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To cite this article:

Hutabarat, S. P. H. (2023). The terms of trade effect on agriculture export the case of Indonesia as a net oil importer country. *International Journal on Engineering, Science, and Technology (IJonEST), 5*(3), 212-229. https://doi.org/10.46328/ijonest.169

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International Journal on Engineering, Science, and Technology
2023, Vol.5, No.3, 212- 229 https://doi.org/10.46328/ijonest.169

The Terms of Trade Effect on Agriculture Export the Case of Indonesia as a Net Oil Importer Country

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Article Info

Article History

Received:
28 January 2023
Accepted:
01 June 2023

Keywords

Terms of trade
Economic indicators
Oil price fluctuations
Energy security

Abstract

This study investigates the effects of changes in terms of trade (t.o.t) on economic indicators in net oil-importing countries. Findings demonstrate that improving trade conditions lead to increased profitability, investment opportunities, and capital accumulation, although the pace of accumulation slows down after an initial period of rapid growth. The study also highlights the positive impact of trade terms on foreign debt in developing economies, as enhanced terms of trade contribute to higher export revenues and better capacity to service debt obligations. The study suggests two measures: strengthening domestic energy production and implementing hedging strategies to mitigate the impact of oil price fluctuations on foreign debt. Furthermore, the analysis explores the influence of terms of trade on employment, interest rates, capital costs, net oil imports, final output, and agricultural product exports. These indicators are affected by changes in terms of trade, driven by factors such as increased productivity, shifts in comparative advantage, and market dynamics. Overall, this study emphasizes the significance of terms of trade in shaping economic dynamics and provides insights into policy measures to enhance energy security, reduce oil import dependency, and promote economic resilience in net oil-importing countries.

Introduction

The rising of the original "Seven Sisters," i.e., Anglo-Iranian Oil Company (now British Petroleum), Gulf Oil (now Chevron), Royal Dutch Shell, Standard Oil Co. of California (merged into Chevron); Standard Oil Co. of New Jersey (merged into Exxon), Standard Oil Co. of New York (acquired by Exxon, became ExxonMobil), and Texaco (incorporated into Chevron), led to the advent of global oil cartels until the formation of the Organization of the Petroleum Exporting Countries (OPEC) in 1961 (McNally, 2017). Collectively, OPEC producers accounted for over 80 percent of the world's oil exports. Its primary goal is to coordinate and unify the petroleum policies of its member countries. It also ensures the stabilization of oil markets to secure an efficient, economic, and regular supply of petroleum to consumers, a steady income to producers, and a fair return on capital for those investing in the petroleum industry. The early member of OPEC, i.e., Venezuela, Iran, Iraq, Kuwait, Saudi Arabia, and later, Indonesia, Qatar, and Libya, administered the oil price cut and set quotas to prevent the cartel practice of the Seven Sisters. However, this policy is just the beginning of the volatile oil price movement due to the supply and demand dynamics in the world market.

The oil crisis in 1973 and 1974 became the primary concern of the oil exporters, where Arab countries used their powers to embargo oil production against the United States and their counterparts. The political action created the oil price to quadruple from USD3 to USD12 (Amadeo, 2020). Like Indonesia, most resource-dependent countries and oil exporters confer huge windfall gains from the two rounds of oil price increases. It removed the balance of payments constraint that had hampered economic development ever since independence and placed hitherto unimaginable resources at the disposal of the central government (Arndt and Hill, 1988). However, Indonesia's dominant financial problem in the mid-1980s after this oil boom was restoring external balance and economic growth during low commodity prices. From its 1982 peak of US$35 per barrel, the average export price of Indonesian crude oil fell to US$25 per barrel in 1985 and precipitously to US$12 per barrel in early 1986 (and lower still for some spot market transactions) as OPEC increasingly lost control over world supply and conservation measures in the West began to take effect. After a decade of booms in the 1970s, Indonesia soon ran out of oil revenues, dropping oil prices twice in 1982 and 1986. Indonesia shifted from import substitution to an export-oriented industrial strategy to move the economy away from its dependence on oil exports. The government did not push trade reforms toward export promotions until 1986 when oil prices fell more steeply than in 1982. The strategy resulted in an anti-export bias, which allowed exporters to purchase foreign and domestic suppliers at international prices (Wihardja, 2016). The government also adopted an active exchange rate policy to support the growth of non-oil exports by ensuring that the real effective exchange rate remained competitive.

Although Indonesia joined OPEC in 1962, the membership was not last when the country left the organization in 2009 due to the increase in world oil prices in early 2008. But the country sought its reentry in 2015 as an oil importer. Then, finally, Indonesia suspended its OPEC membership again a year later, in 2016, because it could not agree to the group's production cuts. OPEC had proposed Indonesia cut oil production by about 37,000 barrels per day (b/d), or about 5 percent of its output, which would dent the already slipping oil rent in Southeast Asia's largest economy. Indonesia's crude oil output peaked at around 1.7 million barrels per day in the mid-1990s. But with few significant oil discoveries in Western Indonesia in the past ten years, production has fallen to roughly half that as old fields have matured and died (Reuters, 2016).

Nevertheless, after domestic demand exceeded production, Indonesia had become a net importer of petroleum and other liquids by 2004. Moreover, Indonesia's petroleum and other liquids production has been on a general decline since the mid-1990s (EIA, 2015). As a result, Indonesia produced about 790,000 b/d of crude oil and condensates in 2014, the third-lowest level among OPEC countries. It resulted in a significant oil trade deficit, peaking at 3.3% of GDP in 2014.

Figure 1 (a) displays Indonesia's balance of payments from 1990 to 2021, as obtained from the OECD website. Specifically, it highlights the Producer Support Estimate (PSE) levels for market price support. The graph provides insights into two significant declines observed in 1998 and 2008.

The graph depicts Indonesia's balance of payments, a comprehensive record of all economic transactions between the country and the rest of the world. It includes trade in goods and services, income flows, and financial transactions. The PSE levels for market price support indicated in the graph are related to government support

provided to producers through market price interventions, such as subsidies or tariffs.

The steep decline observed in 1998 may be linked to the Asian financial crisis, significantly impacting Indonesia's economy. During this period, the country experienced severe economic turmoil, including a sharp depreciation of its currency and a significant decline in foreign investment. These factors likely influenced the payment balance and necessitated government interventions to stabilize the market.

Similarly, the steep decline in 2008 may be attributed to the global financial crisis, which originated from the collapse of the housing market in the United States. This crisis had widespread repercussions across the global economy, affecting trade, investments, and financial markets. Like many other countries, Indonesia experienced a significant economic downturn during this period, leading to a decline in its payment balance and necessitating government measures to mitigate the impact.

Additionally, during high oil prices, oil-exporting countries like Indonesia may experience increased export earnings, positively affecting their payment balance. Higher export earnings provide more resources for the country to invest, save, or use for various economic purposes, which can affect the payment balance.

