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INITIAL REFLECTIONS ON THE LIKELY EFFECTS OF ETHIOPIA'S FOREIGN EXCHANGE RATE REFORM ON MACROECONOMIC INDICATORS

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Policy Working Paper 26/2024

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ABSTRACT

This paper offers preliminary insights on Ethiopia's shift to a market-determined foreign exchange rate policy to reunify the official and the parallel exchange market rates. The initial trend analysis suggests that a floating exchange rate regime has narrowed the gap between the official and parallel market exchange rates. The margin decreased to less than 10 percent during the third week of August 2024, compared to 98 percent before the policy announcement. Whether this trend will continue depends on evolving circumstances, including the responses of other macroeconomic indicators. A dynamic stochastic general equilibrium (DSGE) model has been built and calibrated to assess the likely responses of selected macroeconomic indicators to exchange rate adjustment. Two scenarios have been considered on the path of exchange rate adjustment, namely gradual and reunification scenarios. The trade-off between these two scenarios hinges on the balance between the immediate disruption and persistence of the effects of the exchange rate shock. Simulation results indicate that both scenarios cause economic contraction and inflation spikes, but a reunification scenario leads to more severe adverse impacts on key macroeconomic indicators and slower recovery, making it a risky path to follow. Since allowing further depreciation of the local currency (Birr) against other foreign currencies could deepen economic contraction and inflation spike, there is a need for caution and pragmatism in managing the foreign exchange market reform.

Keywords: Market-determined exchange rate policy, dynamic stochastic general equilibrium model, Ethiopia.

1. INTRODUCTION

Ethiopia initiated a foreign exchange market reform as part of its second generation Homegrown Economic Reform Agenda (HGER 2.0) in mid-2024. The government announced the introduction of a market-based foreign exchange rate system, which led to a sharp depreciation of the local currency (Birr). This raises concerns about its potential effects on the broader economy, particularly economic growth, inflation, trade balance, and private and government consumption. Given the import dependence of the Ethiopian economy, especially on consumer goods and industrial inputs, large currency depreciation may lead to higher import prices which may fuel inflationary pressures (Aleto, 2018; Gebregziabher, 2019 and Ayirikame, 2021). However, the exact nature of the impact of the exchange rate adjustment on the wider economy is complex as it has both direct and indirect effects. It depends on various factors, including the structure of the economy, the responsiveness of monetary policy, and the behavior of households and firms. This paper seeks to analyze the macroeconomic implications of Ethiopia's recent foreign exchange market reform. By employing a dynamic stochastic general equilibrium (DSGE) model, we quantify the effects of a floating foreign exchange rate regime on key macroeconomic indicators. The findings of this study provide valuable insights into the likely effects of exchange rate pathways on the Ethiopian economy and offer guidance in managing the economy. The ultimate goal is to contribute to evidence-based discussion on exchange rate management in Ethiopia and to inform strategies that mitigate the adverse effects of foreign exchange market reform while promoting economic stability and growth.

2. CONTEXT

2.1 Policy Orientation

The government of Ethiopia has embarked on significant macroeconomic, sectoral and structural reforms to revitalize the economy and lay the foundations for a vibrant private sector. The first generation of Homegrown Economic Reform (HGER 1.0) (2019-2022) unleashed a series of multifaceted reforms to ensure macro-financial stability and sustain economic growth (FDRE, 2020).³ However, the implementation of HGER 1.0 was beset by overlapping shocks, including COVID-19, internal war, prolonged conflicts, the Ukraine-Russia war, and other natural disasters such as climate change. Both domestic and external shocks adversely impacted the implementation of HGER 1.0 as evidenced by limited progress in improving growth performance, boosting exports, halting inflation, reducing debt, and job creation, among others (Policy Studies Institute, 2023).⁴

Cognizant of the short and long-term impacts of these challenges, the Government of Ethiopia designed and adopted the second generation of HGER (HGER 2.0) which is aligned with the Ten-Year Development Plan of the country. HGER 2.0 is anchored on four pillars: macroeconomic reforms; trade and investment reforms; productive sector reforms; and public sector reforms (FDRE, 2024).⁵ These reforms are expected to restore macroeconomic stability, boost private sector activity, and ensure inclusive and sustainable growth going forward.

2.2. Overview of Recent Reforms

Central to the HGER 2.0 is reforming the monetary policy and exchange rate frameworks towards a more modern and market-based approach to ensure price and external stability. In an effort toward an interest rate-based monetary framework, the National Bank of Ethiopia (NBE) adopted a target policy rate of 15 percent which is expected to achieve a positive real interest rate. In July 2024, the government adopted a wide range of macroeconomic reforms, including the adoption of a market-based exchange rate regime (National Bank of Ethiopia, 2024).⁶ On the first day⁷ of the foreign exchange reform announcement, the value of the local currency declined by about 30 percent compared to major foreign currencies (such as the US dollar) and continued to decline thereafter. The primary goal of the introduction of a market-determined exchange rate regime is to address the long-standing foreign exchange misalignment and shortages through boosting exports, encouraging import-substitution, reducing smuggling and informality, reducing import demand, improving investor confidence (e.g., attracting foreign direct investment), and ultimately stabilizing the economy.

The foreign exchange market liberalization has also been accompanied by other complementary reforms. These include end of foreign exchange surrender requirements to the NBE; removal of import restrictions, improvement of retention rules⁸; removal of rules governing foreign exchange rationing; introduction of non-bank foreign exchange bureaus; removal of restrictions on franco valuta imports; allow

³ FDRE (2020). A Homegrown Economic Reform Agenda: A Pathway to Prosperity, Addis Ababa.

⁴ Policy Studies Institute (2023). Assessment Report of the Homegrown Economic Reform (HGER) Agenda (2019-2022), Addis Ababa.

⁵ FDRE (2024). Ethiopia: Homegrown Economic Reform 2.0, 2023/24-2025/26, Addis Ababa.

⁶ National Bank of Ethiopia (2024). Foreign Exchange Directive No. FXD/01/2024, Addis Ababa.

⁷ On July 29, 2024, the government announced the introduction of a competitive and market-based exchange rate system.

⁸ Exporters can now retain 50% of their foreign exchange proceeds, up from 40%.

residents to open foreign currency accounts; simplification of rules on foreign currency accounts; removal of interest rate ceilings on external borrowing by private sector; opening securities market to foreign investors; special privilege to Special Economic Zones (including 100 percent retention of their foreign exchange earnings); and relaxation of foreign exchange controls (National Bank of Ethiopia, 2024). The new policy shift also permits NBE to intervene in the foreign exchange market when there are malpractices in the market.

The government's foreign exchange reform packages are also aligned with the International Monetary Fund (IMF) and World Bank reform programs for Ethiopia. Under the Extended Credit Facility (ECF) program of the IMF⁹, specific measures include exchange rate liberalization, easing of current account restrictions, phase-out of foreign exchange surrender requirements, strengthened NBE independence, introduce interest-rate-based monetary policy framework, phase-out of financial repression mechanisms, tax reforms (e.g., VAT, excise stamp, property, and direct tax reforms), and reform of state-owned enterprises (IMF, 2024).¹⁰ The Development Policy Operation (DPO) program of the World Bank aims to support government reform efforts through restructuring the financial sector, promoting trade liberalization, ensuring fiscal sustainability and transparency, and enhancing social resilience and climate action (World Bank, 2024).¹¹ The DPO program includes a number of specific reforms, such as energy tariff reform, removal of agricultural export bans, alignment with the Africa Continental Free Trade Area (AfCFTA), strengthening supervision capacity of NBE, enhancing regulatory standards, and safety net expansion and modernization to protect the vulnerable from the adverse effects of reform measures. As part of the reform measures and fiscal consolidation, electricity tariffs will be increased on average by 10 percent each quarter beginning in September 2024. Additionally, fuel prices will be raised by 5 percent per month to close the price gap resulting from foreign exchange reform by early 2025. These will trigger soaring prices of goods and services. There is also expressed intention to increase interest rates to achieve a positive real policy rate in the first quarter of 2025 (IMF, 2024).

Acknowledging the adverse effects of the reforms, the government will provide subsidy packages to help the public cope with the adverse effects of the market-determined foreign exchange rate regime and other reforms. The subsidy packages will cover fuel, food items, and medicines, fertilizer, and transport. The government will also increase the salaries of low-earning civil servants.

The effects of the foreign exchange market reform and accompanied complementary measures require data-driven evidence to inform and guide interventions going forward.

2.3. Initial Economic and Social Conditions

2.3.1. Highlights of selected macroeconomic and sectoral indicators

Ethiopia has registered promising growth performance in the last two decades. This growth acceleration has been slowed down recently due to overlapping and multiple shocks. The economy registered a 7.2 percent growth rate in 2022/23, up from 6.4 percent in 2021/22. Recently, the country experienced persistent inflation, low international reserves, sluggish exports, unsustainable debt levels, low

⁹ In order to assist the Ethiopian Government in implementing its HGER 2.0, the Executive Board of the International Monetary Fund (IMF) approved a four-year agreement under the Extended Credit Facility (ECF) in the amount of US\$3.4 billion on July 29, 2024 (IMF, 2024).

¹⁰ IMF (2024). IMF Country Report No. 24/253, *The Federal Democratic Republic of Ethiopia request for an arrangement under the extended credit facility—press release; staff report; and statement by the executive director for the Federal Democratic Republic of Ethiopia*.

¹¹ World Bank (2024). *The Ethiopia First Sustainable and Inclusive Growth Development Policy Operation*, July 12, 2024.

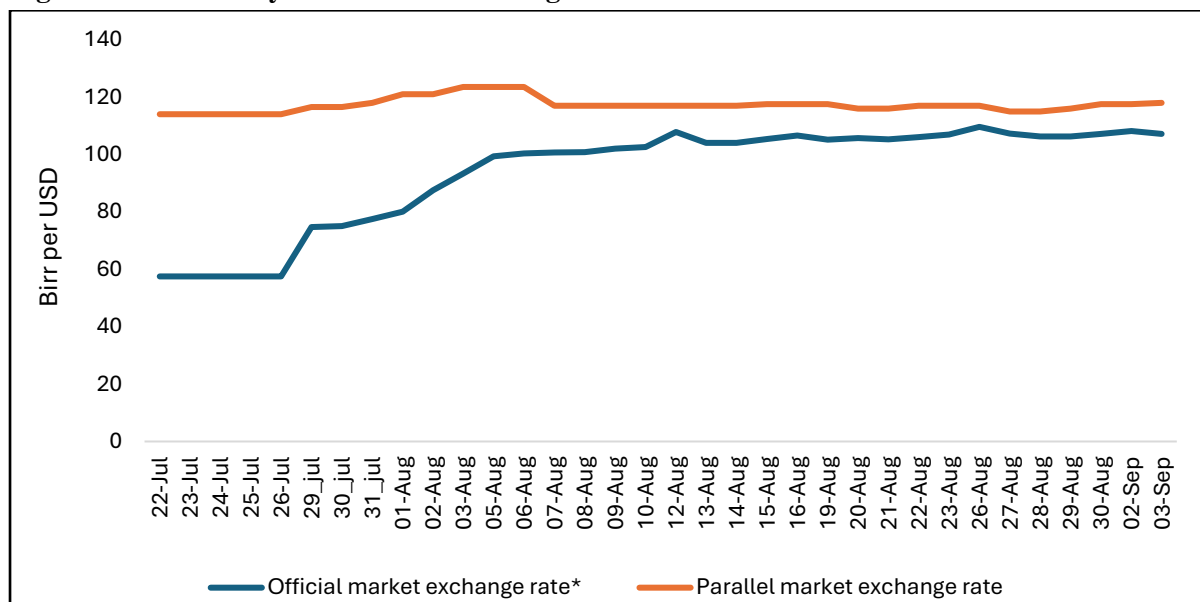
international reserves, and chronic unemployment. There is also a large spread between the official and parallel exchange rates, reported at more than 50 percent.

