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Indonesia's Agriculture Tax: An Approach to the GTAP Model

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Abstract

Tax is a policy tool to control the market. As Indonesia implied an agriculture tax of about 10% in 2014, it is worthy of capturing how it affects the market. This paper aims to find the effect of the implied tax on the market by seeing the country's sales, demand, imports, exports, and welfare. The method used is GTAP model simulation with the base of GTAP9 and aggregated based on the case applied. The result shows that the tax implied makes the demand, import, and export decrease even for the country that implements it. However, the sale and welfare gained by the origin country are increasing. Even China, the United States, and Australia have difficulty dealing with the policy as their welfare decreases. This research tries to find the effect of the agriculture tax that Indonesia implied in 2014. Using GTAP model simulation reveals how the tax affects the sale, demand, import, export, and gain or loss of welfare country.

Keywords: Agriculture Tax, GTAP model, Agricultural Economics, International Trade
JEL Classification: Q17, Q18

INTRODUCTION

Indonesia is one of the leading agricultural countries in the era of the early 1980s and 1990s. With the amount of production exceeding its people's needs and becoming an exporter of such production. Nowadays, it has become an agriculture importer country as its population was increasing from time to time and hit around 260 million or more (World Bank, 2018). Tax policy is one of the tools to control a nation's needs and the needs of its society (Barney & Flesher, 2008). For example, one of Indonesia's taxes introduced in early 2014 is an agriculture tax widely used in other countries since the early 1900s (Barney & Flesher, 2008; Doye & Boehlje, 1985; Hertel & Tsigas, 1988). Such tax aims to control the volume of goods imported and improve the domestic farmer's production, but sometimes it can make the domestic farmers suffer (Milošević et al., 2020). Seeing the value of imported goods in Indonesia, we can see some decline in 2014 till 2016 as its value is at its peak in 2013. The use of a new policy clarifies the number of goods imported, as shown in Figure 1.

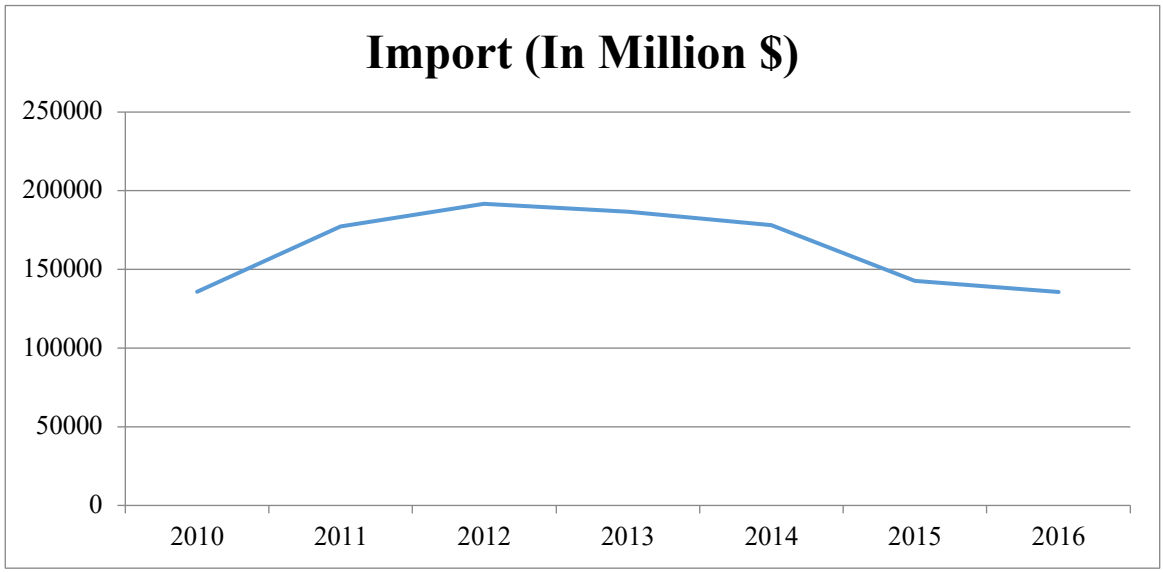

Figure 1. Indonesia's Import
Source: BPS Data processed

Research has been conducted to find tax reform's effect, especially in the agriculture sector. The leading research is by Haygood (1949), and the latest is by Nasim (2012). However, research is rarely found because the tax change in agriculture is not as common as the other tax reform. In the Haygood work, we can find that the government needs an adequate and reliable tax measure. Unfortunately, the work scope in analyzing the agriculture tax is not adequate for the needs, and measuring the tax load is beset by some other complex problems. While in Nasim's work, we found that the income tax of agriculture is still short of expectation even though the income tax can exceed the expectation in reality.

