

ECONOMYWIDE RISK ASSESSMENT

COUNTRY SERIES

COUNTRY BRIEF 8 | APRIL 2025

ETHIOPIA

Systematic Analysis of World Market and Domestic Production Shocks

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This study is part of a series of country briefs by IFPRI that leverages economywide models to deliver detailed risk assessments of key economic indicators. This initial analysis evaluates vulnerabilities across economic sectors and key population groups to answer two questions: (1) How vulnerable are Ethiopia's national economy and population to world market and domestic production shocks? (2) What are the largest risks to Ethiopia's overall economic performance, private consumption, and reductions in poverty and undernourishment?

Overview

Achieving development goals is subject to economic uncertainties, yet policymaking rarely accounts for these risks. This Country Brief quantifies the risks facing Ethiopia's economy and population, focusing on two primary sources:

- 1) **External risks** stemming from shocks in international commodity prices and foreign capital flows and
- 2) **Domestic risks** associated with production shocks in volatile sectors of the Ethiopian economy, such as primary agriculture and hydropower electricity generation, often caused by extreme weather.

The significance of these risks is assessed based on the range of the shocks' impacts on four main economic and development indicators: total GDP, private consumption, poverty rate, and prevalence of undernourishment.

The analysis uses data mining methods to simultaneously sample many shocks from historical data, constructing a comprehensive set of realistic shock scenarios for Ethiopia. A country-specific, economywide Computable General Equilibrium (CGE) model then simulates the impacts of these shocks on both total and sector-specific economic outcomes, deriving changes in poverty and undernourishment for each

shock scenario. Finally, machine learning techniques are applied to obtain metrics for the relative importance of different risk factors.

The results suggest that domestic production volatility is the primary risk factor for GDP and undernourishment in Ethiopia. External risks, particularly the volatility of foreign capital flows and world energy prices are crucial for household consumption and poverty levels. Among domestic risk factors, the yield volatility of cereals stands out as the most significant, impacting consumption, poverty, and undernourishment for both urban and rural households in Ethiopia.

Understanding these economic risks is a critical first step in facilitating discussions on potential risk management strategies, such as promoting domestic productivity growth and diversifying economic activity away from high-risk sectors.

1. Background and Objectives

An examination of the historical dynamics of Ethiopia's key economic indicators helps identify some of the main factors influencing the country's development (Figure 1). Since a structural trend break in the early 2000s, Ethiopia has experienced rapid growth (Figure 1A). A major driver of this growth has been public investment in infrastructure, with the country prioritizing large-scale projects such as roads, railways, energy generation, and telecommunications. Additionally, the Agricultural Development-Led Industrialization strategy focused on increasing agricultural productivity (Figure 1C) and contributed to significant reductions in extreme poverty—from 58 percent in 1999 to 27 percent in 2015—measured at the \$2.15 international poverty line (World Bank, 2016; World Bank, 2024a). As the country made progress toward industrialization, the share of agriculture in the economy declined (Figure 1B), while other sectors, particularly construction within industry, gained prominence.

At the same time, periodic shocks such as world market turbulence in 2008 (Figure 1D) and drought-caused low agricultural yields in 2008 and 2016 (Figure 1C) were accompanied by increasing macroeconomic instability, including volatility in the current account deficit (Figure 1E) and inflation (Figure 1F). According to the Systematic Country Diagnostic by the World Bank (2016), besides long-term fundamental developmental factors such as human capital development, political stability and challenges in transitioning to private-sector-driven growth, exogenous risks such as droughts, world market prices, and dependence on foreign capital flows remain highly influential risks for Ethiopian economy.