Growth has mainly been driven by a rapid expansion of services, particularly in recent years, though the sector remains largely informal, low-skill, and low-technology intensive. Nevertheless, its value-added as a share of GDP accounted for 40.3 percent in 2022/23 while that of agriculture was 32.1 percent. The industry has also been increasing its share in GDP, but much of industrial GDP originated from the construction subsector and to a certain extent mining rather than from manufacturing. The share of the manufacturing industry in GDP has stagnated at around 6.7 percent.

2.3.2. Preliminary trends of official and parallel market exchange rates

Preliminary trend analysis shows that a shift to a floating exchange rate regime seems to narrow the gap between the official and parallel exchange rates (Figure 1). The official market exchange rate (blue line) showed a steep upward trend during the first week of August before leveling out afterward. On the other hand, the parallel market exchange rate is represented by the red line (World Bank, 2024). The Ethiopia First Sustainable and Inclusive Growth Development Policy Operation, July 12, 2024, showed a minor uptick in early August, followed by a steady fluctuation around the same level. On the day of the policy announcement (July 29, 2024), the spread between the two market rates declined from 98.3 percent on July 22 to 56 percent on July 29, a reduction of 42.3 percentage points. The divergence between the two rates continued diminishing during the post-policy announcement period. Since the third week of August, the margin has decreased to less than 10 percent. Although it is early to conclude, the initial response suggests that the floating exchange rate regime has narrowed the gap between the official and parallel market rates. Whether this trend will continue depends on evolving circumstances, including the participation of market actors. Market actors such as importers and foreign exchange traders are in the wait-and-see mode, reflecting uncertainty and speculation on the foreign exchange market. When these actors actively engage in business and fully respond to the policy reform, their participation will determine the long-term stability and effectiveness of the new exchange rate regime. The initial trend sheds light on the dynamics of the foreign exchange market and potential uncertainties for the Ethiopian economy going forward.

Figure 1: Preliminary behaviour of exchange rates

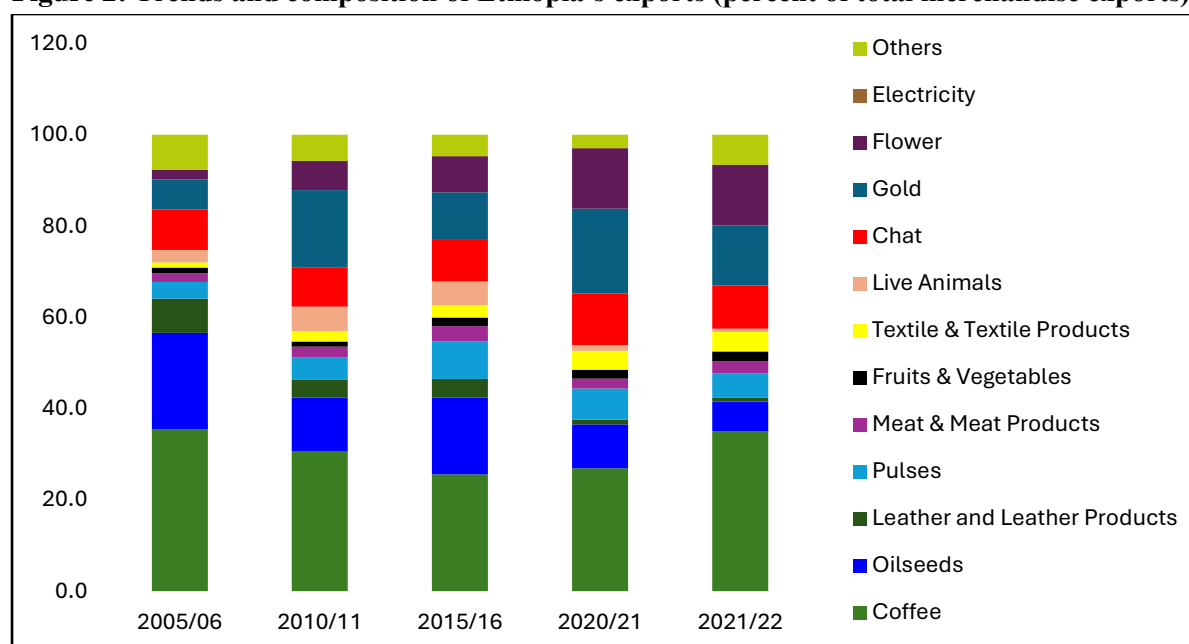


Source: National Bank of Ethiopia update report

2.3.3. Export Composition

The export of goods and services as a share of GDP remained low at 6.6 percent in 2022/23, compared to the import of goods and services at 14 percent, leading to a significant gap in the current account balance. Ethiopia's main merchandise exports are mainly dominated by agricultural products such as coffee, pulses, oilseeds, chat, flowers, and live animals. Merchandise exports have grown by 6.1 percent per year, mainly driven by a surge in exports of coffee, gold, and flowers. However, Ethiopia's export base has remained narrow, with no significant change in the composition of export products. In 2005/6, the top five export products were coffee, oilseeds, gold, chat, and leather and leather products, accounting for 71.9 percent of total merchandise exports. The composition of exports has shown no significant change in 2021/22, with the top five export commodities being coffee, gold, flower, chat, and oilseeds, accounting for more than 77.4 percent of total merchandise exports (Figure 2). The dominance of coffee continued, accounting for more than a third of total merchandise exports.

Figure 2: Trends and composition of Ethiopia's exports (percent of total merchandise exports)



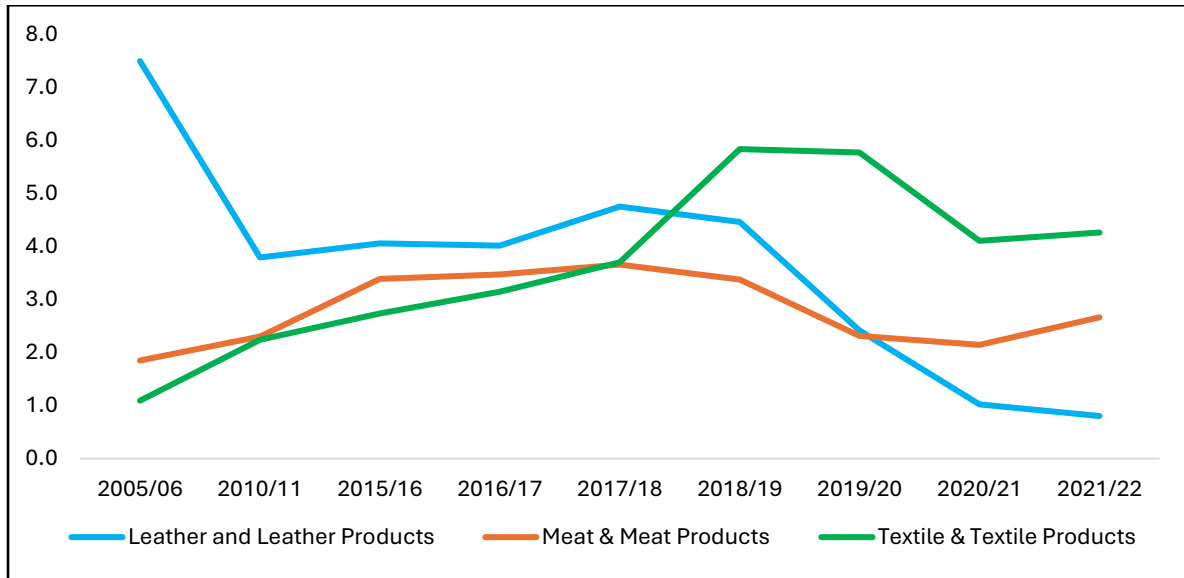
Source: Based on National Bank of Ethiopia (various years)

Major manufacturing exports include leather and leather products, textiles and textile products, and meat and meat products (Figure 3). The country has not been able to diversify the composition of its manufacturing export products. Manufacturing exports have been driven by the intensive margin, with no diversification and structural change. Despite the country's potential in agro-processing products and policy push through integrated agro-industrial parks, this has not contributed to diversifying the export base of the country.

In terms of volume, Ethiopia's export commodity landscape is concentrated in a few primary commodities (Figure 4). In 2021/22, the top five export commodities were coffee, fruits and vegetables, pulses, and oilseeds. In real terms, coffee export grew by 3.8 percent per year in the last two decades and remained the most important export item. The increase in coffee export earnings was mainly due to an increase in the global price of coffee. Among the manufacturing export products, export of textile and textile products has shown an increasing trend, growing by 9.9 percent per annum between 2005/6 and 2021/22. The government's policy push to promote manufacturing exports through industrial parks and

other incentives has not resulted in improving the performance of manufacturing exports and inducing shifts in the structure of the manufacturing export landscape. The country has a low manufacturing product diversification index and lags behind its competitors in diversifying manufacturing products (African Development Bank, 2014).¹²

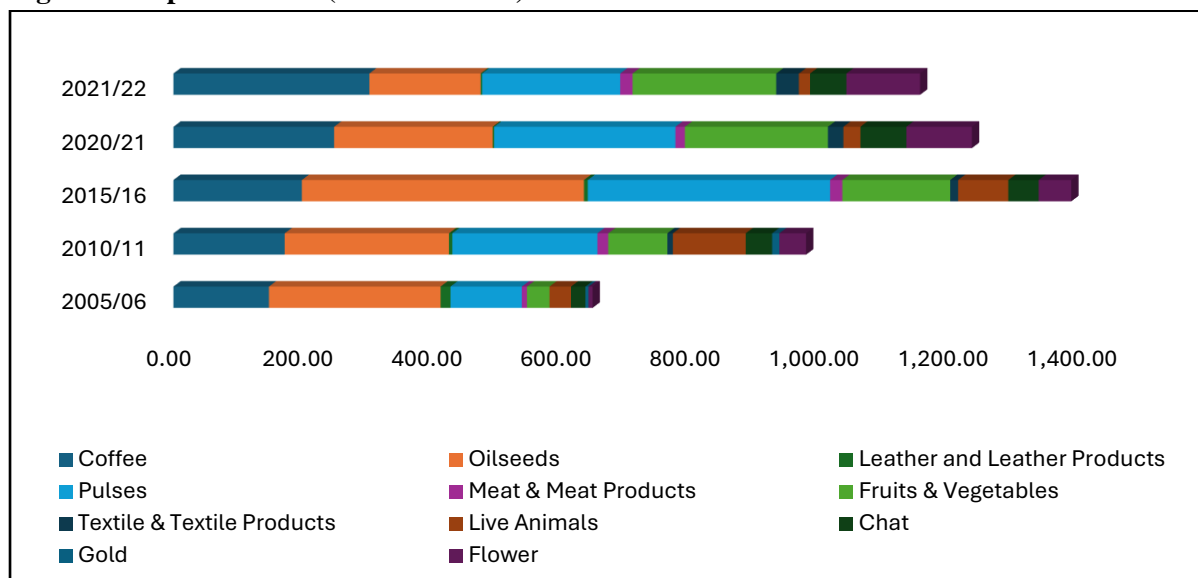
Figure 3: Trends in the share of major manufacturing exports (percent of total merchandise exports)



Source: Based on National Bank of Ethiopia (various years)

Overall, the export commodity landscape has skewed toward agricultural products, and the contribution of the manufacturing sector to exports has remained dire both in value and volume.

