Green Squeeze: countrywide modeling for Ethiopia

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March 28, 2024

1 Summary

Ethiopia is one of the least developed countries in the world, with a per capita gross national income of 1,020 USD in 2022 (World Bank, 2023), a 24% of its population below its national poverty line in 2016, and a population of 126 million inhabitants (2023) that, growing at 2.55% per year, doubles every 28 years (United Nations, 2023), pressing on its scarce resources. Its coffee industry is not only a driving force of its socio-cultural, and spiritual life, but of its economy. Apart from the well-known Ethiopian coffee ceremony, coffee is used at major events, including birth and marriage, and provides the means to build and sustain relationships among family, friends, and community in Ethiopia. Also, Ethiopia is Africa's largest coffee producer and exporter. Coffee is the main export revenue generator for the country, with USD 1.45 billion in 2021, explaining consistently from 30 to 35% of its export earnings during the last decade (USDA, 2023), with annual exports above 200 million kilograms of coffee beans, reaching 300 million kilograms in 2021. Most of these exports are sold to Asia (39% of value), the EEA (33%) and the US (14%). The highest quality coffee is the most profitable, and is sold to the EEA and the US with a price premium of up to 34%.

While there are a few coffee plantations in Ethiopia, its main production system relies on 4 million small farmholders mostly lacking access to electricity, in what is known as the Garden Coffee System, where the size of production units is measured in coffee plants rather than hectares. The system is characterized by very low and declining yields of 0.68 tons per hectare, only $\frac{1}{3}$ to $\frac{1}{2}$ of those achieved by major Latin American producers (Minten et al, 2019). Most coffee is bought by local village collectors who sell it to a set of 'traders' who process the cherries into coffee beans that they bring to the Ethiopian Commodity Exchange (ECX), where it is inspected, graded, auctioned, and from where it is finally exported. As such, the supply chain has multiple links and an atomized production structure that make it impossible at present to locate the coffee source in a trustworthy way, making the traceability of the production source of coffee a critical issue for which its government needs foreign aid and time.

Ethiopia is already affected by global warming increasing the intensity and frequency of pests and diseases in coffee plants resulting in decreasing yields in its relatively low

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lands, and incentivising them to move their coffee production to higher lands, with some associated deforestation that could be offset by reforesting the low lands. In this setup, the export requirements coming into force 30-Dec-2024 with the EUDR European Union deforestation free regulation decision are expected to disrupt trade with the EU, and over time possibly with the US. It is informed that Ethiopia has designed a National Action Plan engaging its Ministries of Finance and Agriculture and the Ethiopian Coffee and Tea Authority, outlining action items to be executed over the next three years as part of compliance efforts (Addis Standard, 2024). David Krivanek, deputy head of delegation of the EU to Ethiopia, mentioned the EU's willingness to assist Ethiopia in overcoming potential challenges during the implementation of the regulation, but nothing concrete seems to have been agreed. Adapting the Standard IFPRI CGE model, and allowing for factor reallocation, an increase in export requirements by 10% leads to a 9.5% fall in exports and to a 0.7% fall in GDP measured at factor cost. Tax revenue goes down by more than 2%, reducing in turn public expenditure. Wages for most factors go down, especially to workers without secondary education, which go down by 1.3 to 1.6%. Also, modelling a polar case where exports to the EU stop completely results in significant general equilibrium trade effects, with a 18.4% fall in exports, a 5.4% real devaluation, a 5.8% fall in imports, and also in a fall in GDP at factor cost of 0.6%, a 3.3% reduction in public revenue, and a worsening income distribution as the land wage goes down by 3.5% and the unskilled labour wage goes down by 2.6% and, as a result, the poorest income quintile of per capita income both in rural and urban areas suffer income falls of 2.3%. This is prone to affect income poverty and child labour negatively, compromising in turn meeting the SDGs.

2 Ethiopia and the role of coffee in its economy

Ethiopia is one of the least developed countries in the world, with a per capita gross national income of 1,020 USD in 2022 (World Bank, 2023), a 24% of its population below its national poverty line[1] in 2016, and a population of 126 million inhabitants (2023) that, growing at 2.55% per year, doubles every 28 years (United Nations, 2023), pressing on its resources. Most of its population (78%) lives in rural areas (FAOSTAT, 2023). Agriculture, even with its low productivity in Ethiopia, is a substantial part of its economy and remains essential to the livelihood of the poor. It explains 32% of the domestic value added, 80% to the country's export value, and employs almost $\frac{2}{3}$ (64.9%) of the Ethiopian workers (NBE, 2022). Its main production mode consists of household farms who practice rain-fed mixed farming using traditional technology: the land tilled by small-scale farmers accounts for 92.5 percent of the total crop land area while the remaining is cultivated by commercial farms.

Within agriculture's value added, 68% is explained by crops, and 27% by livestock (CSA, 2021), and coffee is a pillar not only of its national economy, but of its culture. Besides drinking coffee being part of Ethiopia's everyday life, and apart from the well-known Ethiopian coffee ceremony, coffee is used at major events, including birth and marriage, and provides the means to build and sustain relationships among family, friends, and

[1]The absolute poverty line is set at 7,184 Ethiopian Birr per year per adult person which is around 340 USD based on the weighted average exchange rate in 2015/16.

community in Ethiopia. Overall, the coffee industry in Ethiopia is a driving force of its economy, and socio-cultural and spiritual life.

Coffee is a key cash crop in Ethiopia with a crucial role for national GDP, exports and the livelihoods of 4 million households with small farms (USDA, 2023). Ethiopia is Africa's largest coffee producer and exporter. Globally, it has the 5th position in the export of Arabica coffee, the variety of coffee that Ethiopia produces. Coffee is also the main export revenue generator for the country, with USD 1.45 billion in 2021, explaining consistently from 30 to 35% of its export earnings during the last decade (USDA, 2023). Each year during the last decade, Ethiopia has exported more than 200 million kilograms of coffee beans, reaching 300 million kilograms in 2021, as shown in Figure 1 (NBE, 2022).

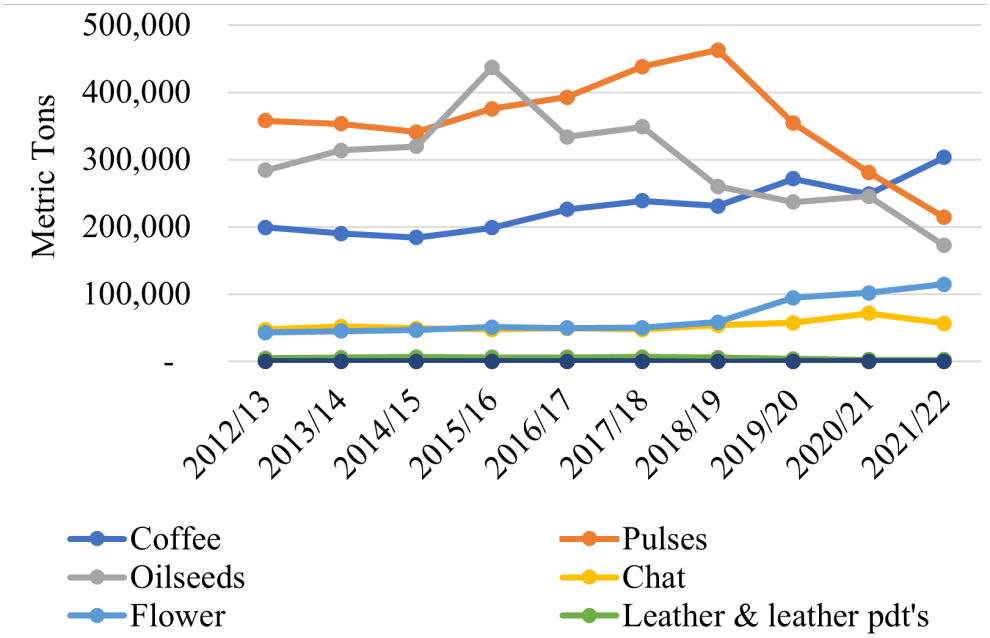

Figure 1: Export weight by crop

Source: NBE (2022) Annual Report

Following the Observatory of Economic Complexity (OEC, 2021), and as shown in Figure 2, even after very high growth during the last decade of coffee exports to Asia, which became the first destination, Ethiopia continues relying significantly on EEA as an export destination for its coffee, explaining 33% of its value in 2021. Interestingly, the EEA and the USA are the major buyers of washed coffee, with a price premium that more than offsets its higher production cost, making it significantly more profitable, while most of the coffee exported to Asia is unwashed and as such less profitable. (See production Technology below), with a higher quality and higher price that more than offsets its higher production cost, making it more profitable.