Other research that highlighted tax and agriculture supply was conducted by Hanson & Bertelsen (1987). They found that tax savings improve farm efficiencies and encourage the substitution of capital for labor. This paper concludes that tax policy will be less likely to encourage production expansion strongly, while simultaneous commodity policy encourages the contraction of farm output. Guither & Uchtmann (1978) said that capital transfer affects agriculture in a place of the source and affects the nearby. So the tax policy implied by the Indonesian government in 2014 will affect the nearby countries affiliated with the agriculture sector. Even some agricultural goods are not being taxed, and it has their tariff so that it will have a different payment transfer.

Ojha (1969) said that there is a debate about whether an agriculture tax is less than other taxes. However, tax ratios of agriculture and non-agriculture are noncomparable. Because the tax is comparable and based on a comparable basis, the tax revenue from agriculture would be lower than what can be found. It suggests that concerning 'taxable income,' farm households pay a higher proportion of their incomes than their non-farm sector counterparts. So, land revenue is the most suitable form of land taxation. Other writing by Gulati & Kothari (1968) said that the comparison of land revenue with agricultural income-tax suggests that land revenue's superiority is absolute from the point of ensuring efficient use of land. The marginal tax rate is zero since land revenue is a fixed charge. Thus the incentives for (additional effort and investment to raise land productivity are left

unimpaired. From the equity point of view, while there is a case for introducing a measure of progression in taxing agricultural incomes, economic considerations suggest that this objective can be more effectively secured within the existing land revenue system framework.

Farmers are faced with some difficulties that differ from others but have others that are the same, and it was a tax (Carman, 1969). Special income tax provisions applicable to farmers offer favorable tax planning opportunities and problems-opportunities that revolve primarily around cash accounting. Cash accounting, combined with accelerated depreciation, full deductibility of farm losses from income, timing of income and expenses, and capital gains provisions on agricultural assets, has been used by farmers, ranchers, and non-farm investors to maximize after-tax income.

Another research by Carman (1972) found that tax reform had differential effects on tax shelter investments in agriculture. Profits from breeding livestock were reduced, while the tax advantages of citrus and almond orchard establishment were terminated. However, other orchard crops that offered tax shelter advantages before reform continue to be profitable. Hanson & Eidman (1985) found that tax expenditures were beneficial to all significant enterprises and farm sizes. While large farmers received nearly three times the value of small farm tax savings, small farmers received more tax expenditures per dollar of farm sales. During the sample period, tax progressivity declined based on adjusted gross and economic measures of income, and combined state income and self-employment taxes exceeded federal income taxes from 1973 to 1978. Also, tax expenditures far exceeded direct government payments in sampling farmers from 1973 to 1978.

A quantitative approach was used by Hanson & Bertelsen (1987) by using farm survey data for Iowa and Alabama, which analyzed and related to Internal Revenue Service sample data for these states and published tax statistics for the agricultural sector whole. The primary research objective was to characterize several tax preparation and management costs associated with these states' three taxes levied on income. Typical tax preparation costs ranged from $650-$1,000 for the two states when the cost of operator time was included with preparation fees. This compliance cost was estimated to represent 40 percent of commercial-sized farms' income tax liabilities and a higher percentage for small farms. A clear perception among the farmers sampled was that the income tax system strongly influenced farm investment, marketing, and management decisions. Relationships between preparation costs and operator and farm characteristics were explored with regression.

Hanson & Bertelsen (1987) came with another view and horizon, highlighting the Tax Reform Act of 1986 (TRA). It was the most significant revision of the tax code since 1954. The act was intended to be revenue-neutral while broadening the tax base and lowering marginal rates. Two primary structural goals of the TRA were to simplify the tax code and to lessen the scope of business practices motivated by tax rather than economic incentives. Thus, investment and production decisions based on the maximization of before-tax and after-tax profits were anticipated to become less divergent after the TRA. At this time, it appears that tax policy changes embedded in the TRA are likely to have a significant long-run impact on the structure of the agricultural sector.