Figure 4: Export volume (Thousand MT)



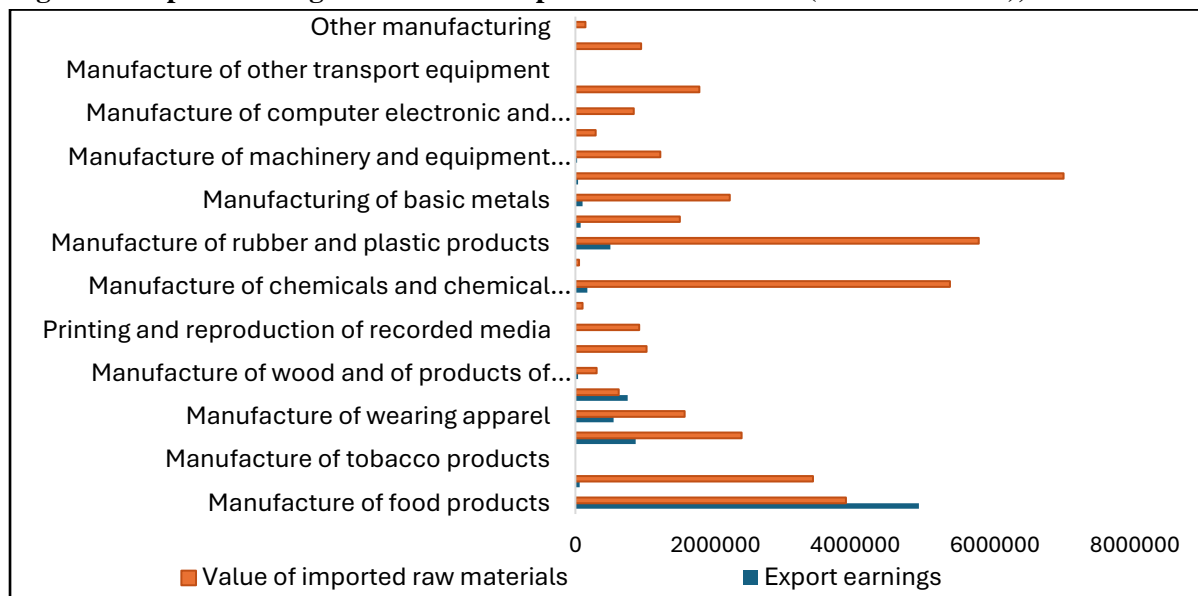
Source: Based on National Bank of Ethiopia (various years)

¹² Africa Development Bank (2014). Eastern Africa’s Manufacturing Sector: Promoting Technology, innovation, productivity, and linkages, Ethiopia Country Report.

2.3.4. Import intensity

The agricultural sector heavily depends on chemical inputs such as fertilizers and pesticides. Prices of agricultural commodities are highly influenced by the cost of these inputs, which will rise following the implementation of a floating exchange rate. The recent data on large and medium manufacturing industries indicate that the manufacturing industry heavily relies on imports of raw materials, with import intensity ranging from 13 percent for the manufacture of food products to 98 percent for the manufacture of computer electronic and optical products.¹³ The net export earnings of the large and medium-scale manufacturing industries are negative, indicating net users of foreign exchange to import raw materials. In 2020/21, only the food and leather manufacturing industries generated positive net export earnings (Figure 5). Given the import-intensive nature of the manufacturing industries, a shift to a market-determined exchange rate regime will escalate the cost of imported inputs, which will increase the cost of production and adversely affect their competitiveness. In addition, this policy shift will also raise the working capital requirements of manufacturing firms if there is an increase in interest rates (Krugman and Taylor, 1978).

Figure 5: Export earnings and value of imported raw materials (Thousand ETB), 2020/21



Source: Survey of Large and Medium-Scale Manufacturing Industry 2020/21

¹³ The 2020/21 Large and Medium-Scale Manufacturing survey data.

3. LITERATURE REVIEW AND COUNTRY EXPERIENCE

3.1. Exchange Rate Shocks in DSGE Models

Exchange rate dynamics and their macroeconomic implications have been widely studied using DSGE models. Gali and Monacelli (2005) pioneered using small open economy DSGE models to analyze how exchange rate fluctuations impact economies that are significantly exposed to international trade. Their model highlights the role of exchange rate pass-through to import prices and the subsequent effects on inflation and output. Justiniano and Preston (2010) extended this framework by incorporating incomplete exchange rate pass-through and analyzing its implications for optimal monetary policy in small, open economies. Their findings suggest that the degree of pass-through is critical in determining the optimal monetary response to exchange rate shocks, emphasizing the need for policymakers to account for the economy's structural characteristics.

In the context of small open economy models, particularly within the New Keynesian DSGE framework, several studies focused on capturing the unique dynamics of developing economies, such as their heightened exposure to external shocks and the challenges posed by limited financial markets and less credible monetary policies. For instance, Andrieu et al. (2013) adapted the DSGE framework to low-income countries by incorporating specific features such as aid flows and restricted access to international capital markets. Their model was instrumental in analyzing the effects of exchange rate shocks on key macroeconomic variables like inflation and output, highlighting the trade-offs faced by policymakers in maintaining macroeconomic stability. Similarly, Cespedes et al. (2004) explored the role of exchange rate regimes in small open economies using a DSGE model with financial frictions. Their findings suggested that while flexible exchange rate regimes allow economies to absorb external shocks better, they also increase the pass-through to inflation, requiring a strong and credible monetary policy response to mitigate the inflationary pressures. In related work, Edwards (1985) and Krugman and Taylor (1978) examined the contractionary effects of exchange rate devaluations within small open economies. Edwards emphasized that devaluations could lead to short-term reductions in output, particularly in economies with significant structural rigidities. Meanwhile, Krugman and Taylor (1978) identified specific conditions under which devaluations could exacerbate economic downturns, thereby challenging the traditional view that devaluations are always expansionary. Furthering this line of research, Ghosh et al. (2016) discussed the delicate balance that small open economies must maintain between managing exchange rate fluctuations and controlling inflation. Their study highlighted the complexity of conducting monetary policy in these settings, where external shocks can quickly translate into domestic economic instability. Reinhart and Rogoff (2008) added to this discussion by analyzing the historical performance of various exchange rate regimes in small open economies. They argue that fixed exchange rates often conceal underlying vulnerabilities, making these economies more susceptible to crises when external shocks occur.

Rodrik (2008) and Levy-Yeyati and Sturzenegger (2003) focused on the impact of exchange rates on economic growth in small open economies. Rodrik (2008) argued that maintaining a competitive exchange rate is crucial for fostering export-led growth. At the same time, Levy-Yeyati and Sturzenegger (2003) found that flexible exchange rate regimes generally support better growth outcomes by allowing economies to adjust more effectively to external shocks. In the context of inflation dynamics, Dornbusch and Frankel (1988) and Taylor (2001) explored the interaction between exchange rates and price levels. Dornbusch's model illustrated how exchange rate shocks could lead to significant inflationary pressures in small open economies. Taylor emphasized the importance of incorporating exchange rate considerations into monetary policy rules to better control inflation.

Finally, Grydaki and Fountas (2009) examined the impact of exchange rate volatility on productivity growth in small open economies. They found that exchange rate volatility can severely hinder productivity in environments with underdeveloped financial markets, underscoring the need for robust financial institutions to mitigate these adverse effects. These studies collectively provide a comprehensive understanding of how small open economies, particularly in the developing world, navigate the complex interplay between exchange rates, inflation, output, and overall macroeconomic stability within the New Keynesian DSGE framework.

3.2. Country Experiences and Lessons

The literature on exchange rate regimes indicates that different exchange rate regimes have merits and demerits. The introduction of floating exchange rates in the 1980s and early 1990s marked a significant shift in the exchange policies of developing countries. Countries that adopted a floating exchange rate needed more foreign exchange reserves and macroeconomic instability. Political considerations and institutional arrangements also play a role in adopting a floating exchange regime in developing countries (Kimaro, 1988). Under a floating exchange rate regime, the real and nominal exchange rates are endogenous variables determined in the market by demand and supply conditions.

The practical issue is the appropriate management of the exchange rate after liberalization, both in the immediate aftermath and in the longer term.

3.2.1. Eastern Europe

Eastern European nations and the former Soviet Union encountered challenges in managing exchange rates as they embraced open, market-based international trade without any prior experience with currency convertibility. Liberalization of prices, unification of the exchange rates, and the opening of the economy to international trade constituted the initial phase of market reforms in nearly all the transition countries. These economies also shared a number of structural imbalances, such as low levels of domestic competitiveness, severe currency inconvertibility, including a sizable black-market premium on the exchange rate, repressed inflation, large fiscal deficits, including an overhang of foreign debt, and weak trade and financial linkages with market economies Sachs (1996).

In early 1990, four countries relied initially on pegged exchange rates: Czechoslovakia, Estonia, Hungary, and Poland while Kyrgyzstan, Latvia, Russia, and Ukraine adopted floating exchange rates (Sachs, 1996). The International Monetary Fund (IMF) also urged Bulgaria and Romania to float their exchange rates beginning in 1990. Many floaters, such as Russia and Ukraine, suffered from triple-digit annual inflation rates as late as 1995 (Ibid). In Bulgaria and Romania, loose monetary and fiscal policies led to triple-digit inflation that persisted for several years. The reform experiences of many countries (e.g., the Czech Republic, Estonia, and Poland) benefited from early exchange rate pegging, which not only helped macroeconomic stability but also enhanced the government's ability to advance other reform initiatives. Even where stabilization under floating rates was achieved, the costs seem to be higher than alternative exchange rate arrangements. Effective anti-inflation initiatives in a floating exchange rate environment are typically contractionary, which has a negative impact on other macroeconomic metrics including job creation and growth performance. It seems that no exchange rate regime has ever worked perfectly in every situation.