The oil bonanza showed itself in the form of "expenditure recycling" effects, either directly through government investment (such as utilities, construction, and dwellings) or indirectly through government expenditure on services (such as public administration and finance) or both (such as transport, oil/gas processing, and manufacturing). Since 1981, the sectors most dependent on government expenditure have grown noticeably more slowly. By contrast, Indonesia's agriculture has proved to be a good deal more resilient during the recession years, producing only a little slower than in the earlier period and sustaining GDP growth in the face of the slow-down of the industry sector. Figure 2 (b) shows that Indonesia's agricultural export within the last ten years (2010 – 2019) also indicates an increase in growth with some exceptions from 2018 to 2019 due to a decrease in non-oil export, for example, the export of rice and other crops due to a long dry season and a reduction of agricultural land about 32% since 2017.

Moreover, many of Indonesia's economists predicted the impact of oil price volatility and trade balance. For example, Nizar (2012) uses the oil price shocks as a "transmission" to the economy, i.e., supplies, demand, and even the terms of trade effect. The dynamics of the trade balance in the last five years have covered the trade war between China and the USA, slow growth and the depreciation of the Rupiah, and an increase in world oil price, mainly due to the OPEC+ production cuts. However, there are few empirical studies in energy economics literature to explain the phenomena of the trade balance or terms of trade effect on the developing country's overall macroeconomic performance. This paper will discuss the role of agriculture export as a proxy to the macroeconomic dynamics that would be a rigorous analysis of the specific case of developing economies like Indonesia.

This paper has five sections. In the next section, I will describe the theoretical foundation of the economics of dynamics in developing countries' macroeconomics sector. In the Theoretical/Empirical Modelling section, I will

elaborate on and derive the fundamental formula of the dynamic model. Then, I will present and interpret the results in the Key Results (Sensitivity Analysis) section. Finally, the last section is the conclusion based on the results found in the previous section.

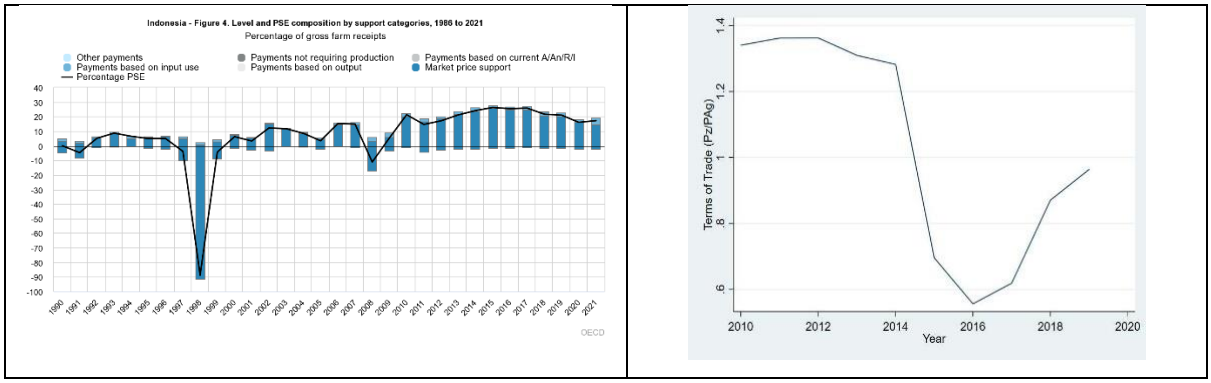


Figure 1. (a) Balance of Payment for Indonesia from 1990-2021; (b) The Terms of Trade for Indonesia from 2010 to 2019

Literature Review

Backus and Crucini (2000) and Bodenstein et al. (2007) find that oil accounts for much of the variation in trade over the last twenty-five years, and its quantitative role varies significantly over time. And since their dynamic general equilibrium model predicts that the economy responds differently to oil supply shocks than to other shocks, changes in their relative importance help to account for the unstable correlations in the data. Moreover, they adopt a two-country setting, where both countries produce oil. One is a net oil importer, and the other is a net oil exporter using Dynamic Stochastic General Equilibrium (DSGE). Likewise, Rebucci and Spataforta (2006) find that oil price shock affects the trade balance. Although global imbalances had emerged long before the current oil price shock began, some of these imbalances have clearly been exacerbated by higher energy prices. Also, McNally (2017), in his book, explained the three periods of oil boom and bust. It started from the finding of crude oil in Texas in the mid-1800s, establishing the Organization of Petroleum Exporter Countries (OPEC) until the oil price volatility OPEC basket price plunged to USD22-USD28, the bust era from 2000-2008. He suggests that policies and corporate practices should mitigate the resulting uncertainty and volatility in costs and revenues to cope with higher oil price volatility. While adapting to new, larger price cycles and avoiding panicky or mistaken reactions may do more harm than good.

On the other hand, Gupta (2008) assesses the relative oil vulnerability of 26 net oil-importing countries for the year 2004 based on various indicators, such as the ratio of the value of oil imports to gross domestic product (GDP); oil consumption per unit of GDP; GDP per capita and oil share in total energy supply, the ratio of domestic reserves to oil consumption. Chen and Hsu (2012) investigate the impacts of oil price fluctuations on international trade, namely exports and imports. They present solid and robust evidence that international trade flows will be lower when oil prices fluctuate significantly. They, therefore, conclude that oil price volatility hurts globalization. As mentioned earlier in the paper, the variability of the terms of trade plays an important role in characterizing the movement of extreme movements in oil prices. The work of Van der Ploeg (2009, 2011) reveals that countries

specializing in commodities with substantial price volatility have more volatility in their terms of trade. He uses examples from developing countries like Mexico and Indonesia; resource-rich economies often produce natural resources and tend to be more volatile. Similar research by Barbier (2019), quoting on Quoted on Prebisch (1950, 1959) and Singer (1950), the terms of trade of developing countries' primary product exports relative to imports of manufacturing goods were falling. Prebisch and Singer argued that falling terms of trade affect a developing country's growth prospects. It is because the income elasticity of demand for manufactured goods is much higher than that of primary commodities. Next, Harvie & Hoa (1994) emphasize the macroeconomic consequences arising from terms of trade shocks for a resource-producing and exporting economy, with emphasis placed on the Australian experience. This paper has presented a simple rational expectations macroeconomic model to analyze the adjustment process arising from a period of volatile terms of trade adjustment and applied this specifically to the case of Australia.