Regarding the production structure and technology, coffee is almost exclusively a smallholding[2] business: 4 million smallholder farmers account for 95% of total coffee production (Petit, 2007). With a low adoption of improved agronomic practices, Ethiopian

[2]On average less than 1 hectare of land per farm (Dorosh and Rashid, 2013). Smallholdings are family-operated with no or a very limited amount of hired labor.

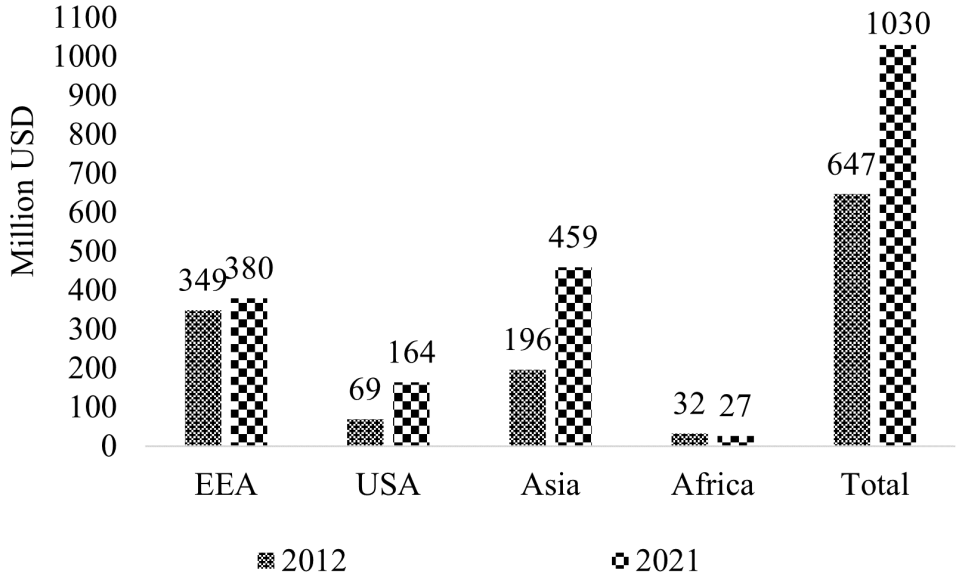

Figure 2: Coffee export value by destination

Source: OEC (2021)

yields are only $\frac{1}{3}$ to $\frac{1}{2}$ of those achieved by major Latin American producers (Minten et al, 2019). Most of the production of coffee takes place in areas of humid (moist) evergreen forest, and is at present mainly confined to altitudes from 1200 to 2100 metres. The main production system, used to produce the vast majority of coffee, is 'Garden Coffee': household members grow and harvest coffee trees along with other crops in a small plot surrounding their house, with the size of the plot usually measured in terms of plants rather than hectares. Coffee also grows in the wild and is harvested by the local population ('Forest Coffee'). Finally, a small share of coffee beans is produced in large estates ('Plantation Coffee')[3]. Regardless of the production system, Ethiopian coffee is mainly grown under the shade of trees, either within forest or forest-like environments, or in farming systems that incorporate specific shade plants – usually indigenous (native) trees, or sometimes fruit trees. Coffee is grown with little or no shade (sun coffee) only in a few areas. The use of chemical inputs, such as pesticides, fungicides and artificial fertilizers is rarely practiced, and although certification is not common, with no more than 5 percent of Ethiopian coffee exports being certified, Ethiopian coffee can often be considered as organic by default (Minten, 2018).

Coffee yields in Ethiopia are low and show a tendency to fall. The yearly yield in the 2012-22 period is in a range of between 619 and 748 kilograms per hectare, and shows an average of 676 kilograms per hectare per year, and a yield for 2021/22 (687 kilograms per hectare) 2.9% below the yield in 2012. As shown in Figure 3, the area planted with coffee has increased significantly during this period, by 50.2%, and in combination with the falling yield (-4.3%), results in production growing by a very significant 45.9% during this period, which underlies its export growth. Among the reasons for the low and falling yields is the limited adoption of improved production practices. Ethiopian yields are only

[3]In future research, and to inform the modelling simulations, it would be interesting to dig into the yield of 'Garden Coffee' vs. 'Plantation Coffee' as the latter will presumably find it easier to comply with EU export requirements.

one-half to one-third of the level achieved in major Latin American producing countries (Minten et al, 2019).

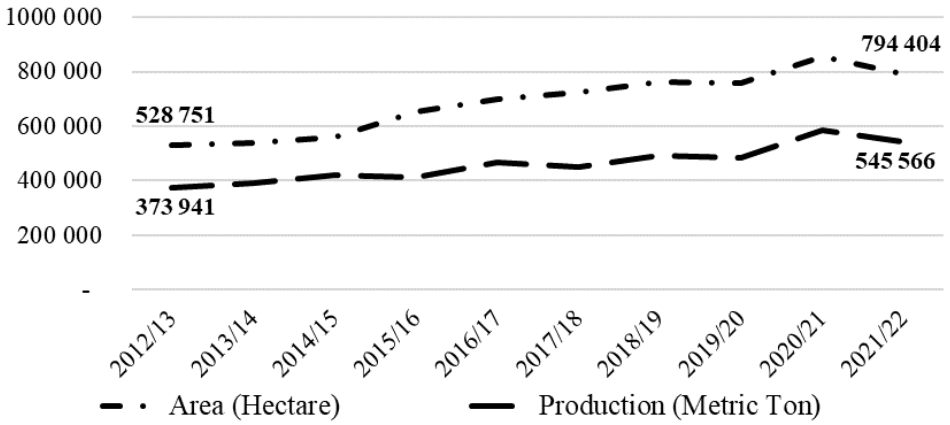

Figure 3: Coffee production and area

Source: CSA (2022) Annual Report

We find that, in the main set of production chains, included in Figure 4, farmers harvest the coffee cherries, dry them on the sunshine, and sell them to 'village collectors' (legal or illegal) who, in turn, sell them to 'private traders'. These traders then hull the dried cherries to remove the outer layers and transport it to the Ethiopia Commodity Exchange (ECX) for inspection, grading and auctioning, where licensed exporters buy them and ship it mostly to the Middle East and further Asia, a market that prefers dried coffee beans (Tefera and Tefera, 2013). There are variations from this production chain:

1. **Washed coffee**. The farmers sell the beans without drying them ('red' beans) and the private traders wash them to remove the outer layers ('washed coffee'). Washing preserves better the intrinsic quality of the beans, and leads to a more homogeneous and less defective product that is preferred in EEA and USA markets. Washed coffee has a significant price premium of 15% to 34% (Minten et al, 2014).

2. **Cooperatives**. Cooperatives of farmers buy the coffee beans to the farmers, process it, go through ECX for inspection and grading, and export it through their Unions. This involves at present around 10% of exports and may be of some use to deal with the new EU regulations.

3. **Farmer to trader**. Farmers sell the coffee beans directly to private traders at primary coffee market centers or regular markets.

4. **Trader-exporter**. Private traders who hold export licenses export the beans by themselves after going through ECX.

5. **Domestic use**. Coffee beans below the export quality are legally sold in the domestic market.

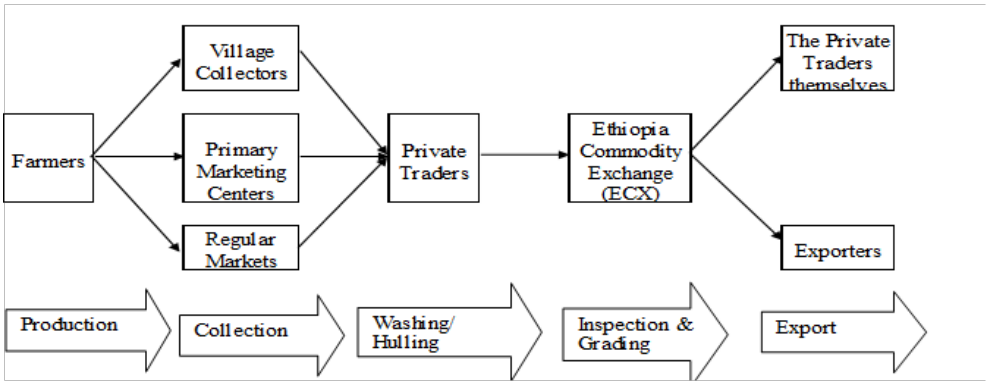

Figure 4: Coffee production chain via private traders

3 The Green Squeeze in Ethiopia

Even when, as shown above, the area used to grow coffee in Ethiopia has expanded in the last decade, the capacity of the country to produce and export its coffee in a profitable way, and hence to avoid a massive loss of income with repercussions on public finances, income poverty and income inequality, is being subjected to a Green Squeeze. This phenomenon of a Green Squeeze, sustained by Jodie Keane from ODI at a more general level, takes a patent physical dimension in the case of Ethiopia. On the one hand, global warming has brought abnormally long dry seasons that are drying out coffee fields and bringing pests and diseases to coffee plants at low altitudes, leading to declining yields. Recent studies, including Royal Botanic Gardens (KEW and ECFF, 2017), suggest relocating coffee fields at higher altitude, something that could cause deforestation. On the other hand, the European Union (EU) has recently decided to implement the EU Deforestation Regulation (EUDR) that with the aim of addressing the EU's role as a consumer in driving deforestation and climate change, imposes a ban on importing goods that contribute in production to foreign deforestation, making the producers and traders responsible to demonstrate not having contributed to deforestation.