The recent experience of Turkey provides interesting insights. The country experienced devaluations in 1970, 1979, early 1980s, 1994, and 2001 (Onuk and Fodor, 2023). Particularly, the country

has suffered from different economic crises since 1990, caused by widespread administrative inefficiency, political crisis, large-scale squandering of resources, excessive politicization of the economy, and other disasters (Koch et al., 2001). The country continued to experience high inflationary pressures and a large current account deficit. At the beginning of 2000, Turkey adopted an exchange rate-based stabilization program with support from the IMF. Increased interest rates, inconsistent fiscal policy, inadequate regulatory and monitoring capacity, and a weak banking system led to deteriorating macroeconomic performance and depleted foreign exchange reserves. Following the 2001 political and economic crises, Turkey introduced a floating exchange rate regime within the framework of an inflation-targeting regime. Both monetary and fiscal policies were formulated to gradually bring inflation to the target level. The Turkish Central Bank continued to build up its reserves if market conditions were relevant.

3.2.2. Asia and Pacific

Asian countries took a different path than many African countries, moving from managed to free-floating only after making great progress in their development processes. Many Asian economies employ controlled floating, including those in China, India, Thailand, Singapore, and Vietnam to ensure financial stability, boost exports, improve international competitiveness, and promote economic growth. Only after the Asian financial crisis of 1997 did Indonesia and South Korea make the switch to free-floating, while Malaysia has done so since 1983. India's exchange rate management strategy provides valuable insights. India has pursued a strategy of macroeconomic reforms since the early 1990s, including a gradual liberalization of the exchange rate policy. Although the country maintains a "de facto free float", the Reserve Bank of India (RBI) intervenes to stabilize the national currency when needed (Sengupta, 2021). The interventions by RBI have managed to reduce volatility. For instance, the rupee traded in the narrow range of 80.88-83.42 against the U.S. dollar between December 2022 and October 2023. The India experience indicates that even under a free-float exchange regime, there is room for government intervention to correct malpractices in the foreign exchange market based on evolving circumstances. Before implementing managed or free-floating exchange rate regimes, successful Asian countries have strengthened their productive capacities, greatly increased productivity, extended their industrial bases, undertaken structural reforms, and raised living standards (Delelegn, 2024). These efforts and policy actions helped Asian countries to maximize the benefits of a floating exchange rate regime in terms of boosting their exports, managing inflation, attracting foreign direct investment, and improving the current balance. Importantly, the transition to a floating exchange regime and export-led growth was made possible under a stable political environment, including peace and security, a foundation for socio-economic transformation. Once the economy matures, guided market forces largely determine foreign exchange market outcomes, including the exchange rate.

3.2.3. Africa

Foreign exchange markets in African countries have undergone changes through time. Many countries have liberalized their foreign exchange markets and have moved to more flexible exchange rates (Kaltenbrunner, Ruiz, and Oko, 2022). Several countries have also shifted to monetary regimes that give priority to controlling inflation and use the interest rate as the main policy instrument. In the 1980s, a number of African countries introduced floating exchange rate regimes under the auspices of the Structural Adjustment Program (SAP). These include Uganda, Sierra Leone, the Democratic Republic of Congo, Somalia, Zambia, Gambia, Ghana, Guinea, and Nigeria (Kimaro, 1988). A floating exchange rate regimes

were introduced in African countries during periods of large financial and economic imbalances, weak productive capacities, unsustainable fiscal deficits, financial repression, and administrative and other controls in the goods markets.

Nonbank foreign exchange traders were also allowed as part of the liberalization process. In many African countries, the introduction of floating exchange rates and large devaluation of local currencies led to a sharp increase in domestic prices. Soaring prices of basic commodities contributed to widespread inflation pressures that caused a substantial decline in household incomes, especially urban and low-wage earners, which were badly affected. Consequently, countries resorted to administrative and other regulations to check the effective demand for foreign exchange and thereby to limit the trend of depreciation of the exchange rate. Due to the economic and political sensitivity, the implementation of a floating exchange rate regime was not uniform in African countries. Some countries (e.g., Sierra Leone, Somalia, Uganda, and Zambia) eventually abandoned the floating exchange rate regimes, with Sierra Leone, Somalia, and Zambia revaluing their rates (Kimaro, 1988).

Note that these countries also reintroduced a floating exchange rate regime in the 2000s, following a ‘stop-go’ approach (Simwaka, 2010). The recent experiences of Nigeria, Egypt, Kenya, Sudan, and South Sudan also provide a compelling illustration of the intricate trade-offs that developing economies face when managing exchange rate shocks. These countries, each with unique economic structures and challenges, have all encountered situations where domestic and external pressures forced significant but imperfect reforms in their exchange rate policies (Delelegn, 2024). Additionally, Algeria, Morocco (since 2018), Mauritius, and Tunisia have adopted a managed floating system. Such experiences underscore the multifaceted nature of exchange rate management, where the potential benefits of devaluation must be carefully weighed against its associated risks and whether the economy is ready to withstand risks and benefit from such policy treatment (Green and Taylor, 2019). At the beginning of 2021, Sudan’s transitional government launched a managed floating exchange rate system, and the Sudanese national currency lost more than 600 percent of its value (Sharaf and Shahen, 2023). Subsequently, the rate of inflation in Sudan reached 304 percent. In April 2022, the exchange rate for Sudan increased to 445 pounds per U.S. dollar and crossed 630 pounds in the parallel market (Sharaf and Shahen, 2023). Similarly, South Sudan, which adopted a floating exchange rate regime, has experienced rapid inflation and widespread suffering due to a continuous decline in the value of the country’s currency.

Egypt has devalued its currency in an effort toward a market-determined exchange rate to boost investment and exports, improve foreign exchange reserves, driving economic growth through increased production and international trade (Business Today Egypt, 2024; Ayeb and Bush, 2019). As part of the reform package, the Central Bank of Egypt increased the interest rate by 6 percent to halt inflation and liberalization of the foreign exchange market, allowing the introduction of a free-floating exchange rate regime (Economic Policy Center, 2024; Abou Hamia, 2024). Egypt has secured a USD 24 billion new fund from the United Arab Emirates (UAE) to develop a city on the Mediterranean coast and more than USD 15 billion from the IMF, World Bank, and other development partners in exchange for the reforms. The new UAE fund has helped Egypt negotiate with the IMF on its macroeconomic policy reforms, especially changes in the exchange rate policy. These inflows would provide a huge boost to Egypt’s foreign exchange-starved economy and stabilize the exchange rate.

3.2.4. Key takeaways from country experiences

The foreign exchange rate policy is one of the macroeconomic policy instruments used to stabilize the economy and promote growth. However, its effectiveness could be enhanced when supported by other complementary interventions such as disciplined fiscal and other monetary policies as well as requisite

institutional and regulatory structures, including implementation and supervisory capacity and independence of central banks. Foreign exchange liberalization in the context of loose fiscal and monetary policies as well as weak implementation capacity led to disastrous outcomes, including soaring inflation and worsening socioeconomic and political conditions.

Transparency and establishing monitoring capability are crucial in managing the foreign exchange market through high-frequency data to inform economic actors through data analytics and automated dashboards (Asian Consultative Council Citaristi, 2022). This has also improved the quality of decision-making and introduced corrective measures to strengthen the functioning of the foreign exchange market.

Successful countries followed a gradual approach in their exchange rate policy management after building their productive capacities. In particular, they made large investments to increase their production capacity, boost productivity, broaden their industrial bases, and modernize agriculture through investments in irrigation agriculture. These investments amplify the benefits of exchange rate liberalization by enhancing the diversification and competitiveness of export products. Economic diversification is crucial in bolstering resilience against exchange rates and other shocks as over-reliance on a narrow range of export commodities could make countries highly vulnerable to price fluctuations in global markets and further weaken the local currency. A realistic assessment of the impacts of foreign exchange policy is necessary to understand the exchange rate pass-through effect and determine how floating exchange regimes influence the economy, including growth performance, inflation, employment, exports, and other social impacts such as its impact on low-income earners and other vulnerable populations. Particularly, careful targeting and implementation of subsidies help lessen adjustment costs.

The success of exchange rate liberalization also depends on the availability of foreign exchange reserves to satisfy foreign exchange demand at the going exchange rate. Countries that don't have adequate foreign exchange reserves compared to foreign exchange demand suffered serious macroeconomic imbalances, including the continuous decline of local currency against major foreign currencies which also caused massive inflation and re-emergence of parallel foreign exchange market, leading to divergence between the official and parallel foreign exchange rate.

Competition in the foreign exchange markets could be strengthened by allowing nonbank foreign exchange dealers, which also enhanced the efficiency of the foreign exchange market, thereby reducing the spread between the official and parallel foreign exchange rates. This also contributed to increased inflows of foreign exchange by reducing smuggling and rerouting remittance from informal to formal channels.

Finally, countries' experience also indicates that successful foreign exchange liberalization shall be accompanied by liberalization of both commodity and financial markets. These measures stimulated investment and attracted foreign direct investment, which resulted in increased foreign exchange inflow and contributed to foreign exchange reserves. However, investment requires political stability, peace, and security since conflicts and political instability can deter investment by disrupting production or raising uncertainty.

3.3. Empirical Studies in Ethiopia

A substantial body of empirical literature has explored the impact of exchange rate shocks on key macroeconomic variables in small open economies, particularly within developing countries. These studies often utilize DSGE models and other empirical methods to understand how these shocks propagate through the economy, influencing inflation, output, and financial stability. Several studies have highlighted the vulnerability of developing economies to exchange rate shocks, mainly due to their limited financial

markets and reliance on external financing. For instance, Edwards (1985) and Ashour and Chen Yong (2018) provided empirical evidence that exchange rate shocks can significantly disrupt macroeconomic stability in developing countries. Edwards (1985) discussed the contractionary effects of devaluation on output. At the same time, Ashour and Chen Yong (2018) found that flexible exchange rate regimes, despite their potential for better shock absorption, can lead to higher inflation volatility due to pass-through effects.

The role of exchange rate regimes in shaping the response of developing economies to external shocks has also been extensively studied. Céspedes et al. (2004) demonstrated how financial frictions in emerging markets amplify the effects of exchange rate shocks, particularly under different exchange rate regimes. Similarly, Levy-Yeyati and Sturzenegger (2003) and Zhou and von Hagen (2004) examined the "fear of floating" phenomenon in developing countries, showing that even in officially flexible regimes, governments often intervene in currency markets to mitigate the adverse effects of exchange rate volatility on inflation and output. The inflationary consequences of exchange rate shocks have been a central focus of empirical research. Using a VAR model, Ito and Sato (2008) examined how exchange rate pass-through affects inflation in post-crisis Asian economies, emphasizing the importance of credible monetary policy frameworks in mitigating these effects. Similarly, Taiwo et al. (2023) studied the impact of exchange rate policies on inflation in Sub-Saharan Africa, finding that countries with less flexible exchange rates tend to experience higher and more volatile inflation rates in response to exchange rate shocks.