Recent research by Yudong et al. (2014) describes oil shocks can explain minor friction of agricultural commodity price variations before the food crisis in 2006–2008. On the other hand, Hollander et al. (2019) developed and estimated a small open economy New-Keynesian DSGE model with a role for oil in consumption and production using South Africa, a net importer of oil case. They observe foreign real oil price shocks substantially and persistently affect domestic production and consumption activities. Hence, they are a fundamental driver of output, inflation, and interest rates in both the short- and long-run. Their findings suggest an essential role of oil prices in predicting South African production during and after the recession that followed the 2008 global financial crisis. Finally, Baghestani et al.'s (2019) study on BRIC indicates these economies are particularly susceptible to oil price shocks. The results for 2008–2017 show that the change in oil prices accurately predicts directional change in Brazil and Russia's real effective exchange rates under asymmetric loss.

Method

Model Setup

The author modifies the model by Schubert and Turnovsky (2011) as follows. It employs a standard one-sector neoclassical model of an open economy that imports a foreign good, oil that produces traded output, Y_i, using capital, K_i, labor, L_i, imported oil, Z_i, and export oil, X_i, according to the neoclassical production function:

$$Y_i = F(K_i, L_i, (Z_i - X_i)) \quad (1)$$

where each factor has a positive but diminishing marginal product [$F_i > 0$, $F_{ii} < 0$, $i = K, L, Z$]. The $(Z_i - X_i)$ states the case of Indonesia as a net oil importer. The representative agent consumes the traded good (assuming that all are agricultural products) at the rate, Ag_i, and employs labor, L_i, deriving utility over an infinite horizon represented by the isoelastic utility function:

$$U_i \equiv \int_0^\infty \left(\frac{(Ag_i L_i)^{1-\gamma}}{1-\gamma}\right) e^{-\beta t}\, dt, \gamma > 1, \gamma \neq 1\,, \beta > 0 \quad (2)$$

The agent also accumulates K_i, with expenditure on a given change in the capital stock, I_i, involving installation (adjustment) costs specified by the quadratic cost function:

$$\Phi(I_i\,,\, K_i) = I_i + h\frac{I_i^2}{2K_i} = I_i(1 + \frac{h}{2}\frac{I_i}{K_i}) \quad (3)$$

where h is the adjustment cost parameter proportional to the investment rate per unit of installed capital, I_i/K_i.

The agent's net rate of capital accumulation is thus:

$$\dot{K}_i = I_i - (n + \delta)K_i \tag{4}$$

where n is the population growth, and δ is the depreciation rate.

They assume that the world capital market assesses the economy's ability to service its debt costs and views its debt–capital (equity) ratio as an indicator of its potential default risk. Accordingly, the interest rate a country is charged on the world capital market increases with this ratio. It is summarized as follows:

$$r \equiv r\left(\frac{B}{qK}\right) = r^* + \omega\left(\frac{B}{qK}\right); \omega' > 0 \tag{5}$$

where r, B, q, r^*, are the borrowing rate, national foreign debt, the market price of equity, and exogenously given riskless world interest rate. The ratio of $\omega(B/qK)$ is the country-specific borrowing premium that increases with its debt–capital ratio.

Given this access to the world goods and financial market, the domestic agent's instantaneous budget constraint is specified by:

$$\dot{B}_i = \left(r\left(\frac{B}{qK}\right) - n\right)B_i + p(Z_i - X_i) - Ag + \Phi[I_i\ , K_i] - F\left[K_i, L_i, [(Z_i - X_i)]\right] \tag{6}$$

where p in the case of Indonesia as a net imported country, i.e., imported oil minus the exported oil or $(Z_i - X_i)$, is the relative price of oil imports to the agricultural export $\left(\frac{p^z}{p^{Ag}}\right)$, determined exogenously in the world market. Also, Ag is exported and goes into Equation (6) from the import and export equation $p^z(Z_i - X_i) = p^{Ag}Ag$ where the import of the commodities will equal the exported product.

Since we are concerned with a small developing country facing limited access to the world financial market, it is natural to focus on a debtor economy, which corresponds to $B_i > 0$ (or $B > 0$). But in fact, whether the country turns out to be a debtor or creditor is endogenous, depending upon whether

$$(\beta + n) > (<) r^* \tag{7}$$

where the latter case (creditor's case) corresponds to $B_i < 0$.

The maximization problem is:

$$\max_{Ag_i, L_i, Z_i I_i} \int_0^\infty \left(\frac{(Ag_i L_i)^{1-\gamma}}{1-\gamma}\right) e^{-\beta t}\, dt \tag{8}$$

subject to equations (4) and (6).

The fundamental First Order Conditions in this problem concern the individual's choices of C_i, L_i, Z_i, and I_i and set them equal to zero:

$$-{Ag_i}^{-\gamma} L^{1-\gamma} = \lambda_i \tag{9}$$

$$\lambda_i F_L[(K_i, L_i, (Z_i - X_i))] = -{Ag_i}^{1-\gamma} L^{-\gamma} \tag{10}$$

$$F_Z[(K_i, L_i, (Z_i - X_i))] = p \tag{11}$$

Equation (9) is the usual condition that says that the discounted marginal utility of consumption of Agricultural products equals the shadow price of capital. A similar interpretation for Equation (10), i.e., the marginal product of labor marginal equals the cost of labor. Also, Equation (11) shows that imported oil's marginal utility equals the exogenous traded oil price. Also, to be determined in this equilibrium:

$$1 + h\frac{I_i}{K_i} = q \tag{12}$$

which equates the marginal cost of an additional unit of (new) capital to the market price of capital.

From Equation (11) can be derived the oil demand, given labor and capital, and expressed as:

$$Z_i - X_i = [\![Z_i - X_i]\!](K_i, L_i, p) \quad Z_{i,K} - X_{i,K} > 0 \quad Z_{i,L} - X_{i,L} > 0 \quad Z_{i,p} - X_{i,p} < 0 \tag{13}$$

For convenience, we can write Eq. (13) equivalently in terms of capital and leisure (omitting p for simplicity):

$$Z_i - X_i = \varphi(K_i, L_i) \quad (14)$$

Then, we divide Equation (10) by Equation (9) to get:

$$\frac{Ag_i}{L_i} = F_L(K_i, L_i, (Z_i - X_i) \quad (15)$$

the standard optimality condition equates the marginal rate of substitution between leisure and consumption to the real wage. The Equation (15) can be written as follow in the form of:

$$Ag_i = L_i F_L(K_i, L_i, \varphi(K_i, L_i)) \equiv \psi(K_i, L_i) \quad (16)$$

Optimizing with respect to B_i and K_i leads to the usual no-arbitrage conditions, equating the rates of return on consumption and investment in capital to the costs of borrowing abroad, we get:

$$\beta - \frac{\dot{\lambda}_i}{\lambda_i} = r\left(\frac{B}{qK}\right) - n \quad (17)$$

$$\frac{F_K(K_i, L_i, Z_i)}{q} + \frac{\dot{q}}{q} + \frac{(q-1)^2}{2hq} - \delta = r\left(\frac{B}{qK}\right) \quad (18)$$