For Ethiopia's coffee production and trade that rely on the atomized production of coffee by millions of households in their gardens with scarce access to electricity and patchy internet coverage, the mapping of land and monitoring of deforestation is virtually impossible. Additionally, land rights disputes, weak law enforcement, and clan conflicts may further complicate efforts to gather accurate data on farm ownership and enforce regulations related to deforestation. The EUDR requires companies to digitally map their supply chains down to the plot where the raw materials were grown. As Alan Beattie from the Financial Times argues, "to prove that a particular batch of coffee was not grown on recently deforested land involves complex processes of combining satellite photos with geolocation data showing exactly to which piece of land they refer." This seems to ignore the challenge of tracing millions of small farms in remote areas of a low-income country affected by conflict. From the perspective of the economic development of Ethiopia, besides the obviously desperate need to increase coffee yields in existing coffee fields, this tracing is akin to the Big Push Model of Roselstein-Rodan: it could require the development of trust along the coffee supply chain that is absent at present, a strong diffusion of internet coverage, and possibly the need to extend the present set of producer cooperatives that take the coffee from the small farmers to the Ethiopia Commodity

Exchange and/or to concentrate land holdings. All these steps, if feasible, would take significant time and resources that are extremely challenging even to identify. While at COP28 the European Commission has kindly expressed its commitment to support producing countries and smallholders in complying with the EUDR, nothing suggests that the export requirements imposed by the EUDR are in line with the capacity of Ethiopia to fulfill them. At the beginning of 2024, the Ethiopian government, in partnership with the UNDP and the Global Environment Facility (GEF), launched a major project to tackle deforestation, promote forest restoration, and integrate sustainability into the country's coffee value chains and food systems. However, the EUDR has no room to allow for the substitution of compensating additional deforestation with additional reforestation and afforestation. Most likely, Ethiopia will be forced to change its export destination out of the EU to Asia, losing the price premium that EU consumers are willing to pay for high-quality coffee beans produced by their poor farmers.

In the next section, we provide a hint of the direction of the general equilibrium effects that the EUDR can impose on Ethiopia. For this, we rely on the static version of the IFPRI Computable General Equilibrium (CGE) Model for a small country that engages in international trade, which we calibrate for Ethiopia.

4 The Model

IFPRI Computable General Equilibrium (CGE) Model is summarized below, and a complete description of each equation is available at Lofgren et al. (2002). At its core, the model takes into account the interaction between producers and consumers in the economy. Abstracting for the moment from the foreign and public sectors, and as shown in Figure 5, the model tracks the sales of goods from firms to households and to other firms, the sales of factor services from households to firms, and the savings that finance the investment in the economy, as the following diagram shows. The arrows in the diagram track the (explicit or implicit) payments in the countrywide economy. Firms pay wages and rents to households, and buy goods produced by other firms (intermediate inputs). Households use their income to buy products from firms and to save, in turn financing investment, i.e. an additional demand for firms' product markets.

We describe below the components of the model, going through the behavior of consumers and producers, the introduction of the government, investment and the foreign sector, the way the model equilibrates supply and demand in the product and factor markets, and its macroeconomic behavior.

4.1 Consumer and producer behavior

Following general equilibrium theory, representative consumers (i.e., households) and producers in our model are treated as individual economic agents. Household incomes are determined by the sum of factor income, public transfers and foreign remittances. Households use their income for consumption and saving. Consumption is allocated over different goods to maximize household's utility subject to their budget constraint. Producers are defined at the sector level (i.e. agriculture, industry, services). Each representative producer maximizes profits taking the prices at which they buy/hire inputs and sell their outputs as given. Following neoclassical theory, we assume constant returns to scale in production i.e. increasing all the factors by a given percentage leads to increase

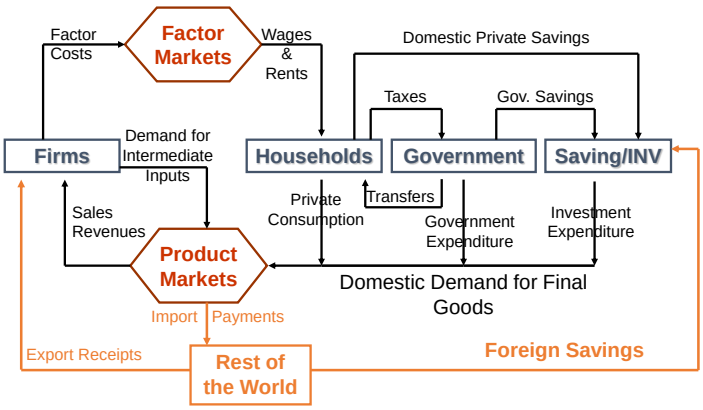

Figure 5: Circular flow in the economy.

the production by the same percentage. In particular, a constant elasticity of substitution (CES) function is used to determine production:

$$QX_i = \alpha_i \left(\sum_f \delta_{fi} . QF_{fi}^{-\rho_i} \right)^{-\frac{1}{\rho_i}} \tag{1}$$

where QX_i is the output quantity of sector i, α_i is a shift parameter reflecting the sector's total factor productivity, QF_{fi} is the quantity used of each factor f (i.e., land, labor and capital) by the firm i, and δ_{fi} is a share parameter of factor f employed in the production of good i. The maximization of profits by the sector-specific producers provides the system of factor demand equations used in the model: for example, a producer who faces an increase in the price at which he sells his output will tend to increase his factor demand, trying to hire more workers and other production factors. The model captures the use of intermediate inputs in the production process. In particular, the demand for intermediates is based on fixed physical input-output coefficients.

4.2 Government and investment demand

The government is treated as a separate agent with income and expenditures, but without any behavioral functions. Total domestic revenues R is the addition of all individual taxes (sales taxes, income taxes, tariffs, etc). Tax rates are exogenous so that they can be used to simulate policy changes. The government uses its revenues to purchase goods and services (i.e., recurrent consumption spending), to make transfers to other actors (households, firms, non-residents) and to save (i.e., finance public capital investment).

There are also no behavioral functions determining the level of investment demand for goods and services. The total value of all investment spending must equal the total amount of investible funds I in the economy. This value is split among different commodities in fixed proportion, as informed by the composition of investment in National Accounts.

4.3 International trade

World prices are exogenous, reflecting the perception that the domestic economy does not have significant power to affect the world prices (small country assumption). Given observed two-way trade between countries for similar goods, the model assumes imperfect substitution between domestic goods and goods supplied to foreign markets through a CET function, and between domestic goods and goods supplied by the rest of the world through a CES function. To capture the additional export requirements imposed by the EU, we include in the export CET function a commodity-specific variable $REQE_i$ multiplying the export quantity, QE_i, such that:

$$QX_i = \alpha_i^t \left[\delta_i^t (QE_i REQE_i)^{\rho_i^t} + (1 - \delta_i^t) QD_i^{\rho_i^t} \right]^{\frac{1}{\rho_i^t}} \tag{2}$$

This variable also enters multiplicatively in the export-domestic allocation function, making the sector-specific export-domestic supply ratio a direct function of its relative price:

$$\frac{QE_i REQE_i}{QD_i} = \left[\left(\frac{PE_i}{PDS_i} \right) \frac{1 - \delta_i^t}{\delta_i^t} \right]^{\frac{1}{\rho_i^t - 1}} \tag{3}$$

When the export requirements in a given sector $REQE_i$ increase, its export quantity QE_i falls given the sector's total production QX_i and domestic sale QD_i, as shown in Figure 6.