Hertel & Tsigas (1988) used different approaches, where their paper employs a computable general equilibrium model to analyze the effects of eliminating farm and food tax preferences in 1977. Tax differentials on capital income, labor payments, production, and sales taxes are examined. Results indicate that these combined preferences lowered food costs by about $4.5 billion while enhancing after-tax returns to farmland, labor, and capital. The associated general equilibrium tax expenditure is estimated to have been between $5.5 and $6.6 billion. Long (1990) finds his interest in the work, which examines "farming the tax code." Economic theory suggests that the investment in agricultural tax shelters is positively related to the marginal tax rate. This hypothesis is empirically investigated using a sample of federal individual income tax returns filed for 1983. The probability of reporting a farm tax loss and the number of farm losses are increased by a rise in the marginal tax rate, especially among upper-income taxpayers.

Halvorsen (1991) tries to examine the effects of tax policy on agricultural investment by estimating a dynamic, interrelated input demand system. Net investment is specified to increase internal costs of adjustment, resulting in capital inputs being quasi-fixed. The demand equations system is derived by incorporating a quadratic normalized restricted cost function into a long-run dynamic optimization framework. U.S. agriculture's input demand equations system is estimated with aggregate annual time series data for 1955 through 1978. Simulation of the dynamic model indicates that tax policy changes, including introducing investment tax credits, shortened tax lives, and accelerated depreciation, increased the 1978 stocks of equipment and structures by 2.7% and 1.3%, respectively.

Garcia & Randall (1994) saw the tax in the form of fertilizer policy and become a cost for farmers. Cost functions by crop (U.S. and French wheat and corn, and English wheat) are estimated, and marginal costs are derived. Fertilizer input demand and output supply elasticities, estimated via marginal cost, are computed, capturing the effect of fertilizer-reducing policies (a tax and a quota). Supply and fertilizer demand effects are compared within and across countries. The results generally support the hypothesis that fertilizer reducing policies significantly affect crop supplies that use fertilizer more intensively. That fertilizer policy multilaterally imposed will give U.S. producers a relative competitive advantage vis-a-vis French and English producers.

The same policy in Pakistan has been researched by Chaudhry (1999). He found that agriculture is subjected to direct, indirect, and implicit taxes. Therefore, its contribution to total tax revenues must be based on incidence analysis of all three, which would reveal the vast and oppressive burden of taxes on agriculture if equitable taxation of agriculture land taxes has to be achieved indirectly. Therefore, a proportional land and a uniform tax on marketed surplus can be recommended for agricultural taxation. Manner, the two-tier system would be equitable, responsive, and easy to implement, manage, and administer.

With the tax system that happened in the U.S., Wilson, Featherstone, & Elffner (2002) examine the impact of a federal flat tax on agriculture by determining the tax liability under the current and flat tax systems using actual farm records. The study considers the linkages between agriculture and the rest of the economy by examining the impact of a flat tax on interest rates and capital investment and how those changes would affect agriculture. Results indicate that roughly 63% of

agricultural producers would benefit from a flat tax to lower taxes paid. In addition, under the flat tax, larger farms and more profitable farms would be relatively better off.

Barney & Flesher (2008) want to explore agricultural influences on the income tax passage in 1913, using qualitative and quantitative analysis in their paper. The results show that agricultural interests were influential in developing and passing tax/tariff laws. The percentage of members of Congress with agricultural ties explains the strong affection for agriculture. Discussion in congressional debates and agricultural journals was passionate and patriotic in support of equity for farmers. The quantitative analysis reveals that the percentage of farm population was a significant predictor of the passage of the 16th Amendment by the states and the adoption of state income taxes in the 20th century.

Nguyen et al. (2020) try to find the impact of higher tobacco tax on the output and employment. The results found was it gives a positive effect for both output and employment. But the tobacco industry was not affected significantly, because it has a small contribution to national economy and employment. While the money for tobacco consumption reduced, it would be reallocated to other goods and services, and make the output and jobs for nontobacco sectors would increase. This paper aims to know the impact of the agriculture tax shock of 10% by those researches before, which Indonesia implies to the number of goods produced by itself and imported from another country using the GTAP model. The hypothesis is that the tax policy will decrease imported goods and increase the goods produced.