Finally, to ensure that the agent's intertemporal budget constraint is met, the following transversality conditions must hold:

$$\lim_{t\to\infty} \lambda_i B_i e^{-\beta t} = \lim_{t\to\infty} q\lambda_i K_i e^{-\beta t} = 0 \quad (19)$$

Macroeconomic Equilibrium

We combine the optimality conditions with the budget constraints and accumulation equations to derive the macroeconomic equilibrium. The dynamics can be expressed as an autonomous system in the four stationary variables, K, B, q, and l. They can be achieved as follows. From combining equations (4) and (12):

$$\frac{\dot{K}}{K} = \frac{q-1}{h} - \delta - n \quad (20)$$

Next, substituting for I, C and Z into the agent's flow debt constraint in Equation (6), we may express the per capita accumulation of debt as:

$$\dot{B} = \left[r\left(\frac{B}{qK}\right) - nB\right] + p\varphi(K, L) - \psi(K, L) + \left(\frac{q^2-1}{2h}\right)K - F(K, 1-l, \varphi(K_i, L_i)) \quad (21)$$

Then, we can write Equation (18):

$$\frac{\dot{q}}{q} = r\left(\frac{B}{qK}\right) + \delta - \frac{(q-1)^2}{2hq} - \frac{F_K(K, 1-l, \varphi(K, l))}{q} \quad (22)$$

Next, taking the time derivative of the equilibrium condition Equation (9) and combining it with Equation (17) yields:

$$\frac{\dot{Ag}}{Ag} + (1-\gamma)\frac{\dot{L}}{L} = \beta + n - r\left(\frac{B}{qK}\right) \quad (23)$$

Then, taking the time derivative of Equation (16):

$$\frac{\dot{Ag}}{Ag} = \frac{\psi_K(K,L)K}{\psi(K,L)}\left(\frac{\dot{K}}{K}\right) + \frac{\psi_L(K,L)L}{\psi(K,L)}\left(\frac{\dot{L}}{L}\right) \quad (24)$$

Finally, by solving Equation (23) and (24) and combining them with Equation (20), we may express the dynamics of leisure in the form:

$$\frac{\dot{L}}{L} = \frac{\left[(\beta+n)-r\left(\frac{B}{qK}\right)\right]+\left[(\delta+n)-\left(\frac{q-1}{h}\right)\left(\frac{\psi_K(K,L)K}{\psi(K,L)}\right)\right]}{(1-\gamma)+\frac{\psi_L(K,L)L}{\psi(K,L)}} \quad (25)$$

Equations (22), (24), and (25) complete the description of the equilibrium dynamics.

Results and Discussion

I use the procedures Schubert and Turnovsky (2011) developed to produce graphs like Figure 2. For sensitivity analysis purposes, I use the simple parameters for the terms of trade (t.o.t), $p = \left(\frac{p^z}{p^{Ag}}\right)$ to see its effect on several key variables, i.e., Capital (K), Foreign Debt (B), Labor (L), Interest (i), cost of capital (q), net oil import (Z), output (Y), and Agriculture Export (Ag). The setup is as follows: (i) First scenario is the ratio between the price of oil import and agriculture export change from 0.5 to 1, meaning that I will see the long-term effect double increasing the ratio on the macroeconomics equilibrium. For simplicity, I ignore the oil export (X) since we will focus on the case of Indonesia as the net oil importer. Also, the values of $\boldsymbol{p^z}$ and $\boldsymbol{p^{Ag}}$ are the multiplier or index value of the average price of net oil imports and agricultural export, respectively. For example, $p = 0.5$, that is $\boldsymbol{p^z} = 1$, and $\boldsymbol{p^{Ag}} = 2$. That means that the price of agricultural export is twice the net of oil imports. The goal of the simulation is to see what the effect will be if $p = 0.5$ increases to $p = 1$ or if there is a 1-to-1 effect and from $p = 0.5$ to $p = 2$, or if the price of the net of oil imports is twice of agricultural export; (ii) The other parameters of to include is as follows:

Table 1. Parameters Calibration for Sensitivity Analysis

Parameter	Definition	Value
r_f	risk-free interest	0.045
η	the sensitivity of the borrowing premium to the country's debt position	1
A	the production function's TFP	1
α_1	the elasticity of labor	0.6
α_2	the degree of oil dependence on the economy, with the corresponding productive elasticities	0.06
α_3	the elasticity of capital	0.34
ρ	the elasticity of substitution	1/3
γ	the preference parameter of the utility function	-1.5
n	population growth rate	.015
h	installment of adjustment parameter	12
θ	the preference parameter of labor	1.75
β	discount rate	0.04
δ	rate of depreciation	0.05
χ	country-specific borrowing premium	1

The parameters of interest are mirrored in developing economies like Indonesia to see the impact of the particular shock on the macroeconomic posture. The degree of oil dependence is 0.06, characterizing a relatively high oil-dependent economy. The sensitivity of the borrowing premium to the country's debt represents its degree of access to the world financial market. We can note that our benchmark value of $\eta = 1$ implies that each percentage point increase in debt raises the country borrowing premium by something over ten basis points.

Figures 2 (a) and (b) illustrate the long-term effects of increasing the terms of trade from 0.5 to 1 on capital accumulation. A distinct pattern emerges over the 100 observation periods, where capital accumulation experiences a rapid surge from the initial period until approximately period 30. This notable increase in capital accumulation during the initial period can be attributed to the positive impact of the improved terms of trade.

The terms of trade, representing the ratio between the price of net oil imports and the price of agricultural exports, play a crucial role in shaping the economy's trade dynamics. As the terms of trade increase from 0.5 to 1, the economy benefits from more favorable trading conditions. This improvement fosters enhanced profitability and investment opportunities, which, in turn, stimulate higher levels of capital accumulation.

After the initial period of rapid growth, the trajectory of capital accumulation becomes more gradual, suggesting that the influence of the improved terms of trade reaches a relatively stable state. While the positive impact of the improved terms of trade continues, the subsequent increases in capital accumulation exhibit a more moderate pace. However, they still contribute to the overall upward trend.

It is worth noting that a different trend emerges when the terms of trade rise from 0.5 to 2. In this scenario, capital accumulation experiences a decrease. However, a similar pattern occurs as in the previous simulation: an initial period of rapid growth followed by a more gradual increase in capital accumulation, indicating a relatively stable influence of the higher terms of trade.

Figures 2 (c) and (d) provide insights into the long-term impact of trade terms on developing economies' foreign debt. The analysis considers the ratio between the price of net oil imports and the price of agriculture exports, which plays a crucial role in shaping the dynamics of terms of trade.