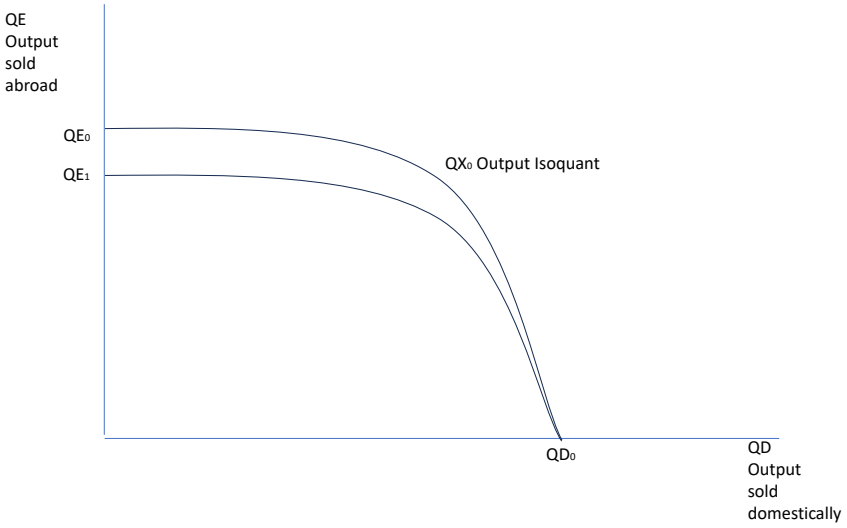

Figure 6: An increase in export requirements.

4.4 Equilibrium conditions

Full employment and factor mobility across sectors is assumed in the base model. This means that when the price of a commodity increases, the producer of the commodity will increase its demand for factors, and factors will move into the sector. Relative prices are determined such that their supplies equal their demands. More specifically, in each commodity, the supply of the good QX_i equals total demand, composed by consumption by

households (QC_{ih}), investment (QI_i), public sector demand (QG_i), intermediate demand by other production sectors ($\sum_{i'} a_{ii'} QX_{i'}$), and net exports ($QE_i - QM_i$):

$$QX_i = \sum_h QC_{ih} + QI_i + QG_i + \sum_{i'} a_{ii'} QX_{i'} + QE_i - QM_i \tag{4}$$

4.5 Macroeconomic closures

Macroeconomic balance in a CGE model is determined exogenously by a series of "closure rules". Either total savings S or total investment I (but not both) should be determined exogenously. We call this choice the "savings-investment" closure. Our model is savings driven, with households saving a fixed share of their income and investment I automatically determined by the level of total available savings. Recurrent consumption spending of the government G is endogenously determined by the model to keep the public sector deficit constant. The current account balance is treated as an exogenous variable within our single-country open economy CGE model. To accomodate the inclusion of the sector-specific export requirement variable ($REQE_i$), either it or its accompanying export quantity QE_i is exogenously determined. In the base model, $REQE_i$ is exogenous. Finally, the original consumer basket is chosen as the model's numeraire i.e. the consumer price index (CPI) is fixed.

5 Calibration of parameters

The sector-specific total factor productivity and share parameters in the model are calibrated against the SAM for Ethiopia 2018 available from IFPRI. Minor adjustments were done to correct for minor imbalances in its accounts and tiny sectors were aggregated to facilitate the model solution and interpretation. The size of the household groups are taken from the accompanying population sizes provided by the same source, with a total of 109 million individuals. Production elasticities are informed by Engeda et al. (2011). Consumption elasticities are informed by Tafere et al. (2015), and the associated Frisch parameter by Debowicz and Segal (2014). For trade elasticities we rely on GTAP's Fontagné et al. (2019).

6 Observations on the Ethiopian economy from the Social Accounting Matrix

Agriculture explains 32% of GDP, including cereals (11%), cattle (7%), and forestry (3%). Construction and trade are also prominent sectors, explaining 21% and 14%, respectively. As Table 1 shows, the sectors with the highest share of their output exported are, in decreasing order, machinery (85.8%), coffee (47.8%), transport (43.4%), and textiles (33.6%). Having said that, almost all the machinery is imported (99.5%). Leaving trade aside, which is in essence a service derived from the trade of commodities, coffee and pulses are the main exports of Ethiopia. On the imports side, non-agriculture explains 99.38%, with machinery (27.2%) and chemicals (20.8%) the main imports.

As Table 2 shows, imports are worth 24% of GDP at market prices, while exports are worth only 7% of it. This trade deficit makes domestic absorption 17% above GDP.

Absorption is explained in turn mainly by private consumption (70% of GDP), a small share of public consumption (11% of GDP), and a sizable investment share (36% of GDP). Indirect taxes are worth 7% of GDP, and composed of sales taxes (near $\frac{2}{3}$) and import tariffs (near $\frac{1}{3}$).

As Table 3 shows, land is used only in agricultural activities, and agriculture's income goes mainly to unskilled labour and land. Capital has a very high share in the income of manufacturing and services, and explains more than 60% of total income, which probably reflects that some labour income was incorrectly classified in the Ethiopian SAM as capital income. Almost half of capital income comes from construction and trade. As shown in Table 4, households in quintile 1 and 2 (both their rural and urban components) derive at least 40% of their income from unskilled labour. While in the rural area the share of capital income in household income is decreasing on income quintile, in the urban area only the top 2 quintiles earn capital income.

7 Simulations

To get a hint at the general equilibrium effects of the EUDR, we run the following simulations:

1. Increase export requirement by 10 percent: $REQE + 10P$
2. Increase export requirement by 10 percent with factors fixed by sector: $REQE_{FF}$
3. Decrease exports by 10 percent: $QE - 10P$
4. Fix exports at level of non-EEA ones: $QE - EEA$

To simulate the absence of Ethiopian exports to EEA, we map COMTRADE FOB export values 2022 at HS2 disaggregation by destination country into the 9 Ethiopian SAM export sectors, and identify the EEA share for each of these sectors, deriving the shares in Table 5[4]. However, for coffee exports, we use the share provided by the Observatory of Economic Complexity (OEC), which is 37%.

7.1 Results of REQE+10P

1. Overall, the higher export requirements lead to an overall fall in exports of 9.5%, and a smaller fall of GDP of 0.7% (Table 2). The export fall, in turn, leads to a 2.8% real devaluation (Table 6), that increases the prices for import goods in the same proportion. Given that imports are required to produce industrial goods and services but not agricultural goods (Table 1), capital and labour production factors move into agriculture, raising the productivity of land, and increasing its output and its wage in real terms (Table 7).

2. While exports fall on aggregate, those for agricultural products increase (Table 8). The two key export goods, coffee and pulses, grow by 4.1% and 3.5%, respectively, and their production increases by 9.4% and 2.8% (Table 9). Sectors that rely heavily on imported inputs suffer the highest proportional export falls: textiles (15.9%),

[4]The Stata do file is available from the authors.

machinery (81.8%), and transport (21.3%). While imports generally fall, there is significant heterogeneity in their magnitudes. As shown in Table 10, after the devaluation the import of non-metals fall by 21.4%, those for chemicals by 3.6%, and those for machinery 0.6%, associated to import elasticities of 13.8%, 8.1%, and 4.7%.

3. As export requirements go up (10%) and the amount of export that can be generated for a given domestic production falls, the producers of goods that are significantly consumed domestically react mainly by reallocating their production out of exports into domestic sales. This reduces their prices in the domestic market, and discourages its production to some extent.

4. Regarding GDP and its macroeconomic composition, as shown in Table 2, there is an output reduction at factor cost of 0.7%, and a fall in trade both regarding exports and imports that keep foreign savings constant. The consequent fall in absorption affects, in real terms, private consumption (0.9%) and fixed investment (0.5%). While in nominal terms public expenditure goes down following the fall in tax revenue linked to lower imports and hence import tariffs, in real terms government consumption goes slightly up given that the relative prices of the services demanded by the government fall in price: the price of public administration services, educational services, and health services, which explain, respectively, 53%, 36% and 11% of public expenditure fall by 1.0%,1.1%, and 0.7%, respectively[5].

5. The sector composition of production shifts in favour of agriculture, suggesting a de-industrialization process with some re-distribution from the urban area to the rural area. All production factors suffer real wage falls, except land, whose wage goes up by 0.5%. Land receives between 23.8% and 66.7% of agricultural income (Table 3). The wage for capital is the one with the highest relative fall (1.8%). The wages for labour for the unskilled, semi-skilled and skilled workers go down by 1.3%, 1.6% and 1.1%, respectively. These changes in factor wages manifest themselves at the level of household groups and drive a progressive change in urban and to some extent rural income distribution. As Table 11 shows, the share of land in the income of rural households goes down as we move up in the income distribution, and the share of capital goes up as we move into higher income quintiles, both in rural and urban areas. The share of remittances in household income is also significant and, similar to capital, its share is higher the higher the income quintile, both in rural and urban areas. Overall, the shock has a progressive income distribution effect: as land's wage increases and capital's wage decreases, the income distribution among households in rural areas become more equal, and among those in urban areas more unequal (mainly explained by the higher value of remittances to urban households).