Tax is a burden and will lead to a decline in production (Doye & Boehlje, 1985). This idea is becoming the base for the research as Indonesia is still low in production, but the needs are so high, and being an importer from another country, referring to the tax policy's aim can give an ambiguous effect. As the study of this law is still low, this paper wants to check whether the implied agriculture tax in 2014 made Indonesian demand and production of agricultural goods decrease or not and the import from other countries.

METHOD

GTAP is an analytical tool based on the CGE model developed by the Center for Global Trade Analysis, Purdue University, to help economists conduct international economic research using the extensive economic linkage framework. The CGE model is a system of equations that model the broad economy. It explains all producers' and consumers' motivations and behavior in the economy and their interrelationships (Burfisher 2011). In the recent years, CGE was used for several researches such as Aminu (2019), Eshete et al. (2020), Friman & Hyytiä (2022), Li et al. (2020), and Quatrebarbes et al. (2021) The model structure contained in GTAP is described in full by Hertel (1997).

GTAP model assumes that the production function follows the constant return to scale, the market is perfectly competitive, product differentiation based on country of origin, and full employment. This study uses a Global Trade Analysis Project (GTAP) version 9A developed by the Center for Global Trade Analysis, Purdue University, covering 140 countries and 57 sectors (Aguiar, Narayanan, and McDougall 2016). The regional and sectoral aggregation use the 2001 baseline with the following details.

Table 1. Regional Aggregation

No.	Country/Region	GTAP 9A Database (140 Country)
1.	Indonesia	Indonesia
2.	China	China
3.	Japan	Japan
4.	Thailand	Thailand
5.	UnitedStates	United States of America
6.	Australia	Australia
7.	Malaysia	Malaysia
8.	Germany	Germany
9.	India	India
10.	Netherland	Netherland
11.	Taiwan	Taiwan
12.	Korea	Korea
13.	Rest of South East Asia	Brunei Darussalam, Singapore, Vietnam, Philippines, Cambodia, Lao PDR
14.	Rest of World	All the other economies or regions

Source: Author specification base on GTAP Database 9A

Regional aggregates were taken from the countries that became net importers of Indonesia. Indonesia's biggest net importer is China, followed by the following country listed in the table.

Table 2. Sectoral Aggregation

No.	Sectors	GTAP 9A Database (57 sectors)
1.	AgrTaxed	Wheat, Cereal grains n.e.c., Sugar, Sugarcane and sugar beet, Oilseeds, Plant-based fibers, Crops n.e.c., Forestry
2.	AgrNonTaxed	Paddy rice, Processed rice, Vegetables, and fruits
3.	MeatLstk	Cattle, Sheep, Goats, Horse, Animal product n.e.c., Raw milk, Wool, Silk-worm cocoons, Cattle, sheep, goat, and horse meat products, meat products n.e.c.,
4.	Extraction	Fishing, Coal, Oil, Gas, Mineral n.e.c.
5.	ProcFood	Vegetables oil and fats, food products n.e.c., beverages, and tobacco products, Dairy products
6.	TextWapp	Textiles, Wearing apparel
7.	LightMnfc	Leather products, Wood products, Paper products, Publishing, Metal products, Motor vehicles and parts, Transport equipment n.e.c.,
8.	HeavyMnfc	Petroleum, Coal products, Chemical, Rubber, Plastic products, Ferrous metal, Metal n.e.c., Electronic equipment, Machinery and equipment, Mineral products n.e.c., Manufactures n.e.c.
9.	Util_Cons	Construction, Electricity, Gas manufacture and distribution, Water
10.	TransComm	Trade, Sea transport, Air transport, Transport n.e.c., Communication
11.	OthServices	Insurance, Financial services n.e.c., Business services, Recreation, and other services, Public administration and defense, Education, Health services

Source: Author specification base on GTAP Database 9A

The aggregation for sectoral is based on the listed goods included in the goods being taxed for agriculture. For the other sectoral is being kept as before. The products from wheat, cereal grains n.e.c., sugar cane and sugar beet, oilseeds, plant-based fibers, crops n.e.c., and forestry are being taxed as dictated in the law enforced in 2014. Another agricultural product is not having tax but has some other payment such as tariff.

Table 3. Factor Aggregation

Factor of Production	Aggregation Grup	Factor Mobility
Land	Land	Sluggish (ETRAE = -1)
Technicians, Associates, Professionals, Official and Managers.	Skilled Labor	Mobile
Agricultural and Unskilled Clerks Service/Shop Workers	Unskilled Labor	Mobile
Capital	Capital	Sluggish (ETRAE = -1)
Natural Resources	Natural Resources	Sluggish (ETRAE = -0,001)

Source: Author's specification base on Rosyadi and Widodo (2017), GTAP Database 9A

This study assumes that agriculture tax implied by Indonesia in 2014 with various. The scenario being used in this model is a 10% agriculture tax implied for domestic products and imported goods.

