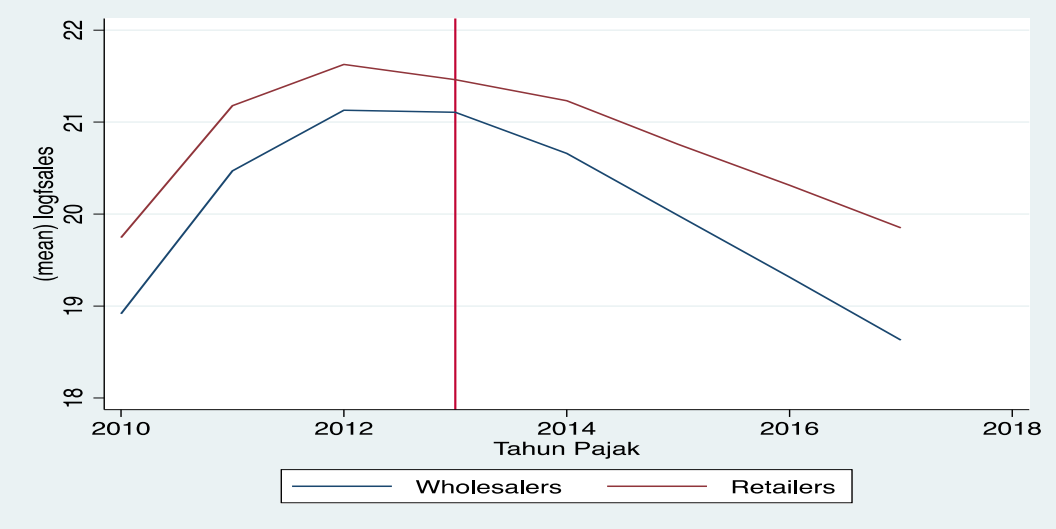

Figure 2.6: Log Reported Revenue (Adjusted) for Firms with Revenue above 600 million IDR Any Year in 2010-2013

Table 2.9 shows the estimates for the VAT threshold effect on reported sales. While the parallel trends are not satisfied, all estimates still show that the wholesale group reports fewer revenues for four years. The results show that the wholesale groups reported less revenue than the retail group by 24 to 30 percent for four years.[53]If the data is collapsed into two periods (column 3), the wholesale reported lower reported revenues by 27 percent than the retail in four years. These estimates support the argument that a high VAT threshold affects the wholesale group reporting fewer revenues even using a larger sample of firms. However, the magnitude of the impact becomes lower.

[52] The parallel trend shows F (1, 193) = 3.33, Prob > F = 0.0695. The null hypothesis that the linear trend is parallel can be rejected at a 10% significance level. For unbalanced panel data, the rejection is even stronger. With a higher number of firms and sectors (290,339 firms and 195 sectors), the parallel trend shows F (1,194) = 4.43, Prob > F = 0.0367. The null hypothesis that the linear trend is parallel can be rejected at a 5% significance level.

[53] The wholesale reports lower revenues by 22 to 28 percent and by 41 percent if the data are collapsed into two periods using unbalanced panel data.

Table 2.9: VAT Threshold Effect for Firms with Revenue above 600 million IDR Any Year in 2010-2013

	Log Reported Revenue		
	(1)	(2)	(3)
DD (Post 2014 x Wholesale)	-0.2419	-0.2973*	-0.2733*
	(0.1794)	(0.1720)	(0.1461)
Firm Fixed Effect	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes
Provinces Fixed Effect	Yes	Yes	No
Recalculated Revenue	No	Yes	Yes
Panel	Balanced	Balanced	Balanced
Observation	233,032	233,032	58,258
Observation Recalculated	No	1,667	1,667
Firms	29,129	29,129	29,129
Sector	194	194	194

Standard errors in parenthesis cluster at the sector level. * p<0.1, ** p<0.05, *** p<0.01.

7. Real Economic Responses or Tax Evasion

In this section, this paper aims to observe whether the lower reported revenues are due to real economic responses or tax evasion activities. Table 2.10 shows the regression result using generalized DD specification for the impact of the new VAT threshold on the reported cost of goods sold (COGS). Samples of firms used align with the previous section for estimating the impact of the policy on reported revenues (the main specification and other three approaches of robustness test). However, the number of samples is lower than in the previous sections due to some firms reporting negative COGS or a very high ratio of COGS to sales. Those firms are excluded to reduce the noise (unreasonable) in the mean of reported COGS. The firms that are included in this section are the firms that reported maximum COGS twice than reported revenues.[54]

[54] It is still not normal for a firm to have a COGS larger than revenues as it must have other direct and indirect costs such as wages or salary, selling and administration costs, but it could happen sometimes. In the medium run, this firms should be out of businesses (not exist).

All estimates in every column in Table 2.10 show that the impact of the VAT threshold on reported cost is negative.[55] The wholesale groups were not only reporting fewer reported revenues but also reporting fewer costs. This response could be interpreted as the actual economic impact, as lower reported revenues cause lower reported costs. However, it could also lead us to the other interpretation. If the reported revenues estimates are much lower than the reported costs estimate, it may indicate tax evasion (underreporting revenues) activities.

Table 2.11 shows the comparison of estimates for reported revenues and costs. The wholesale reported higher decreases in revenues than costs in the four categories of samples. It can be concluded that the high VAT threshold induces the firms to underreport revenues. The fewer reported revenues are not only due to real economic responses but also due to tax evasion activities.

Table 2.10: VAT Threshold Impact on Reported Cost: Wholesale vs. Retail

	Log Cost			
	(1)	(2)	(3)	(4)
DD (Post 2014 x Wholesale)	-0.5397***	-0.3846**	-0.3582**	-0.2030
	(0.1901)	(0.1549)	(0.1426)	(0.1751)
Firm Fixed Effect	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes
Provinces Fixed Effect	Yes	Yes	Yes	Yes
Observation	29,064	39,168	126,768	211,408
Firms	3,633	4,896	15,846	26,426
Sector	151	161	186	194

Standard errors in parenthesis, cluster at the sector level. * p<0.1, ** p<0.05, *** p<0.01.

[55] It is also valid for unbalanced panel data.

Table 2.11: Comparison of Estimates

Firm Types	DD estimates for Wholesale vs Retail	
	Reported Lower Revenues (%)	Reported Lower Costs (%)
Main Spesification	58-70	54
Robustness Check:		
1. Revenue above 600 million up to 4.8 billion IDR every year in 2010-2013	46-55	38
2. Revenues above 600 million every year in 2010-2013	37-42	36
3. Revenues above 600 million IDR in any year in 2010-2013	24-30	20

8. Conclusion and Recommendation

This paper studies the impact of the VAT threshold on reported revenues. Many studies have observed the VAT threshold impact on a firm's behavior, but none have been conducted specifically to observe underreporting revenues. Some studies have observed bunching phenomena around the threshold (Liu et al., 2021; Himawan,2021; and many others), squeezing the size of the large firm into smaller firms (Onzy, 2009), or just seeing real economic responses for a low threshold (Harju et al., 2019). The existence of a threshold will be counterproductive in its strength of providing transaction information, especially if the VAT threshold is set at a high level. Due to a lack of trading information, the tax authority will have more difficulties assessing the correct tax obligation owed by the taxpayers.

This paper finds that small firms will report lower revenues when the VAT threshold is high. Small firms (which reported revenues from 600 million to 4.8 billion IDR) in the wholesale sectors will report lower revenues by 58-70 percent for four years than those in the retail sectors using generalized DD specification. Using 2x2 DD specification, the impact is lower. The wholesale groups report lower revenues by 21-27 percent than the retail groups. The impact of the VAT

threshold on reported revenues becomes lower when more firms in terms of revenues are included in the regression. The wholesale reports lower revenues by 24-55 percent (using generalized DD specification) or 18-27 percent (using 2x2 DD specification) than the retail. When introducing more firms (smaller sizes of firms) into the regression, the parallel trend assumption can be rejected. However, the estimates still show that the VAT threshold can reduce reported revenues. This paper also finds that the decrease in reported revenues is larger than the reported costs. This may lead us to conclude that the lower reported revenues are due to tax evasion (underreporting revenues).

Small firms use several potential mechanisms. First, due to the high threshold, the small firms that formerly registered businesses are out of the VAT system. These firms do not need to report monthly VAT return that provides trading information to the tax authority. No counterpart information will be available to the tax authority as there is no VAT credit. The second possible way is that the firms' buyers become non-VAT registered. These firms will not provide information on their inputs or purchases to the tax authority. The latter mechanism put the wholesale firms to act like the retail sectors when their customers do not have any incentive or interest to claim their purchases for VAT credit.

The policy implication for this finding is to reduce the VAT threshold. The majority of firms in Indonesia are under this threshold.[56] As the tax authority tends to utilize advanced technologies to monitor tax compliance, the lower threshold will provide more information to generate more

[56] Based on tax administration data, about 86% of firms from all sectors had reported annual revenues of up to 4.8 billion IDR in 2014-2017. Based on Economic Census in 2016 conducted by Statistics Indonesia, 26.42 million businesses or 98,9% of total recorded businesses (firms and individuals), have annual revenues below 2.5 billion IDR.

tax revenues.[57] In addition, small tax offices need to strengthen their capacity to monitor compliance due to the high tendency of small firms to tax evasion.

This paper cannot estimate the overall impacts of the result on VAT revenue as it needs complete information on the VAT returns of the firms. This paper has a limitation as it uses corporate tax returns data. Using firms' monthly VAT return data can have a better picture in several ways. First, it can identify which firms are registered businesses, as here, this paper uses a proxy for a registered business. Second, tax revenue impacts could be estimated since VAT returns will provide the reported inputs. However, it is quite apparent, or intuitively that VAT revenue will be lower due to the VAT threshold and tax evasion. These results will also impact the income tax revenue since revenues and inputs are used to assess the income tax liabilities. Future research is still open to better results if the VAT returns are available. Other firms from different sectors may also do the underreporting of revenues. Still, the identification is rather difficult as the customers cannot be clearly defined as businesses or final customers.

[57] Currently, the tax authority is developing an advanced tax system called core tax and continuing to enhance the e-invoice system.

Chapter 3 - Household's Choice of Cooking Fuel and Energy Policy in Indonesia

1. Introduction

Cooking fuel has become an interesting discussion component regarding air pollutants, family health, women's empowerment, and economic development (Heltberg, 2005; Bharati et al.,2021). Household air pollution from inefficient fuel combustion is among today's most critical global environmental health risks (WHO, 2018). Almost 3 billion people in developing countries still depend on solid fuels such as fuelwood, animal dung, charcoal, crop wastes and coal for cooking and heating (WHO, 2018). Dirty cooking fuel causes 4 million premature deaths yearly among children and adults from respiratory illness, cardiovascular diseases, and cancer (WHO, 2018). The transition to clean cooking fuel may help to reduce those problems, especially in developing countries.

Many studies have examined the determinants of household behavior in choosing cooking fuel and its transition to cleaner energy. Income or wealth is one of the main factors in choosing cooking fuel (Leach, 1975; 1992; Kroon et al., 2013, among others). A household with more income or wealth can afford cleaner cooking fuel and appliances. This phenomenon is often called an energy ladder hypothesis, where households switch to cleaner cooking fuel as they become more affluent. The energy ladder ranks cooking fuel according to quality, ease of use, and price, from solid fuels such as wood and coal at the bottom, liquid fuels such as kerosene and gas in the middle, and finally, electricity at the top (Leach 1992, 1975: Rahut et al., 2020).

Meanwhile, some studies observe that households can have more than one type of cooking fuel (Kroon et al., 2013; Masera et al., 2000). They can switch to cleaner fuel but still maintain the previous ones. This is called an energy stacking hypothesis. This behavior is motivated by

tradeoffs due to the affordability and accessibility of the fuels. Clean cooking fuel is relatively more expensive than unclean ones, and this expense will cause problems for households with budget constraints.

Furthermore, there may be supply constraints. Clean cooking fuel is also easier to find in big cities than less populated areas. It will cause unpleasant experiences for the households if they want to use clean energy but are unavailable or wait for the unreliable distribution schedule. This means that energy transition is a complex phenomenon. In addition, some studies also find that determinants of household in choosing cooking fuel could differ in different places due to social, economic, and cultural dynamics (Abdullah et al., 2022, among others).

Indonesia has one of the highest percentages of households using fuelwood traditionally, in addition to China, India, and Pakistan from 1980 to 2010 (Bonjour et al., 2013). Firewood is easier to find and cheaper than modern fuels such as oil and gas. Fuelwood could be collected from fallen branches of trees along the village road, yard or in the forest. Andadari et al. (2014) observed that 67% of fuelwood users did not buy firewood as there is abundant firewood for free, mainly in rural areas. This could be counterproductive to the energy ladder hypothesis, and households could be reluctant to use cleaner energy as they are incentivized to use unhealthy cooking fuel to save money. This behavior may not be considering negative health externalities and their value that could be more costly than the saved money in the long run.

Kerosene was introduced intensively and extensively by the government of Indonesia in the 1960s (Sosiawan et al., 2011). As kerosene is subsidized, people are incentivized to use it for cooking. Then not very long, kerosene was the most used non-traditional fuel for cooking, leaving behind electricity and gas. In 2004 and 2006, kerosene users were 88.9% and 85% of households, respectively (BPS, 2007).

At the end of 2007, the government introduced a mega energy conversion program to push the public to switch from Kerosene to Liquified Petroleum Gas (LPG) which is more modern, easier to use, and cleaner than kerosene. Due to the program's complexity, the conversion spanned multiple years and targeted first the most populated areas in Indonesia. The government has provided 57 million LPG starter kits across Indonesia's regions from 2007 to 2013. However, until 2019, approximately 14.9 million households still cook using firewood (Kitt & Yates, 2020).

This paper studies the factors or determinants of households' cooking fuel choices in Indonesia and the impact of the mega conversion program on the choice of clean energy in the early implementation period. Families use several cooking fuels to prepare food. Cooking fuels commonly used are fuelwood, charcoal, kerosene, liquified petroleum gas (LPG), city gas, and electricity. Like many studies on several countries, the rich data from the national socioeconomic survey will be used. As the behavior of urban and rural households could differ, this paper also observes both urban and rural households' behaviors.

This study adds value to the existing research in several ways. First, this paper introduces the public policy variable corresponding to the LPG starter kit program in addition to affordability and accessibility of cooking fuel variables that have been the main factors from the previous studies. The public policy variable is the number of LPG kits distributed across provinces in Indonesia since the mega energy program was initiated. Second, rather than using only one period of survey data (Rahut et al., 2020; Kojima et al.,2011), this paper uses three waves of nationally representative datasets from Indonesia to observe the impact of the energy program. Third, this paper adds value to studies of cooking fuel used in Indonesia. Some recent studies have been conducted on determinants and energy transition of cooking fuel used. However, most of them focus on using LPG alone (Kojima et al., 2011; Andadari et al., 2014; Astuti, 2017; Thoday et al.,

2018; Lestarianingsih & Adrison, 2021). On the other hand, this paper will observe a more expansive menu of cooking fuels used in Indonesia.

Finally, this paper will add value to studies that observe determinants of cooking fuel used both in urban and rural areas in developing countries like Guatemala (Heltberg, 2005), India (Rao & Reddy, 2007), and Zimbabwe (Hosier & Dowd, 1987). These two groups of households may have different characteristics. Also, a comparative approach to cooking fuel used by urban and rural households is needed to see the energy transition in different areas. The energy program initially covered as many families as possible, mainly in the urban area. Energy transition in a rural area could be slowly affected due to the availability of clean energy, the abundance of free fuelwood, and the lack of information about the program.

The rest of the paper is organized as follows. Section 2 describes the background of Indonesia with a focus on energy use and the zero kerosene program, and section 3 reviews relevant literature. Section 4 explains the data and methodology applied in the study. Section 5 presents the study's findings with some discussions of the results and robustness checks. Section 6 concludes the research and includes some policy implications and recommendations.

2. Background

Indonesia is an archipelago country in Southeast Asia and Oceania, between the Indian and Pacific Oceans. It has around 17.000 islands and 34 provinces. There are five large islands: Sumatra, Java, Kalimantan, Sulawesi, and Papua. The distance from the west to the east part of Indonesia is about 3,200 miles. Three different time arrangements exist: the West, Central, and East Indonesia. There are vast differences in geographic and socioeconomic characteristics across the regions of Indonesia (Nasution, 2016). About two-thirds of the population of Indonesia lives on Java, one of the most populous islands on earth.

As shown in Table 1, GDP at its current price grew almost ninefold from $106 billion in 1990 to $912 billion in 2013. During the same period, GDP per capita increased from $585.1 to $ 3,623.9. The population increased from 181.4 million in 1990 to 251.8 million in 2013, with an annual growth rate of more than 1.1%. Indonesia tends to be more urbanized as the urban population rapidly increased from 30.6% in 1990 to 52% in 2013, while the rural population declined from 69.4% to 48%. In the same time range, energy use (kilograms of oil equivalent) increased by 59%, while electric power consumption (kilowatt-hours per capita) increased significantly by 3.8 times. The percentage of the urban population with access to electricity increased from 93.9% in 1995 to 99.7% in 2013. On the other hand, the portion of the rural population with access to electricity increased from 51.6% to 93%. The number of people with access to clean cooking fuels and technologies rose from 5.4% in 2000 to 51.1% in 2013.

Table 2 summarizes the energy production and consumption statistics from 1990-2018. Total kerosene consumption declined significantly from 7,302 thousand metric tons (MT) in 1990 to 1,307 (MT) in 2013. Fuelwood consumption increased from 150,677 thousand cubic meters in 1990 to 180,158 cubic meters in 2005 but decreased to 133,968 in 2013. The consumption of charcoal increased from 53 thousand m^3 to 254 thousand m^3. Households consume only 15% of the total consumption of charcoal. LPG consumption increased significantly from 354 MT to 3372 MT. The significant consumption jump happened from 2005 to 2010, from 992 MT in 2005 to 4,190 MT in 2010. Currently, the production of LPG cannot support the demand for LPG. Gross electricity production increased 4.5 times from 48,897 million kilowatt-hours (kWh) in 1990 to 222,017 million kWh. The share of combustible fuels as the power source becomes dominant currently stands at 87%. The role of geothermal energy gradually increased, but its share was only

at 6% in 2013. Supply from hydropower was relatively stagnant, and its percentage decreased in 2013 to only 7% compared to 27% in 1990.