7.2 Results of $REQE_{FF}$

1. Given that production factors take time to adjust to economic signals, we consider in this simulation the effects on the economy of the increase in export requirements before factors move among sectors. This means, in turn, that the production of each sector of activity is given, as shown in Table 12, and that the economy adjusts to the increase in export requirements either by re-directing this given production

[5]Not tabulated

from the domestic market to export, or by reducing imports, or by both. In turn, the adjustment of the domestic use of domestic production can occur via a reduction in marketed sales or in the domestic the household production for self-consumption, both of which are captured by the model.

2. Considering the macroeconomic aggregates, the GDP at factor cost has a similar reduction than in the previous simulation (0.7%, as shown in Table 2), but the reduction in trade - both exports and imports - is significantly smaller even when the devaluation of the domestic currency is significantly stronger than with mobile factors.

3. While on aggregate exports and imports fall, there is significant heterogeneity at the sector level, as can be seen in Table 8. In general, the higher the share of the domestic production that is exported rather than used domestically, the lower the capacity of the sector to transform domestic sales into exports. In terms of Figure 2, given domestic output QX_c, sectors with originally high level of exports per unit sold domestically (high $\frac{QE_c}{QD_c}$) are less able to respond to the higher export requirements by exporting more. Coffee, for example, has $\frac{11}{12}$ of its production value exported originally and no imports, and its exports fall in real terms by 8.2% while its domestic price goes 33.5% up (Table 13. Conversely, that ratio is less than $\frac{1}{3}$ in the case of pulses, a sector where export goes up by 10.8%.

4. Similarly, while on aggregate imports fall, there is significant heterogeneity. The imports of minerals, in particular, while small, grow by 24%. This, in turn, is explained by their exports growing by 75%, which reduces the supply to the domestic market, increasing its domestic price and driving imports up to substitute the domestic production, which goes down 5.8%.

5. With production factors immobile, their wages suffer greater variations than when allowed to move across sectors. Wages for factors that are intensively used in the production of export goods go up, particularly in the case of land, whose wage increases by 3.9%, but also for workers with primary and with secondary school education, whose wages increase by 1.6%-1.7% (Table 7). The wage for capital, on the other hand, used in import-competing sectors whose price goes down with the domestic currency devaluation, goes down by 3.1%.

6. The changes in factors wages and those in remittances due to higher purchasing power of foreign currency that the domestic households receive make its way to the household income distribution, as shown in Table 4. In the rural area, as we go up the quintile income distribution, the reliance on capital income and remittances goes up. In the rural area, as we go up the income distribution by quintiles, the reliance on land income goes down. Given that the share of capital is higher than that of land or remittances for each household quintile, almost all incomes go down. In the rural area, given the changes in the factors wages for land and capital, the income distribution becomes more equal. In the urban area, the first two quintiles, who receive no remittances, suffer the highest income falls due to the fall in capital income. The highest three quintiles, with a high reliance on both capital income and remittances, have small proportional changes (0.1% for quintile 3, 0.2% for quintile 4, and 0.3% for quintiles 5).

7.3 Results of $QE - 10P$

1. This simulation makes the export quantities QE_c exogenous making the export requirements $REQE_c$ endogenous to keep the number of endogenous variables consistent with the number of equations in the model[6].

2. When the exports go down by 10%, the effect on the economy is relatively similar to an increase in the same magnitude of the export requirements (simulation 2). This is particularly the case for the macroeconomic aggregates (Table 2).

3. However, the real devaluation is stronger (3.3% instead of 2.8%), and the reduction in exports, by construction, is common across sectors. Imports show a higher reduction in the agricultural sector: for example, the imports of food and beverages, which fall by 12.7% and 16.0%, fall by 15.1% and 18.0%.

4. Contrasting with the $REQE + 10$ simulation, as shown in Table 12, the coffee sector does not increase its production in a significant way, and production that is capital-intensive, such as machinery, falls much less.

5. Comparing to the same simulation, and linked to the lower incentive to produce coffee, the wage for land, instead of increasing, actually falls by 1.6%, and the wage for unskilled labour falls more (1.7% vs. 1.3%). Also, the wage for capital suffers a lower reduction, of 1.5% instead of 1.8%. At the household level, this means that the first quintiles both in the rural and urban area suffer a stronger income fall. It also means that the top quintile, with high reliance on capital and remittances, suffer a slightly lower income fall.

7.4 Results of $QE - EEA$

1. This simulation, similar in terms of the direction of the effects to the previous one ($QE - 10P$), also has the export quantities QE_c exogenous and makes the export requirements $REQE_c$ endogenous to keep the number of endogenous variables consistent with the number of equations in the model, but reduces the exports by the sector-specific shares of the EU in Ethiopia's exports.

2. When exports to the EU stop and only non-EEA exports remain, there is a very strong effect on exports, which fall by 18.4% and, imports, which fall by 5.8%, via a devaluation of 5.4%. The changes in the macroeconomic aggregates can be seen in Table 2, and include a fall in final private consumption above 1%, and a fall in public revenue via indirect taxes of 3.3%.

3. Contrasting with simulation, however, the export of coffee falls drastically, by 16.3%, as shown in Table 12. This should not be surprising, given the high reliance of Ethiopia on the EU to export its coffee beans.

4. As a result of the export reduction to the EU, wages fall quite significantly: the wage for unskilled labour falls by 2.6%, the one for semi-skilled labour by 2.0%, and

[6]We chose this modelling against other alternatives after careful consideration at the start of the project. One of these alternatives was to endogeneize the TFP parameter α_c, and it was rejected due to not being specific to the export sector.

the one for skilled labour by 1.3%. Wages also fall for land (3.5%) and for capital (2.0%).

5. These falls in factor income lower households income for every representative household group. These falls are larger for the poorer quintiles, both in rural and urban areas. In both areas, the poorest (first) quintile's income falls by 2.3%, and the one for the second quintile by 2.2%.

8 Conclusions and research agenda

With the aim of avoiding deforestation and reducing climate warming, the unilateral EUDR policy can lead to an unintended but substantive Green Squeeze in Ethiopia, one of the least developed countries in the world, as it is prone to reduce its small export ability and lead in turn to a substantive disruption of its economy that increases its income poverty and inequality. Without adequate time and resources to consider how to relocate and geolocate its coffee production to satisfy the EUDR needs, and without opening space for the possibility of compensating additional deforestation with additional reforestation and afforestation that could satisfy environmental needs without damaging Ethiopia's economic capacity, the EUDR will likely cause trade diversion with Ethiopia's coffee further directed to Asia, a significant fall in Ethiopia's export revenue and income, and worsening income poverty and inequality. The modeling exercise that we conducted in this report for ODI is admittedly a very simple one and should be considered an initial step. Our modeling does not capture a series of important economic characteristics and effects that should be addressed in future work, including:

1. Reflecting that Ethiopia exports its coffee to the EU at a premium price of up to 34%, and hence the particularly strong expected economic effects of losing this market. This calls for modeling multiple trading partners, with a set of export prices, for which both the Social Accounting Matrix and the model equations need to be adapted.

2. Capturing a time-path for land use reflecting alternative geographic locations for coffee in Ethiopia, with a dynamic model and associated data needs.

3. Simulating public incentives to change the place of coffee production to higher altitudes in Ethiopia, ideally in a dynamic setup.

4. The Social Accounting Matrix should be modified to reflect the important role of the domestic market for Ethiopia's coffee, something that IFPRI's SAM unfortunately fails to capture (this probably has a strong impact on the modeling results).

5. The potential boost in coffee yields and hence incomes via further use of its coffee plantations, which would also facilitate the geo-location of its production and hence coffee exports without losing the EU price premium. This could also inform a discussion of land policy rights.

6. To get a more realistic idea of the general equilibrium effects at household level, the general equilibrium model should be linked to a microsimulation model based on an existing household-level survey, and Foster-Greer-Thorbecke (FGT) income poverty and Gini inequality indicators should be estimated.