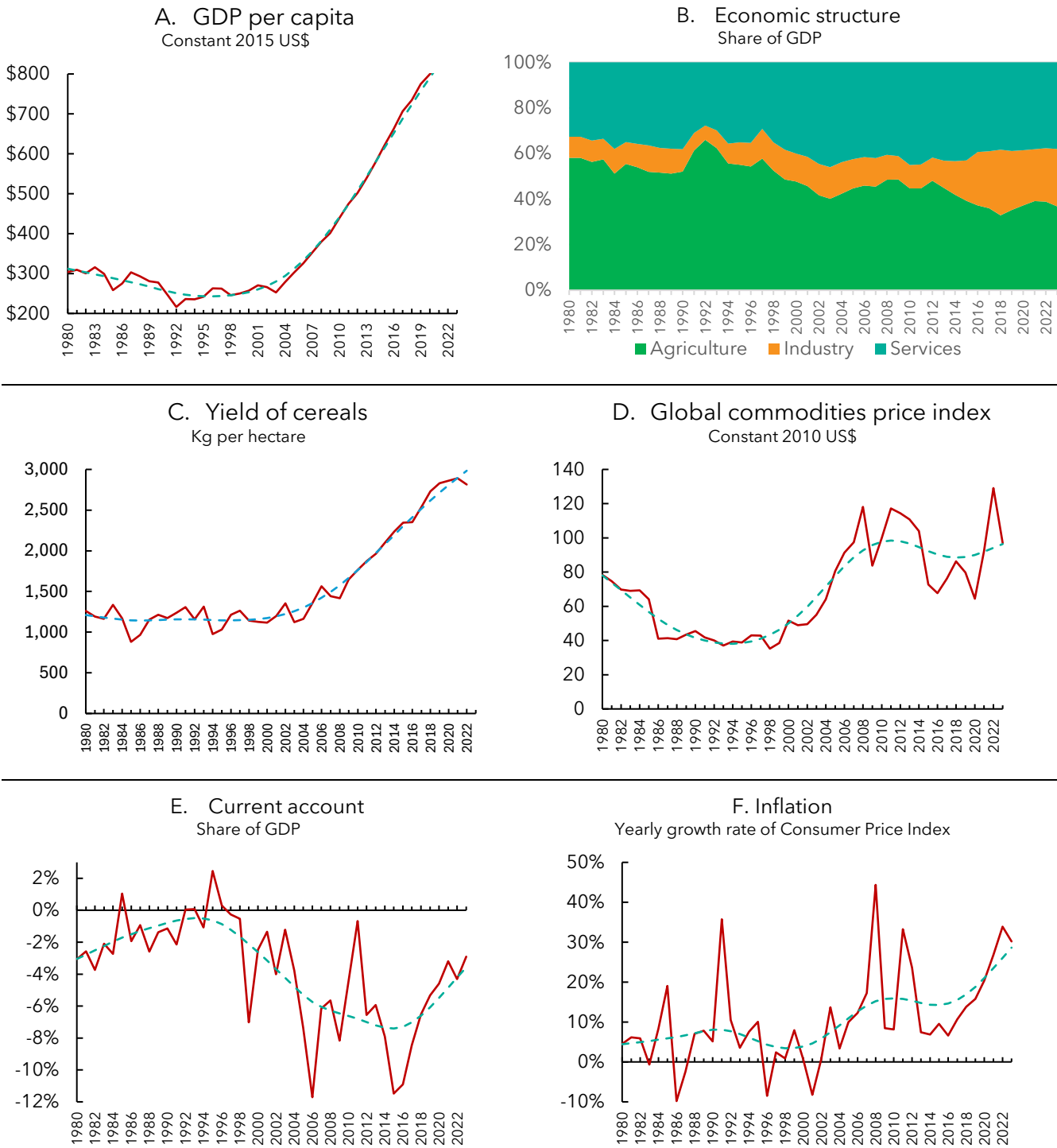
Governments in Ethiopia and around the world rely on economic projections to inform policy decisions and achieve development goals. However, the accuracy of projected trends and, even more so, the occurrence of economic shocks are naturally uncertain. Recent economic crises such as the global COVID-19 recession and global food and market disruptions due to Russia's invasion of Ukraine are stark reminders of the unpredictability of future events and the severity of these crises' impacts on the national economies and populations of many countries highlighted the unpreparedness of their governments. Major impacts in developing countries included setbacks in poverty and hunger reduction, jeopardizing the achievement of the first two Sustainable Development Goals of UN Member States by 2030.

Policymaking rarely considers the economic risks around projections and shock occurrence. This is mainly because systematic analyses of economic shocks and quantification of the associated risks are lacking, especially for developing countries. We address this gap by providing country-specific economywide risk assessments and detailed risk profiles for key economic and development indicators.

Our analysis addresses two main questions:

- 1) How vulnerable are Ethiopia's national economy and population to world market and domestic production shocks?
- 2) What are the largest risks to Ethiopia's overall economic performance, private consumption, and progress toward ending poverty and hunger?