Like many developing countries, Indonesia's fuel market (kerosene, electricity, and LPG) is wholly controlled and managed by the government. Fuel prices are not derived from the interaction of supply and demand but are regulated with specific arrangements like ceiling prices or maximum margins for certain distribution areas.[58]

As shown by Table 2, there was a specific change or jump from 2005 to 2010 regarding the composition of the type of cooking fuels used, especially regarding the consumption of kerosene and LPG. In 2005, household consumption of kerosene was higher than that of LPG. Households consumed 7,361 MT of kerosene and 704 MT of LPG. However, in 2010, the condition was reversed; households used LPG higher than kerosene. Households consumed 3,564 MT of LPG and only 2,237 MT of kerosene. This condition was the impact of the mega conversion program implemented by the government of Indonesia that aimed to increase the usage of LPG for cooking.

The policy to replace kerosene with LPG had achieved the target of improving LPG use and reducing kerosene. On the other hand, this policy had a minor influence on reducing traditional fuel such as fuelwood for cooking use. However, as shown in Table 2, the latest condition in 2018 indicated that households already change their habits drastically from kerosene and fuelwood to LPG.

[58] The Price of LPG 3 kg (subsidized) is regulated by Minister, see Regulation of Minister of Energy and Mineral Resources Number 26 of 2009 (KESDM 26) on LPG Provision and Distribution.

Table 3.1: Economy, Population, Energy Use and Electricity Access Rate

Indicator	1990	1995	2000	2005	2008	2010	2013
				Economy			
GDP (current US$ million)	106,141	202,132	165,021	285,869	510,229	755,094	912,524
GDP per capita (current US$)	585.1	1,026.4	780.2	1,263.3	2,166.9	3,122.4	3,623.9
GDP growth (annual %)	7.2	8.2	4.9	5.7	6.0	6.2	5.6
				Population			
Total Population (million)	181.4	196.9	211.5	226.3	235.5	241.8	251.8
Urban population (% of total)	30.6	36.1	42.0	45.9	48.3	49.9	52.0
Rural population (% of total)	69.4	63.9	58.0	54.1	51.7	50.1	48.0
Population growth (annual %)	1.8	1.5	1.4	1.3	1.3	1.3	1.3
Urban population growth (annual %)	4.9	4.8	4.3	3.1	3.0	2.9	2.7
Rural population growth (annual %)	0.4	(0.2)	(0.7)	(0.1)	(0.2)	(0.2)	(0.1)
				Energy Use			
Energy use per capita (kilograms of oil equivalent)	543.8	664.4	735.9	794.4	793.1	877.1	863.8
Electric power consumption (kilowatt-hours per capita)	162.5	263.6	390.4	500.7	570.1	636.0	774.0
				Access to electricity			
Access to electricity (% of population)		66.9	86.3	85.7	92.7	94.2	96.5
Access to electricity, urban (% of urban population)		93.9	95.4	96.8	97.8	99.0	99.7
Access to electricity, rural (% of rural population)		51.6	79.7	76.3	88.0	89.4	93.0
Access to clean fuels and technologies for cooking (% of population)			5.4	18.1	31.0	40.2	51.1

GDP= gross domestic product
Source: World Bank. Https://data.worldbank.org/indicator (Accessed May 1, 2023)

Table 3.2: Production and Consumption of Energy in Indonesia

	1990	1995	2000	2005	2010	2013
	Kerosene (thousand metric tons)					
Production	5,956	6,193	7,494	6,941	2,478	1,233
Consumption by households	7,053	7,765	10,184	7,361	2,237	692
Final Consumption	7,302	8,355	10,510	8,687	2,495	1,307
	Fuelwood (thousand cubic meters)					
Production	162,318	176,077	185,881	186,152	167,807	139,848
Consumption by households	117,179	124,793	139,698	150,447	132,020	103,322
Final Consumption	150,677	163,330	180,171	180,158	161,955	133,968
	Charcoal (thousand cubic meters)					
Production	126	211	735	681	602	599
Consumption by households	53	60	591	537	298	35
Final Consumption	53	60	591	537	374	254
	Liquefied petroleum gas (thousand metric tons)					
Production	2,996	3,936	2,047	1,828	2,483	2,388
Consumption by households	166	977	1,147	704	3,564	2,621
Final Consumption	354	1,291	1,387	992	4,190	3,372
	Electricity (million kilowatt-hours)					
Gross Production	48,897	68,399	99,511	127,369	169,570	222,017
Combustible Fuels	37,532	55,276	83,141	110,006	142,752	192,591
Geothermal	1,125	2,210	2,649	6,604	9,357	13,492
Hydro	10,240	10,913	13,721	10,759	17,456	15,710
Solar					0.5	5.5
Wind					4.02	1.4
Other						218
Net Production	47,225	66,138	98,456	122,067	163,297	211,175
Import					2	3
Own Use by electricity, heat, and CHP plants	1,672	2,261	1,055	5,302	6,273	10,842
Losses	7,562	4,968	8,175	15,035	15,953	20,701

CHP= combined heat and power
Source: United Nations. Http://data.un.org (accessed May 1, 2023)

2.1 The Zero Kerosene Program

At the end of 2007, the government of Indonesia introduced a massive energy program to encourage kerosene users to switch to LPG, also known as the *Zero Kerosene Program,* for various reasons (Budya & Arofat, 2011). The main reason is to change the subsidy for kerosene to LPG

due to the high subsidies spent on kerosene. When the program was launched, the price per kilogram of LPG was 24% more expensive than kerosene, but LPG's higher calorific value would make it cheaper to subsidize (Thoday et al., 2018). It is estimated that 1 liter of kerosene was equivalent in end-use to 0.39 kg of LPG (Budya & Arofat, 2011). Thus, this program potentially saved the government budget of 10.81 trillion IDR annually (MEMR, 2007).

The program targeted poor households and microenterprises.[59] The government provided free cooking appliances for targeted households and micro enterprises, consisting of 3 kg LPG cylinders, stoves, and equipment. Before the program was initiated, LPG was available in 12 kg and 50 kg, but those types of LPG have higher prices per kg than the 3 kg LPG. Filtering the program recipients was challenging due to the lower cost of 3 kg LPG, and there was no apparent sanction for ineligible users. As an impact, the largest subsidized LPG users were non-poor households (Lestarianingsih & Adrison, 2021).

Due to the program's large scale and distribution complexity, it took multiple years to execute. Furthermore, as the purpose is to reduce the subsidies, it targeted the most populated area and ease of distribution access. The package distribution took place in phases between 2007 and 2015, starting in Java Island, then at the end of 2018, covering all Indonesian provinces except East Nusa Tenggara, Maluku, North Maluku, Papua, and West Papua (Lestarianingsih & Adrison, 2021). Figure 3.1 shows the phases of the program implementation based on provinces coverage.[60] Until 2015, 57.2 million packages were distributed, as shown in Figure 3.2 (Wiratmaja, 2016).

[59] Presidential Regulations No. 104/2007 on Provision of Distribution and Pricing of 3 Kg cylinder and KESDM 26, states that the target of subsidized LPG is poor households (households with a monthly income of 1.5 million IDR or can show a poor certificate) and micro business.

[60] The list of provinces and time of covered of the program based on Figure 1 shown in Appendix A.

Figure 3.1: Kerosene to LPG Conversion Area
Source: Thoday et al. (2018), adapted from Wiratmaja (2016).

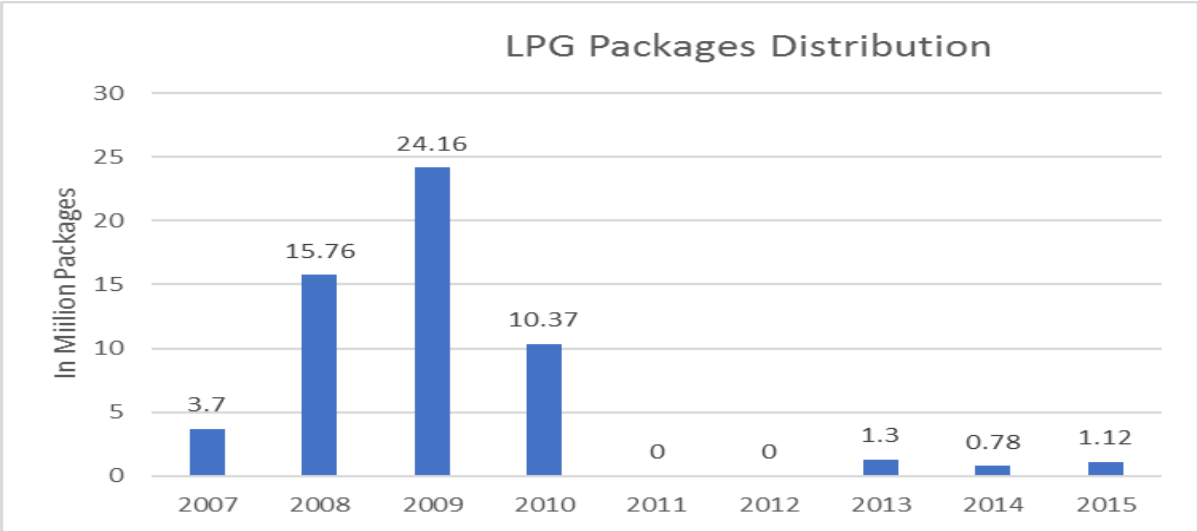

Figure 3.2: LPG Packages Distribution
Source: Wiratmaja (2016).

3. Literature Review

3.1. Determinant of Fuel Use

The study on cooking fuel and the transition to cleaner energy is thriving worldwide as an interesting subject due to the severe impacts of solid or biomass fuels on human health, the environment and economic development (Heltberg, 2005). As a person's productivity is

proportional to his on her health status, using biomass fuels restricts people's financial contribution (Rao & Reddy, 2007). Women and children often spend the most time and effort on cooking and collecting firewood and are, therefore, most prone to the negative impacts of using biomass fuels (Heltberg, 2005).

Many studies have observed the factors contributing to households' cooking fuel choices. It could be income or affordability, availability or accessibility, human capital or education, infrastructure, and family or social tradition (Kroon et al., 2013). Traditional fuels or solid fuels are often consumed by poor households with fewer financial resources (Khandker et al., 2010; Rahut et al., 2020). It is formulated in the energy ladder theory (Leach, 1975, 1992), where consumption of energy technology is related to a household's income (Hosier & Dowd, 1987; Masera et al., 2000). According to the energy ladder, low-income families can move up if their income increases.

However, there is another possibility that wealthier people still use traditional fuel, while poor people may use modern fuel due to access to modern energy infrastructure. Non-poor households in some areas use traditional fuel as they have a plentiful and cheap supply. Meanwhile, poor people in affluent infrastructure areas can access modern energy. This suggests there may be nonlinearities in wealth or income for cooking fuel choices. In addition to low income, the lack of infrastructure led people to suffer from a lack of modern fuel (Kaygusuz, 2011). Most solid fuel users live in rural areas with underdeveloped transportation infrastructure.

The rational choice of cooking fuel energy based only on economic reasons may provide insufficient information to energy policymakers (Stern, 1986). A study shows that income less influences energy adoption than other non-financial factors, such as social norms (Carrico et al., 2011) or culture and tradition (Treiber et al., 2015). Tradition influences foods that are eaten and

how to cook food. Cultures and traditions also affect the type of building. Households with a modern lifestyle are likelier to live in a modern house. On the other hand, traditional families tend to have traditional dwellings. Education also plays a significant role in using clean energy for cooking (Rahut et al., 2020; Rao & Reddy, 2007). Human capital increases earnings, which leads to a boost in purchasing power and the value of time, influencing preferences.

The study of cooking fuel use in Indonesia has emerged over the last two decades. Kojima et al. (2011) observe the factors influencing the household's decision to use gaseous fuel in several developing countries, including Indonesia. They find that income and LPG prices are the two most important factors for Indonesian households to select LPG, as well as the level of consumption. Education also plays an important role. The higher the education of household members, the more households are likely to select LPG. The education level of female household members is more significant than male household members. The size of households hurts their selection of LPG due to the family has to feed more people and spend more money if LPG is used. They also find that the number of nonworking women in the households could be used as a signal for more using solid cooking fuel. However, they did not observe the mega conversion program because the national survey data used is from 2005 and does not separate analysis into two urban and rural groups.

Similar findings were also observed by Andadari et al. (2014) and Astuti (2017). Andadari et al. (2014) found that the level of education and household income positively influenced the shift to cleaner energy. However, they did not find that household size influences cleaner energy use. Astuti (2017) finds several factors that affect the adoption of LPG, including price and the market for LPG and kerosene, trust, the tangible and intangible characteristics of appliances, the campaign for LPG by family and neighbors, and kitchen architecture. She also concludes that four main

factors were connected with continuing firewood use: behavior and lifestyle, economic reasons, being elderly in a rural area, and living in a location with plentiful firewood resources.

Lestarianingsih and Adrison (2021) also observe the behavior of households on Java Island in choosing LPG, like Andadari et al. (2014) but using more options for LPG usage and richer data from the national socioeconomic survey (Susenas) 2018. Using multinomial logit, they observed why households choose subsidized LPG, non-subsidized LPG, and a combination of subsidized and nonsubsidized LPG. They found that an increase in income and a decrease in subsidized LPG quotas were correlated with an increase in the opportunity to choose non-subsidized LPG as household cooking fuel in Java in 2018. They also revealed that the largest subsidized LPG users were non-poor households.

Abdullah et al. (2022) focused on urban fuel stacking behavior in a particular area in Indonesia. Mataram City and Sumbawa Regency were chosen. They study the driving factors of such phenomena and explore the reasons for fuel stacking. The purpose is to observe how different urban contexts affect cooking fuel choices. They interviewed 20 households across two sites. They find that for Sumbawa Regency, an area with a high percentage of low-income households, encouraging poorer families to transition to clean cooking fuel will require substantial financial and technical support. For Mataram city, stacking behavior is due to various factors such as fuel availability, affordability and accessibility, cultural reasons, convenience and safety of cooking, ideal preference of the future, awareness of health issues induced by dirty fuels, opinions on the GOI and cooking fuel aspirations.

3.2. The Energy Policy Impact

Andadari et al. (2014) studied the impact of the LPG conversion program on energy poverty reduction in a particular province in Java Island, Indonesia. They survey 550 households in Central

Java Province in five subdistricts (two rural, two suburban, and one urban subdistrict). They found that the program was very effective in causing a large-scale shift from kerosene to LPG. Against the energy-ladder model, the program increased fuel stacking, including electricity and traditional biomass consumption. The LPG program failed to substantially reduce the number of energy-poor people, but it has effectively alleviated extreme energy poverty.

Astuti (2017) studies the household transition to modern fuel under the LPG Conversion Program on a larger scale than Andadari et al. (2014). She utilized national survey data from 2007 to 2011 and interviewed in certain areas. Like Andadari et al. (2014), Astuti (2017) finds that the program improves LPG use and reduces kerosene use but only had a minor influence on reducing traditional fuel for cooking use. From interviews with families, she finds three levels of LPG adoption, i.e., full adopters, partial adopters, and non-adopters.

The cooking fuel choice may impact female labor force participation (FLPP). Bharati et al. (2021) argue that the mega conversion program is a labor and time-saving cooking technology subsidy. The program can increase FLPP and women's decision-making power in the household, especially in financial matters. They conclude that the benefits of switching to LPG far outweighed the costs to the families.

4. Data and Methodology

4.1. Data

This paper uses the National Socioeconomic Survey of Indonesia of 2008, 2010, and 2013 (Susenas 2008, 2010 and 2013) conducted by Badan Pusat Statistik (BPS) or Statistic Indonesia. The survey was conducted across regions of Indonesia, rural and urban areas in 33 provinces. The survey data do not indicate that the respondents or households are the same in each wave. Thus, this study assumes the data are repeated cross-sections.

In Susenas 2008, there were samples of 282,387 households and six types of primary cooking fuel comprising fuelwood, charcoal/briquette, kerosene, gas/LPG, electricity, and others. Since the question in the survey is about primary fuel, this study cannot look at the stacking hypothesis. During data processing, 149 households were deleted due to an undefined cooking fuel choice. For clarity of clean and unclean cooking fuel grouping, households that use others as the primary cooking fuel are also excluded. There are 2,365 households choosing others as cooking fuel. Thus, this paper uses 279,873 households of Susenas 2008 to be analyzed.

In Susenas 2010, there were samples of 293,715 households, and the primary cooking fuel became seven types as charcoal and briquette were separated. Similar treatment to Susenas 2008, households using others (2761 households) and undefined cooking fuel choices (419 households) are excluded. Thus, this paper uses 290,535 households to be included in the observation.

In Susenas 2013, the main cooking fuel types become nine due to additional city gas and never cooking options. Households that use others (239 households) and never cook (4,236 households) are excluded. Thus, 279,588 households are used for observation.

This study did not encounter the problem of missing observations. One of the reasons is that this kind of survey has been conducted annually for many years. These experiences enable the survey team to provide an easy-to-understand questionnaire and anticipate regular feedback from the respondents.

4.2. Methodology

This paper uses the probit regression model to observe the determinants of the household's choice of cooking fuel and the impact of energy policy, assuming that the standard normal cumulative distribution function determines the probability of a positive outcome. The model is

estimated using the maximum likelihood method as it cannot be consistently estimated using ordinary least squares because of the binary nature of the dependent variable.

Suppose the underlying association to be considered is

$$y^*_{ipt} = \gamma_t + \alpha LPG_{pt} + X'_{ipt}\beta + \varepsilon_{ipt} \qquad (3.1)$$

Where y^*_{ipt} is the exact but unobserved dependent variable, γ_t is time fixed effect, LPG_{pt} is the distribution of L PG Kit across provinces (in the log), X' is other explanatory variables, and α and β are the vector of regression coefficients, which we try to estimate. ε_{ipt} is independent of explanatory variables, and ε_{ipt} ~ Normal (0,1). Instead of observing y^*_{ipt} we observe only a binary variable indicating the sign of y^*_{ipt}:

y_{ipt} = 1 if $y^*_{ipt} > 0$

y_{ipt} = 0 if $y^*_{ipt} \leq 0$

Or $y_{ipt} = 1[y^*_{ipt} > 0]$

The dependent variable is a binary variable showing that households choose clean cooking fuel or otherwise. A family that uses gas/LPG, city gas, and electricity as the main cooking fuel is categorized as a household that uses clean cooking fuel ($y_{ipt} = 1$), while a family that uses other than those energies like fuelwood, charcoal, briquette, and kerosene is classified as a household that does not choose clean cooking fuel ($y_{ipt} = 0$). This paper uses the average marginal effect to have a more meaningful estimation of the impact of the explanatory variables**.** By doing so, this paper can estimate changes in the probability of the dependent variable due to changes in one unit of the continuous independent variable or the different marginal effects of categorical variables**.**

In the equation, X' is a vector of variables that have the potential to influence the household's choice of cooking fuel, as explained in the previous section. The wealth and assets of families are

frequently used to show the ability of the families to have clean energy (Dongzagla & Adams, 2022; Rahut et al., 2020; Astuti, 2017). This study uses household expenditure as the proxy of income or wealth, home ownership, and house infrastructure, like the type of wall and floor of the houses. Except for household expenditure, the other variables are categorical. The categories for home ownership are family owns the house (1) and otherwise (0); house wall with brick or concrete (1) and otherwise (0); house floor with brick or concrete (1) and soil, wood, and others (0).