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Table 1: Economic structure table by commodity

COMMODITY	QQSHR	EXPshr	EXP-OUTshr	IMPshr	IMP-DEMshr
cmaiz	1.5				
crice	0.1			0.2	33.3
cocer	5.2				
cpuls	1.2	7.8	22.6	0.4	8.8
coils	0.1				
croot	0.5				
cvege	1.0				
csugr	0.1				
cfrui	0.2				
ccoff	0.3	15.0	47.8		
cocrp	0.4				
ccatt	4.9				
cpoul	0.3				
coliv	0.5	0.7	5.2		
cfore	2.5				
cfish	0.1				
cmine	0.6	0.7	5.8	0.6	19.7
cfood	6.1	3.9	3.2	4.9	16.0
cbeve	1.3			0.2	3.6
ctext	1.3	5.9	33.6	3.5	61.6
cwood	1.1			2.5	56.0
cchem	4.4			20.8	87.1
cnmet	0.9			1.2	30.8
cmetl	2.9	3.9	13.4	9.5	64.5
cmach	5.5	3.9	85.8	27.2	99.5
coman	0.9	0.7	4.5	0.6	18.9
celec	0.8				
cwatr	1.1				
ccons	19.4			1.2	0.9
ctrad	10.1				
ctran	5.1	40.5	43.4	21.2	56.0
chotl	2.3	7.8	13.6	1.6	9.5
ccomm	2.0				
cfsrv	1.5			1.0	8.9
creal	4.3				
cbsrv	1.0	3.3	17.9	2.7	36.1
cpadm	3.3	5.9	7.2	0.4	1.7
ceduc	2.6				
cheal	0.8				
cosrv	1.7				
TOTAL-1	100.0	100.0	4.6	100.0	17.3
TAGR	18.9	23.5	3.7	0.6	0.7
TNAGR	81.1	76.5	4.9	99.4	21.2
TOTAL-2	100.0	100.0	4.6	100.0	17.3

Table 2: Macroeconomic aggregates

AGGREGATE	BASE	REQE+10P	REQE_FF	QE-10P	QE-EEA
ABSORP	2,333	-0.7	-0.6	-0.6	-0.7
PRVCON	1,394	-0.9	-0.8	-0.9	-1.2
FIXINV	724	-0.5	-0.3	-0.5	-0.1
GOVCON	215	0.2	-0.1	0.3	0.6
EXPORTS	153	-9.5	-1.8	-10.0	-18.4
IMPORTS	-485	-3.0	-0.6	-3.2	-5.8
GDPMP	2,001	-0.8	-0.7	-0.7	-0.8
NETITAX	131	-2.2	-0.2	-2.1	-3.3
GDPFC2	1,870	-0.7	-0.7	-0.7	-0.6

Table 3: Factor shares within sector (%)

ACTIVITY	flab-n	flab-p	flab-s	flnd	fcap	total
amaiz	66.7	4.8		23.8	4.8	100
arice	50.0			50.0		100
aocer	64.7	5.3	0.6	24.7	4.7	100
apuls	52.7	3.6		40.0	3.6	100
aoils	33.3			66.7		100
aroot	56.8	5.4		35.1	2.7	100
avege	60.7	3.6		32.1	3.6	100
asugr	50.0			50.0		100
afrui	33.3			50.0	16.7	100
acoff	25.0			43.8	31.3	100
aocrp	50.0	6.3		43.8		100
acatt	18.5	0.7	0.7		80.0	100
apoul	33.3				66.7	100
aoliv	33.3				66.7	100
afore	27.1	3.4	1.7		67.8	100
afish					100.0	100
amine	25.0				75.0	100
afood	9.8	4.9	2.4		82.9	100
abeve	14.3	7.1			78.6	100
atext	22.2	11.1	11.1		55.6	100
awood	11.1	11.1	11.1		66.7	100
achem	14.3				85.7	100
anmet	11.1				88.9	100
ametl	6.7				93.3	100
amach	33.3				66.7	100
aoman	6.7	13.3			80.0	100
aelec			20.0		80.0	100
awatr			8.3		91.7	100
acons	9.3	6.5	4.8		79.4	100
atrad	12.2	2.0	1.6		84.3	100
atran	17.1	11.4	8.6		62.9	100
ahotl	2.0	16.3	16.3		65.3	100
acomm	18.8	6.3	8.3		66.7	100
afsrv		4.3	28.3		67.4	100
areal			3.1		96.9	100
absrv	7.1		35.7		57.1	100
apadm	8.4	6.0	19.3		66.3	100
aeduc	6.1	6.1	47.0		40.9	100
aheal	17.4	4.3	52.2		26.1	100
aosrv	27.3	6.8	9.1		56.8	100
total	21.4	4.7	6.9	6.5	60.5	100

Table 4: Household income

HOUSEHOLD	BASE	REQE+10P	REQE_FF	QE-10P	QE-EEA
hhd-r1	121	-1.0	0.1	-1.5	-2.3
hhd-r2	194	-1.1	-0.2	-1.4	-2.2
hhd-r3	245	-1.1	-0.5	-1.4	-2.1
hhd-r4	281	-1.1	-0.6	-1.2	-1.8
hhd-r5	401	-1.1	-1.1	-1.0	-1.3
hhd-u1	4	-1.5	-0.4	-1.6	-2.3
hhd-u2	10	-1.5	-0.5	-1.6	-2.2
hhd-u3	22	-1.3	-0.1	-1.3	-1.7
hhd-u4	67	-1.2	-0.2	-1.1	-1.5
hhd-u5	469	-0.9	-0.3	-0.7	-0.7

Table 5: Ethiopian exports by destination (USD) (before OEC adjustment)

Commodity	EEA (USD)	Total (USD)	EEA(%)
ccoff	38,070,973	573,233,600	6.6
coliv	10,805,806	24,946,810	43.3
cmine	4,173,290	276,211,360	1.5
cfood	53,371,847	254,335,760	21.0
ctext	13,350,297	707,062,208	1.9
cmetl	32,681,325	513,194,784	6.4
cmach	640,766,251	3,221,033,472	19.9
coman	584,350,355	2,395,109,376	24.4

Table 6: Exchange rate (% change)

BASE	REQE+10P	REQE_FF	QE-10P	QE-EEA
1.0	2.8	7.0	3.3	5.4

Table 7: Factor wages

FACTOR	BASE	REQE+10P	REQE_FF	QE-10P	QE-EEA
flab-n	1.0	-1.3	0.0	-1.7	-2.6
flab-p	1.0	-1.6	1.7	-1.5	-2.0
flab-s	1.0	-1.1	1.6	-1.1	-1.3
flnd	1.0	0.5	3.9	-1.6	-3.5
fcap	0.2	-1.8	-3.1	-1.5	-2.0

Table 8: Exports

COMMODITY	BASE	REQE+10P	REQE_FF	QE-10P	QE-EEA
cpuls	9.3	3.5	10.8	-10.0	-6.6
ccoff	11.0	4.1	-8.2	-10.0	-37.0
coliv	0.9	12.7	27.4	-10.0	-43.3
cmine	0.8	38.7	75.0	-10.0	-1.5
cfood	5.0	16.9	20.1	-10.0	-21.0
ctext	7.4	-15.9	5.7	-10.0	-1.9
cmetl	4.6	15.4	32.1	-10.0	-6.4
cmach	5.1	-81.8	-7.1	-10.0	-19.9
coman	0.8	13.5	13.5	-10.0	-24.4
ctran	62.0	-21.3	-8.8	-10.0	-17.3
chotl	12.0	3.5	0.4	-10.0	-17.3
cbsrv	5.0	1.6	-8.2	-10.0	-17.3
cpadm	9.0	6.6	-7.7	-10.0	-17.3

Table 9: Quantity of aggregate marketed commodity output (% change)

COMMODITY	BASE	REQE+10P	REQE_FF	QE-10P	QE-EEA
cmaiz	47	1.2	0.0	0.8	1.2
crice	2	6.7		9.5	15.9
cocer	159	0.4	0.2	0.2	0.4
cpuls	41	2.8	2.1	-0.4	1.5
coils	4	0.1	0.6	0.3	0.8
croot	7	-0.2	1.0	-0.1	-0.2
cvege	22	-0.6	0.8	-0.4	-0.3
csugr	4	2.0		1.6	2.6
cfrui	5	0.1	0.8	0.0	0.2
ccoff	23	9.4		0.2	-16.3
cocrp	8	-0.3	1.9	-0.4	-0.4
ccatt	146	-0.3	0.8	-0.3	-0.3
cpoul	9	-0.2	0.4	-0.2	-0.1
coliv	18	0.8	1.0	-0.5	-2.4
cfore	79	-0.8	0.6	-1.1	-1.5
cfish	3	-1.4		-1.5	-2.2
cmine	13	7.4		4.4	8.6
cfood	157	3.2		2.5	3.7
cbeve	27	0.3		-0.3	-0.5
ctext	22	-6.6	0.0	-3.3	3.8
cwood	11	12.4	0.0	15.1	23.1
cchem	16	13.0		15.8	25.2
cnmet	18	8.8		9.6	15.4
cmetl	34	8.3		4.8	12.1
cmach	6	-76.3	0.0	-2.9	-12.5
coman	18	3.1		2.0	2.9
celec	29	0.0		0.3	0.4
cwatr	41	-0.1		-0.1	0.0
ccons	696	-0.3		-0.3	0.0
ctrad	362	-1.1	0.0	-0.9	-1.8
ctran	143	-9.0		-2.3	-4.6
chotl	88	2.0		-0.1	-0.6
ccomm	71	-1.2		-0.5	-0.8
cfsrv	51	1.2		1.4	2.2
creal	154	-0.5		-0.5	-0.8
cbsrv	28	2.7		1.9	2.4
cpadm	125	1.7	0.0	0.5	0.2
ceduc	95	0.1		0.2	0.4
cheal	29	0.1		0.2	0.3
cosrv	61	-0.7		-0.5	-0.8