Majeed and Noreen (2018) explored financial development and its role in buffering the economy against exchange rate shocks. Their empirical analysis reveals that exchange rate volatility can severely impede productivity growth in developing countries with less developed financial markets, underscoring the importance of strengthening financial institutions to enhance economic resilience. Other studies have focused on the broader macroeconomic consequences of exchange rate shocks. Calderón and Schmidt-Hebbel (2003) analyzed the macroeconomic performance of Latin American countries, showing that exchange rate shocks can lead to significant output losses, especially in economies with weak monetary policy credibility. Meanwhile, Mishkin and Savastano (2007) provided evidence of the effectiveness of different monetary policy strategies in Latin America, highlighting how exchange rate fluctuations can complicate the conduct of economic policy, particularly in environments with high external vulnerability. Beyond doubt, the transmission of exchange rate shocks to the real economy has been a key area of investigation. Burstein et al. (2005) empirically assessed the impact of large devaluations on the real exchange rate, prices, and output in developing countries, finding that such shocks often result in significant inflation and contractionary effects. Similarly, Kalyoncu et al. (2009) focused on Turkey, showing how exchange rate fluctuations can have contractionary effects on output, reflecting the broader challenges developing economies face in managing exchange rate volatility.

The above theoretical effects can be tested empirically using a DSGE model calibrated for Ethiopia. By introducing an exchange rate shock and simulating the model, we assessed the likely impact on inflation, output, trade balance, and other key macroeconomic variables, which will be the contribution of this work to the empirical literature.

4. MODEL CONSTRUCTION AND ASSUMPTIONS

The following vital assumptions provide the foundation for an open economy DSGE model for Ethiopia. They cover the behavior of households, firms, the government, and the foreign sector, each playing a critical role in determining how the economy responds to various shocks, including changes in monetary policy, technology, and external conditions. The assumptions about price stickiness (Calvo pricing) and the use of a Taylor rule for monetary policy are particularly important for generating realistic dynamics in the model.

Households: Maximize utility by choosing consumption C_t and labor L_t . Households derive utility from consumption and disutility from labor. They make decisions based on their preferences, subject to a budget constraint that includes income from labor, returns on capital, and prices of goods and services. The optimization problem leads to first-order conditions that describe consumption savings and labor supply decisions.

Firms: Produce goods using labor and capital, with pricing set via Calvo. Firms employ labor and capital to produce goods, typically following a production function like Cobb-Douglas or CES (Constant Elasticity of Substitution). In Calvo pricing, only a fraction of firms can adjust their prices each period, introducing price stickiness into the model. This assumption is crucial for generating realistic inflation and output dynamics in response to shocks.

Government: Implements monetary policy through a Taylor rule. The central bank sets the nominal interest rate according to the Taylor rule, which typically responds to deviations of inflation and output from their target levels. This rule captures the systematic behavior of monetary policy in stabilizing the economy. The government may also engage in fiscal policy, though your focus here is economic policy.

Foreign Sector: This sector captures the role of the exchange rate in imports and exports. The exchange rate influences the relative price of domestic and foreign goods, affecting the trade balance. In our case, a depreciation (or appreciation) of the domestic currency is expected to make exports cheaper for foreign buyers and imports more expensive for domestic consumers. This assumption is essential for modeling the open economy's interaction with the rest of the world, including trade and capital flows.

$$E \sum_{t=0}^{\infty} \beta^t U(C_t, N_t) \tag{1}$$

This utility function setup provides a structured framework for analyzing two-period economic decisions, offering insights into optimal consumption and labor decisions under uncertainty and time preference.

4.1 Households' Problem

The representative household maximizes its expected lifetime utility, a function of consumption C_t and leisure $1 - N_t$, where N_t represents labor supply at time t . The utility function is given by:

$$\max_{\{C_t, L_t\}} E_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{C_t^{1-\sigma}}{1-\sigma} - \frac{L_t^{1+\phi}}{1+\phi} \right] \tag{2}$$

Subject to the budget constraint:

$$C_t + B_t + \frac{Q_t}{P_t} = W_t L_t + R_t K_{t-1} + \frac{B_{t-1}}{R_t} + \Pi_t - T_t \tag{3}$$

Where P_t is the domestic price level. C_t is the consumption of the household at time t . B_{t+1} is the amount of domestic bonds the household holds at the beginning of period $t + 1$. E_t is the nominal exchange rate (domestic currency per unit of foreign currency). B_t^* is the amount of foreign bonds the household holds, and R_t is the gross nominal return on these foreign bonds. W_t is the nominal wage rate. N_t is the labor supply by the household. R_t is domestic bonds' gross nominal interest rate. Π_t represents profits from firms owned by the households (if any). T_t denotes lump-sum transfers or taxes received/paid by the household.

We can produce the Lagrange function from the above utility function and budget constraint. The corresponding Lagrangian function is:

$$L = \sum_{t=0}^{\infty} \beta^t \left\{ \frac{C_t^{1-\sigma}}{1-\sigma} - \frac{L_t^{1+\phi}}{1+\phi} + \lambda_t \left[W_t L_t + R_t K_{t-1} + \frac{B_{t-1}}{R_t} + \Pi_t - T_t - C_t - B_t - \frac{Q_t}{P_t} \right] \right\} \quad (4)$$

This Lagrangian function represents the household's problem of maximizing utility subject to a budget constraint in a typical DSGE model. We expand upon this by deriving the first-order conditions for consumption, labor, and bond holdings, which will further define the household's optimal behavior in the model. To do so, we derive the first-order conditions by taking the derivative of the Lagrangian function. The first-order conditions are calculated as follows:

With respect to C_t :

$$\frac{\partial \mathcal{L}}{\partial C_t} = \beta^t (C_t^{-\sigma} - \lambda_t) = 0 \quad (5)$$

$$C_t^{-\sigma} = \lambda_t \quad (6)$$

With respect to L_t :

$$\frac{\partial \mathcal{L}}{\partial L_t} = \beta^t (-L_t^\phi + \lambda_t W_t) = 0 \quad (7)$$

$$L_t^\phi = \lambda_t W_t \quad (8)$$

With respect to B_t :

$$\frac{\partial \mathcal{L}}{\partial B_t} = -\beta^t \lambda_t + \beta^{t+1} \frac{\lambda_{t+1}}{R_{t+1}} = 0 \quad (9)$$

$$\lambda_t = \beta \frac{\lambda_{t+1}}{R_{t+1}} \quad (10)$$

Substituting $\lambda_t = C_t^{-\sigma}$ into $\lambda_t = \beta \frac{\lambda_{t+1}}{R_{t+1}}$, We obtain the Euler equation for the household's optimization problem as follows:

$$C_t^{-\sigma} = \beta \frac{C_{t+1}^{-\sigma}}{R_{t+1}} \quad (11)$$

Taking the reciprocal and raising to the power of $-\sigma$:

$$\left(\frac{c_{t+1}}{c_t}\right)^\sigma = \beta R_{t+1} \quad (12)$$

Or approximated as:

$$\hat{C}_{t+1} - \hat{C}_t = \frac{1}{\sigma} (\hat{R}_{t+1} - \hat{r}_{t+1}) \quad (13)$$

The Euler equation is a fundamental result that describes intertemporal consumption choice. It balances the marginal utility of consumption today against expected future consumption, adjusted for the real interest rate.

4.2. Firms' Production and Pricing

Assume that firms produce output, Y_t using a Cobb-Douglas production function,

$$Y_t = A_t K_{t-1}^\alpha L_t^{1-\alpha} \quad (14)$$

Where:

A_t is a technology shock, K_{t-1} is the capital stock from the previous period, L_t is the labor input, α is the output elasticity of the capital.

We also assume that firms follow the Calvo Pricing Assumption. Under Calvo pricing, a fraction $(1 - \theta)$ of firms can adjust their prices in any given period, while the remaining fraction θ keeps their prices unchanged (Calvo 1983). The firms that can reset their prices at the time t choose a price P_t^* to maximize their expected discounted profits. Following the assumptions of the profit maximization problem of the firm that can reset their prices P_t^* maximize the expected discounted sum of profits:

$$\max_{P_t^*} E_t \sum_{k=0}^{\infty} \theta^k \beta^k \Lambda_{t,t+k} [P_t^* Y_{t+k|t} - MC_{t+k} Y_{t+k|t}] \quad (15)$$

where θ is the probability that the firm cannot change its price, β is the discount factor, $\Lambda_{t,t+k}$ is the stochastic discount factor between periods t and $t+k$, $Y_{t,t+k}$ is the demand for the firm's output at the time $t+k$ given the price set at time t , MC_{t+k} is the marginal cost at time $t+k$. Then, we look for the Demand for the output equation, The demand for the firms output at time $t+k$, given the price P_t^* , is

$$Y_{t+k|t} = \left(\frac{P_t^*}{P_{t+k}}\right)^{-\epsilon} Y_{t+k} \quad (16)$$

Taking the derivative of the profit function with respect to P_t^* and setting it equal to zero yields the first-order condition:

$$\sum_{k=0}^{\infty} \theta^k \beta^k E_t \left\{ \Lambda_{t,t+k} Y_{t+k|t} \left[P_t^* - \epsilon MC_{t+k} \frac{P_{t+k}}{P_t^*} \right] \right\} = 0 \quad (17)$$

Simplifying this expression gives us:

$$P_t^* = \frac{\epsilon}{\epsilon-1} \frac{\sum_{k=0}^{\infty} \theta^k \beta^k E_t(\Lambda_{t,t+k} MC_{t+k} Y_{t+k|t} P_{t+k})}{\sum_{k=0}^{\infty} \theta^k \beta^k E_t(\Lambda_{t,t+k} Y_{t+k|t})} \quad (18)$$

This equation shows that the optimal price P_t^* is a markup over the expected marginal cost, weighted by the present value of future output.

4.3. Profit Maximization Problem

The firm sets its price P_t^* to maximize expected discounted profits over time, considering that it may not be able to change prices every period due to the Calvo pricing assumption. The optimal price P_t^* is determined by balancing the discounted future marginal revenues and marginal costs, which is why the equation involves expectations and discount factors using the first order optimization conditions.

Markup: The factor $\frac{\epsilon}{\epsilon-1}$ represents the optimal markup over marginal cost, which is standard in models with monopolistic competition. The optimal markup over marginal cost is given by $\frac{\epsilon}{\epsilon-1}$.

4.4. Monetary Policy Rule (Taylor Rule)

The Taylor rule:

$$R_t = \rho_m R_{t-1} + (1 - \rho_m) [\psi_\pi (\pi_t - \pi^*) + \psi_y (y_t - y^*)] + \epsilon_t^m \quad (19)$$

The central bank typically follows a Taylor rule, which adjusts the nominal interest rate R_t in response to deviations of inflation π_t and output y_t from their targets:

4.4.1. External Sector and Exchange Rate Dynamics

The exchange rate equation in the model is defined as:

$$e_t = e_{t-1} + i_t - i_t^* + \epsilon_t \quad (20)$$

where e_t is the exchange rate, i_t and i_t^* are the domestic and foreign interest rates, respectively, and ϵ_t is the exchange rate shock.

The exchange rate equation is further elaborated as follows:

$$e_t = \rho_e e_{t-1} + \epsilon_t^e \quad (21)$$

Where:

- e_t is the exchange rate at time t .
- ρ_e (with $0 \leq \rho_e < 1$) is the autoregressive coefficient that captures the persistence of the exchange rate. A higher value of ρ_e indicates a more persistent exchange rate, meaning that its past value highly influences the current exchange rate.
- ϵ_t^e is a stochastic shock to the exchange rate at time t , assumed to be a white noise process with mean zero and constant variance σ_e^2 .