The findings reveal that an increase in trade from 0.5 to a 1-to-1 ratio positively affects the foreign debt of developing economies. That can be attributed to the improved trading conditions resulting from the ratio between the price of net oil imports and the price of agriculture exports. As the terms of trade become more favorable, export revenues increase, allowing these economies to generate more foreign exchange. It enhanced earning potential and strengthened their capacity to service their foreign debt obligations.

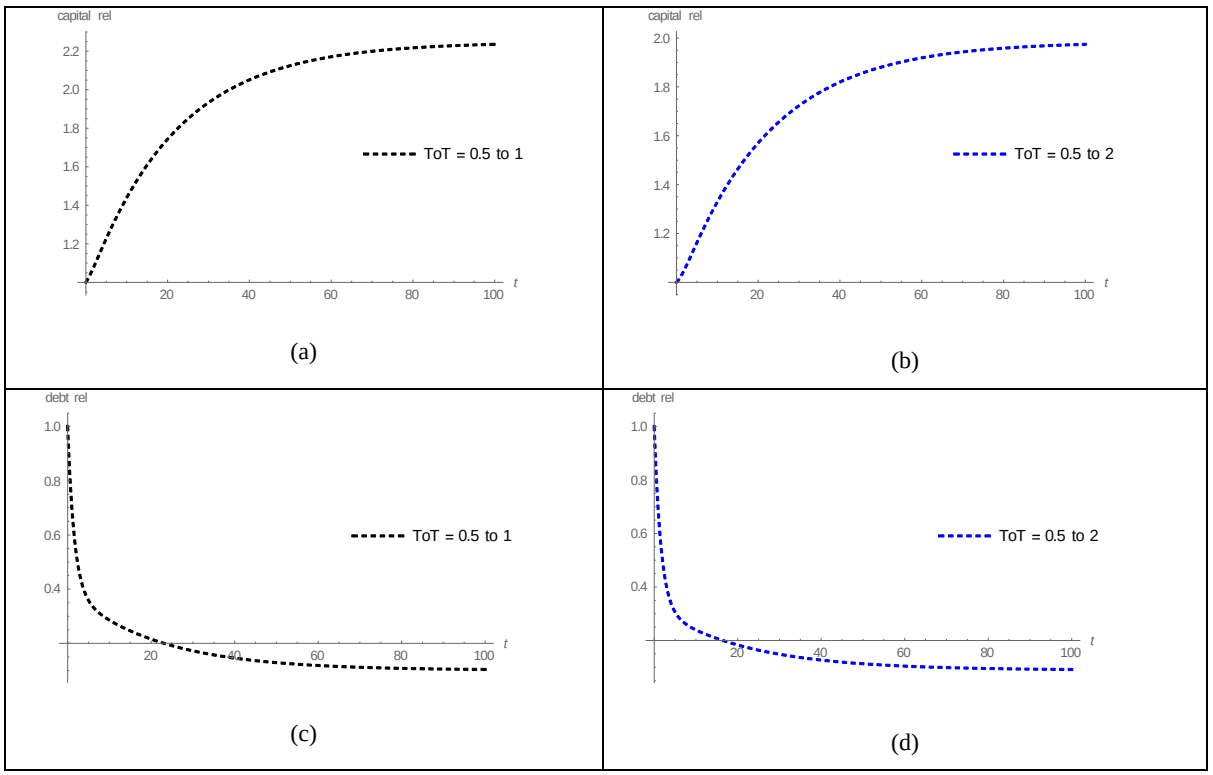
Consequently, when the terms of trade change from 0.5 to 2, there is a slight decrease in the duration of the debt. The reasons for this outcome may stem from various factors, including changes in the ratio between the price of net oil imports and agriculture exports. By reducing dependence on oil imports for energy, the economy becomes

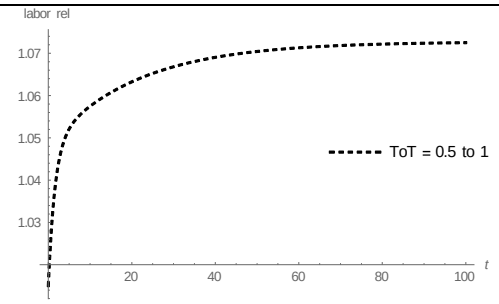
less vulnerable to price volatility, thus helping to stabilize the duration of foreign debt. To alleviate this situation, the Government of Indonesia (GoI) can implement two key measures:

First, Strengthen domestic energy production: The GoI should prioritize developing and expanding domestic energy production capabilities. This can be achieved by increasing investments in domestic oil exploration and production, fostering partnerships with oil-producing nations, and incentivizing the growth of domestic energy companies. By enhancing domestic energy production, Indonesia can reduce its reliance on net oil imports, thereby mitigating the impact of oil price fluctuations on the duration of foreign debt.

Second, Implement hedging strategies: The GoI should explore adopting hedging strategies or financial instruments to manage the risks associated with oil price volatility. That involves entering into contracts or options that allow the government to secure prices for net oil imports in advance. Using such hedging mechanisms, Indonesia can establish price certainty and stability for its oil imports, minimizing the adverse effects of sudden oil price fluctuations on the duration of foreign debt.

These measures would enable the GoI to enhance energy security, reduce dependency on international oil markets, and improve financial stability. By strengthening domestic energy production and implementing effective hedging strategies, Indonesia can better manage the risks associated with oil price fluctuations, promoting economic resilience and ensuring a more stable duration of foreign debt.

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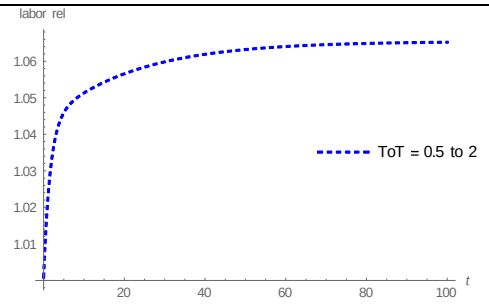
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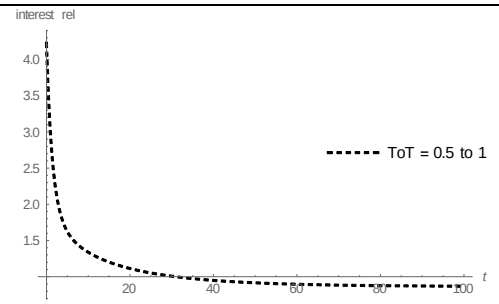
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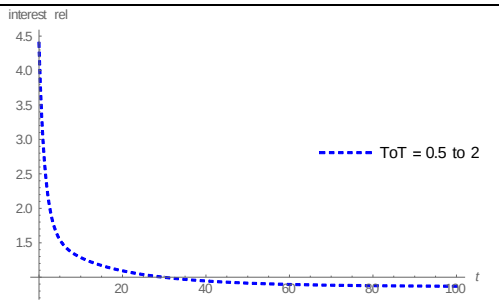
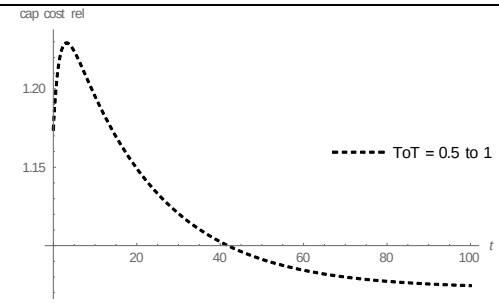
3.5
3.0
2.5
2.0
1.5
ToT = 0.5 to 1
20
40
60
80
100
t