Table 10: Imports

COMMODITY	BASE	REQE+10P	REQE_FF	QE-10P	QE-EEA
crice	1.0	-10.8	0.0	-17.0	-28.0
cpuls	3.0	-7.0	10.3	-11.5	-23.5
cmine	3.0	-13.5	24.0	-15.5	-24.7
cfood	29.0	-12.7	0.3	-15.1	-24.2
cbeve	1.0	-16.0	-23.0	-18.0	-27.1
ctext	23.4	-0.9	1.9	-1.2	-4.7
cwood	14.0	-13.1	-1.4	-12.5	-19.6
cchem	108.0	-3.6	-0.7	-2.2	-3.7
cnmet	8.0	-21.4	-0.4	-22.9	-33.9
cmetl	53.5	-3.6	3.5	-3.2	-6.1
cmach	170.1	-0.6	-0.5	-0.5	-0.3
coman	4.0	-11.6	-1.2	-11.9	-18.0
ccons	6.0	-14.3	-26.9	-15.2	-22.4
ctran	103.0	2.8	-0.9	1.1	-1.5
chotl	8.0	-11.9	-12.5	-12.4	-20.6
cfsrv	5.0	-17.0	-0.9	-17.5	-25.9
cbsrv	13.0	-9.1	-1.5	-7.3	-13.3
cpadm	2.0	-13.9	-1.7	-14.2	-22.4

Table 11: Decomposition of the total income of hhd H (%)

HOUSEHOLD	flab-n	flab-p	flab-s	flnd	fcap+ent	row	total
hhd-r1	47.1	5.0	1.7	16.5	27.3	2.5	100
hhd-r2	41.2	4.6	2.1	14.4	34.0	3.6	100
hhd-r3	34.3	4.5	2.4	11.8	42.4	4.5	100
hhd-r4	27.4	4.3	3.2	9.3	48.8	7.1	100
hhd-r5	12.0	2.2	3.5	4.0	66.8	11.5	100
hhd-u1	50.0	25.0			25.0		100
hhd-u2	40.0	20.0	10.0		30.0		100
hhd-u3	27.3	18.2	18.2		31.8	4.5	100
hhd-u4	20.9	11.9	19.4	1.5	38.8	7.5	100
hhd-u5	6.0	5.5	16.2	0.2	55.4	16.6	100
total	22.1	4.9	7.1	6.7	49.9	9.4	100

Table 12: Level of domestic activity (% change)

ACTIVITY	BASE	REQE+10P	REQE_FF	QE-10P	QE-EEA
amaiz	52	1.0	0.0	0.6	1.0
arice	2	6.7		9.5	15.9
aocer	201	0.0		0.0	0.1
apuls	60	1.7		-0.4	0.9
aoils	9	-0.4		0.0	0.3
aroot	40	-0.1		-0.1	-0.1
avege	28	-0.6	0.0	-0.4	-0.3
asugr	4	2.0		1.6	2.6
afrui	6	0.0		0.0	0.2
acoff	23	9.4		0.2	-16.3
aocrp	16	-0.4		-0.3	-0.3
acatt	259	-0.4		-0.5	-0.6
apoul	13	-0.3	0.0	-0.3	-0.2
aoliv	30	0.3		-0.5	-1.7
afore	106	-0.9		-1.1	-1.6
afish	3	-1.4		-1.5	-2.2
amine	13	7.4		4.4	8.6
afood	157	3.2		2.5	3.7
abeve	27	0.3		-0.3	-0.5
atext	22	-6.6		-3.3	3.8
awood	11	12.4		15.1	23.1
achem	16	13.0		15.8	25.2
anmet	18	8.8		9.6	15.4
ametl	34	8.3		4.8	12.1
amach	6	-76.3	0.0	-2.9	-12.5
aoman	18	3.1		2.0	2.9
aelec	29	0.0	0.0	0.3	0.4
awatr	41	-0.1		-0.1	0.0
acons	696	-0.3	0.0	-0.3	0.0
atrad	362	-1.1	0.0	-0.9	-1.8
atran	143	-9.0		-2.3	-4.6
ahotl	88	2.0	0.0	-0.1	-0.6
acomm	71	-1.2	0.0	-0.5	-0.8
afsrv	51	1.2		1.4	2.2
areal	154	-0.5		-0.5	-0.8
absrv	28	2.7		1.9	2.4
apadm	125	1.7		0.5	0.2
aeduc	95	0.1		0.2	0.4
aheal	29	0.1		0.2	0.3
aosrv	61	-0.7		-0.5	-0.8

Table 13: Demand price for commodity c produced and sold domestically (% change)

COMMODITY	BASE	REQE+10P	REQE_FF	QE-10P	QE-EEA
cmaiz	1.15	-0.6	-3.1	-1.2	-1.9
crice	1.00	-0.4	7.0	-1.7	-3.1
cocer	1.19	-0.7	-3.8	-1.3	-2.0
cpuls	1.21	1.0	4.9	0.5	-0.6
coils	1.25	-0.1	-3.9	-1.4	-2.6
croot	2.57	-0.5	-10.6	-0.7	-1.1
cvege	1.59	-0.6	-3.4	-1.1	-1.8
csugr	1.25	-0.4	-0.8	-1.2	-2.1
cfrui	1.80	-0.4	-3.6	-1.0	-1.7
ccoff	1.00	4.6	33.5	4.7	5.8
cocrp	1.88	-0.4	-7.0	-1.0	-1.6
ccatt	1.21	-0.9	-3.2	-1.0	-1.4
cpoul	1.11	-1.0	-2.2	-1.2	-1.8
coliv	1.06	-0.6	1.4	-0.6	-0.9
cfore	1.16	-0.6	-2.5	-0.5	-0.5
cfish	1.33	0.1	-1.9	0.3	0.6
cmine	1.24	0.8	4.1	1.0	1.6
cfood	1.17	-0.1	3.6	-0.2	-0.4
cbeve	1.14	-0.3	-0.3	-0.2	-0.2
ctext	1.16	3.2	4.9	3.2	3.6
cwood	1.08	-1.0	4.9	-0.8	-1.0
cchem	1.27	0.2	1.7	0.4	0.9
cnmet	1.23	-0.1	2.3	0.0	0.3
cmetl	1.23	1.1	3.6	1.4	1.9
cmach	1.00	22.0	7.1	6.2	8.6
coman	1.18	-0.8	3.2	-0.5	-0.6
celec	1.00	0.0	-1.0	0.3	0.8
cwatr	1.00	-0.1	-1.6	0.2	0.6
ccons	1.00	-0.5	0.0	-0.3	-0.2
ctrad	1.00	-1.0	-21.9	-0.8	-1.0
ctran	1.00	4.8	6.8	4.3	5.4
chotl	1.00	0.0	4.3	0.3	0.2
ccomm	1.00	-1.1	-1.2	-1.0	-1.2
cfsrv	1.00	-1.4	6.8	-1.2	-1.6
creal	1.00	-1.0	-1.2	-0.8	-0.9
cbsrv	1.00	0.6	6.7	1.1	1.2
cpadm	1.00	-0.5	6.6	-0.2	-0.4
ceduc	1.00	-1.1	-2.2	-0.9	-1.1
cheal	1.03	-0.7	-3.2	-0.6	-0.7
cosrv	1.02	-1.2	-1.6	-1.1	-1.4

Table 14: Price of composite good (% change)