Households demographic variables are also often used to explain cooking fuel usage (Rahut et al., 2020; Dendup & Arimura, 2017; Kroon et al., 2013). This study uses the age and gender of the household head (HH), household size, women working, and education of HH. Except for age and household size, all other variables are categorical variables. The categories for the gender of HH are female (1) and male (0); at least one woman working (1) and otherwise (0); education of HH are no education (0), some primaries or elementary (1), elementary completed (2), junior high school completed (3), senior high school completed (4), and university completed (5).

To show the accessibility of clean energy, this study uses variables that may indicate whether the households have a better opportunity to get clean energy, like the households' location, the HH's working field, and electrified house variables. Those are categorial or binary variables. The categories for location are urban (1) and rural (0); working fields are HH works in the plantation, forestry, and fishery sectors (1) and otherwise (0); electrified houses are houses with electricity (1) and without electricity (0).

This study assumes mobile phone ownership as a proxy for exposure to clean cooking fuel technology, like know-how of LPG usage.[61] This variable is also assumed to indicate whether the family has information regarding the zero kerosene program and free LPG kits distribution. The

[61]It is not clear whether the program officers called the households to inform the program. However, the program officers need to collect data of eligible households for the LPG starter kit.

category for mobile phones is households with at least one mobile phone (1) and without a mobile phone (0).

5. Result and Discussion

5.1. Summary

Table 3.3 provides the summary statistics of all variables used in this study. The number of households using clean energy increased from 2008 to 2013. In 2008 only 14.43 percent of households used clean energy, while the number of users increased to 47 percent (almost half of the samples) in 2013. The energy conversion policy plays a significant role in these changes as access to kerosene is limited to certain areas where subsidized LPG is available. Almost 57 million LPG kits were distributed in major cities or provinces until 2013.

The income of people that use clean and unclean energy can be differentiated. Using expenditure as a proxy of income, households with clean energy have a higher income (almost double) than those with unclean energy. On average clean energy households earn 3 million IDR per month, while unclean energy users earn 1.7 million IDR. Homeownership does not have a clear contribution to clean energy as the two groups have no clear differentiation. In the unclean energy group, about 81 percent of households own their houses, while 76 percent own their homes in clean energy users. An interesting finding is shown in the house infrastructure. Households that have a house wall made of brick/cement tend to use clean energy. It is shown that 80 percent of clean energy households have house walls made of brick/cement, while 53 percent of unclean energy households do not have those kinds of houses.

From the demographic side, the average household head is 46-47 years old. It can be identified that the household head of unclean cooking fuel users is older than those who use clean cooking fuel, and it is consistent from 2008 to 2013. Almost 14 percent of the sample of households is a

female head. The proportion of female household heads in unclean cooking fuel groups is more significant than the other group. The household size is four people per family, but the two groups have yet to differentiate clearly. Almost 59 percent of the household samples report that at least one female is working. The proportion of females working in the unclean cooking fuel group is consistently higher than in the clean cooking fuel group.

Table 3.3: Summary Statistics

Variables	Total		Total				2008				2010				2013			
			Clean		Unclean		Clean		Unclean		Clean		Unclean		Clean		Unclean	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Expenditure	2.1	2.3	3.0	3.3	1.7	1.4	3.2	3.0	1.5	1.1	2.6	2.6	1.7	1.2	3.2	3.8	2.1	1.9
Home	80%		76%		82%		72%		81%		73%		80%		79%		86%	
House Wall	57%		79%		47%		84%		48%		82%		47%		76%		45%	
House Floor	83%		91%		80%		97%		87%		95%		85%		86%		62%	
Age	46.7	13.8	46.1	12.8	47.0	14.2	45.3	12.7	46.6	14.2	44.7	12.8	46.2	14.3	47.3	12.7	48.6	14.1
Female	14%		12%		14%		11%		14%		12%		14%		13%		16%	
Size	4.0	1.8	4.0	1.6	4.0	1.8	4.1	1.7	4.1	1.8	4.0	1.7	4.0	1.9	3.9	1.6	3.9	1.8
Women Working	59%		56%		60%		57%		59%		55%		58%		57%		63%	
No School	8%		3%		10%		2%		10%		3%		10%		3%		11%	
Some Primaries	28%		18%		33%		7%		24%		30%		49%		13%		25%	
Primary Full	25%		22%		26%		16%		30%		16%		16%		27%		33%	
Junior H.S.	16%		19%		15%		16%		16%		24%		14%		17%		13%	
Senior H. S.	16%		25%		12%		39%		17%		11%		6%		29%		14%	
University	7%		14%		4%		20%		3%		16%		5%		11%		3%	
Urban	41%		67%		29%		73%		29%		72%		33%		62%		24%	
Farming	42%		20%		52%		12%		49%		16%		51%		24%		56%	
Electricity	89%		99%		85%		99%		85%		99%		85%		100%		86%	
Mobile Phone	68%		91%		58%		85%		44%		89%		63%		93%		72%	
Samples	849,996		259,559		590,437		40,386		239,487		86,833		203,702		132,340		147,248	

Note: The total number of observations is 849,996 households, consisting of 279,873 samples of Susenas 2008, 290,535 of Susenas 2010, and 279,588 of Susenas 2013. The clean category refers to LPG, city gas and electricity. All variables except expenditure, age, and household size are binary or categorical. Expenditure is in a million IDR.

The data also show that education level is different between the two groups. The proportion of higher education of household heads, starting from junior high school graduates (9 years of schooling and up), is larger in the clean cooking fuel group than in the unclean cooking fuel group. It shows that higher-educated families prefer clean energy to unclean ones. This finding is

consistent with findings by previous studies (Dongzagla & Adams, 2022; Rahut et al.,2020; among others).

In line with the high electricity rate information in Table 1, the number of households that have their houses electrified is 89 percent of total households. If the data is separated into households that use clean and unclean energy, the proportion is relatively similar from 2008 to 2013. About 99 percent of families that use clean energy have access to electricity and 85 percent of those that do not.

Moving forward to the location of the households, the data shows that clean energy usage is concentrated in the urban area and dirty energy in the rural. Sixty-seven percent of households in the clean energy group live in the urban area, and 33 percent live in the rural area. In contrast, 29 percent of households in the unclean energy group live in urban and 71 percent in rural areas. This supports the idea that the accessibility of energy is also an essential factor. Another indicator of whether the households will use unclean energy, such as fuelwood, is the field where the head of household working. On the clean energy side, only 20 percent of household head work in plantation, farming, and forestry, while it is almost 52 percent on the unclean energy side. To see if the household is exposed to information regarding the zero-kerosene program, mobile phone ownership is used as the proxy of information exposure. Almost 91 percent of households on the clean energy side have a mobile phone, while only 58 percent are in the other group.

5.2. Probit Estimation

This study utilizes the probit econometric model to estimate the policy impact and factors determining households' choice of clean energy. The households are divided into two groups, clean and unclean cooking fuel users. Electricity, LPG, and city gas are clean cooking fuels, while

fuelwood, charcoal, briquette, and kerosene are unclean (Dendup & Arimura, 2017; Dongzagla and Adams, 2022).

Table 3.4 shows the explanatory variables' average marginal effect (AME) on the probability of households using clean energy using several specifications.[62] Columns 1, 2 and 3 provide the AME of LPG kits distributed in the same year of survey data, while columns 4, 5, and 6 provide the AME of lag one year of LPG kits distribution. Time fixed effect is used for all specifications to eliminate bias from unobservable that change over time but is constant over households. It also controls for factors that differ across households but are constant over time. This paper does not consider provinces fixed effect because the LPG kits distribution is a continuous variable at the province level.[63]

The results show that the zero-kerosene policy is statistically significant in increasing the use of clean cooking fuel. One percent increase in LPG kits will increase the probability of a household choosing clean cooking fuel by 0.0159 to 0.0208 (1.6 percent to 2.1 percentage points). The impact of using a lag distribution of LPG kits is higher than non-log distribution. Those magnitudes of effects are statistically significant at a 1% level. This shows that government intervention is vital to transition to clean cooking fuel.[64]

The results show that income or wealth is crucial in clean cooking fuel use. Families must spend their income buying clean fuel and the required cooking equipment. It is in line with findings by previous studies in Indonesia (Kojima et al., 2011) and other countries (Dongzagla & Adams, 2022; Rahut et al., 2020, Heltberg, 2005). Households with higher incomes will use clean cooking

[62] See Richard Williams (2012) for the average marginal effect using Stata Software.

[63] The correlations of explanatory variables are provided in Appendix C. The highest correlation is between household expenditure and households with mobile phone of 0.503.

[64] Similar results are also obtained if the national data is divided into several regions as shown in Appendix C.

fuel as it is clean and more efficient. A one percent increase in revenue will increase the probability of clean cooking fuel by 0.1023 to 0.1269 percentage points (10 to 13 percent).[65]

Other wealth indicators like home ownership and house infrastructure positively impact clean energy. The impact of house infrastructure, like concrete walls and floors, is more significant than home ownership. The probability of households with houses with concrete walls using clean energy is 6 to 10 percentage points higher than those without. This issue also aligns with previous findings (Astuti, 2017). A better infrastructure of a house or kitchen has a positive relation to clean cooking fuel.

The probability of using clean energy increases with the level of education. This finding endorses the critical role of human capital in the transition to clean energy for several reasons (Dendup & Arimura, 2019; Rahut et al., 2020; Kojima et al.,2011; Rao and Reddy, 2007; Heltberg, 2005). First, the importance of education in clean energy use arises from the high opportunity cost for educated people to collect fuelwood. Second, education brings awareness of the negative health impacts of using dirty fuel. Third, knowledgeable people tend to have a higher income as they are assumed as skillful workers. If the head has a university degree, the family is 13 to 16 percentage points higher to choose clean cooking fuel than those without any education.

The results also show that households with older heads are not likely to adopt clean energy for cooking in five specifications (models 2 to 6). On the other hand, older heads are likely to use clean energy in model 1. It needs to be noticed that both sides have a minimal effect on clean energy choice, at 0.01 percentage points or close to zero. As discussed, the two groups have no apparent difference in mean head age.

[65] Expenditure as a proxy of income is in natural log transformation because there could be nonlinear impacts on cooking fuel choice.

Table 3.4: Determinants of Clean Cooking Fuel: Probit Model (marginal effects)

Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)
LPG Kit (Log)	0.0164***	0.0159***	0.0159***			
	(0.0001)	(0.0001)	(0.0001)			
Lag LPG Kit (Log)				0.0208***	0.0205***	0.0205***
				(0.0001)	(0.0001)	(0.0001)
Wealth and Asset						
Log expenditure	0.1035***	0.1023***	0.1023***	0.1269***	0.1260***	0.1261***
	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)
Home Ownership[ab]	0.0171***	0.0182***	0.0182***	0.0087***	0.0093***	0.0091***
	(0.0011)	(0.0011)	(0.0011)	(0.0010)	(0.0010)	(0.0010)
Housewall[ac]	0.0978***	0.0917***	0.0917***	0.0622***	0.0584***	0.0580***
	(0.0010)	(0.0917)	(0.0010)	(0.0010)	(0.0010)	(0.0010)
House Floor[ad]	0.0263***	0.0207***	0.0205***	0.0353***	0.0324***	0.0318***
	(0.0013)	(0.0013)	(0.0013)	(0.0012)	(0.0013)	(0.0013)
Demographic						
Age household head	0.0001***	-0.0000	-0.0000	-0.0000	-0.0001***	-0.0001***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.00003)
Gender of the head[ae]	-0.0049***	-0.0051***	-0.0051***	0.0071***	0.0070***	0.0071***
	(0.0013)	(0.0013)	(0.0013)	(0.0012)	(0.0012)	(0.0012)
Household size	-0.0197***	-0.0194***	-0.0194***	-0.0192***	-0.0190***	-0.0190***
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)
Women Working[af]	-0.0110***	-0.0103***	-0.0103***	-0.0144***	-0.0140***	-0.0141***
	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)
Education						
Some Primaries[ag]	0.0336***	0.0299***	0.0299***	0.0300***	0.0281***	0.0281***
	(0.0020)	(0.0020)	(0.0020)	(0.0018)	(0.0019)	(0.0019)
Primary Full[ag]	0.0511***	0.0465***	0.0466***	0.0554***	0.0529***	0.0528***
	(0.0020)	(0.0021)	(0.0021)	(0.0019)	(0.0019)	(0.0019)
Junior High School[ag]	0.0790***	0.0740***	0.0740***	0.0915***	0.0886***	0.0884***
	(0.0022)	(0.0022)	(0.0022)	(0.0021)	(0.0021)	(0.0021)
Senior High School[ag]	0.1143***	0.1090***	0.1090***	0.1213***	0.1183***	0.1181***
	(0.0023)	(0.0023)	(0.0023)	(0.0022)	(0.0022)	(0.0022)
University[ag]	0.1369***	0.1319***	0.1320***	0.1616***	0.1583***	0.1584***
	(0.0026)	(0.0026)	(0.0026)	(0.0025)	(0.0025)	(0.0025)

Continued.

Table 3.4: *Continued.*

Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)
Accesibility						
Urban[ah]	0.1179***	0.1134***	0.1134***	0.0936***	0.0910***	0.0910***
	(0.0010)	(0.0010)	(0.0010)	(0.0010)	(0.0010)	(0.0010)
Workfield[ai]	-0.0786***	-0.0741***	-0.0741***	-0.0682***	-0.0653***	-0.0650***
	(0.0010)	(0.0010)	(0.0010)	(0.0010)	(0.0010)	(0.0010)
Electricity[aj]		0.1461***	0.1478***		0.1066***	0.1324***
		(0.0022)	(0.0024)		(0.0023)	(0.0025)
Information						
Mobile Phone[ak]	0.1041***	0.0958***	0.0957***	0.0885***	0.0840***	0.0846***
	(0.0012)	(0.0012)	(0.0012)	(0.0011)	(0.0011)	(0.0011)
Interaction						
LPG Kit (Log) x Electricity			0.0050***			0.0117***
			(0.0003)			(0.0003)
Observation	849,996	849,996	849,996	849,996	849,996	849,996
Year Fix Effect	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parenthesis. * p<0.1, ** p<0.05, *** p<0.01.

[a] Dummy Variables

[b] Excluded category: household does not own the house

[c] Excluded category: house without brick/cement

[d] Excluded category: house with soil, wood, and other type of floor

[e] Excluded category: male household head

[f] Excluded category: household without any women working

[g] Excluded category: household head without any formal education

[h] Excluded category: household lives in rural area

i Excluded category: household head working in non farming, fishery, and forestry

[j] Excluded category: household without electricity

[k] Excluded category: household have no mobile phone

i Excluded category: household head working in non farming, fishery, and forestry

[j] Excluded category: household without electricity

[k] Excluded category: household have no mobile phone

The role of the female head in choosing clean energy is still being determined in this study. Using LPG kits as the policy factor, the female head uses unclean cooking fuel. On the other hand, using a lag of LPG kits distribution, the female head chooses clean energy. Previous studies also show two different impacts of female heads on clean cooking fuel usage. It could be positive (Rao & Reddy, 2007) or negative (Rahut et al., 2020).[66]

The number of a household's members is observed to be negative on clean cooking fuel use. One member increase in the home will reduce the probability of using clean energy by two percentage points. Households with larger families are likely to use more fuel for cooking, and it will cost them more money if they use clean energy. Those households will likely have an abundant labor supply to collect fuelwood (Rahut et al., 2020). Suppose in a family at least one female is working to help the household earning. In that case, the household is statistically significant to stay away from clean energy by one percentage point compared to the family without.

The location of the household also plays an essential role in clean cooking fuel choices due to access to clean energy and the priority of the zero-kerosene program. The results show that the probability of urban households using clean energy is 9 to 12 percentage points higher than rural households. One of the possible reasons is that clean energy is more accessible in the urban area. The zero kerosene program targeted as many households as possible to use LPG. The easiest way is to make the LPG kits available in the urban area. Another reason is that rural areas are a relatively abundant source of fuelwood. To observe further, the job of the household head can be used to show access to fuelwood. The results show that the probability of families with heads working in agriculture, forestry, and fishery choosing clean energy is lower by 6.5 to 7.9 percentage points

[66] The correlation between age and female gender of the household head is positive (0.2217). This means that age tends to be higher for female heads than male heads (54.6 years in comparison to 45.5 years). The difference of mean age of the two group is 9.1 years and is statistically significant using ttest. This is consistent with cultural norms where female households heads are often widows.

than those with heads not working in those fields. Again, those families can have better access to fuelwood or dirty fuel, which are relatively cheaper than clean energy. Another variable that can show the accessibility of clean energy is the electricity network. The results show that the probability of a family that has electricity networks using clean energy is 11 to 15 percentage points higher than non-electric users.

Shifting to cleaner energy requires adequate information to motivate households to change (Dengdup & Arimura, 2019). This study uses mobile phone ownership as a proxy for information exposure regarding the zero-kerosene program and cooking fuels technology. The results show that the probability of a family that owns a mobile phone choosing clean energy is 8 to 10 percentage points higher than a family that does not have a mobile phone. Exposure to the program information is essential to increase LPG or clean energy users.

This paper also observes the interaction term of LPG kit and electricity network. Columns 3 and 6 show that including the interaction term in the models does not change the magnitude of the explanatory variables. Only in column 6, using the lag distribution of LPG kits, can we find that the magnitude of the electricity network is higher from 11 to 13 percentage points. The interpretation of the magnitude of the interaction term from Column 3 is that the probability of a household using clean energy due to the zero-kerosene program is 0.5 percentage points higher for a household with an electricity network compared to non-electricity users. The impact is higher if we use the lag of LPG distribution, as shown in Column 6. Families with electricity networks will use clean energy by 1.2 percentage points higher than those without due to the energy program.