This equation is a standard representation of exchange rate dynamics in macroeconomic models. It captures both the predictable and unpredictable components of exchange rate movements Engel and West (2005) and Taylor 1995).

4.4.2. Imports and Exports

The open economy model captures both the quantity of exports X_t and imports M_t at any given time t which are influenced by exchange rate, relative prices of goods, and other determinants. The value of exports (EX_t) can be expressed as:

$$EX_t = e_t p_x^f X_t \quad (22)$$

Where p_x^f denotes the foreign price of exported goods and services at time t , and e_t is the nominal exchange rate.

Similarly, the value of imports IM_t is given by: Similarly, imports (M_t) are given by:

$$IM_t = e_t p_m^f M_t \quad (23)$$

Where p_m^f is the foreign price of imported goods and services at time t .

4.4.3. Trade Balance

Trade balance (TB) or net export is given by the difference between exports and imports:

$$TB_t = EX_t - IM_t \quad (24)$$

Making use of 22 and 23, the trade balance can be expressed as:

$$TB_t = e_t p_x^f X_t - e_t p_m^f M_t \quad (25)$$

To achieve the objective of this study, we incorporate imports and exports into the model, which involves adjusting the national income identity and the market-clearing condition. Typically, the national income identity for an open economy as a market clearing condition is given by:

$$Y_t = C_t + I_t + G_t + EX_t - IM_t \quad (26)$$

Where Y_t is the total output (GDP) at time t , C_t is consumption at time t , I_t is investment at time t , G_t is government spending at time t .

In this formulation, imports reduce the domestic output available for consumption, investment, and government spending, while exports add to it. As provided by Uribe and Schmitt-Grohé 2017) and Galí (2015), a solid foundation for understanding the market-clearing condition in the context of open economy DSGE models ensures that all produced goods are either consumed domestically or exported. Thus, the

external sector and exchange rate dynamics, together with imports and exports, play a crucial role in determining the equilibrium in the goods market.

4.5. Log-Linearization and Steady-State Solution

Linearize the model around the steady state to obtain the system of linear equations. The following process shows the log linearization of the nonlinear DSGE model.

4.5.1 Household's Euler equation

The equation below is a log-linearized form of the household's Euler equation in a standard New Keynesian DSGE model. This captures the balance households strike between current and future consumption, driven by their expectations of future consumption and the real interest rate. The equation shows that current consumption is higher if households expect higher future consumption or lower accurate interest rates.

$$\hat{c}_t = \left\{ E_t \hat{c}_{t+1} - \frac{1}{\sigma} (\hat{r}_t - \{E_t \hat{\pi}_{t+1}\}) \right. \quad (27)$$

The log linearized household Euler equation expresses a fundamental relationship in the household's intertemporal decision-making process. Consumption Smoothing: Households want to smooth consumption over time. The term $E_t \hat{c}_{t+1}$ indicates that current consumption depends positively on expected future consumption. If households expect higher future consumption, they will likely consume more today. This behavior is consistent with consumption smoothing, where households prefer to maintain a stable level of consumption over time rather than experiencing large fluctuations Berger and Vavra (2015).

4.5.2 Labor supply condition

The labour supply condition is given by:

$$\hat{w}_t = \phi \hat{n}_t + \hat{c}_t \quad (28)$$

Where

\hat{w}_t is the log deviation of the real wage from its steady state value;

\hat{n}_t is the log deviation of labor (employment) from its steady state value;

\hat{c}_t is the log deviation of consumption from its steady state value; and

ϕ is the inverse of the Frisch elasticity of labor supply, which measures the responsiveness of labor supply to changes in the real wage.

4.5.3. Production function

The following log-linearized form of a standard Cobb-Douglas production function is commonly used in macroeconomic models to describe the relationship between output, capital, labor, and technology.

$$\hat{y}_t = \alpha \hat{k}_{t-1} + (1 - \alpha) \hat{n}_t + \hat{a}_t \quad (29)$$

The equation suggests that capital, labor, or productivity increases can drive output growth. For sustained economic growth, improvements in capital, labor, or productivity increase \hat{a}_t (technology) are crucial because capital and labor are subject to diminishing returns. The log-linearized production function encapsulates the relationship between the inputs (capital and labor) and the output while highlighting technology's role in driving economic performance.

The capital accumulation equation is log linearized and presented in the following form.

$$\hat{k}_t = (1 - \delta) \hat{k}_{t-1} + \delta \hat{i}_t \quad (30)$$

4.5.4. Phillips Curve (Price Setting)

The Phillips Curve represents the relationship between inflation and economic activity, precisely the output gap or marginal costs. This equation indicates that current inflation $\hat{\pi}_t$ depends on expected future inflation $E_t \hat{\pi}_{t+1}$ and the current marginal cost $\hat{m}c_t$.

$$\hat{\pi}_t = \beta E_t \hat{\pi}_{t+1} + \kappa \hat{m}c_t \quad (31)$$

4.5.5. Taylor Rule

As of the monetary policy directives by Taylor (1993), the central bank sets the nominal interest rate. A basic understanding of the simplified Taylor rule can be expressed as:

$$\hat{r}_t = \rho_m \hat{r}_{t-1} + (1 - \rho_m) [\psi_\pi \hat{\pi}_t + \psi_y (\hat{y}_t - \hat{y}^*)] + \epsilon_t^m \quad (32)$$

4.5.6 Exchange Rate Dynamics

The exchange rate shock equation below in (equation 33) encapsulates the dynamic response of the exchange rate to shocks and its persistence over time. In the context of Ethiopia, such a shock can have far-reaching implications across various economic sectors, influencing inflation, output, the trade balance, external debt, and overall economic stability. Understanding these dynamics is crucial for designing effective monetary and fiscal policies to mitigate adverse effects and harness potential benefits.

$$\hat{e}_t = \rho_e \hat{e}_{t-1} + \epsilon_t^e \quad (33)$$

ϵ_t^e is the exchange rate shock, assumed to be a white noise process with mean zero and variance. This is the point where we want to focus on the gradual exchange rate shock or one-time shock which will be

detailed in the next section. The exchange rate plays a crucial role in an open economy like Ethiopia's, influencing several key economic variables, including inflation, output, trade balance, and overall economic stability.

4.5.7. Terms of Trade

Terms of trade (TOT) is a critical component of an open economy, and its behavior in response to an exchange rate shock can have significant implications for overall economic stability. Here's a more detailed exploration of the terms of trade within the context of an exchange rate shock in Ethiopia.

$$T\hat{O}T_t = \hat{p}_t^f - \hat{p}_t^{f,m} \quad (34)$$

The above equation is a representation of the terms of trade, capturing the impact of exchange rate fluctuations on exports and imports.

4.5.8. Steady-state Conditions

$$Y^* = C^* + I^* + G^* + EX^* - IM^* \quad (35)$$

The steady-state represents the point where the economy's endogenous variables (like output, consumption, investment, inflation, interest rates, etc.) are constant, implying that the shocks and dynamic adjustments have fully played out.

5. DATA AND CALIBRATION

The analysis in this study utilizes quarterly data (obtained from the National Bank of Ethiopia, NBE) spanning from the first quarter of 2004 to the second quarter of 2024. The key endogenous variables of interest include output, inflation, consumption, interest rate, and the exchange rate in addition to export, import, trade balance and government expenditure. These variables are integral to understanding the dynamics of the Ethiopian economy and were chosen for their relevance in capturing both macroeconomic stability and growth. The data were in a yearly format and interpolated to a quarterly basis. The exchange rate data reflects the value of the Ethiopian Birr relative to a basket of foreign currencies, primarily the US Dollar, as reported by NBE.

5.1. Calibration

The model parameters were calibrated using the historical data to match the observed behavior of the Ethiopian economy. Parameters such as the elasticity of substitution, discount factors, and policy rule coefficients were adjusted to ensure that the model accurately reflects the dynamics of the endogenous variables within the given time frame.

6. FINDINGS AND DISCUSSIONS

6.1. Scenarios and Forecasting

The calibrated model was used to forecast key macroeconomic variables¹⁴ in response to the foreign exchange rate adjustment from the second quarter of 2024 to the third quarter of 2026. The quarterly data was forecasted based on existing trends and economic conditions observed in the historical data. The baseline forecast serves as a reference point for comparing the effects of alternative exchange rate adjustment pathways.

The impact of foreign exchange rate adjustment on the Ethiopian economy is assessed using an open economy dynamic stochastic general equilibrium (DSGE) model. Two scenarios have been considered to analyze the response of selected macroeconomic indicators to exchange rate shocks.

Gradual scenario evaluates a phased approach to exchange rate adjustment and its effect on key macroeconomic variables. Two variants of the gradual scenario have been considered: an initial 30 percent exchange rate depreciation and subsequently, a 60 percent exchange rate adjustment.

Reunification scenario considers a 100 percent exchange rate adjustment that leads to closing or significantly narrowing of the gap between the official and the parallel foreign exchange market rates. This scenario involves a free-floating foreign exchange rate regime.

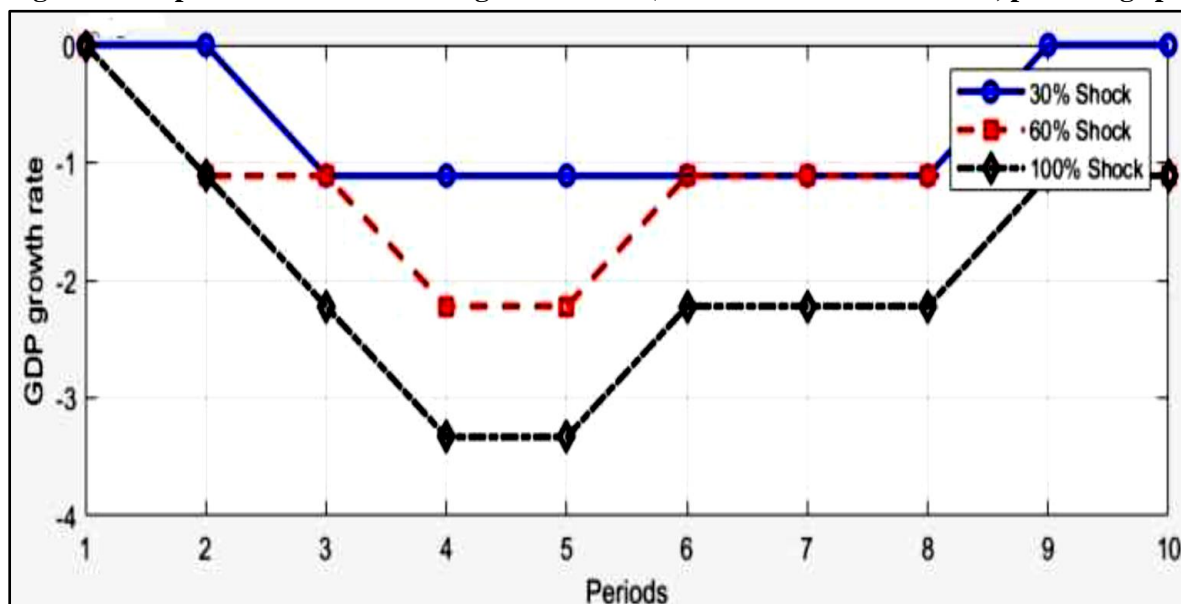
The likely effects of these scenarios are assessed with respect to selected macroeconomic indicators, including economic growth, inflation, trade balance, private consumption and government consumption expenditure.