COMMODITY	BASE	REQE+10P	REQE_FF	QE-10P	QE-EEA
cmaiz	1.1	-0.6	-3.1	-1.2	-1.9
crice	1.0	0.6	7.0	-0.2	-0.7
cocer	1.2	-0.7	-3.8	-1.3	-2.0
cpuls	1.2	1.1	4.6	0.6	-0.2
coils	1.3	-0.1	-3.9	-1.4	-2.6
croot	2.6	-0.5	-10.6	-0.7	-1.1
cvege	1.6	-0.6	-3.4	-1.1	-1.8
csugr	1.3	-0.4	-0.8	-1.2	-2.1
cfrui	1.8	-0.4	-3.6	-1.0	-1.7
ccoff	1.0	4.6	33.5	4.7	5.8
cocrp	1.9	-0.4	-7.0	-1.0	-1.6
ccatt	1.2	-0.9	-3.2	-1.0	-1.4
cpoul	1.1	-1.0	-2.2	-1.2	-1.8
coliv	1.1	-0.6	1.4	-0.6	-0.9
cfore	1.2	-0.6	-2.5	-0.5	-0.5
cfish	1.3	0.1	-1.9	0.3	0.6
cmine	1.3	1.1	3.6	1.3	2.1
cfood	1.2	0.2	3.5	0.2	0.3
cbeve	1.6	-0.3	-0.1	-0.1	0.0
ctext	1.3	2.7	3.8	2.9	4.2
cwood	1.6	0.9	5.0	1.2	2.1
cchem	1.3	1.9	1.7	2.2	3.8
cnmet	1.3	0.5	2.3	0.7	1.3
cmetl	1.3	1.8	2.6	2.2	3.4
cmach	1.2	2.5	3.9	2.8	4.8
coman	1.6	-0.2	3.2	0.1	0.3
celec	1.0	0.0	-1.0	0.3	0.8
cwatr	1.0	-0.1	-1.6	0.2	0.6
ccons	1.0	-0.4	0.1	-0.2	-0.1
ctrad	1.0	-1.0	-21.9	-0.8	-1.0
ctran	1.0	3.7	6.9	3.7	5.4
chotl	1.0	0.3	4.6	0.6	0.6
ccomm	1.0	-1.1	-1.2	-1.0	-1.2
cfsrv	1.0	-1.1	6.8	-0.9	-1.0
creal	1.0	-1.0	-1.2	-0.8	-0.9
cbsrv	1.0	1.4	6.8	1.8	2.6
cpadm	1.0	-0.5	6.6	-0.2	-0.3
ceduc	1.0	-1.1	-2.2	-0.9	-1.1
cheal	1.0	-0.7	-3.2	-0.6	-0.7
cosrv	1.0	-1.2	-1.6	-1.1	-1.4

Table 15: Producer prices

COMMODITY	BASE	REQE+10P	REQE_FF	QE-10P	QE-EEA
cmaiz	1	-0.6	-0.9	-1.3	-2.2
crice	1	-0.4	7.0	-1.7	-3.1
cocer	1	-0.7	-1.2	-1.5	-2.4
cpuls	1	-0.5	7.9	-1.5	-2.7
coils	1	-0.1	-0.5	-1.6	-3.2
croot	1	-0.7	0.8	-1.6	-2.7
cvege	1	-0.7	5.2	-1.7	-2.8
csugr	1	-0.4	3.5	-1.4	-2.6
cfrui	1	-0.5	7.8	-1.6	-3.0
ccoff	1	0.6	27.9	0.0	-0.5
cocrp	1	-0.5	2.5	-1.7	-3.0
ccatt	1	-1.0	0.0	-1.2	-1.7
cpoul	1	-1.1	-0.4	-1.3	-2.0
coliv	1	-1.0	2.1	-1.1	-1.5
cfore	1	-0.6	0.0	-0.5	-0.6
cfish	1	0.3	3.4	0.5	0.8
cmine	1	0.5	8.7	0.8	1.5
cfood	1	-0.3	7.0	-0.5	-0.8
cbeve	1	-0.3	2.3	-0.3	-0.2
ctext	1	0.5	5.9	0.7	1.2
cwood	1	-1.1	6.7	-0.9	-1.1
cchem	1	0.3	6.8	0.6	1.2
cnmet	1	-0.1	6.9	0.1	0.4
cmetl	1	0.3	7.5	0.6	1.0
cmach	1	0.2	1.7	0.4	0.9
coman	1	-1.2	6.6	-1.0	-1.2
celec	1	0.0	-1.0	0.3	0.8
cwatr	1	-0.1	-1.6	0.2	0.6
ccons	1	-0.5	0.0	-0.3	-0.2
ctrad	1	-1.0	-21.9	-0.8	-1.0
ctran	1	0.1	2.7	0.3	0.7
chotl	1	-1.0	3.2	-0.9	-1.2
ccomm	1	-1.1	-1.2	-1.0	-1.2
cfsrv	1	-1.4	6.8	-1.2	-1.6
creal	1	-1.0	-1.2	-0.8	-0.9
cbsrv	1	-0.8	5.0	-0.6	-0.7
cpadm	1	-1.0	5.9	-0.9	-1.1
ceduc	1	-1.1	-2.2	-0.9	-1.1
cheal	1	-0.7	-2.7	-0.6	-0.7
cosrv	1	-1.2	-1.3	-1.1	-1.5

Table 16: Dictionary of activities

amaiz	Activities - Maize
arice	Activities - Rice
aocer	Activities - Other cereals
apuls	Activities - Pulses
aoils	Activities - Oilseeds
aroot	Activities - Roots
avege	Activities - Vegetables
asugr	Activities - Sugarcane
afrui	Activities - Fruits and nuts
acoff	Activities - Coffee, tea and cocoa
aocrp	Activities - Other crops
acatt	Activities - Cattle and raw milk
apoul	Activities - Poultry and eggs
aoliv	Activities - Other livestock
afore	Activities - Forestry
afish	Activities - Fisheries
amine	Activities - Mining
afood	Activities - Processed foods
abeve	Activities - Beverage and tobacco
atext	Activities - Textiles, clothing and footwear
awood	Activities - Wood and paper products
achem	Activities - Chemicals and petroleum
anmet	Activities - Non-metal minerals
ametl	Activities - Metals and metal products
amach	Activities - Machinery, equipment and vehicles
aoman	Activities - Other manufacturing
aelec	Activities - Electricity, gas and steam
awatr	Activities - Water supply and sewage
acons	Activities - Construction
atrad	Activities - Wholesale and retail trade
atran	Activities - Transportation and storage
ahotl	Activities - Accommodation and food services
acomm	Activities - Information and communication
afsrv	Activities - Finance and insurance
areal	Activities - Real estate activities
absrv	Activities - Business services
apadm	Activities - Public administration
aeduc	Activities - Education
aheal	Activities - Health and social work
aosrv	Activities - Other services

Table 17: Dictionary of commodities

cmaiz	Commodities - Maize
crice	Commodities - Rice
cocer	Commodities - Other cereals
cpuls	Commodities - Pulses
coils	Commodities - Oilseeds
croot	Commodities - Roots
cvege	Commodities - Vegetables
csugr	Commodities - Sugarcane
cfrui	Commodities - Fruits and nuts
ccoff	Commodities - Coffee, tea and cocoa
cocrp	Commodities - Other crops
ccatt	Commodities - Cattle and raw milk
cpoul	Commodities - Poultry and eggs
coliv	Commodities - Other livestock
cfore	Commodities - Forestry
cfish	Commodities - Fisheries
cmine	Commodities - Mining
cfood	Commodities - Processed foods
cbeve	Commodities - Beverage and tobacco
ctext	Commodities - Textiles, clothing and footwear
cwood	Commodities - Wood and paper products
cchem	Commodities - Chemicals and petroleum
cnmet	Commodities - Non-metal minerals
cmetl	Commodities - Metals and metal products
cmach	Commodities - Machinery, equipment and vehicles
coman	Commodities - Other manufacturing
celec	Commodities - Electricity, gas and steam
cwatr	Commodities - Water supply and sewage
ccons	Commodities - Construction
ctrad	Commodities - Wholesale and retail trade
ctran	Commodities - Transportation and storage
chotl	Commodities - Accommodation and food services
ccomm	Commodities - Information and communication
cfsrv	Commodities - Finance and insurance
creal	Commodities - Real estate activities
cbsrv	Commodities - Business services
cpadm	Commodities - Public administration
ceduc	Commodities - Education
cheal	Commodities - Health and social work
cosrv	Commodities - Other services

Table 18: Dictionary of other accounts

trc	Aggregate transaction costs
trd	Domestic transaction costs
tre	Export transaction costs
trm	Import transaction costs
flab-n	Factors - Labor - Low (not finished primary schooling)
flab-p	Factors - Labor - Medium (finished primary, but not finished secondary schooling)
flab-s	Factors - Labor - High (finished secondary and/or tertiary schooling)
flnd	Factors - Agricultural land
fcap	Factors - Capital
ent	Enterprises
hhd-r1	Households - Rural (quintile 1)
hhd-r2	Households - Rural (quintile 2)
hhd-r3	Households - Rural (quintile 3)
hhd-r4	Households - Rural (quintile 4)
hhd-r5	Households - Rural (quintile 5)
hhd-u1	Households - Urban (quintile 1)
hhd-u2	Households - Urban (quintile 2)
hhd-u3	Households - Urban (quintile 3)
hhd-u4	Households - Urban (quintile 4)
hhd-u5	Households - Urban (quintile 5)
gov	Government
dtax	Taxes - Direct (personal or corporate)
mtax	Taxes - Imports (products)
stax	Taxes - Sales, excise and/or value-added (products)
s-i	Savings-investment
row	Rest of world
total	Total