RESULTS AND DISCUSSION

GTAP model predicts some movement through the scenario that has been used. For domestic sales, Indonesia increases agricultural products being taxed, extraction goods, heavy manufactured goods, and other services by about 2,22%, 0,02%, 0,05%, and 0,08%, respectively.

Table 4. Change in Domestic Sale of Indonesia

No	Sector	Indonesia
1	AgrTaxed	2.22
2	AgrNonTaxed	-0.44
3	MeatLstk	-0.17
4	Extraction	0.02
5	ProcFood	-0.38
6	TextWapp	-1.07
7	LightMnfc	-0.09
8	HeavyMnfc	0.05
9	Util_Cons	-0.18
10	TransComm	-0.08
11	OthServices	0.08

Source: GTAP model simulation result(2018), Processed

For other sectors such as non-taxed agricultural goods, meat livestock, processed food, textile goods, light manufactured goods, utility consumption, and

transportation communication have a decrease of their domestic sales about 0,44%, 0,17%, 0,38%, 1,07%, 0,09%, 0,18%, and 0,08% respectively. It is in line with the tax's aim, which made the wholesale of domestic products for the agricultural sector being taxed is increasing, as we can see in the table below for the result of GTAP prediction.

Another prediction from the GTAP model is about the demand of households. For the two sectors being discussed are taxed and non-taxed agricultural goods. The prediction find that the amount of demand for the agricultural sector being taxed is decreasing in Indonesia, the United States, Australia, Malaysia, Germany, India, and the rest of southeast Asia about 21,15%, 0,16%, 0,47%, 0,34%, 0,01%, 0,66%, and 0,02% respectively. While China, Japan, Taiwan, and Korea have an increase about 0,03%, 0,04%, 0,02%, and 0,03% respectively. However, the tax has two countries unaffected: Thailand, the Netherland, and the rest of the world. For another sector or the non-taxed agricultural products, the change is different from the one being taxed. Indonesia and Japan have a positive change with 1,63% and 0,01%, respectively. For China, United States, Australia, India, Korea, and the rest of southeast Asia have a negative change in demand of this product by 0,03%, 0,05%, 0,18%, 0,05%, 0,02%, and 0,02% respectively. While others are unaffected by their demand for non-taxed agricultural products.

Table 5. Change of Demand

No	Country	Sector	
		AgrTaxed	AgrNonTaxed
1	Indonesia	-21.15	1.63
2	China	0.03	-0.03
3	Japan	0.04	0.01
4	Thailand	0	0
5	UnitedStates	-0.16	-0.05
6	Australia	-0.47	-0.18
7	Malaysia	-0.34	0
8	Germany	-0.01	0
9	India	-0.66	-0.05
10	Netherland	0	0
11	Taiwan	0.02	0
12	Korea	0.03	-0.02
13	RestofSEAsia	-0.02	-0.02
14	RestofWorld	0	0

Source: GTAP model simulation result (2018), Processed

The value of imports predicted by the GTAP model can be viewed in table 6. Some changes happened for the agricultural goods being taxed. Indonesia, Japan, United States, Australia, Malaysia, India, and the rest of southeast Asia has a negative change for the value of import about 16,01%, 0,01%, 0,13%, 0,37%, 0,39%, 0,26%, and 0,01% consecutively. For China, Thailand, and Netherland has a positive change about 0,02%, 0,01%, and 0,01% consecutively. Nevertheless, Germany, Taiwan, Korea, and the rest of the world are unaffected. In the sector of

non-taxed agricultural goods Indonesia, Japan, Thailand, Malaysia, Taiwan, Korea, and the rest of Sout East Asia have a positive change in the value of imported goods about 1,49%, 0,01%, 0,04%, 0,02%, 0,01%, 0,05%, and 0,01% consecutively. While China, United States, Australia, and India have a negative change about 0,01%, 0,04%, 0,17%, and 0,03% consecutively. Germany, the Netherland, and the rest of the world are unaffected.