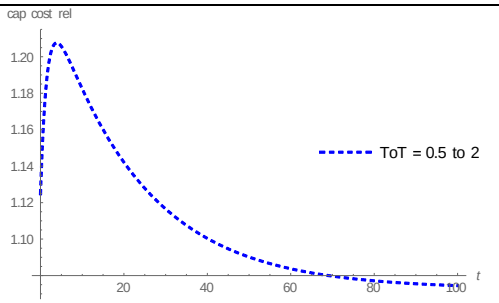
(g)


interest rel
4.5
4.0
3.5
3.0
2.5
2.0
1.5
ToT = 0.5 to 2
20
40
60
80
100
t

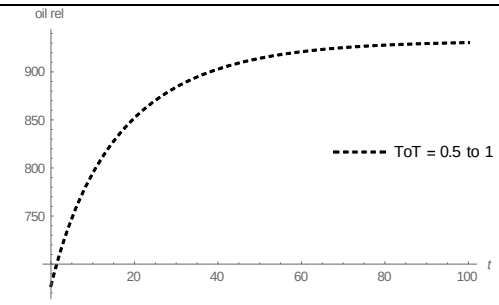
(h)


cap cost rel
1.20
1.15
ToT = 0.5 to 1
20
40
60
80
100
t

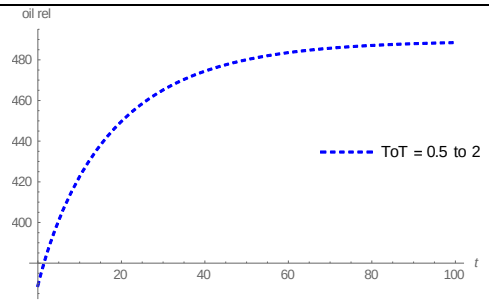
(i)


cap cost rel
1.20
1.18
1.16
1.14
1.12
1.10
ToT = 0.5 to 2
20
40
60
80
100
t

(j)


oil rel
900
850
800
750
ToT = 0.5 to 1
20
40
60
80
100
t

(k)


oil rel
480
460
440
420
400
ToT = 0.5 to 2
20
40
60
80
100
t

(l)

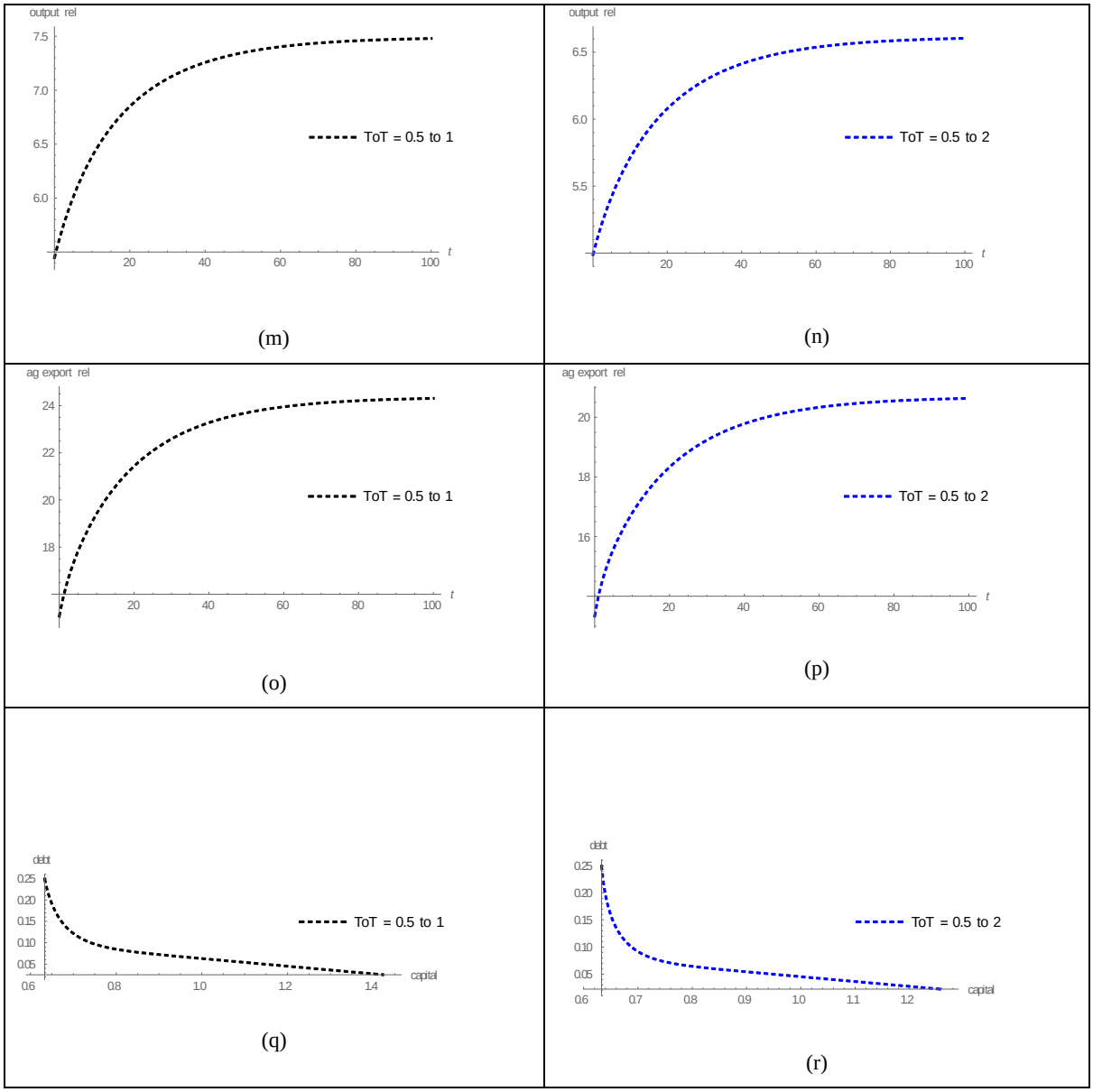


Figure 2. The Comparative Statics on the Effects of Terms of Trade on Macroeconomics Posture in Indonesia