5.3. Robustness Check

As demonstrated by previous studies (for urban studies, see Dongzagla & Adams, 2022; Rahut et al., 2020; for rural studies, see Hou et al., 2017), the determinants of cooking fuel choice can

differ (magnitudes and directions) if the study is explicitly conducted for urban households or rural households. In this part, this study aims to show the consistency of the magnitude of explanatory variables by dividing the data into urban and rural data. The explanatory variables used in this section are the same as the primary specification except for the urban and rural locations.

Table 3.5 shows the estimated effects of clean energy determinants for households in urban and rural areas. Columns 1, 2, 3 and 4 show the estimated marginal effect of explanatory variables for urban households and columns 5, 6, 7, and 8 for rural households. All variables show a similar direction with the primary results except three variables needing attention: head age, head gender, and women working.

The results show that the older head is statistically significant in increasing the probability of clean energy usage in urban areas while decreasing in rural areas. This finding can be used to identify why the previous results could be in both directions and statistically insignificant in some models. Nevertheless, again, the impact of this variable is still relatively low in both directions. The probability of choosing clean energy increases by 0.03 to 0.05 percentage points if the head is one year older in the urban area. Conversely, the likelihood of using clean energy decreases by 0.04 percentage points if the head is one year older.

Dividing the data into urban and rural shows a consistent impact of a female household head. In urban areas, the female head negatively impacts the use of clean energy, which is different in rural areas.[67] Female head in urban areas has a lower probability of choosing clean energy by 0.6 to 2 percentage points compared to males. It is a contrast in rural areas where the female head is more likely to use clean energy by 0.7 to 2 percentage points compared to the male head. The

[67] The correlation between age and female household head is 0.2031 in urban and 0.2454 in rural households. The difference of mean age between female and male household head in rural is larger than in urban, 10.1 and 7.8 years, respectively. Both differences are statistically significant using ttest.

women working variable in the main specification has a negative effect. At the same time, this part is valid for all models except for urban households using non-lag LPG distribution in the policy variable.

Table 3.5: Urban and Rural Households (Average Marginal Effect)

Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
LPG Kit (Log)	0.0237***	0.0237***			0.0102***	0.0102***		
	(0.0002)	(0.0002)			(0.0001)	(0.0001)		
Lag LPG Kit (Log)			0.0287***	0.0287***			0.0140***	0.0140***
			(0.0001)	(0.0001)			(0.0001)	(0.0001)
Wealth and Asset								
Log expenditure	0.1250***	0.1250***	0.1525***	0.1525***	0.0848***	0.0848***	0.1044***	0.1046***
	(0.0015)	(0.0015)	(0.0014)	(0.0014)	(0.0010)	(0.0010)	(0.0010)	(0.0010)
Home Ownership[ab]	0.0206***	0.0206***	0.0121***	0.0121***	0.0120***	0.0120***	0.0034**	0.0030**
	(0.0017)	(0.0017)	(0.0016)	(0.0016)	(0.0014)	(0.0014)	(0.0014)	(0.0014)
Housewall[ac]	0.1561***	0.1561***	0.0905***	0.0905***	0.0551***	0.0551***	0.0392***	0.0388***
	(0.0019)	(0.0019)	(0.0018)	(0.0018)	(0.0011)	(0.0011)	(0.0010)	(0.0010)
House Floor[ad]	0.0337***	0.0339***	0.0485***	0.0484***	0.0152***	0.0151***	0.0219***	0.0217***
	(0.0030)	(0.0030)	(0.0027)	(0.0027)	(0.0013)	(0.0013)	(0.0012)	(0.0012)
Demographic								
Age household head	0.0005***	0.0005***	0.0003***	0.0003***	-0.0004***	-0.0004***	-0.0004***	-0.0004***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0000)	(0.0000)	(0.0000	(0.0000)
Gender of the head[ae]	-0.0227***	-0.0227***	-0.0062***	-0.0062***	0.0073***	0.0073***	0.0169***	0.0171***
	(0.0022)	(0.0022)	(0.0021)	(0.0021)	(0.0016)	(0.0016)	(0.0016)	(0.0016)
Household size	-0.0223***	-0.0223***	-0.0216***	-0.0216***	-0.0176***	-0.0177***	-0.0176***	-0.0176***
	(0.0005)	(0.0005)	(0.0004)	(0.0004)	(0.0003)	(0.0003)	(0.0003)	(0.0003)
Women Working[af]	0.0002	0.0002	-0.0054***	-0.0054***	-0.0186***	-0.0186***	-0.0209***	-0.0209***
	(0.0015)	(0.0015)	(0.0014)	(0.0014)	(0.0010)	(0.0010)	(0.0010)	(0.0010)
Education								
Some Primaries[ag]	0.0543***	0.0543***	0.0439***	0.0438***	0.0172***	0.0173***	0.0181***	0.0183***
	(0.0044)	(0.0044)	(0.0040)	(0.0040)	(0.0019)	(0.0019)	(0.0018)	(0.0018)
Primary Full[ag]	0.0750***	0.0750***	0.0797***	0.0796***	0.0280***	0.0281***	0.0337***	0.0338***
	(0.0045)	(0.0045)	(0.0041)	(0.0041)	(0.0020)	(0.0020)	(0.0019)	(0.0019)
Junior High School[ag]	0.1019***	0.1019***	0.1181***	0.1180***	0.0525***	0.0526***	0.0639***	0.0640***
	(0.0046)	(0.0046)	(0.0043)	(0.0043)	(0.0023)	(0.0023)	(0.0022)	(0.0022)
Senior High School[ag]	0.1475***	0.1475***	0.1540***	0.1539***	0.0843***	0.0843***	0.0929***	0.0931***
	(0.0047)	(0.0047)	(0.0043)	(0.0043)	(0.0025)	(0.0025)	(0.0024)	(0.0024)
University[ag]	0.1715***	0.1715***	0.2010***	0.2009***	0.1075***	0.1076***	0.1292***	0.1300***
	(0.0050)	(0.0050)	(0.0046)	(0.0046)	(0.0034)	(0.0034)	(0.0033)	(0.0033)

Continued.

Table 3.5: Continued

Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Accesibility								
Workfield[ai]	-0.1165***	-0.1165***	-0.0978***	-0.0978***	-0.0515***	-0.0515***	-0.0466***	-0.0463***
	(0.0023)	(0.0023)	(0.0021)	(0.0021)	(0.0010)	(0.0010)	(0.0010)	(0.0010)
Electricity[aj]	0.2218***	0.2124***	0.1513***	0.1628***	0.1096***	0.1105***	0.0881***	0.1020***
	(0.0082)	(0.0098)	(0.0087)	(0.0096)	(0.0014)	(0.0016)	(0.0016)	(0.0017)
Information								
Mobile Phone[ak]	0.1271***	0.1271***	0.1146***	0.1146***	0.0757***	0.0758***	0.0663***	0.0669***
	(0.0024)	(0.0024)	(0.0022)	(0.0022)	(0.0012)	(0.0012)	(0.0011)	(0.0011)
Interaction								
LPG Kit (Log) x Electric.		0.0007		0.0049***		0.0055***		0.0098***
		(0.0012)		(0.0012)		(0.0002)		(0.0003)
Observation	346,529	346,529	346,529	346,529	503,467	503,467	503,467	503,467
Location	Urban	Urban	Urban	Urban	Rural	Rural	Rural	Rural
Year Fix Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parenthesis. * p<0.1, ** p<0.05, *** p<0.01.

[a] Dummy Variables

[b] Excluded category: household does not own the house

[c] Excluded category: house without brick/cement

[d] Excluded category: house with soil, wood, and other type of floor

[e] Excluded category: male household head

[f] Excluded category: household without any women working

[g] Excluded category: household head without any formal education

[h] Excluded category: household lives in rural area

i Excluded category: household head working in non farming, fishery, and forestry

[j] Excluded category: household without electricity

[k] Excluded category: household have no mobile phone

For explanatory variables that show the consistency of effects similar to the main specifications, the magnitude of the impact of those variables is higher in urban areas. For example, the LPG kits distribution variable shows that the magnitudes of the energy program are almost double in urban areas than in rural areas. An important finding shows by the interaction term of the program and electricity. The marginal effect of the interaction terms shows that the program effect on clean cooking fuel is higher for households with electricity in rural areas by 0.6 to 1

percentage points than those without. This result is different from the previous study in India. Gupta and Pelli (2021) find that electrification increases the probability of adopting biomass fuels and decreases the likelihood of adopting modern cooking fuels in rural India.

6. Conclusion and Recommendation

This paper studies the determinants of cooking fuel choices and Indonesia's transition to clean energy amid the-zero kerosene program. This study finds that government policy is vital for growing clean energy. One percent increase in the distribution of LPG Kits increases the probability of clean energy usage by 2%. The impact is almost double in urban areas compared to rural areas.

All socioeconomic and demographic factors significantly influence the household choice of cooking fuel. Households with higher income and wealth, better infrastructure, formal education, electric network, and mobile phone are identic to clean energy users. On the other hand, working women, the agricultural working field of the head, and bigger household sizes are identic to unclean energy. The age and gender of the head have different effects on urban and rural households.

In line with the findings of previous studies, household income is still the primary variable of clean energy. One percent increase in income will impact the probability of clean energy by 10 to 13 percentage points. With steady GDP growth of around 5-6 percentage points yearly, Indonesia may have a good path for the transition to clean energy. Economic empowerment of poor households will help them to have a better chance to consume clean energy. The other possibility is to reduce the prices of clean energy. However, this should be prudently done by ensuring that non-poor households are not the recipients of subsidized LPG. The zero-kerosene program still

has a big issue where the biggest recipients of subsidized LPG are non-poor families (Lestarianingsih & Adrison, 2021).

The availability of information on the clean cooking fuel benefit is a crucial element in the acceleration of new technology adoption. Using mobile phone ownership as the proxy of exposure to the policy program and clean energy information, this study finds that adoption to clean energy is higher by 8 to 10 percentage points for a family with a mobile phone than those without. The impact is higher for households in urban areas than in rural areas. Nowadays, people use mobile phones more than television to get information and news. Thus, adopting clean energy could be more extensive if the government can utilize the mobile phone network more.

To make the transition to clean cooking fuels faster, the government must pay special attention to families with less educated heads, big family sizes, and family lives close to the fuelwood resources. Thus, one possible way is to provide more information on the benefit of clean cooking fuel and how to use it for those families. The government must also ensure that clean cooking fuel is affordable and accessible to families close to abundant fuelwood resources.

It is reasonable to expect the impact of the zero kerosene program to clean cooking fuel to be high as the LPG kits distributed around from 2008-2013 were 57 million kits for estimated 60 million households. It is reasonable to think that about 90 percent of households already use LPG as cooking fuel. However, this study finds that the magnitude of the program's effects on the probability of clean cooking fuel is relatively low. One possible reason is that this study uses data on the main cooking fuel choices provided by the survey. Households that do not use LPG as the primary cooking fuel possibly have LPG in their house but use it as the second choice (Astuti, 2017). This study assumes that those types of households (LPG partial adopters) are still high. The other reason is that the program can switch families from kerosene to LPG users, but its influence

on reducing fuelwood for cooking use is still tiny (Astuti, 2017). Another consideration, as mentioned by Lestarianingsih and Adrison (2021), is that the largest recipients of subsidized LPG are the non-poor households. No strict regulation in the field (market) prohibits non-poor families from buying subsidized LPG. This situation will limit the ability of poor households to buy subsidized LPG as the retail price will increase due to demand competition, and the non-poor households are assumed to have a better capacity to buy first.

This study shows that electricity users as the primary cooking fuel are relatively minimal. It is the contrast to the fact that the rate of electrified houses in Indonesia is very high. It provides a chance for cleaner cooking fuel by pushing households to use an electric stoves. The government has already considered providing free electric stoves for millions of families currently heavily subsidized LPG for cooking to reduce Indonesia's dependence on imported LPG. However, the execution of the plan was presently halted without clear reasons.[68]

Hakam et al. (2022) mention that the induction stove requires high power for an efficient and shorter cooking time. It is problematic for families to switch to induction stoves as most families in Indonesia still need to use low-power electric capacity (below 1300 Volt Ampere).[69] Thus, families using low-power induction stoves may have unpleasant cooking experiences. The instability of electric power in rural and remote areas may also cause the reluctance to use electricity for cooking. Families will be very disappointed if the electric power is suddenly off while cooking.

[68]https://www.thejakartapost.com/business/2022/09/28/pln-aborts-electric-stove-conversion-program-in-last-minute-decision.html

[69] See Appendix B for the composition of electricity power used by households from the surveys.

References

Abdullah, T.A., Lumban Gaol, R.., &Andrade, R. J. (2022). *Study of Urban Fuel Stacking in Mataram City and Sumbawa Regency, Indonesia.* Modern Energy Cooking Services.

Alm, J. & El-Ganainy, A. (2013). Value-added Taxation and Consumption. *International Tax and Public Finance*, 105-128.

Alm, J. (2019). Can Indonesia Reform its Tax System? Problems and Options. *Tulane Economics Working Paper Series*, Working Paper, 1906.

Andadari, R. K., Mulder, P., & Rietveld, P. (2014). Energy Poverty Reduction by Fuel Switching. Impact Evaluation of The LPG Conversion Program in Indonesia. *Energy Policy*, *66*, 436–449.

Astuti, S. P., (2017). *An Analysis of Household Transition to Modern Fuel under Indonesia's Energy Conversion Program*. Dissertation, University of Birmingham.

Bachas, P., Fattal J., R. N., & Jensen, A. (2019). Size-dependent Tax Enforcement and Compliance: Global Evidence and Aggregate Implications. *Journal of Development Economics*, 140, 203-222.

Bachas, P., Gadenne, L., & and Jensen, A. (2020). Informality, Consumption Taxes, and Redistribution. *NBER Policy Research*, Working Paper, 9267.

Basri, M. Chatib, Felix, M., Olken, B., & Hanna, R. (2019). Tax Administration VS. Tax Rates: Evidence from Corporate Taxation in Indonesia. *NBER Working Paper Series*, 26150.

Bavier, R. (2008). Reconciliation of Income and Consumption Data in Poverty Measurement. *Journal of Policy Analysis and Management*, 27 (1), 40-62.

Bellon, M., Dabla-Norris, E., Khalid, S., & Lima, F. (2022). Digitalization to improve tax compliance: Evidence from VAT e-Invoicing in Peru. *Journal of Public Economics*, 210, 104661.

Bergman, M., & Nevarez, A. (2006). Do Audits Enhance Compliance? An Empirical Assessment of VAT Enforcement. *National Tax Journal*, 59(4), 817-832.

Bertrand, M., Duflo, E., & Mullainathan, S. (2004). How Much Should We Trust Differences-in-Differences Estimates? *Quarterly Journal of Economics*, 119(1), 249-75.

Benedek, D., De Mooij, R.A., Keen, M., & Wingender, P. (2020). Varieties of VAT Pass-Through. *International Tax and Public Finance*, 890-930.

Benzarti, Y., Carloni, D., Harju, J., & Kosonen, T. (2020). What Goes Up May Not Come Down: Asymmetric Incidence of Value-Added Taxes. *Journal of Political Economy*, *128 (12),* 4438-4474.

Besley, T., & Persson, T. (2014). Why Do Developing Countries Tax So Little? *Journal of Economic Perspectives*, *28 (4),* 99-120.

Bharati, T., Qian, Y., & Yun, J. (2021). Fuelling the Engines of Liberation with Cleaner Cooking Fuel. *ERIA Discussion Paper Series*, 361.

Bird, R.M. (2007). *The VAT in Developing and Transitional Countries*. New York: Cambridge University Press.

Bisu, D. Y., Kuhe, A., & Iortyer, H. A. (2016). Urban Household Cooking Energy Choice: An Example of Bauchi Metropolis, Nigeria. *Energy, Sustainability and Society*, 6(1), 1-12.

Bonjour, S., Adair-Rohani, H., Wolf, J., Bruce, N. G., Mehta, S., Pruss-ustun, A., & Smith, K. R. (2013). Solid Fuel Use for Household Cooking: Country and Regional Estimates for 1980-2010. *Environmental Health Perspectives*, 784(7), 78–79.

BPS. (2007). *Statistik Indonesia 2007*. Badan Pusat Statistik.

Budya, H., & Arofat, M.Y. (2011). Providing cleaner energy access in Indonesia through the mega project of kerosene conversion to LPG. *Energy Policy* 39, 7575-7586.

Buhmann, B., Rainwater, L., Schmaus, G., & Smeeding, T. (1988). Equivalences Scales, Well-Being, Inequality, and Poverty: Sensitivity Estimates Across Ten Countries using the Luxemburg Income Study (LIS) Database. *Review of Income and Wealth*, 34 (2), 115-142.

Carillo, P., Pomeranz, D., & Singhal, M. (2017). Dodging the Taxman: Firm Misreporting and Limits to Tax Enforcement. *American Economic Journal: Applied Economics*, 9(2), 144-164.

Carrico, A. R., Vandenbergh, M. P., Stern, P. C., Gardner, G. T., Dietz, T., & Gilligan, J. M. (2011). Energy and Climate Change: Key Lessons for Implementing the Behavioral Wedge. *George Washington Journal of Energy & Environmental Law*, *2*(61), 10–24.

Caspersen, E., & Metcalf, G. (1994). Is a Value Added Tax Regressive? Annual versus Lifetime Incidence Measures. *National Tax Journal,* 47 (4), 731-746.

Coulter A., Cowell, F., & Jenkins, S. (1992). Equivalence Scale Relativities and the Extent of Inequality and Poverty. *Economic Journal,* 102 (414*)*, 1067-1082.

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

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

Cutler, D., & Katz, L. (1992). Rising Inequality? Changes in the Distribution of Income and Consumption in the 1980s. *American Economic Review*, 82 (2), 546-551.

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

Dendup, N., & Arimura, T. H. (2019). Information Leverage: The adoption of clean cooking fuel in Bhutan. *Energy Policy*, 125, 181-195.

Dongzagla, A., & Adams, A. (2022). Determinants of urban household choice of cooking fuel in Ghana: Do socioeconomic and demographic factors matter? Energy, 256, 124613.

Ebrill, L, Keen, M., Bodin, J., & Summers, V. (2001). *The Modern VAT*. International Monetary Fund.

Faridy, N., & Sarker, T. (2011). Progressivity of Value Added Tax in Developing Countries: Empirical Evidence from Bangladesh. *Asia-Pacific Tax Bulletin* May/June 2011.

Fields, G.S. (1994). Data for Measuring Poverty and Inequality Changes in the Developing Countries. *Journal of Development Economics*, 44(1), 87-102.

Fullerton, D., & Metcalf, G. (2002). *Tax Incidence*, in Auerbach, A. J. and M. Feldstein (eds.), Handbook of Public Economics 4, Amsterdam, Elsevier, 1787-1872.