Table 6. Change of Import Value

No	Countries	Sector	
		AgrTaxed	AgrNonTaxed
1	Indonesia	-16.01	1.49
2	China	0.02	-0.01
3	Japan	-0.01	0.01
4	Thailand	0.01	0.04
5	UnitedStates	-0.13	-0.04
6	Australia	-0.37	-0.17
7	Malaysia	-0.39	0.02
8	Germany	0	0
9	India	-0.26	-0.03
10	Netherland	0.01	0
11	Taiwan	0	0.01
12	Korea	0	0.05
13	RestofSEAsia	-0.01	0.01
14	RestofWorld	0	0

Source: GTAP model simulation result (2018), processed

The next thing is the prediction of GTAP model about value export. All of the regional being simulated have a negative change for export value in agricultural goods being taxed from Indonesia until the rest of the world about 8,35%, 0,94%, 0,13%, 0,95%, 0,39%, 1,32%, 1,62%, 0,05%, 1,29%, 0,02%, 0,08%, 0,07%, 0,19%, and 0,16% sequentially. While on other hand, for non-taxed agricultural goods mostly has a positive change such as China, Japan, thailand, United States, Australia, Malaysia, India, and Taiwan with the number of 0,18%, 0,01%, 0,04%, 0,07%, 0,25%, 0,08%, 0,04%, and 0,01% respectively. But Indonesia, Germany, Netherland, and Korea have a negative change about 1,85%, 0,01%, 0,01%, and 0,01% consequencially.

Table 7. Change of Value Export

No	Countries	Sector	
		AgrTaxed	AgrNonTaxed
1	Indonesia	-8.35	-1.85
2	China	-0.94	0.18
3	Japan	-0.13	0.01
4	Thailand	-0.95	0.04
5	UnitedStates	-0.39	0.07
6	Australia	-1.32	0.25
7	Malaysia	-1.62	0.08
8	Germany	-0.05	-0.01
9	India	-1.29	0.04
10	Netherland	-0.02	-0.01
11	Taiwan	-0.08	0.01
12	Korea	-0.07	-0.01
13	RestofSEAsia	-0.19	0
14	RestofWorld	-0.16	0

Source: GTAP model simulation result (2018), processed

The last thing predicted in the GTAP model is equivalent variation, which describes the gain or loss of a welfare country. Indonesia, China, Japan, Thailand, Germany, Netherland, Taiwan, and Korea gain from Indonesia's agriculture tax. At the same time, others have a loss, especially India, United States, and Australia, which have more than 40 million dollars.

Table 8. Equivalent Variation (Million Dollars)

No	Countries	Equivalent Variation
1	Indonesia	137.74
2	China	62.67
3	Japan	24.04
4	Thailand	7.55
5	UnitedStates	-87.09
6	Australia	-48.9
7	Malaysia	-13.79
8	Germany	1.53
9	India	-120.2
10	Netherland	1.95
11	Taiwan	4.23
12	Korea	12.37
13	Rest of South East Asia	-9.98
14	Rest of World	-82.95

Source: GTAP model simulation result (2018), processed

The simulation result was linear with some research that tried to explain tax that happened in agriculture. Such as the research of Wilson et al. (2002), Chaudhry

(1999), Garcia & Randall (1994), and Halvorsen (1991) which find that tax will upset the farmers as there was a decrease in the demand for agricultural goods being taxed, its value import, and value export. However, it had some positive impact, and domestic sales increased. It means that Indonesia's farmers can produce more, which relates to the increase in equivalent variation, which has a positive sign for Indonesia. Therefore, the agriculture tax implied by Indonesia is a fair tax, which affects some major importers country—then giving the result of decreasing some export of those countries and giving them a hard case to deal with. So the hypothesis being built was accepted as the tax increases the sale of domestic and decreases imports.

CONCLUSION

This research tries to find the effect of the agriculture tax that Indonesia implied in 2014. Using GTAP model simulation reveals how the tax affects the sale, demand, import, export, and gain or loss of welfare country. The agriculture tax implied by the Indonesian government in 2014 is one way to control the country's trade. Other tools are to use tariff or quota barriers to limit the stream of goods being imported. The 10% tax is giving importer countries a hard decision as they have to decrease their goods or be taxed and decrease profit. As a result, the tax can control the stream of agricultural goods being imported, but it affects Indonesia's exporters and makes them lose their trade. China, the United States, and Australia have a hard time facing the policy that Indonesia implied by seeing the equivalent variation.

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