6.2. Effect on Economic Growth

The reunification scenario, which involves a 100 percent depreciation of the Birr, results in a sharp short-term contraction in economic activity (Figure 2). Under the reunification scenario (black line), economic growth of gross domestic product (GDP) contracts by more than 3 percentage points in the first and second quarters of 2025. This is primarily due to the increase in import prices, which negatively impacts local production (e.g., rising cost of inputs), consumption, and investment. Conversely, the gradual adjustment scenario offers a more tempered contraction as it would entail a smaller contraction in economic growth compared to the reunification scenario. Specifically, the 60 (blue line) and 100 percent shocks lead to progressively more significant adverse effects on GDP compared to the 30 percent (red line) exchange rate shock. By allowing more time for businesses and consumers to adjust to price changes, this phased approach helps mitigate the immediate adverse effects on the growth of GDP. Unlike the gradual scenario, the reunification scenario would lead to a slow recovery of the economy. As a result, growth in exports critical to improving Ethiopia's trade balance would remain slow in the initial periods, delaying full economic recovery. Firms that rely on imported inputs face higher costs, reducing output in the near term. In particular, the import-intensive manufacturing industry would likely suffer from the rising cost of imported and local raw materials, exacerbating the already weak performance of the domestic manufacturing industries.

¹⁴ The quarterly data was forecasted using a Dynamic Stochastic General Equilibrium model. This model incorporates the calibrated parameters and historical data to simulate the future paths of the endogenous variables under different exchange rate shock scenarios. The model's structure allows for examining both short-term and long-term impacts of the shocks, capturing the economy's response over the next three-year forecast period.

Figure 6: Response of GDP to exchange rate shock (deviation from the baseline, percentage point)



Source: Model simulation

Notes: The horizontal axis refers to periods in quarters (Q) (e.g., period 1 refers to the second quarter of 2024 (2024: Q2), and period 2 is the third quarter of 2024 (2024: Q3)). The vertical axis denotes the percentage change in GDP in response to the exchange rate shock relative to the baseline value.

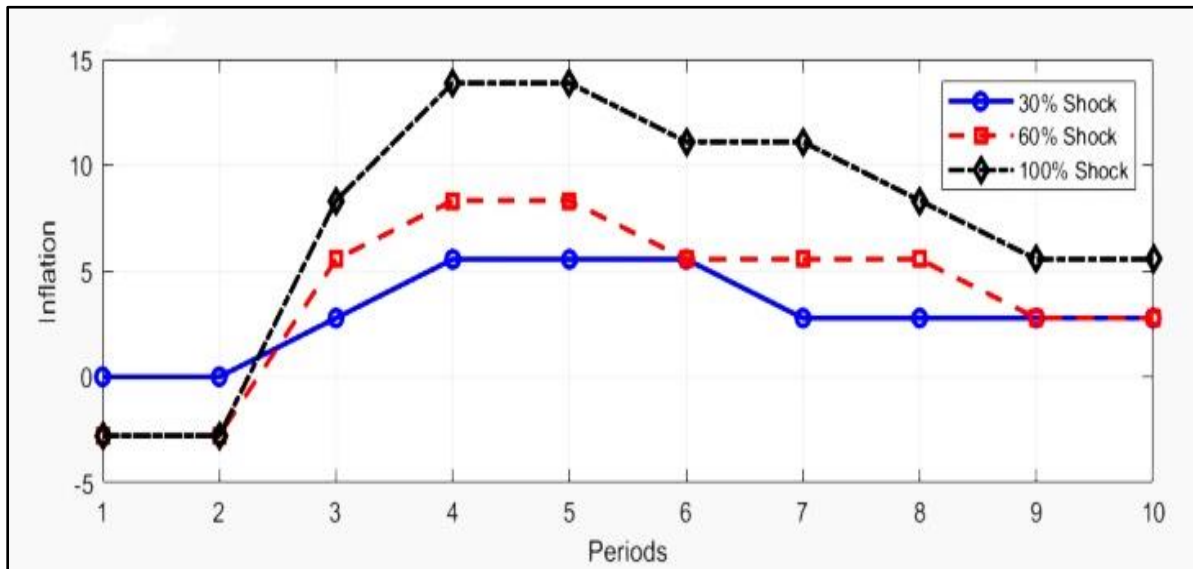
6.3. Effect on Inflation

Inflationary pressures are a key concern, particularly in Ethiopia, where inflation is already structurally high. The domestic market reacts to the announcement of the floating exchange rate regime by raising the prices of both imported and domestically produced commodities.¹⁵ Early observations showed that the price increase for some commodities¹⁶ was faster than the fall in the value of birr against major currencies such as the United States dollar. Simulation results also show that the reunification scenario leads to the highest inflation spike due to the increase in the prices of commodities, including critical commodities like fuel and food (Figure 3). Specifically, the reunification scenario would result in significant inflation pressure beginning in the third quarter of 2024 and continuing through 2025. For example, inflation would rise by more than 10 percentage points in the first and second quarters of 2025, compared to the baseline. This creates a broad-based rise in the cost of living, disproportionately affecting low-income households. In the gradual adjustment scenario, inflation still rises at a more manageable pace. This may give monetary authorities greater flexibility in implementing policy measures to control price increases, particularly on essential goods. Long-term expectations of economic actors drive persistent inflation, which makes it expensive to reduce inflation to lower levels. The economy would continue to face significant inflationary pressure in the reunification scenario.

¹⁵ Ethiopia's unprecedented macroeconomic reform and future uncertainties - Addis Standard

¹⁶ During the first two days, for instance, the price of edible oil climbed by 40 percent and that of nails by 50 percent (Ibid)

Figure 7: Response of inflation to exchange rate shock (deviation from the baseline, percentage point)

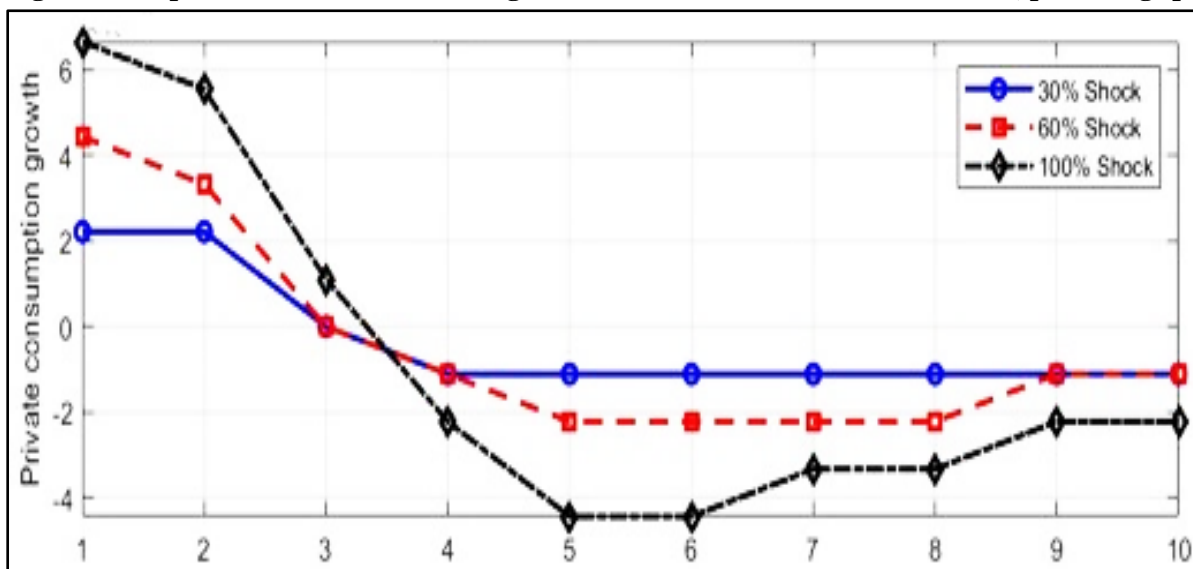


Source: Model simulation

6.4. Response of Private Consumption

Private consumption is another critical variable that would be influenced by exchange rate adjustments. The sharp rise in the cost of imported and locally produced commodities reduces real consumption growth in both scenarios (Figure 5). Low-income individuals are particularly susceptible to inflationary pressures as they spend a higher proportion of their budgets on basic commodities such as food, housing and energy. In the reunification scenario, consumers would suffer a significant decline in purchasing power, making the impact more severe. In the gradual scenario, the decline in consumption growth would be less severe as households have more time to adjust to price changes. Nevertheless, consumption would remain lower in both scenarios compared to the baseline. In particular, private consumption would recover slowly under the reunification scenario, highlighting the significance of social safety nets for low-income and vulnerable households.

Figure 8: Response of inflation to exchange rate shock (deviation from the baseline, percentage point)

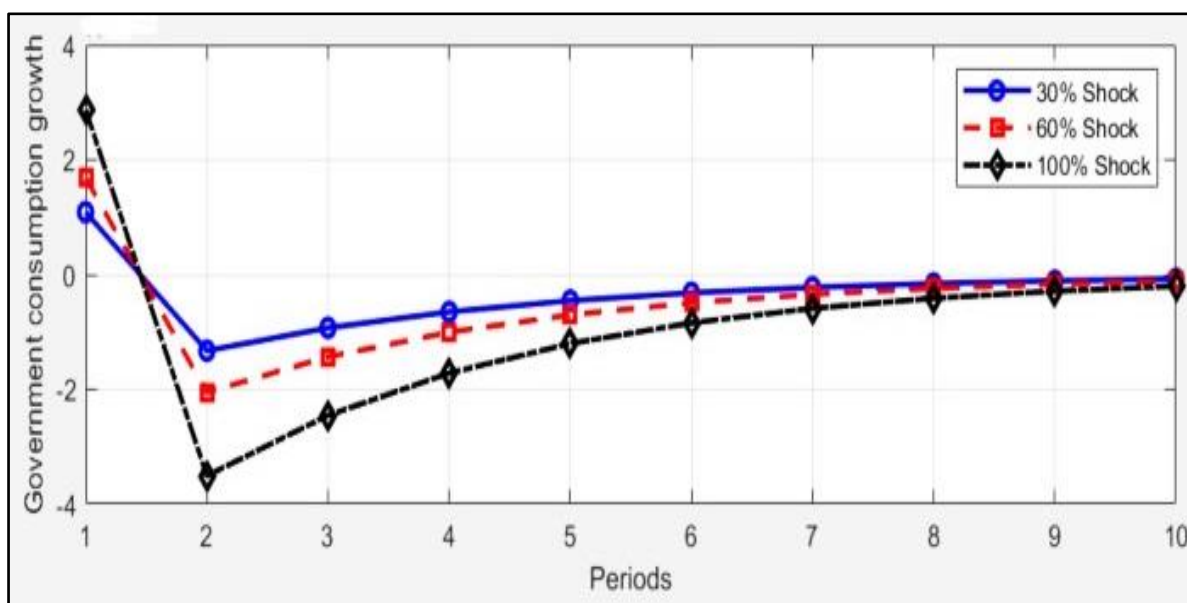


Source: Model simulation

6.5. Response of Government Consumption Expenditure

Government spending is another crucial variable impacted by exchange rate adjustments. Simulation results indicate a substantial decrease in the growth of government consumption spending, and the extent of this response becomes greater in the reunification scenario (Figure 6). The initial decline in the growth of government spending could be related to fiscal consolidation as the government would take austerity measures to curtail its spending. In the gradual scenario, the decline in the growth of government spending looks more controlled, allowing for more measured fiscal responses over time. As inflationary pressure picks up, government spending would increase, especially on social programs and subsidies that help vulnerable population and lessen the impact of the rising cost of living. Exchange rate depreciation would also increase the debt servicing cost of the government and state-owned enterprises as debt service payments are denominated in foreign currency. In both scenarios, the government needs to balance and prioritize its spending between immediate relief and long-term investments, especially in sectors that can drive exports and reduce dependency on imports to support economic recovery and resilience.