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

GSI. (2015). Indonesia Energy Subsidy Review. Retrieved from http://www.iisd.org/gsi/sites/default/files/ffs_newsbriefing_indonesia_feb2015_eng.pdf.

Gupta, R., & Pelli, M. (2021). Electrification and Cooking Fuel Choice in Rural India. *World Developmen*t, 146, 105539.

Hakam, D. F., Nugraha, H., Wicaksono, A., Rahadi, R. A., & and Kanugrahan, S. P. (2022). Mega conversion from LPG to induction stove to achieve Indonesia's clean energy transition. *Energy Strategy Reviews,* 41, 100856.

Harju, J., Matikka, T., & Rauhanen, T. (2015). The Effect of VAT Threshold on the Behavior of Small Businesses: Evidence and Implications, *CESifo Area Conference on Public Sector Economics*.

Harju, J., Matikka, T., & Rauhanen, T. (2019). Compliance Costs vs. Tax Incentives: Why Do Entrepreneurs Respond Size-Based Regulations? *Journal of Public Economics*, 173, 139-164.

Heltberg, R. (2005). Factors Determining Households Fuel Choice in Guatemala. *Environment and Development Economics,* 10, 337-61.

Himawan, 2021. *Three essays on Tax Compliance*. Dissertation, Kentucky University.

Hosier, R. H., & Dowd, J. (1987). Household Fuel Choice in Zimbabwe. An Empirical Test of The Energy Ladder Hypothesis. *Resources and Energy*, *9*(4), 347–361.

Hou, B., Tang, X., Ma, C., Liu, L., Wei, Y., & Liao, H. (2017). Cooking Fuel Choice in Rural China: Results from Microdata. Journal of Cleaner Production, 142, 538-547.

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

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

International Energy Agency. (2006). *World Energy Outlook*, Energy for Cooking in Developing Countries.

International Energy Agency. (2017). *Energy Access Outlook*, from Poverty to Prosperity.

Joshi, J., & Bahora., A. K. (2017). Household Preferences for Cooking Fuels and Interfuel Substitutions: Unlocking the Modern Fuels in the Nepalese Household. *Energy Policy,* 107, 507-23.

Kaygusuz, K. (2011). Energy Services and Energy Poverty for Sustainable Rural Development. *Renewable and Sustainable Energy Reviews*, *15*(2), 936-947.

Keen, M., & Mintz, J. (2004). The Optimal Threshold for A Value Added Tax. *Journal of Public Economics,* 88, 559-576.

Keen, M., & Smith, S. (2006). VAT Fraud and Evasion: What Do We Know and What Can Be Done? *National Tax Journal*, 59(4), 861-887.

Kitt, F., & Yates, K. (2020). *Indonesia Energy Sector Assessment, Strategy, and Road Map*. Asian Development Bank.

Khandker, S. R., Barnes, D. F., & Samad, H. A. (2012). Are The Energy Poor Also Income Poor? Evidence from India. *Energy Policy*, 47, 1–12.

Kleven, H.J., Kreiner, C. T., & Saez, E. (2016). Why Can Modern Governments Tax So Much? An Agency Model of Firms as Fiscal Intermediaries. *Economica*, 83(330), 219-246.

Kojima, M., Bacon, R., & Zhou, X. (2011). Who uses bottled gas? *Policy Research Working Paper* 5731, The World Bank.

van der Kroon, B., Brouwer, R., & van Beukering, P. (2013). The Energy Ladder: Theoretical Myth or Empirical Truth? Results from A Meta-analysis. *Renewable and Sustainable Energy Reviews,* 20, 504-513.

Le, T. M. (2003). Value Added Taxation: Mechanism, Design and Policy Issues. *World Bank Course: Practical Issues of Tax Policy in Developing Countries*.

Leach, Gerald. 1975. Energy and Food Production. *Food Policy*, 1(1), 62-73.

Leach, Gerald. 1992. The Energy Transition. *Energy Policy,* 20(92), 116-23.

Lestarianingsih, R., & Adrison, V. (2021). Fuel Availability and Java Households Cooking Fuel Choices: Evidence from Indonesia's LPG Subsidy Policy. *Jurnal Ekonomi & Studi Pembangunan,* 22 (1), 21-36.

Lewis, C. (2019). Raising More Public Revenue in Indonesia in a Growth and Equity Friendly Way. OECD *Economic Department Working Papers No. 1554.*

Liu, L., Lockwood, B., Almunia, M., & Tam, E. H. F. (2021). VAT notches, voluntary registration, and bunching: theory and U.K. Evidence. *The Review of Economics and Statistics*, 103(1), 151-164.

Marks, S. V. (2005). Proposed Changes to the Value Added Tax: Implications for Tax Revenue and Price Distortions. *Bulletin of Indonesian Economic Studies*, 41(1): 81-95.

Masera, O. R., Saatkamp, B. D., & Kammen, D. M. (2000). From Linear Fuels Switching to Multiple Cooking Strategies: A Critique and Alternative to The Energy Ladder Model. *World Development*, *28*(12), 2083–2103.

Mekonnen, A., & Kohlin, G. (2008). Determinants of Household Fuel Choice in Major Cities in Ethiopia. *Working Papers in Economics 399*, University of Gothenburg.

MEMR. 2007. *Kerosene to LPG conversion program 2007-2012*. Blueprint. Jakarta: Ministry of Energy and Mineral Resource Republic of Indonesia.

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

Meyer, B., & Sullivan, J. (2003). Measuring the Well-Being of the Poor Using Income and Consumption. *Journal of Human Resources*, 38, 1180–122.

Mirrless, J., Adam, S., Besley, T., Blundell, R., Bond, S., Chote, R., Gammie, M., Johnson, P., Myles, G., & Poterba, J. (2011). The Mirrless Review: Conclusions and Recommendations for Reform. *Fiscal Studies*, 32(3), 331-359.

Muñoz, S., & Cho, S. S. (2003). Social Impact of a Tax Reform: The Case of Ethiopia. *IMF Working Paper 232*.

Mushi, D. P. (2009). *The Value Added Tax: Annual vs. Lifetime Perspective Evidence from Tanzania Household Data*. Dissertation, Colorado State University.

Naritomi, J. (2019). Consumers as Tax Auditors. *American Economic Review*, 109 (9), 3031-3072.

Nasution, A., 2016. Government Decentralization, *ADBI Working Paper* Series, 601.

Nurfauzi, E., Nuryakin, C., & Putra, B. (2019). Firms Bunching Response to Indonesian Income Tax Threshold. JEJAK: *Jurnal Ekonomi dan Kebijakan*, 12(1), 153-167.

OECD. (2020). *Consumption Tax Trends 2020: VAT/GST and Excise, Rates, Trends and Policy Issues.*

Onji, K. (2009). The Response of Firms to Eligibility Thresholds: Evidence from the Japanese Value-added Tax. *Journal of Public Economics,* 93, 766-775.

Ouedraogo, B. (2006). Household Energy Preferences for Cooking in Urban Ouaga-dougou, Burkina Faso. *Energy Policy*, 34, 3787-95.

Pomeranz, D. (2015). No Taxation without Information, Deterrence and Self-Enforcement in the Value Added Tax. *The American Economic Review*, 105(8), 2539-2569.

Poterba, J. (1989). Lifetime Incidence and the Distributional Burden of Excise Taxes. *National Tax Journal* 49, 165-176.

Poterba, J. (1991). *Is the Gasoline Tax Regressive?* In Tax Policy and the Economy 5, 145-64. D. Bradford, ed. Cambridge, MA: MIT Press.

Pundo, M. O., & Fraser, G. C. G. (2006). Multinomial Logit Analysis of Household Cooking Fuel in Rural Kenya: The Case of Kisumu District. *Agrekon*, 45, 24-37.

Rahut, D. B., Ali, A., Mottaleb, K. A., & Aryal, J. P. (2020). Understanding Households' Choice of Cooking Fuels: Evidence from Urban Households in Pakistan. *Asian Development Review*, 37(1), 185-212.

Rao, M. N., & Reddy, B. S. 2007. Variations in Energy Use by Indian Households: An Analysis of Micro Level Data. *Energy* 32(2), 143-53.

Satterthwaite, E. A. (2018). On the Threshold: Smallness and The Value-Added Tax. *Columbia Journal of Tax Law*, 9, 177-227.

Scholz, J. T., & Pinney, N. (1995). Duty, Fear, and Tax Compliance: The Heuristic Basis of Citizenship Behavior. *American Journal of Political Science*, 39(2), 490-512.

Slemrod, J. (2019). Tax Compliance and Enforcement. *Journal of Economic Literature*, 904-954.

Sosiawan, O., Azhar, A., & Baptista, I. (2011). *Selamat Datang LPG, Selamat Tinggal Minyak Tanah*. Jakarta: Dian Rakyat.

Stern, P. C. (1986). Blind Spots in Policy Analysis: What Economics Doesn't Say About Energy Use. *Policy Analysis*, *5*(2), 200–227.

Stiglitz, J. E. (2009). Development-Oriented Tax Policy. *Initiative for Policy Dialogue Working Paper Series.*

Thomas, Alastair (2022). Reassessing the regressivity of the VAT. *Fiscal Studies*, 43(1), p.23-38.

Treiber, M. U., Grimsby, L. K., & Aune, J. B. (2015). Reducing Energy Poverty Through Increasing Choice of Fuels and Stoves in Kenya: Complementing the Multiple Fuel Model. *Energy for Sustainable Development*, 27, 54–62.

Tumiwa, F., & Imelda, H. (2011). Kemiskinan Energi: Fakta-Fakta yang Ada di Masyarakat.

Warren, N. (2008). A Review of Studies on the Distributional Impact of Consumption Taxes in OECD Countries. OECD Social, *Employment and Migration Working Papers* 64.

Warwick, R., Harris, T., Philips, D, Goldman, M., Jellema, J., Inchauste, G., & Karolina, G.T. (2022). The redistributive power of cash transfers vs. VAT exemptions: A multi-country study. *World Development* 151, 105742.

World Bank. (2001). *Attacking Poverty*. World Development Report 2000/2001. Oxford University Press.

World Health Organization. (2018). Opportunities for Transition to Clean Household Energy.

Appendix A – Chapter 1 Supplemental Information

VAT Law in Indonesia

According to the Law of The Republic of Indonesia Number 42, the Year 2009 of The Third Amendment of Law Number 8, the Year 1983 on the Value Added Tax of Goods and Services and Tax of Luxury Goods Sale that has been implemented since 2009, all consumption of goods and services are subject to VAT except goods and services as follows:

1. Goods:
    a. mining and drilling products which are taken directly from their sources.
    b. staple goods which are required mainly by the people.
    c. food and beverages which are served in the hotel, restaurant, food shop, shop, or the similar desired, including dine-in and takeout food, including food and beverage which the catering company presents; and
    d. money, gold bullion, and securities.
2. Services:
    a. medical services.
    b. social services.
    c. courier services with stamp
    d. financial services.
    e. insurance services.
    f. religious services.
    g. education services.
    h. art and entertainment services.
    i. Non-advertisement broadcasting services.

j. land and water transportation services, as well as domestic air transport services, which is an integral part of the international air transport services.

k. employment services.

l. hospitality services.

m. services that the Government provides in the framework of the implementation of general administration.

n. parking services.

o. public telephone service that uses coins.

p. remittance service by postal money order; and

q. catering services

Based on Article 16B of the VAT law, goods and services are taxable but excused from VAT as those goods are needed by many people or so-called strategic goods and services. The strategic goods and services list can be found in Government Regulation Number 7 of 2007. Raw or unprocessed agriculture, plantation, forestry, and marine products are classified as strategic goods. Water and electricity are also included in this category.

Using the VAT Law and Government Regulation as a guideline, it can be derived from the Susenas 2013 consumption data that 125 out of 215 food items and 32 out of 87 nonfood items are exempted from VAT. More than half of food items are exempted due to unprocessed food required mainly by the people, such as rice, vegetables, meat, fruits, and similar kinds.

The following is the detail of exempted consumption. Not all items can be directly related to the regulation, especially for nonfood consumption, as several expenditures are combined in a single code. Thus, subjective assessment is needed for some items to be included as exempted items.

Table A.1: Exempted Food and Nonfood

No	Food	Susenas Codes	Items
1	Grains	2-5	4
2	Tubers	11-16	6
3	Fish/Shrimp/Squid/Clams	21-34, 35-39	19
4	Meat	54-61, 66-70	13
5	Egg and Milk	72-78	7
6	Vegetables	86-112	27
7	Nuts	116-121	6
8	Fruits	128-148	21
9	Cooking Oil and Fat	-	0
10	Beverage Ingredients	159	1
11	Spices	168-174	7
12	Other Consumption	-	0
13	Ready Food and Drinks	196-205, 208-210	13
14	Tobacco and Betel Leaf	228	1
			125

No	Nonfood	Susenas Codes	Items
1	Housing and Facilities	254	1
2	Variety of Goods and Services		
	Curative Health Services	269-275	7
	Preventive Health Services	280-283	4
	School/tuition Fee	285-288	4
	Fuel and maintenance of motor vehicles	298-302	5
3	Clothes, Footwear, and Headgear	-	0
4	Durable Goods	-	0
5	Tax, Retribution, and Insurances	331-336	6
6	Party and Ceremonial	338-339, 341-343	**5**
			32

Based on the new VAT Law (Law Number 7 on Tax Harmonization) enacted in late October 2021, several groups of nontaxable goods and services become taxable but excused from VAT. Those goods and services are as follows:

Table A.2: Comparison of old VAT Law and Latest Amendment (Law Number 7 of 2021)

	Goods and Services	Old VAT Law	Latest Amendments
I	**Goods**		
a	mining and drilling products of which are taken directly from their sources;	Non Taxable	Taxable
b	staple goods of which are mostly required by the people;	Non Taxable	Taxable but Exempted
c	food and beverage of which are served in the hotel, restaurant, food shop, shop, or the similar is desired, including dine in and takeout food, including food and beverage of which are presented by catering company; and	Non Taxable	Non Taxable
d	money, gold bullion, and securities	Non Taxable	Non Taxable
II	Services		
a	medical services;	Non Taxable	Taxable but Exempted
b	social services;	Non Taxable	Taxable but Exempted
c	courier services with stamp	Non Taxable	Taxable
d	financial services;	Non Taxable	Taxable but Exempted
e	insurance services;	Non Taxable	Taxable but Exempted
f	religious services	Non Taxable	Non Taxable
g	education services	Non Taxable	Taxable but Exempted
h	art and entertainment services	Non Taxable	Non Taxable
i	non advertisement broadcasting services;	Non Taxable	Taxable
j	land and water transportation services as well domestic air transport services of which is the integral part of the international air transport services;	Non Taxable	Taxable but Exempted
k	Employment services;	Non Taxable	Taxable but Exempted
l	hospitality services	Non Taxable	Non Taxable
m	services of which are provided by the Government in the framework of the implementation of general administration;	Non Taxable	Non Taxable
n	parking services;	Non Taxable	Non Taxable
o	public telephone service that uses coins;	Non Taxable	Taxable
p	remittance service by postal money order; and	Non Taxable	Taxable
q	catering services	Non Taxable	Non Taxable

Nontaxable goods and services and taxable goods and services but excused of VAT (also called strategic goods) fall under the category of VAT exemption. The government does not impose VAT on sales, and VAT obtained from purchases of input to produce goods and services cannot be credited. A detailed treatment of the listed food and nonfood consumption of Susenas 2013 is shown in Table A.3.

Table A.3 Details of Food and Nonfood Consumption from Susenas 2013
A. Food

Food Subgroup		Items		Treatment		
No	Name	Name	Susenas Code	2009	2022	
					New VAT Law	Upper Bound
1	**Grains**		**1**			
		Rice	**2**	**Non Taxable**	**Excused**	Taxable
		Sticky Rice	**3**	**Non Taxable**	**Excused**	Taxable
		Corn	**4**	**Non Taxable**	**Excused**	Taxable
		Corn Kernel	**5**	**Non Taxable**	**Excused**	Taxable
		Rice Flour	6	Taxable	Taxable	Taxable
		Cornflour	7	Taxable	Taxable	Taxable
		Wheatflour	8	Taxable	Taxable	Taxable
		Other Flour	9	Taxable	Taxable	Taxable
2	**Tubers**		**10**			
		Cassava	11	**Excused**	**Excused**	Taxable
		Sweet Potato	12	**Excused**	**Excused**	Taxable
		Sago	13	**Excused**	**Excused**	Taxable
		Taro	14	**Excused**	**Excused**	Taxable
		Potato	15	**Excused**	**Excused**	Taxable
		Dried Cassava	16	**Excused**	**Excused**	Taxable
		Dried Cassava flour	17	Taxable	Taxable	Taxable
		Cassava flour	18	Taxable	Taxable	Taxable
		Other tubers	19	**Excused**	Taxable	Taxable
3	**Fish**		**20**			
		Yellow tail	21	**Excused**	**Excused**	Taxable
		Tuna	22	**Excused**	**Excused**	Taxable
		Mackerel	23	**Excused**	**Excused**	Taxable
		Selar	24	**Excused**	**Excused**	Taxable
		Indian Mackarel	25	**Excused**	**Excused**	Taxable
		Anchoives	26	**Excused**	**Excused**	Taxable
		Milk Fish	27	**Excused**	**Excused**	Taxable
		Mud Fish	28	**Excused**	**Excused**	Taxable
		Tilapia	29	**Excused**	**Excused**	Taxable
		Gold Fish	30	**Excused**	**Excused**	Taxable
		Catfish	31	**Excused**	**Excused**	Taxable
		Snapper	32	**Excused**	**Excused**	Taxable
		Baronang	33	**Excused**	**Excused**	Taxable
		Other Fishes	34	**Excused**	**Excused**	Taxable
		Shrimp	35	**Excused**	**Excused**	Taxable
		Squid	36	**Excused**	**Excused**	Taxable
		Crab	37	**Excused**	**Excused**	Taxable
		shell	38	**Excused**	**Excused**	Taxable
		other fresh water ani.	39	**Excused**	**Excused**	Taxable
		Salted indian Mackerel	40	Taxable	Taxable	Taxable

Continued.