Figures 2 (e) and (f) illustrate the impact of the terms of trade (t.o.t) on employment or labor in Indonesia. The observed changes in the ratio between the price of net oil imports and the price of agriculture exports, specifically from 0.5 to a 1-to-1 ratio and from 0.5 to 2, decrease the demand for employment. This phenomenon can be attributed to several factors that arise from fluctuations in the terms of trade. The decrease in job needs can be primarily attributed to the following factors. Firstly, as the terms of trade improve, indicating a more favorable ratio between the price of net oil imports and the price of agriculture exports, it often leads to increased productivity and efficiency gains in the economy. This improved efficiency can lead to a reduction in labor-intensive sectors or a shift towards more capital-intensive production processes, which may require fewer workers. Secondly, a higher ratio between the price of net oil imports and the price of agriculture exports can result in shifts in comparative advantage. If the agriculture sector is relatively more competitive and benefits from higher export prices, resources, including labor, may be reallocated towards agriculture at the expense of other sectors. This reallocation can affect the demand for employment in those sectors adversely.

On the other hand, Figures 2 (g) and (h) illustrate the impact of doubling the terms of trade (t.o.t) from 0.5 to 2 on interest rates. The observations reveal that the initial interest rate values are slightly higher compared to the scenario where the t.o.t. changes from 0.5 to a 1-to-1 ratio. Additionally, there is a steeper decrease in interest rates from the period 0 to the period between 5 to 10. Several factors, including expectations of future economic conditions, market dynamics, and policy decisions, can influence the initial higher interest rates. These factors may contribute to higher borrowing costs and lenders' risk perception, resulting in slightly elevated interest rates. However, as the t.o.t. changes from 0.5 to a 1-to-1 ratio, there may be a subsequent decline in interest rates. That can be attributed to improved trading conditions and a more favorable ratio between the price of net oil imports and agriculture exports. A higher ratio indicates a relatively more robust performance of agriculture exports than net oil imports. This enhanced trade performance can boost economic growth, attract investments, and reduce the overall risk perception in the market, leading to downward pressure on interest rates.

The observed steeper decrease in interest rates from period 0 to the period between 5 to 10 further suggests a positive impact resulting from the change in terms of trade. During this period, the economy may experience a more pronounced positive effect from the improved ratio between the price of net oil imports and agriculture exports. It can be attributed to increased trade profitability, investment opportunities, and overall economic growth, which collectively contribute to the decline in interest rates.

Figures 2 (i) and (j) illustrate the impact of the terms of trade (t.o.t) on capital costs. In Figure 2 (i), the analysis reveals an initial increase in capital costs from period 0 to 5, followed by a rapid decline until period 40. Subsequently, when the t.o.t changes from 0.5 to a 1-to-1 ratio, the capital cost becomes negative. On the other hand, Figure 2 (j) represents the effect of increasing the t.o.t from 0.5 to 2, where the capital cost starts slightly higher and experiences a rapid decline from period 5 to 70, ultimately resulting in a negative value. In Figure 2 (i), the initial increase in capital costs from periods 0 to 5 can be attributed to higher investment requirements, inflationary pressures, or increased production costs. However, after period 5, the rapid decline in capital costs until period 40 may indicate improved trading conditions and a more favorable ratio between the price of net oil imports and agriculture exports. This change in terms of trade contributes to reduced production costs, increased profitability, and enhanced investment opportunities, resulting in a significant decrease in capital costs.

The subsequent negative capital costs observed when the t.o.t changes from 0.5 to a 1-to-1 ratio suggest that the economy benefits from favorable trading conditions. A negative capital cost implies that the benefits derived from the improved terms of trade outweigh the initial investment requirements, indicating a net gain for the economy. In Figure 2 (j), the slightly higher initial capital costs may be influenced by market conditions, investment demand, or inflationary pressures. However, the subsequent rapid decline in capital costs from period 5 to 70 indicates the positive impact of increasing the t.o.t from 0.5 to 2. This change in terms of trade leads to reduced production costs, increased efficiency, and enhanced investment opportunities, resulting in a significant decrease in capital costs.

The negative values observed in both figures suggest that the improved terms of trade, particularly the favorable ratio between the price of net oil imports and the price of agriculture exports, provide good conditions for

investment and economic growth. The negative capital costs indicate that the benefits derived from the improved terms of trade surpass the initial investment requirements, resulting in net gains for the economy.

Figures 2 (k) and (l) illustrate the impact of the terms of trade (t.o.t) on net oil imports. In Figure 2 (k), the analysis reveals an increase in net oil imports resulting from the change in t.o.t from 0.5 to 1. The figure shows that net oil imports start with a negative value in the first period and then experience a rapid increase after period 20, followed by a relatively steady path. On the other hand, Figure 2 (l) demonstrates a similar increase in net oil import usage due to the change in t.o.t from 0.5 to 2, but with a decrease of approximately 50% compared to the rise observed in Figure 2 (k). In Figure 2 (k), the initial negative value of net oil imports indicates that, in the early period, the country might have been a net oil exporter or had a surplus of oil production. However, as the t.o.t changes from 0.5 to 1, indicating a more favorable ratio between the price of net oil imports and the price of agriculture exports, there is a subsequent increase in net oil imports. This increase can be attributed to the improved terms of trade, which may lead to increased demand for oil imports, either due to higher domestic consumption or changes in production dynamics. The rapid increase in net oil imports after period 20 suggests that the country is increasingly relying on oil imports due to the improved terms of trade. In Figure 2 (l), the increase in net oil import usage due to the change in t.o.t from 0.5 to 2 is observed, but the magnitude of the increase is approximately 50% lower compared to Figure 2 (k). That indicates that while the change in terms of trade still leads to an increase in net oil imports, the growth rate is relatively lower. It may be attributed to various factors, such as improved domestic energy production, reduced dependency on oil imports, or the diversification of energy sources. The decrease in the magnitude of the increase suggests that the country's reliance on oil imports is less pronounced compared to the scenario depicted in Figure 2 (k).