Figure 9: Government spending responses to exchange rate reform (deviation from the baseline, percentage point)



Source: Simulation result

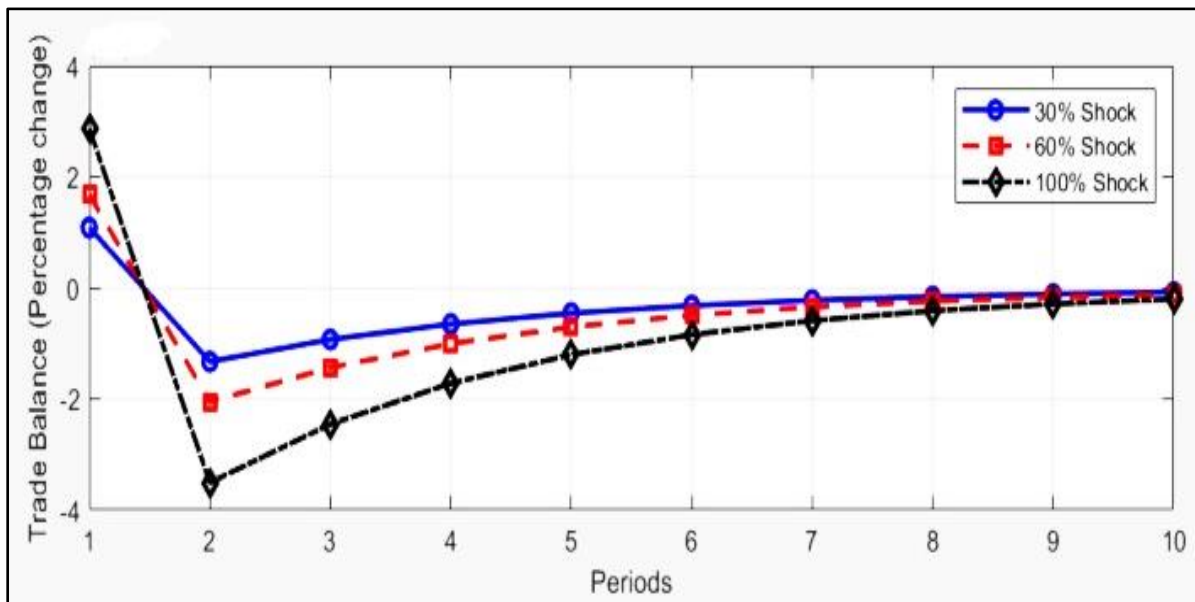
6.6. Effects on Trade Balance

Ethiopia experienced a current account deficit of over USD 12 billion before the policy reform, while its earnings from merchandise exports were less than USD 4 billion. This large excess demand for foreign exchange cannot suddenly be met by banks. The exchange rate reform is expected to have a significant impact on Ethiopia's trade balance. However, simulation results show that Ethiopia's trade balance would not improve following the exchange rate adjustment (Figure 10). The immediate effect of the exchange rate depreciation is to raise the prices of imports compared to export prices, which tends to reduce net export values and exacerbate the current account deficit. The indirect effects are to increase the volume of exports and reduce the volume of imports (e.g., import substitution), which will increase net exports and improve the current account. However, these two effects differ in their timing. The direct effect

of an exchange rate depreciation occurs immediately, while the indirect effects on export and import volumes typically occur with a lag. In view of this, exchange rate depreciation is likely to reduce the value of net exports and worsen the current account deficit. The short-run adverse effects of exchange rate adjustment on trade balance are not surprising for an import-dependent developing country like Ethiopia, which lacks domestic capacity to substitute many imported goods and whose exports are mainly non-processed primary agricultural goods. Due to the high dependence on imports, the increase in export earnings will not offset the reduction in the demand for imports resulting from the import price increases. Woldie and Siddig (2019) also found similar results for Ethiopia. The desired outcomes of several rounds of previous deprecation efforts¹⁷ failed to stimulate exports but rather made imports more expensive, which fed to domestic inflation.

The export landscape is severely constrained by supply-side challenges such as low agricultural productivity, seasonality, inadequate infrastructure, and a lack of value addition which made it difficult for the export sector to respond to and benefit from exchange rate adjustment. In addition, businesses are constrained by other factors, including disruption of production and supply chains due to prolonged internal conflicts, weak productivity, global trade disruptions caused by the Russia-Ukraine war, and recently, the Israel-Gaza conflict, both of which caused significant cost escalations on essential commodities. A recent study indicates that businesses reported an unfavorable business landscape as the cost of doing business in Ethiopia has remained high (Sigmund Peak International Ltd, 2024)¹⁸. Factors such as lack of peace and security, soaring inflation, corruption, poor road conditions, and weak markets severely constrained business activities. Thus, neither the timing nor the fundamentals have been favorable for implementing a floating exchange rate regime.

Figure 10: Response of trade balance (deviation from the baseline, percentage point)



Source: Model simulation

¹⁷ For instance, the government devalued the local currency by 17 percent in September 2010 and 15 percent in October 2017 (NBE, 2017).

¹⁸ Sigmund Peak International Ltd (2024). Ethiopia baseline study for developing capacities for public and private sector, a report prepared for Trademark Africa.

Overall, foreign currency shortage and misalignment are just symptoms of the underlying imbalances in the economic fundamentals facing the Ethiopian economy, which a shift cannot address to a market-determined exchange rate regime. There are other key bottlenecks that the business community and the public at large wanted the government to address. These include a lack of peace and security, a weak supply chain of basic commodities, including raw materials, inflation, poor infrastructure, and lengthy and inefficient bureaucratic processes, among others. These longstanding impediments cannot be addressed by focusing on the symptoms.

7. CONCLUSION AND RECOMMENDATIONS

7.1. Conclusion

This paper provides initial insights regarding the likely effects of a shift to a market-determined exchange rate on selected macroeconomic indicators using a dynamic stochastic general equilibrium (DSGE) model. Scenarios and simulations have been developed and implemented to assess the response of selected macroeconomic variables, such as economic growth, inflation, trade balance, private consumption and government consumption spending. Two scenarios have been developed on the path of exchange rate adjustment, namely gradual and reunification scenarios. The trade-off between gradual and reunification scenarios hinges on the balance between the immediate disruption and persistence of the effects of the exchange rate shock.

Simulation results indicate a reunification scenario leads to more severe adverse impacts on key macroeconomic variables and slower recovery, making it a risky path to follow. On the other hand, a gradual approach causes less disruption, especially on economic growth and inflation spike compared to the reunification scenario. In the gradual scenario, the economy experiences less severe initial disruptions, making managing and mitigating short-term adverse effects easier. Additionally, the adverse effects of a floating exchange rate diminish more rapidly, leading to quicker recovery. The choice between the two avenues should consider the specific economic context, the economy's resilience, and policymakers' capacity to manage the shock's impact.

Based on the results, three main conclusions can be drawn. First, a move to a market-determined exchange rate regime shall be based on weighing the benefits and costs of alternative pathways. Both benefits and costs depend on whether the government follows a reunification or gradual approach to exchange rate adjustment that will lead to narrowing the gap between the official and parallel market exchange rates. Although both scenarios cause economic contraction and inflation spike, the gradual approach is preferred as it is less costly. Second, the cost of accelerated depreciation of the local currency vis-à-vis other foreign currencies appears to be significant. Since the government has already executed a reunification approach, allowing further depreciation could deepen economic contraction and inflation spike. This causes consumption spending to decline even more and the trade balance to worsen. Finally, the choice between the two avenues should be informed by the initial economic conditions, including productive capacities, associated gains or losses, and implementation capacity.

7.2 Recommendations

Foreign currency shortages and misalignment are just symptoms of the underlying imbalances in the economic fundamental facing the Ethiopian economy which cannot only be addressed by a shift to a market-determined exchange rate regime. There are other key bottlenecks that the business community and the public at large wanted the government to address. These include lack of peace and security, weak supply chain of basic commodities, including raw materials, inflation, poor infrastructure, and lengthy and inefficient bureaucratic process, among others. These longstanding impediments cannot be addressed by focusing on the symptoms alone. Neither the timing nor the fundamentals have been favorable for implementing a floating exchange market reform.

Given the low productive capacity of the economy in terms of limited production and productivity, low export base and weak implementation capacity at least in the short and medium-term, there is a need for pragmatism in managing the foreign exchange market reform. Specifically, further depreciation could

not address the economic fundamentals, including macroeconomic imbalances, rather deepen economic contraction and inflation spike.

It is prudent not to allow further accelerated depreciation using informed interventions in the foreign exchange market to avoid the risk of socioeconomic crises and subsequent policy reversals.

Successful implementation of the foreign exchange market liberalization requires a stable political and business environment. In particular, there is an urgent need for ensuring peace and security in the country which is a foundation for stimulating and attracting investments going forward.

The experience of countries indicates that the effectiveness of the foreign exchange market liberalization in stabilizing the exchange rate depends on the stable availability of foreign exchange reserves to satisfy the foreign exchange demand at the going exchange rate. In view of this, specific interventions can include the following:

- Expanding the export base through promoting value addition and identifying potential exportable commodities through reorienting and repurposing incentives linked to targets in value addition.
- Supporting and promoting linkages through identifying and mapping inputs to enhance the supply and quality of locally produced products to substitute imported raw materials.
- Expanding and scaling up investment in irrigation agriculture to ensure a stable supply of basic food commodities and raw materials for the manufacturing industries.
- A disciplined and carefully designed opening of the financial sector will attract foreign direct investment in the sector to boost foreign exchange supply.
- Given the large domestic market, expediting the liberalization of both the wholesale and retail markets shall stabilize prices through creating a competitive environment and attract more foreign direct investment in the commodity sector.

Given the inflationary strain of the floating exchange rate regime and the consequent reduction in real consumption, strengthening social safety nets is imperative. The negative short-term consequences on the vulnerable and low-income people could be mitigated through targeted subsidies and direct cash and in-kind transfers.

Strengthen the monitoring and supervisory capability of relevant institutions (e.g., NBE) through establishing high-frequency data, data analytics and developing automated dashboards. This will improve the quality of decision-making to strengthen the functioning of the foreign exchange market.

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