Table A.3 Food Continued

Food Subgroup		Items		Treatment		
No	Name	Name	Susenas Code	2009	2022	
					New VAT Law	Upper Bound
		Salted Mackarel	41	Taxable	Taxable	Taxable
		Salted Tuna	42	Taxable	Taxable	Taxable
		Dried anchovy	43	Taxable	Taxable	Taxable
		salted yellowtail scad	44	Taxable	Taxable	Taxable
		salted Sepat Fish	45	Taxable	Taxable	Taxable
		salted Milk Fish	46	Taxable	Taxable	Taxable
		salted Mud Fish	47	Taxable	Taxable	Taxable
		canned Fish	48	Taxable	Taxable	Taxable
		other preserved fish	49	Taxable	Taxable	Taxable
		preserved shrimp	50	Taxable	Taxable	Taxable
		preserved squid	51	Taxable	Taxable	Taxable
		other preserved water ani.	52	Taxable	Taxable	Taxable
4	**Meat**		**53**			
		Beef	54	**Non Taxable**	**Excused**	Taxable
		Buffalo meat	55	**Non Taxable**	**Excused**	Taxable
		lamb	56	**Non Taxable**	**Excused**	Taxable
		pork	57	**Non Taxable**	**Excused**	Taxable
		chicken	58	**Non Taxable**	**Excused**	Taxable
		free range chicken	59	**Non Taxable**	**Excused**	Taxable
		other poultry meat	60	**Non Taxable**	**Excused**	Taxable
		other meat	61	**Non Taxable**	**Excused**	Taxable
		jerky meat	62	Taxable	Taxable	Taxable
		shredded meat	63	Taxable	Taxable	Taxable
		canned meat	64	Taxable	Taxable	Taxable
		other preserved meat	65	Taxable	Taxable	Taxable
		lever	66	**Non Taxable**	**Excused**	Taxable
		innards	67	**Non Taxable**	**Excused**	Taxable
		beef trims	68	**Non Taxable**	**Excused**	Taxable
		bones	69	**Non Taxable**	**Excused**	Taxable
		Other	70	**Non Taxable**	**Excused**	Taxable
5	**Egg and Milk**		**71**			
		chicken egg	72	**Non Taxable**	**Excused**	Taxable
		free range chicken egg	73	**Non Taxable**	**Excused**	Taxable
		duck egg	74	**Non Taxable**	**Excused**	Taxable
		quail eggs	75	**Non Taxable**	**Excused**	Taxable
		other egg	76	**Non Taxable**	**Excused**	Taxable
		salted egg	77	**Non Taxable**	**Excused**	Taxable
		Pure Milk	78	**Non Taxable**	**Excused**	Taxable
		processed milk	79	**Taxable**	**Taxable**	Taxable
		condensed milk	80	**Taxable**	**Taxable**	Taxable

Continued.

Table A.3 Food Continued

Food Subgroup		Items		Treatment		
No	Name	Name	Susenas Code	2009	2022	
					New VAT Law	Upper Bound
		Milk Formula	81	**Taxable**	**Taxable**	Taxable
		Baby Formula	82	**Taxable**	**Taxable**	Taxable
		cheese	83	**Taxable**	**Taxable**	Taxable
		Other dairy produces	84	**Taxable**	**Taxable**	Taxable
6	**Vegetables**		**85**			
		Spinach	86	**Non Taxable**	**Excused**	Taxable
		water spinach	87	**Non Taxable**	**Excused**	Taxable
		cabbage	88	**Non Taxable**	**Excused**	Taxable
		white mustard green	89	**Non Taxable**	**Excused**	Taxable
		mustard green	90	**Non Taxable**	**Excused**	Taxable
		beans	91	**Non Taxable**	**Excused**	Taxable
		long beans	92	**Non Taxable**	**Excused**	Taxable
		small tomato	93	**Non Taxable**	**Excused**	Taxable
		carrot	94	**Non Taxable**	**Excused**	Taxable
		cucumber	95	**Non Taxable**	**Excused**	Taxable
		cassava leaves	96	**Non Taxable**	**Excused**	Taxable
		eggplant	97	**Non Taxable**	**Excused**	Taxable
		bean sprouts	98	**Non Taxable**	**Excused**	Taxable
		pumpkin	99	**Non Taxable**	**Excused**	Taxable
		young corn	100	**Non Taxable**	**Excused**	Taxable
		soup vegetable/cap cay	101	**Non Taxable**	**Excused**	Taxable
		Vegetable in Tamarind Soup	102	**Non Taxable**	**Excused**	Taxable
		young jackfruit	103	**Non Taxable**	**Excused**	Taxable
		young papaya	104	**Non Taxable**	**Excused**	Taxable
		mushroom	105	**Non Taxable**	**Excused**	Taxable
		bitter beans	106	**Non Taxable**	**Excused**	Taxable
		stinky beans	107	**Non Taxable**	**Excused**	Taxable
		red onion	108	**Non Taxable**	**Excused**	Taxable
		garlic	109	**Non Taxable**	**Excused**	Taxable
		red chili	110	**Non Taxable**	**Excused**	Taxable
		green chili	111	**Non Taxable**	**Excused**	Taxable
		cayenne pepper	112	**Non Taxable**	**Excused**	Taxable
		canned vegetable	113	**Taxable**	**Taxable**	Taxable
		Other vegetable	114	**Non Taxable**	**Excused**	Taxable
7	**Legumes**		**115**			
		peanuts	116	**Excused**	**Excused**	Taxable
		peanuts with skin	117	**Excused**	**Excused**	Taxable
		soybeans	118	**Excused**	**Excused**	Taxable
		mung beans	119	**Excused**	**Excused**	Taxable
		cashews	120	**Excused**	**Excused**	Taxable

Continued.

Table A.3 Food Continued.

Food Subgroup		Items		Treatment		
No	Name	Name	Susenas Code	2009	2022	
					New VAT Law	Upper Bound
		other nuts	121	**Excused**	**Excused**	Taxable
		tofu	122	**Taxable**	**Taxable**	Taxable
		tempeh	123	**Taxable**	**Taxable**	Taxable
		fermented yellow soybeans	124	**Taxable**	**Taxable**	Taxable
		oncom	125	**Taxable**	**Taxable**	Taxable
		other soybean product	126	**Taxable**	**Taxable**	Taxable
8	**Fruits**		**127**			
		Orange	128	**Non Taxable**	**Excused**	Taxable
		mango	129	**Non Taxable**	**Excused**	Taxable
		Apple	130	**Non Taxable**	**Excused**	Taxable
		Avocado	131	**Non Taxable**	**Excused**	Taxable
		Rambutan	132	**Non Taxable**	**Excused**	Taxable
		duku	133	**Non Taxable**	**Excused**	Taxable
		Durian	134	**Non Taxable**	**Excused**	Taxable
		snakefruit	135	**Non Taxable**	**Excused**	Taxable
		pineapple	136	**Non Taxable**	**Excused**	Taxable
		Ambon Banana	137	**Non Taxable**	**Excused**	Taxable
		King banana	138	**Non Taxable**	**Excused**	Taxable
		other banana	139	**Non Taxable**	**Excused**	Taxable
		Papaya	140	**Non Taxable**	**Excused**	Taxable
		guava	141	**Non Taxable**	**Excused**	Taxable
		sapodilla	142	**Non Taxable**	**Excused**	Taxable
		star fruit	143	**Non Taxable**	**Excused**	Taxable
		hog plum	144	**Non Taxable**	**Excused**	Taxable
		water melon	145	**Non Taxable**	**Excused**	Taxable
		melon	146	**Non Taxable**	**Excused**	Taxable
		jackfruit	147	**Non Taxable**	**Excused**	Taxable
		tomato	148	**Non Taxable**	**Excused**	Taxable
		canned fruit	149	Taxable	Taxable	Taxable
		other fruit	150	Non Taxable	**Excused**	Taxable
9	**Cooking oil and Fat**		**151**			
		coconut oil	152	Taxable	**Excused**	Taxable
		corn oil	153	Taxable	**Excused**	Taxable
		other cooking oil	154	Taxable	**Excused**	Taxable
		coconut	155	Taxable	**Excused**	Taxable
		margarine	156	Taxable	**Excused**	Taxable
		other cooking oil and fat	157	Taxable	**Excused**	Taxable
10	**Beverage Stuff**		**158**			
		sugar	159	Taxable	Taxable	Taxable
		palm sugar	160	Taxable	Taxable	Taxable

Continued.

Table A.3 Food Continued.

Food Subgroup		Items		Treatment		
No	Name	Name	Susenas Code	2009	2022	
					New VAT Law	Upper Bound
		tea	161	Taxable	Taxable	Taxable
		coffee	162	Taxable	Taxable	Taxable
		chocolate drink	163	Taxable	Taxable	Taxable
		chocolate powder	164	Taxable	Taxable	Taxable
		syrup	165	Taxable	Taxable	Taxable
		other beverage ingredients	166	Taxable	Taxable	Taxable
11	**Spices**		167			
		salt	168	Non Taxable	**Excused**	Taxable
		candlenut	169	**Excused**	Taxable	Taxable
		coriander	170	**Excused**	Taxable	Taxable
		pepper	171	**Excused**	Taxable	Taxable
		lemon	172	**Excused**	Taxable	Taxable
		nutmeg	173	**Excused**	Taxable	Taxable
		clove	174	**Excused**	Taxable	Taxable
		shrimp paste	175	Taxable	Taxable	Taxable
		soy sauce	176	Taxable	Taxable	Taxable
		vetsin	177	Taxable	Taxable	Taxable
		chili/tomato sauce	178	Taxable	Taxable	Taxable
		ready packaged spices	179	Taxable	Taxable	Taxable
		other spices	180	Taxable	Taxable	Taxable
12	**Miscellaneous Food items**		**181**			
		instant noodles	182	Taxable	Taxable	Taxable
		noodles	183	Taxable	Taxable	Taxable
		rice noodles	184	Taxable	Taxable	Taxable
		pasta	185	Taxable	Taxable	Taxable
		raw crackers	186	Taxable	Taxable	Taxable
		emping chips	187	Taxable	Taxable	Taxable
		jelly	188	Taxable	Taxable	Taxable
		packaged baby porridge	189	Taxable	Taxable	Taxable
		other consumption	190	Taxable	Taxable	Taxable
13	**Prepared Food and Beverages**		**191**			
		white bread	192	Taxable	Taxable	Taxable
		sweat bread	193	Taxable	Taxable	Taxable
		pastry	194	Taxable	Taxable	Taxable
		cake	195	Taxable	Taxable	Taxable
		fried food	196	Non Taxable	Non Taxable	Non Taxable
		mung beans porridge	197	Non Taxable	Non Taxable	Non Taxable
		gado gado (salad)	198	Non Taxable	Non Taxable	Non Taxable
		mixed rice	199	Non Taxable	Non Taxable	Non Taxable
		fried rice	200	Non Taxable	Non Taxable	Non Taxable

Continued.

Table A.3 Food Continued.

Food Subgroup		Items		Treatment		
No	Name	Name	Susenas Code	2009	2022	
					New VAT Law	Upper Bound
		white rice	201	Non Taxable	Non Taxable	Non Taxable
		compressed rice cake	202	Non Taxable	Non Taxable	Non Taxable
		Indonesian soup	203	Non Taxable	Non Taxable	Non Taxable
		satay	204	Non Taxable	Non Taxable	Non Taxable
		meat ball/fried/boiled noodle	205	Non Taxable	Non Taxable	Non Taxable
		cooked instant noodle	206	Non Taxable	Non Taxable	Non Taxable
		crakers	207	Non Taxable	Non Taxable	Non Taxable
		cooked fish	208	Non Taxable	Non Taxable	Non Taxable
		cooked chicken/meat	209	Non Taxable	Non Taxable	Non Taxable
		other cooked food	210	Non Taxable	Non Taxable	Non Taxable
		packaged/bottled water	211	Taxable	Taxable	Taxable
		Galon bottled water	212	Taxable	Taxable	Taxable
		bottled tea water	213	Taxable	Taxable	Taxable
		packaged/bottled juice	214	Taxable	Taxable	Taxable
		carbonated soft drink	215	Taxable	Taxable	Taxable
		energy drink	216	Taxable	Taxable	Taxable
		other package drink	217	Taxable	Taxable	Taxable
		ice cream	218	Taxable	Taxable	Taxable
		other ice	219	Taxable	Taxable	Taxable
		beer	220	Taxable	Taxable	Taxable
		wine	221	Taxable	Taxable	Taxable
		other alcoholic drinks	222	Taxable	Taxable	Taxable
14	**Tobacco and Betel Leaf**		**223**			
		clove cigarette	224	Taxable	Taxable	Taxable
		clove cigarette without filter	225	Taxable	Taxable	Taxable
		white cigarette	226	Taxable	Taxable	Taxable
		tobacco	227	Taxable	Taxable	Taxable
		betel leaf/areca nut	228	**Excused**	**Excused**	Taxable
		others	229	Taxable	Taxable	Taxable

B. Nonfood

Nonfood Subgroup		Items		Treatment		
No	Name	Name	Susenas Code	2009	2022	
					New VAT Law	Upper Bound
1	**Housing and Household Facilities**		**230**			
		Estimated House Rent (Home Owner)	232	Taxable	Taxable	Taxable
		Contract Housing	233	Taxable	Taxable	Taxable
		House Rent	234	Taxable	Taxable	Taxable
		Estimated House Rent (Employer Housing)	235	Taxable	Taxable	Taxable
		House maintenance	236	Taxable	Taxable	Taxable
		Electricity	238	Excused	Excused	Taxable
		Water	240	Excused	Excused	Taxable
		LPG	242	Taxable	Taxable	Taxable
		City Gas	244	Taxable	Taxable	Taxable
		Kerosene	246	Taxable	Taxable	Taxable
		Generator of Electricity	248	Taxable	Taxable	Taxable
		Generator Oil	250	Taxable	Taxable	Taxable
		Generator Maintenance	251	Taxable	Taxable	Taxable
		Coal/Cricket/charcoal	253	Taxable	Taxable	Taxable
		Fuelwood	254	Excused	Excused	Taxable
		Others	255	Taxable	Taxable	Taxable
		Fix Cable Phone	256	Taxable	Taxable	Taxable
		Mobil Phone Charge	257	Taxable	Taxable	Taxable
		Other phone charges	258	Taxable	Taxable	Taxable
		Postal items	259	Non Taxable	Taxable	Taxable
		other telecomunication charges	260	Taxable	Taxable	Taxable
2	**Variety Goods and Services**		**261**			
		Soap, tooth paste, tooth brush, and shampo	262	Taxable	Taxable	Taxable
		Beauty products and Sanitary napkins	263	Taxable	Taxable	Taxable
		Body treatment	264	Taxable	Taxable	Taxable
		laundry soap	265	Taxable	Taxable	Taxable
		cloths maintenance	266	Taxable	Taxable	Taxable
		Books	267	Taxable	Taxable	Taxable
		other things (tisue, diapers, etc.)	268	Taxable	Taxable	Taxable
		Public/government Hospital	269	Non Taxable	Excused	Taxable
		Private Hospital	270	Non Taxable	Excused	Taxable
		Urgent Care	271	Non Taxable	Excused	Taxable
		Doctor Practice/Clinic	272	Non Taxable	Excused	Taxable

Continued.

Table A.3 Nonfood Continued.

Nonfood Subgroup		Items		Treatment		
No	Name	Name	Susenas Code	2009	2022	
					New VAT Law	Upper Bound
		Medical Workers (other than doctor)	273	Non Taxable	Excused	Taxable
		Traditional Medication	274	Non Taxable	Excused	Taxable
		Midwifes	275	Non Taxable	Excused	Taxable
		Prescription	276	Taxable	Taxable	Taxable
		Over the counter medicine	277	Taxable	Taxable	Taxable
		Traditional medicine	278	Taxable	Taxable	Taxable
		Wheechair, Protese, and Glasses	279	Taxable	Taxable	Taxable
		Pregnancy	280	Non Taxable	Excused	Taxable
		Immunation	281	Non Taxable	Excused	Taxable
		Medical Check Up	282	Non Taxable	Excused	Taxable
		Contraception	283	Non Taxable	Excused	Taxable
		Other health Maintenance	284	Taxable	Taxable	Taxable
		School Development Contribution	285	Non Taxable	Excused	Taxable
		Tuition Fee	286	Non Taxable	Excused	Taxable
		Other School Fee	287	Non Taxable	Excused	Taxable
		School Book	288	Non Taxable	Excused	Taxable
		School Utensil	289	Taxable	Taxable	Taxable
		Extra Courses	290	Non Taxable	Excused	Taxable
		Gasoline	292	Taxable	Taxable	Taxable
		Diesel	294	Taxable	Taxable	Taxable
		Oil Machine	296	Taxable	Taxable	Taxable
		Reguler Vehicle Maintenance	297	Taxable	Taxable	Taxable
		Public Transportation	298	Non Taxable	Excused	Taxable
		Hotel, Cinema, Recreation	299	Non Taxable	Non Taxable	Non Taxable
		House assistance, security, driver, gardener	300	Non Taxable	Excused	Taxable
		Financial services	301	Non Taxable	Excused	Taxable
		Other services	302	Taxable	Taxable	Taxable
3	**Clothing, Footware, and Headware**		**303**			
		Men Clothing	304	Taxable	Taxable	Taxable
		Women Clothing	305	Taxable	Taxable	Taxable
		Kids Clothing	306	Taxable	Taxable	Taxable
		Fabrics	307	Taxable	Taxable	Taxable
		Sewing and tools	308	Taxable	Taxable	Taxable
		Footware	309	Taxable	Taxable	Taxable
		Hat, head cover	310	Taxable	Taxable	Taxable
		Others (towel, belt, hanger)	311	Taxable	Taxable	Taxable

Continued.

Table A.3 Nonfood Continued.