Furthermore, Figures 2 (m), (n), (o), and (p) provide insights into the impact of the terms of trade (t.o.t) on the final output and agricultural product exports. Figures 2 (m) and (o) represent the effect of changing the t.o.t from 0.5 to a 1-to-1 ratio. Both observations show a rapid value increase from 0 to 20 or 25, followed by a plateau. On the other hand, Figures 2 (n) and (p) illustrate the effect of quadrupling the t.o.t from 0.5 to 2. The rapid value increase is observed from periods 0 to 25 in both scenarios. However, there is a decrease in the values compared to the previous simulation using a 1-to-1 ratio, with a more substantial reduction observed in agricultural product exports. In Figures 2 (m) and (o), the rapid increase in the values of the final output and agricultural product exports from period 0 to 20 or 25 can be attributed to the improved terms of trade resulting from the change of t.o.t from 0.5 to a 1-to-1 ratio. This change signifies more favorable trading conditions, which can lead to increased demand for both the final output and agricultural products. The initial rapid increase indicates that the economy benefits from the improved terms of trade, stimulating production and export activities. However, after the initial surge, the values plateau, suggesting a stabilization of the overall output and agricultural product exports. That may be due to various factors, such as capacity limitations, market saturation, or diminishing returns. Figures 2 (n) and (p) show the effect of quadrupling the t.o.t from 0.5 to 2. Similar to the previous scenarios, there is a rapid increase in the final output and agricultural product export values from periods 0 to 25. However, both observations show decreased values compared to the simulation using a 1-to-1 ratio. It indicates that while the change in t.o.t still contributes to growth, the magnitude of the increase is relatively lower. Specifically, the decrease in agricultural product exports suggests that the sector is more sensitive to changes in terms of trade,

especially when the ratio between the price of net oil imports and the price of agriculture exports becomes less favorable. The higher sensitivity of agriculture exports to changes in terms of trade can be attributed to several key factors. First, as a net oil-importing country, the agricultural sector relies heavily on imported inputs such as fertilizers, machinery, and fuel. Any increase in the price of net oil imports, which is reflected in trade changes, directly impacts agriculture's production costs. That, in turn, reduces the competitiveness of agricultural products in international markets, leading to a decline in agricultural exports.

Second, resource allocation plays a significant role. In net oil-importing countries, the government and private sector often prioritize meeting the country's energy demands, resulting in fewer investments and less support for the agricultural sector. Consequently, the agricultural sector experienced lower productivity and limited export capabilities. This lack of resources and infrastructure makes it more vulnerable to changes in terms of trade, as it struggles to adapt to fluctuating market conditions quickly.

Third, price dynamics contribute to the sensitivity of agriculture exports. Agricultural product prices are more responsive to supply and demand changes than oil prices. Weather conditions, crop yields, international trade policies, and consumer preferences influence agricultural markets. Consequently, even small changes in the terms of trade, which affect the relative prices of agricultural products and net oil imports, can significantly impact the competitiveness and profitability of the agricultural sector.

Lastly, market concentration is a contributing factor. Many net oil-importing countries have agricultural sectors with a high concentration of small-scale farmers and limited market diversification. This concentration makes the sector more susceptible to external shocks, including changes in the terms of trade. Agricultural producers often face challenges due to limited bargaining power and struggle to adapt their production and marketing strategies to cope with price fluctuations resulting from changes in the terms of trade.

Furthermore, the terms of trade (t.o.t) influence the relationship between debt and capital in net oil-importing countries. When the t.o.t changes from 0.5 to 1, the decrease in the debt-to-capital ratio exhibits a less steep curve compared to the shift in t.o.t from 0.5 to 2.

This phenomenon can be explained by examining the dynamics between debt, capital accumulation, and the ratio between the price of net oil imports and the price of agricultural exports. As the t.o.t increases from 0.5 to 1, the net oil-importing country experiences a favorable trade environment, improving profitability and investment opportunities. This results in a relatively gradual decrease in the debt-to-capital ratio, indicating a more stable financial position.

On the other hand, when the t.o.t increases from 0.5 to 2, the impact on the debt-to-capital ratio becomes more pronounced. The more significant change in the t.o.t signifies a more substantial shift in relative prices between net oil imports and agricultural exports. It can create challenges for the net oil importing country, as the increase in the price of net oil imports may outpace the gains of farm exports. Consequently, the debt-to-capital ratio experiences a sharper decline, reflecting the potential strain on the country's financial stability.

Conclusion and Policy Recommendation

This study provides valuable insights into the effects of terms of trade (t.o.t) on agriculture exports, focusing on the case of Indonesia as a net oil importer. It underscores the critical role of t.o.t in shaping economic dynamics and highlights the potential benefits and challenges associated with different t.o.t ratios. The findings reveal significant implications for capital accumulation, foreign debt, and employment in the agriculture sector.

The initial period of rapid growth in capital accumulation, driven by improved t.o.t, demonstrates a positive impact on profitability and investment opportunities in agriculture exports. However, subsequent increases in t.o.t show a more gradual influence, suggesting a relatively stable dynamic. Notably, when t.o.t doubles from 0.5 to 2, capital accumulation decreases, emphasizing the need for careful management of trade dynamics to ensure sustained growth and profitability in agriculture exports.

Furthermore, the study reveals the influence of t.o.t on foreign debt in the context of agriculture exports. An increase in t.o.t from 0.5 to 1 positively affects foreign debt, as improved trading conditions lead to increased export revenues and an enhanced capacity to service obligations. However, doubling t.o.t to 2 results in a slight decrease in debt duration, indicating the importance of reducing dependence on oil imports and diversifying energy sources to mitigate the vulnerability of agriculture exports to t.o.t fluctuations.

Moreover, the research highlights the impact of t.o.t on employment in the agriculture sector. It reveals a decrease in job demand due to increased productivity and shifts in comparative advantage. This finding emphasizes the need for policymakers to consider sectoral implications and develop strategies to mitigate any adverse effects on employment, such as skill development programs and support for labor transition within the agricultural value chain.

While this study significantly contributes to our understanding of the effects of t.o.t on agriculture exports and economic dynamics, it is essential to acknowledge certain limitations and potential downsides. The analysis focuses specifically on net oil-importing countries, and therefore caution should be exercised when generalizing the findings to other economies or those heavily reliant on different commodities. Additionally, the study does not consider the potential political and social implications of t.o.t changes, which can significantly influence trade dynamics and impact agriculture exports. Future research should incorporate a more comprehensive framework that includes political and social factors to provide a more nuanced understanding of the relationship between t.o.t and agriculture export dynamics.

In conclusion, this study underscores the critical role of terms of trade in shaping agriculture exports in net oil-importing countries, using Indonesia as a case study. The findings highlight the need for careful trade management to ensure sustained growth and profitability in agriculture exports and the importance of diversifying energy sources to reduce vulnerability to t.o.t fluctuations. Moreover, strategies to mitigate potential adverse effects on employment in the agriculture sector should be developed. Future research should address the limitations identified and explore additional dimensions to provide policymakers with a more comprehensive understanding

of the t.o.t effect on agriculture exports, enabling effective strategies for promoting sustainable economic development in the face of changing terms of trade.

Acknowledgement

The author is very grateful to Lembaga Pengelola Dana Pendidikan (LPDP) Indonesia's Ministry of Finance, which has provided financial support in writing this paper. Also, I express my gratitude to the participants of the International Conference on Humanities, Social and Education Sciences (IHSES) on April 13-16, 2023, for their input and suggestions to ensure perfection in preparing this paper. All errors and typos in the paper are the author's responsibility.

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