Nonfood Subgroup		Items		Treatment		
No	Name	Name	Susenas Code	2009	2022	
					New VAT Law	Upper Bound
4	**Durables**		**312**			
		Furniture/Meubelair	313	Taxable	Taxable	Taxable
		household appliances	314	Taxable	Taxable	Taxable
		Home Furnishings	315	Taxable	Taxable	Taxable
		households utensils	316	Taxable	Taxable	Taxable
		kitchen utensils	317	Taxable	Taxable	Taxable
		Decoration	318	Taxable	Taxable	Taxable
		Maintenance of appliances	319	Taxable	Taxable	Taxable
		Mobile Phone and accessories	320	Taxable	Taxable	Taxable
		Watch, clock, Camera, Video camera	321	Taxable	Taxable	Taxable
		Bag, Luggage, umbrela	322	Taxable	Taxable	Taxable
		Jewelry	323	Taxable	Taxable	Taxable
		Toys	324	Taxable	Taxable	Taxable
		Tv, radio, video, DVD, computer, guitar, piano	325	Taxable	Taxable	Taxable
		sports	326	Taxable	Taxable	Taxable
		Vehicle (car, motor cycle, bike, etc) and overhau	327	Excluded	Excluded	Excluded
		Pet and Plant Maintenance	328	Taxable	Taxable	Taxable
		Other durables and maintenance	329	Taxable	Taxable	Taxable
5	**Tax, Excise, and Insurance**		**330**			
		Property Tax	331	Non Taxable	Non Taxable	Non Taxable
		Vehicle Tax	332	Non Taxable	Non Taxable	Non Taxable
		Retribution (cleaning, security, parking)	333	Non Taxable	Non Taxable	Non Taxable
		Health insurance	334	Non Taxable	Excused	Non Taxable
		Loss insurance (death, accident, car, house)	335	Non Taxable	Excused	Non Taxable
		Others (ticket)	336	Non Taxable	Non Taxable	Non Taxable
6	**Party and Ceremonial**		**337**			
		Wedding Party Expenditure	338	Excluded	Excluded	Excluded
		Circumvate and Birthday	339	Non Taxable	Excused	Taxable
		Religion holiday ceremony (seat/tent rental)	340	Taxable	Taxable	Taxable
		Hajj Pilgrimage Cost	341	Excluded	Excluded	Excluded
		Other religion and custom ceremonial	342	Excluded	Excluded	Excluded
		Funeral	343	Excluded	Excluded	Excluded

Appendix B - Chapter 2 Supplemental Information

Estimation Using Unbalanced Panel Data

In this part, this study shows the results of estimating the policy impacts on reported sales using unbalanced panel data (repeated cross-section). The presentation of the results follows the flow from the main specifications.

This paper will use equation (B.1) below for generalized DD specification using unbalanced panel data. The firm fixed effect will be substituted by the sector fixed effect, η_s. Other things will be the same as equation (1). For the 2x2 DD specification, this section uses the same equation with balanced panel data (equation 2.2).

$$\ln R_{ispt} = \eta_s + \gamma_t + \alpha_p + \beta Treat_s.Post_t + \varepsilon_{ispt} \qquad (B.1)$$

Figure B.1 shows the trend for the unbalanced panel data of small firms. Figure B.1 shows a similar trend to Figure 2.1. The null hypothesis of a parallel trend cannot be rejected statistically. Table B.1 shows the result for the main specification. Columns 1 and 2 show that wholesale sales are 57-58 percent lower compared to retail firms for four years period the policy was implemented. If the data collapsed before and after the policy, as shown in column 3, the wholesale group reports fewer sales by 29 percent compared to the retail group.

Figure B.2 shows the trend for adjusted revenues of unbalanced panel data. The difference between the two groups is wider with adjusted reported revenues, and the down-sloping trend posttreatment is smoother than using the non-adjusted reported revenues. Table B.2 shows the DD estimates for adjusted revenues reported. Column 1 shows the DD coefficient from estimating equation (B.1) and column 2 for equation (2). As shown in column 1, the VAT threshold policy will decrease sales reported by wholesale firms by 70 percent for four years. If the data is collapsed

into two periods, the impact of the policy shows that the wholesale group reported fewer revenues by 35 percent, larger than the previous estimate.

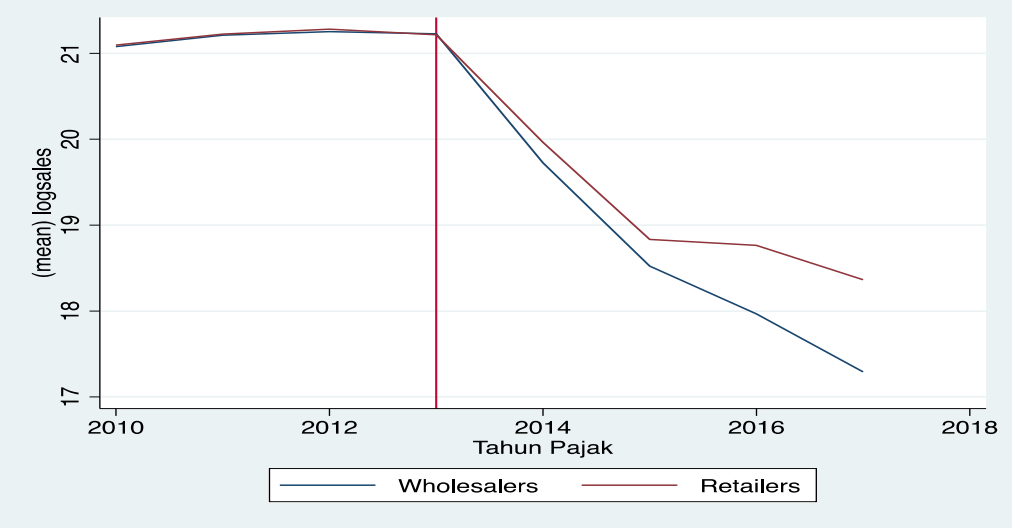

Figure B.1: Log Revenue Trend: Wholesale vs Retail

Table B.1: VAT Threshold Effect-Wholesale versus Retail

	Log Reported Revenue		
	(1)	(2)	(3)
DD (Post 2014 x Wholesale)	-0.5754***	-0.5726***	-0.2878*
	(0.1883)	(0.1881)	(0.1700)
Firm Fixed Effect	No	No	Yes
Time Fixed Effect	Yes	Yes	Yes
Provinces Fixed Effect	No	Yes	No
Sector Fixed Effect	Yes	Yes	No
Observation	42,588	42,588	11,226
Firms	5,613	5,613	5,613
Sector	161	161	161

Standard errors in parenthesis, cluster at the sector level. * p<0.1, ** p<0.05, *** p<0.01.

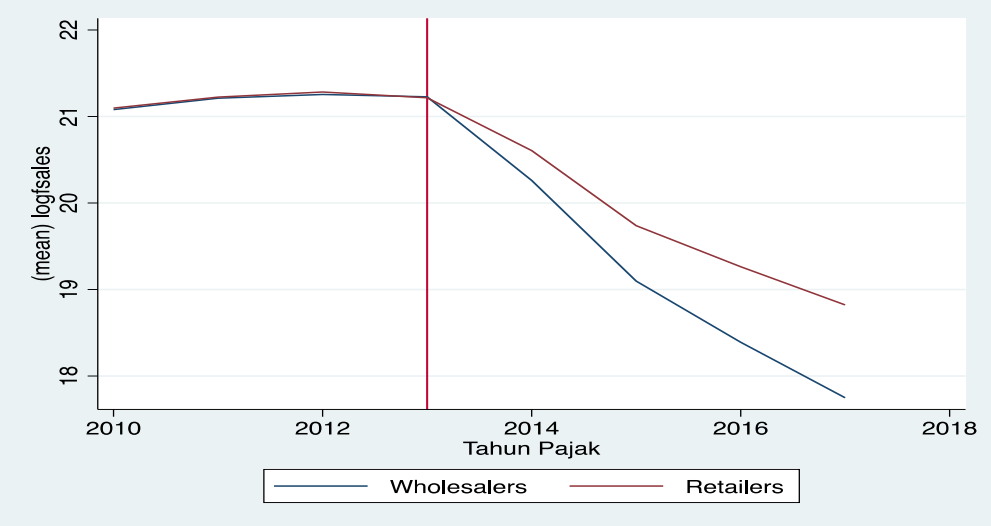

Figure B.2: Reported Adjusted Revenues: Wholesale and Retail

Table B.2: VAT Threshold Effect-Wholesale versus Retail (Adjusted Revenues)

	Log Reported Revenue	
	(1)	(2)
DD (Post 2014 x Wholesale)	-0.7039***	-0.3520**
	(0.2035)	(0.1715)
Firm Fixed Effect	No	Yes
Time Fixed Effect	Yes	Yes
Provinces Fixed Effect	Yes	No
Sector Fixed Effect	Yes	No
Recalculated Revenue	Yes	Yes
Panel	Unbalanced	Unbalanced
Observation	42,588	11,226
Observation Recalculated	536	536
Firms	5,613	5,613
Sector	161	161

Standard errors in parenthesis, cluster at the sector level. * p<0.1, ** p<0.05, *** p<0.01.

To consider the impact of e-invoices, this paper uses the equation (B.2).

$$\ln R_{ispt} = \eta_s + \gamma_t + \alpha_p + \beta_1 Treat_s.Post_{t1} + \beta_2 Treat_s.Post_{t2} + \varepsilon_{ispt} \qquad (B.2)$$

The results from estimating equation (B.2) are shown in Table B.3. The coefficient in columns 1 and 2 indicates that the magnitude of the negative effect of the new VAT threshold on reported revenues is smaller than the effect estimated. The coefficient on ($Treat_s.Post_{t2}$) indicates that

the difference in reported revenues between the treated and control groups was increasing in the post-e-invoices period 2016-2017. The result can be interpreted that the impact of the new VAT Threshold on lower reported revenues is more robust even in the e-invoices policy for the wholesale group.

Table B.3: Two Policies Effects: Wholesale versus Retail

	Log Reported Revenue	
	(1)	(2)
DD (Post 2014-2015 x Wholesale)	-0.0761	-0.2948**
	(0.1442)	(0.1385)
DD (Post 2016 X Wholesale)	-0.6034**	-0.6767***
	(0.2557)	(0.2552)
Time Fixed Effect	Yes	Yes
Provinces Fixed Effect	No	Yes
Sector Fixed Effect	Yes	Yes
Recalculated Revenues	No	Yes
Panel	Unbalanced	Unbalanced
Observation	42,588	42,588
Observation Recalculated	No	536
Firms	5,613	5,613
Sector	161	161

Standard errors in parenthesis, cluster at the sector level. * p<0.1, ** p<0.05, *** p<0.01.

Figure B.3 shows the trend of both groups for robustness checks using firms with revenue above 600 million up to 4.8 billion IDR every year in 2010-2013. Figure B.3 shows a similar trend with the main specifications. The two groups started to make a different trend in 2014. The null hypothesis of linear trends is parallel is satisfied. Table B.4 shows the estimates of the VAT threshold effects for both groups. All estimates show that the wholesale group reported fewer revenues than the retail group for years since the new policy was implemented. The wholesale reports lower revenues by 47 to 57 percent and by 28 percent if the data is collapsed into two periods.

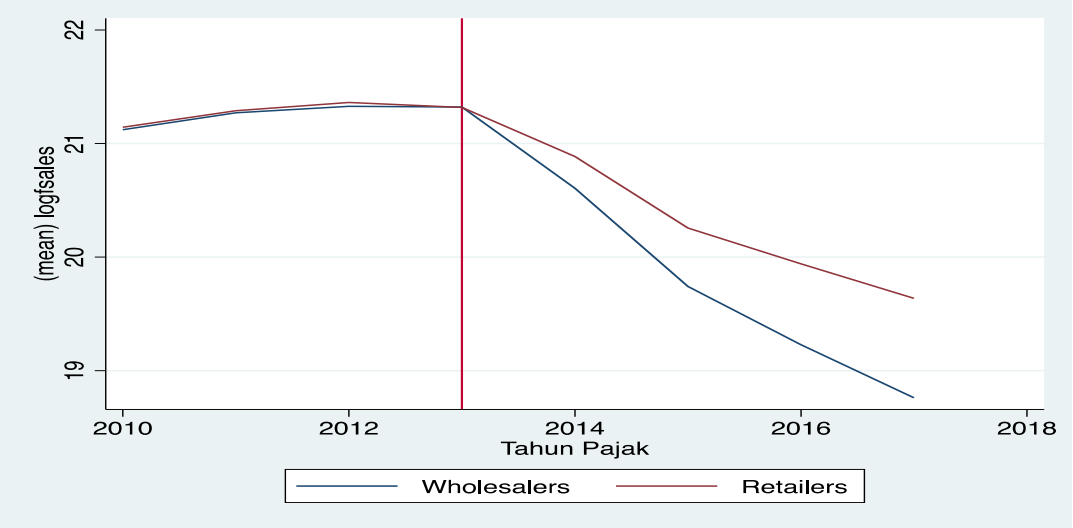

Figure B.3: Trend Log Reported Revenue (Adjusted) of Firms with Revenue above 600 million up to 4.8 billion IDR Every Year in 2010-2013

Table B.4: VAT Threshold Effect of Firms with Revenue above 600 Million up to 4.8 Billion IDR Every Year in 2010-2013: Wholesale vs. Retail

	Log Reported Revenue		
	(1)	(2)	(3)
DD (Post 2014 x Wholesale)	-0.4713**	-0.5684***	-0.2817**
	(0.1863)	(0.1777)	(0.1395)
Firm Fixed Effect	No	No	Yes
Time Fixed Effect	Yes	Yes	Yes
Provinces Fixed Effect	Yes	Yes	No
Sector Fixed Effect	Yes	Yes	No
Recalculated Revenue	No	Yes	Yes
Panel	Unbalanced	Unbalanced	Unbalanced
Observation	54,896	54,896	14,358
Observation Recalculated	No	607	607
Firms	7,179	7,179	7,179
Sector	168	168	168

Standard errors in parenthesis, cluster at the sector level. * p<0.1, ** p<0.05, *** p<0.01.

Figure B.4 shows the trend of both groups for robustness checks using firms with revenue above 600 million IDR every year in 2010-2013. The two groups also started to make a different trend in 2014. The null hypothesis of linear trends is parallel is satisfied. Table B.5 shows the

estimates of the VAT threshold effects for both groups. The wholesale reports lower revenues by 32 to 37 percent and by 19 percent if the data is collapsed into two periods.

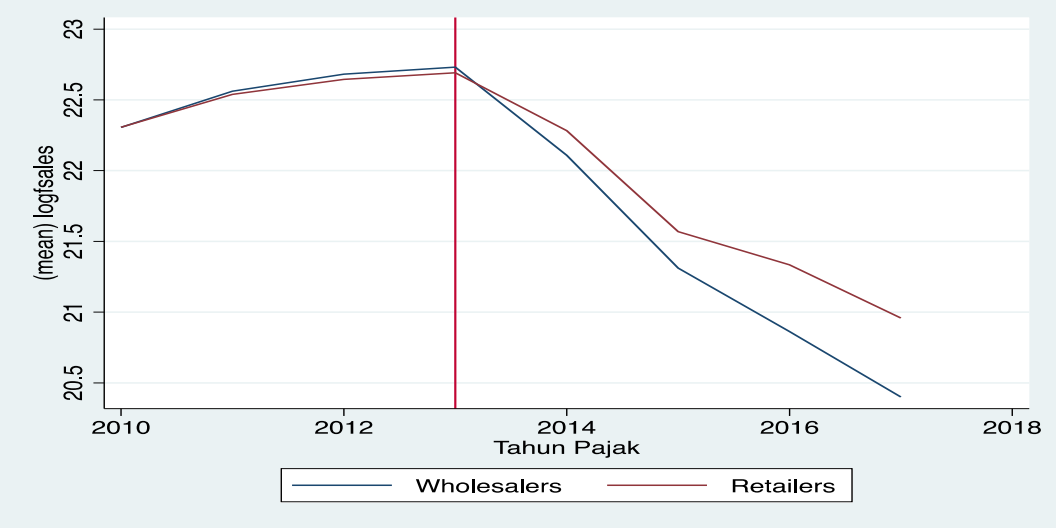

Figure B.4: Trend Log Reported Revenue (Adjusted) of Firms with Revenue above 600 IDR Every Year in 2010-2013

Table B.5: VAT Threshold Effect of Firms with Revenue above 600 Million IDR Every Year in 2010-2013

	Log Reported Revenue		
	(1)	(2)	(3)
DD (Post 2014 x Wholesale)	-0.3228	-0.3719**	-0.1858
	(0.1967)	(0.1793)	(0.1350)
Firm Fixed Effect	No	No	Yes
Time Fixed Effect	Yes	Yes	Yes
Provinces Fixed Effect	Yes	Yes	No
Sector Fixed Effect	Yes	Yes	No
Recalculated Revenue	No	Yes	Yes
Panel	Unbalanced	Unbalanced	Unbalanced
Observation	159,340	159,340	41,254
Observation Recalculated	No	804	804
Firms	20,627	20,627	20,627
Sector	189	189	189

Standard errors in parenthesis, cluster at the sector level. * p<0.1, ** p<0.05, *** p<0.01.

Figure B.5 shows the trend of both groups for robustness checks using firms with revenue above 600 million IDR any year in 2010-2013. The trend of the two groups is relatively different

from previous specifications. The hypothesis of linear trend is parallel satisfied only at a 5 percent significance level. Table B.6 shows the estimates of the VAT threshold effects for both groups. The wholesale reports lower revenues by 22 to 28 percent and by 41 percent if the data are collapsed into two periods.

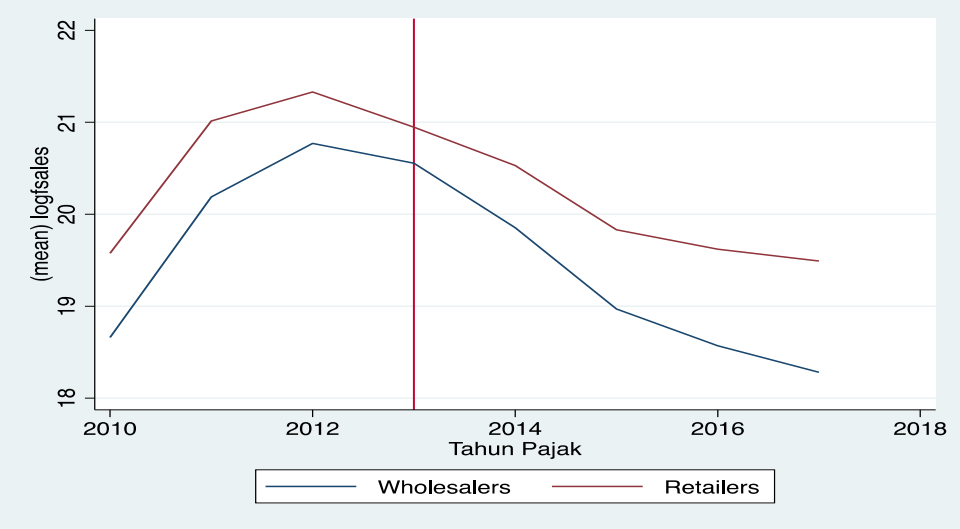

Figure B.5: Trend Log Reported Revenue (Adjusted) of Firms with Revenue above 600 IDR Any Year in 2010-2013

Table B.6: VAT Threshold Effect of Firms with Revenue above 600 Million IDR Any Year in 2010-2013

	Log Reported Revenue		
	(1)	(2)	(3)
DD (Post 2014 x Wholesale)	-0.2153	-0.2826	-0.4073
	(0.2161)	(0.2066)	(0.2681)
Firm Fixed Effect	No	No	Yes
Time Fixed Effect	Yes	Yes	Yes
Provinces Fixed Effect	Yes	Yes	No
Sector Fixed Effect	Yes	Yes	No
Recalculated Revenue	No	Yes	Yes
Panel	Unbalanced	Unbalanced	Unbalanced
Observation	290,339	290,339	76,244
Observation Recalculated	No	2,171	2,171
Firms	38,122	38,122	38,122
Sector	195	195	195

Standard errors in parenthesis, cluster at the sector level. * p<0.1, ** p<0.05, *** p<0.01.

Table B.7 estimates the VAT threshold effects on reported cost for both groups. The wholesale reported lower costs by 14 to 25 percent than the retail. The wholesale reported lower revenues than costs, as shown in Table B.8. It can be inferred that the wholesale firms tend to do tax evasion by underreporting revenues. Those findings are consistent with findings using the balanced panel data.

Table B.7: VAT Threshold Impact on Reported Cost: Wholesale and Retailer

	Log Cost			
	(1)	(2)	(3)	(4)
DD (Post 2014 x Wholesale)	-0.2472	-0.1807	-0.2265	-0.1367
	(0.1702)	(0.1390)	(0.1451)	(0.2133)
Firm Fixed Effect	No	No	No	No
Time Fixed Effect	Yes	Yes	Yes	Yes
Provinces Fixed Effect	Yes	Yes	Yes	Yes
Sector Fixed Effect	Yes	Yes	Yes	Yes
Observation	41,105	53,188	155,933	284,205
Firms	5,613	7,179	20,178	37,249
Sector	161	168	189	195

Standard errors in parenthesis, cluster at the sector level. * p<0.1, ** p<0.05, *** p<0.01.

Table B.8: Comparison of Estimates

Firm Types	**DD estimates for Wholesale vs Retail**	
	Reported Lower Revenues (%)	**Reported Lower Costs (%)**
Main Spesification	57-70	25
Robustness Check:		
1. Revenue above 600 million up to 4.8 billion IDR every year in 2010-2013	47-57	19
2. Revenues above 600 million every year in 2010-2013	32-37	28
3. Revenues above 600 million IDR in any year in 2010-2013	22-28	14

Appendix C - Chapter 3 Supplemental Information

Table C.1: Distribution of Subsidized LPG Kit

Provinces	2007	2008	2009	2010	2011	2012	2013	2014	2015	Sum
NAD				494,885	407,715		38,333	24,761		965,694
Sumatera Utara			1,701,373	48,557	807,752	36,482				2,594,164
Sumatera Barat						1,957	424,676	333,707	115,469	875,809
Kep. Riau			238,724	40,878	18,619					298,221
Riau			54,624	370,226	688,516					1,113,366
Jambi					602,267					602,267
Sumatera Selatan	50,000	672,340	911,065							1,633,405
Bengkulu				210	435,893			1,799		437,902
Lampung			843,245	828,727	9,438	56,427				1,737,837
Kep. Babel							111,153	94,003		205,156
DKI Jakarta	1,236,547	878,656	8,513							2,123,716
Jawa Barat	1,036,677	7,420,399	3,855,545	122,427						12,435,048
Banten	461,315	1,470,742	652,616							2,584,673
Jawa Tengah	284,316	1,982,837	7,280,427		387					9,547,967
DI Yogyakarta	79,841	735,807	56,860		2,613					875,121
Jawa Timur	542,427	2,339,772	6,186,874	1,850,877	93,973					11,013,923
Bali	13,924	256,934	506,961	11,875						789,694
NTB					679,048					679,048
Kalimantan Barat			240,486	191,842	575,586	58,189		8,620		1,074,723
Kalimantan Timur			469,002	65,125	149,289	12,623	8,035			704,074
Kalimantan Selatan					309,116		210,402	17,317	384,478	921,313
Kalimantan Tengah							104,959	84,215	224,533	413,707
Sulawesi Utara					409,242		48,655	31,967	5,012	494,876
Gorontalo					165,335		67,315	3,567		236,217
Sulawesi Barat					226,897				16,731	243,628
Sulawesi Tengah							67,075	55,692	371,587	494,354
Sulawesi Selatan			1,153,721	604,379						1,758,100
Sulawesi Tenggara							220,498	121,075		341,573
NTT										
Maluku										
Maluku Utara										
Papua Barat										
Papua										
Total Nationally	3,705,047	15,757,487	24,160,036	4,630,008	5,581,686	165,678	1,301,101	776,723	1,117,810	57,195,576

Source: The Coverage of the Zero Kerosene Program is based on Wiratmaja (2016).

Table C.2: Electricity Power Used by Households

Electric Capacity	Total		2008		2010		2013	
	Freq.	Percentage	Freq.	Percentage	Freq.	Percentage	Freq.	Percentage
450 VA	321,133	37.78	112,135	40.07	109,699	37.76	99,299	35.52
900 VA	214,082	25.19	62,300	22.26	69,684	23.98	82,098	29.36
1300 VA	51,444	6.05	12,525	4.48	16,116	5.55	22,803	8.16
2200 VA	9,918	1.17	2,850	1.02	3,058	1.05	4,010	1.43
More than 2200 VA	4,711	0.55	1,555	0.56	1,471	0.51	1,685	0.60
Undefined Capacity	102,716	12.08	33,764	12.06	37,430	12.88	31,522	11.27
No Electricity	145,992	17.18	54,744	19.56	53,077	18.27	38,171	13.65
	849,996	100.00	279,873	100.00	290,535	100.00	279,588	100.00

Source: Susenas 2008, 2010, and 2013.

Table C.3: Correlation of Independent Variables at the National Level

	Expend. (log)	Home	Wall	Floor	Electric.	Age	Female	Hh.Size	W. Women
Expend. (log)	1								
Home Own.	-0.058	1							
House Wall	0.259	-0.0412	1						
House Floor	0.1916	-0.0855	0.3707	1					
Electricity	0.2119	-0.0802	0.2914	0.2116	1				
Age	-0.1147	0.3052	0.028	-0.0205	0.0484	1			
Female	-0.2122	0.0224	-0.0187	-0.023	-0.0009	0.2217	1		
Hh.Size	0.4131	0.1057	0.0067	0.0481	-0.0096	-0.0468	-0.2601	1	
Work. Women	0.0477	0.1114	-0.0172	-0.0342	-0.0536	0.081	0.0948	0.127	1
Some Primaries	-0.2011	0.1339	-0.1109	-0.0486	-0.0654	0.2004	0.0591	0.0052	0.04
Primary Comp.	-0.061	0.0439	-0.0415	-0.0408	-0.0094	-0.053	-0.0474	0.023	0.0013
JH School	0.0806	-0.0831	0.0428	0.0565	0.0518	-0.1538	-0.0723	0.0242	-0.0407
SH School	0.2112	-0.1498	0.1271	0.0927	0.0993	-0.1609	-0.0757	0.0132	-0.0502
University	0.2905	-0.0822	0.1514	0.0907	0.0818	-0.0747	-0.0319	0.0028	0.0154
Urban	0.3128	-0.2238	0.3074	0.1993	0.2488	-0.0217	0.0255	-0.0048	-0.0796
Work field	-0.2619	0.187	-0.2723	-0.1769	-0.2632	0.033	-0.0982	0.0427	0.1385
Mobile Phone	0.503	-0.1031	0.239	0.1626	0.3164	-0.12	-0.0951	0.1591	-0.0024

	S. Primaries	Primary Comp.	JH School	SH School	Univ.	Urban	W. Field	MP
Some Primaries	1							
Primary Comp.	-0.3574	1						
JH School	-0.2732	-0.2485	1					
SH School	-0.2768	-0.2517	-0.1924	1				
University	-0.1728	-0.1571	-0.1201	-0.1217	1			
Urban	-0.1623	-0.0735	0.0683	0.1794	0.1814	1		
Work field	0.1885	0.0859	-0.078	-0.1897	-0.2026	-0.4667	1	
Mobile Phone	-0.1498	-0.0365	0.0962	0.1783	0.1705	0.2631	-0.2654	1

The estimates are obtained by using Pearson correlation. Source: Susenas 2008, 2010, and 2013.

Table C.4: Correlation of Independent Variables for Urban Households

	Expend. (log)	Home	Wall	Floor	Electric.	Age	Female	Hh.Size
Expend. (log)	1							
Home Owner.	0.0519	1						
House wall	0.1878	0.0636	1					
House floor	0.1288	-0.0274	0.3234	1				
Electricity	0.104	-0.019	0.1389	0.0929	1			
Age	-0.0544	0.3759	0.0297	-0.0245	0.0023	1		
Female	-0.1922	0.0359	-0.0181	-0.0209	-0.0092	0.2031	1	
Hh. Size	0.4075	0.1372	-0.002	0.0337	0.0124	0.0243	-0.2397	1
Working Women	0.1145	0.1056	0.039	0.0109	0.0134	0.1001	0.1062	0.1387
Some Primaries	-0.2235	0.1129	-0.1099	-0.0629	-0.0578	0.2123	0.0948	0.0034
Primary Comp.	-0.1257	0.0351	-0.0557	-0.0376	-0.0081	0.0354	0.0008	0.017
JH School	0.0197	-0.0662	0.0076	0.0299	0.0163	-0.1165	-0.0575	0.0125
SH School	0.1583	-0.1041	0.0808	0.0534	0.0447	-0.1685	-0.0859	0.0017
University	0.3173	-0.0145	0.125	0.0688	0.0377	-0.085	-0.0514	0.0074
Work field	-0.1785	0.124	-0.1328	-0.0942	-0.1031	0.0933	-0.0726	0.0255
Mobile Phone	0.4555	-0.0371	0.1393	0.0973	0.1288	-0.153	-0.1107	0.184

	W. Women	S. Primaries	Primary C.	JH School	SH School	Univ.	Work Field	MP
W. Women	1							
Some Primaries	0.029	1						
Primary Comp.	0.0021	-0.2546	1					
JH School	-0.0337	-0.2396	-0.249	1				
SH School	-0.0422	-0.2782	-0.2892	-0.2722	1			
University	0.0507	-0.1866	-0.194	-0.1826	-0.212	1		
Work Field	0.0386	0.178	0.0662	-0.0571	-0.1204	-0.122	1	
Mobile Phone	0.0648	-0.1671	-0.0767	0.0642	0.1393	0.1567	-0.1525	1

The estimates are obtained by using Pearson correlation. Source: Susenas 2008, 2010, and 2013.

Table C.5: Correlation of Independent Variables for Rural Households

	Expend. (log)	Home	Wall	Floor	Electric.	Age	Female	Hh.Size
Expend. (log)	1							
Home Owner.	-0.0321	1						
House wall	0.1797	0.0104	1					
House floor	0.1506	-0.0556	0.3387	1				
Electricity	0.1823	-0.0345	0.2717	0.1874	1			
Age	-0.1576	0.2365	0.047	-0.0101	0.0747	1		
Female	-0.2628	0.032	-0.0368	-0.0332	-0.0087	0.2454	1	
Hh. Size	0.46	0.0532	0.0195	0.0593	-0.0132	-0.1101	-0.2722	1
W. Women	0.0411	0.0766	-0.0097	-0.0339	-0.05	0.0633	0.0918	0.1014
Some Primaries	-0.1235	0.0929	-0.0413	0.0007	-0.0222	0.1904	0.0489	0.0005
Primary Comp.	0.0183	0.0183	0.0006	-0.0233	0.0139	-0.1146	-0.0743	0.0213
JH School	0.1002	-0.0768	0.0344	0.0535	0.0475	-0.1831	-0.088	0.0325
SH School	0.179	-0.119	0.076	0.0687	0.0769	-0.1482	-0.0823	0.0353
University	0.1782	-0.0816	0.0913	0.0612	0.0589	-0.0538	-0.0281	0.0115
Work Field	-0.1255	0.0799	-0.1629	-0.0989	-0.1907	-0.007	-0.1103	0.0482
Mobile Phone	0.4731	-0.0515	0.1874	0.1223	0.3093	-0.0919	-0.1034	0.1611

	W. Women	S. Primaries	Primary C.	JH School	SH School	Univ.	Work Field	MP
W. Women	1							
Some Primaries	0.025	1						
Primary Comp.	-0.0117	-0.4421	1					
JH School	-0.0395	-0.2904	-0.2454	1				
SH School	-0.0281	-0.2512	-0.2123	-0.1394	1			
University	0.0127	-0.1309	-0.1107	-0.0727	-0.0629	1		
Work field	0.152	0.1093	0.0542	-0.0527	-0.1337	-0.1811	1	
Mobile Phone	-0.0067	-0.0867	0.0113	0.0932	0.1447	0.1267	-0.1751	1

The estimates are obtained by using Pearson correlation. Source: Susenas 2008, 2010, and 2013.

Table C.6: Determinants of Clean Cooking Fuel for Several Regions: Probit Model (marginal effects)

Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
LPG Kit (Log)	0.0179***		0.0124***		0.0216***		
	(0.0014)		(0.0003)		(0.0003)		
Lag LPG Kit (Log)		0.0387***		0.0135***		0.0217***	
		(0.0011)		(0.0001)		(0.0001)	
Wealth and Asset							
Log expenditure	0.1844***	0.1839***	0.1081***	0.1243***	0.1042***	0.0950***	0.0131***
	(0.0015)	(0.0015)	(0.0015)	(0.0015)	(0.0014)	(0.0013)	(0.0011)
Home Ownership[ab]	-0.0212***	-0.0216***	0.0226***	0.0225***	0.0097***	0.0097***	0.001
	(0.0020)	(0.0020)	(0.0017)	(0.0017)	(0.0018)	(0.0017)	(0.0012)
Housewall[ac]	0.0627***	0.0635***	0.091***	0.0853***	0.0011	0.0122***	0.0033***
	(0.0022)	(0.0022)	(0.0016)	(0.0016)	(0.0016)	(0.0015)	(0.0011)
House Floor[ad]	0.0627***	0.0623***	0.0247***	0.0158***	0.0028	-0.0037*	-0.0017
	(0.0025)	(0.0025)	(0.0023)	(0.0023)	(0.0022)	(0.0021)	(0.0018)
Demographic							
Age household head	-0.0008***	-0.0008***	0.0001**	0.0001**	0.0004***	0.0003***	-0.0000
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0004)
Gender of the head[ae]	0.0253***	0.0255***	-0.0125***	-0.0113***	0.0134***	0.0164***	0.0016
	(0.0022)	(0.0022)	(0.0023)	(0.0022)	(0.0023)	(0.0022)	(0.0018)
Household size	-0.0269***	-0.0267***	-0.0157***	-0.0186***	-0.0122***	-0.0108***	-0.002***
	(0.0005)	(0.0005)	(0.0005)	(0.0006)	(0.0004)	(0.0004)	(0.0003)
Women Working[af]	-0.0230***	-0.0213***	-0.0027*	-0.0039***	-0.0206***	-0.0172***	-0.0027**
	(0.0015)	(0.0015)	(0.0014)	(0.0014)	(0.0015)	(0.0014)	(0.0010)
Education							
Some Primaries[ag]	0.0395***	0.0383***	0.0034	0.0053	0.0044	0.0172***	-0.0004
	(0.0033)	(0.0033)	(0.0039)	(0.0038)	(0.0033)	(0.0029)	(0.0023)
Primary Full[ag]	0.0780***	0.0782***	0.0391***	0.0405***	0.0127***	0.0324***	-0.0018
	(0.0035)	(0.0035)	(0.004)	(0.0039)	(0.0034)	(0.003)	(0.0023)
Junior High School[ag]	0.1351***	0.1373***	0.0795***	0.0792***	0.0347***	0.0575***	0.0015
	(0.0039)	(0.0039)	(0.0042)	(0.0041)	(0.0036)	(0.0032)	(0.0024)
Senior High School[ag]	0.1678***	0.1686***	0.1160***	0.1134***	0.0565***	0.078***	0.003
	(0.0040)	(0.0040)	(0.0043)	(0.0042)	(0.0037)	(0.0033)	(0.0025)
University[ag]	0.2316***	0.2343***	0.1859***	0.1872***	0.0838***	0.1211***	0.0094***
	(0.0051)	(0.0051)	(0.0051)	(0.005)	(0.0042)	(0.0039)	(0.003)

Continued.

Table C.6: *Continued.*

Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Accesibility							
Urban[ah]	0.1451***	0.1453***	0.0765***	0.0714***	0.0632***	0.0554***	0.0045***
	(0.0018)	(0.0018)	(0.0017)	(0.0017)	(0.0017)	(0.0016)	(0.0012)
Workfield[ai]	-0.0924***	-0.0933***	-0.0523***	-0.0573***	-0.0529***	-0.0501***	-0.0023*
	(0.0019)	(0.0019)	(0.0017)	(0.0017)	(0.0017)	(0.0016)	(0.0014)
Electricity[aj]	0.0370***	0.0566***	0.1412***	0.1354***	0.1043***	0.0904***	0.0095***
	(0.011)	(0.0114)	(0.003)	(0.003)	(0.0030)	(0.0033)	(0.0011)
Information							
Mobile Phone[ak]	0.0675***	0.0679***	0.0831***	0.0798***	0.0777***	0.0628***	-0.0013
	(0.002)	(0.002)	(0.0020)	(0.0020)	(0.002)	(0.0019)	(0.0015)
Interaction							
LPG Kit (Log) x Elect.	-0.0061***	0.0530***	0.0082***	0.01***	0.0102***	0.0118***	
	(0.0014)	(0.0078)	(0.0004)	(0.0004)	(0.0005)	(0.0005)	
Observation	268,823	268,823	294,213	294,213	233,351	233,351	53,609
Region	Java	Java	West	West	Central	Central	East
Year Fix Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes

This table shows estimates for different regions in Indonesia. Java means six provinces in Java Island. West means provinces in west of Indonesia (using time of GMT+7) other than Java. Central is for provinces in central of Indonesia (GMT+8) and East means provinces in east of Indonesia (GMT+9). There was no LPG kit distributed in East during 2007-2013. Standard errors in parenthesis. * p<0.1, ** p<0.05, *** p<0.01.

[a] Dummy Variables

[b] Excluded category: household does not own the house

[c] Excluded category: house without brick/cement

[d] Excluded category: house with soil, wood, and other type of floor

[e] Excluded category: male household head

[f] Excluded category: household without any women working

[g] Excluded category: household head without any formal education

[h] Excluded category: household lives in rural area

i Excluded category: household head working in non farming, fishery, and forestry

[j] Excluded category: household without electricity

[k] Excluded category: household without mobile phone