Figure 1. Historical movements of main economic indicators in Ethiopia



Note: The dashed blue line indicates the long-term trend. The trend calculation uses the Hodrick-Prescott filter for annual data (Hodrick and Prescott 1997).
Source: Own presentation based on GDP per capita and official exchange rate data from World Bank (2024a), global commodity price index data from World Bank (2024b), yield of cereals from FAO (2024), and current account and inflation data from IMF (2024).

2. Concept and Methodological Overview

Unlike conventional economic projection analysis, our assessment of economic risks does not require speculation of Ethiopia's future long-term economic performance. Instead, we focus on economic *volatility* and analyze simulated outcomes for the entire bandwidth of potential but realistic shock scenarios. Innovatively, we adopt the concept of *risk* as understood in finance to a macroeconomic policy analysis framework (Box 1).

We assess risks to the national economy and population of Ethiopia belonging to two risk types:

- 1) **External risks** associated with shocks in international commodity prices and foreign capital flows (*world market shocks*)¹ and
- 2) **Domestic risks** associated with production shocks in volatile sectors of the Ethiopian economy (*domestic production shocks*) caused by extreme weather, for example.

The considered commodities are the goods and services that Ethiopia trades. The considered sectors are primary agriculture and hydropower electricity generation, which are essential to Ethiopia's economic performance and Ethiopian's wellbeing. Given the size and diversity of the agricultural sector and its crucial role in achieving development goals such as rural development, food security, and poverty and hunger eradication, we disaggregate agriculture into different crop and livestock production, forestry, and fishery subsectors. Our analysis focuses on exogenous shocks, which are beyond the government's direct control.

Box 1. Terminology

Risk is defined as the measurable likelihood of variation in an economic variable and, therefore, differs from *uncertainty*, which broadly refers to the (unquantifiable) unknown. *Risk* can be quantified by using statistical metrics such as variance or standard deviation that measure the degree of variation around a variable's average. Following the terminology in finance, *risk* and *volatility* have similar meanings in our analysis, but we use *volatility* in a more generic sense. *Risk* is inherent in both economic *shocks* and *outcomes*, with the risks of shocks influencing the risks of outcomes. We refer to the contribution of a given shock variable to the volatility of an outcome as *risk factor*. The representation of the *risk factors* of an economic or development outcome ranked by their relative importance is referred to as *risk profile*. A *shock* is a sudden, measurable change that significantly disrupts the functioning of an economy or a part thereof, and an *outcome* is the resulting, measurable change in an indicator of economic performance or development.

We examine the external and domestic risks in Ethiopia's current economic volatility environment using available historical information for realistic scenario formulation. To do that, we developed a novel methodology – called *Systematic Risk Profiling (SRP)* – that integrates CGE modelling, data mining, and machine learning methods (Mukashov et al. 2024).

The SRP consists of three sequential steps:

- 1) **Data mining methods** are employed to simultaneously sample world market and domestic production shocks from annual time-series data spanning over four decades (1980 – 2023) to construct a comprehensive set of shock scenarios that realistically represent all possible combinations of exogenous shocks for Ethiopia.

¹ International trade flows and foreign capital flows are closely linked, and both affect Ethiopia's trade balance and exchange rate (see Section 4). We therefore refer to sudden changes in either or both flows as "world market shocks" for brevity.

- 2) An **economywide CGE model** for Ethiopia is used to simulate the impacts on various (sub)sector-specific economic outcomes for each shock scenario and derive corresponding changes in development outcomes from a linked microsimulation model, and
- 3) **Data mining and machine learning techniques** are applied to quantify the contributions of individual shock variables to the volatility of key economic and development outcomes that are then used to rank these risk factors and produce detailed risk profiles.

The selected economic outcomes are (1) the overall performance of the national economy, as measured by GDP per capita, and (2) private (or household) consumption, as measured by total consumer spending. The development outcome indicators are (3) the poverty headcount rate (measured at the official national poverty line and using per capita expenditure as proxy for income) and (4) the prevalence of undernourishment (i.e., the share of people with insufficient calories, interchangeably referred to as “hunger” in this brief). The results of our analysis are summarized in separate risk profiles that rank the risk factors by their relative importance for each of these four outcomes.

3. Structure of the National Economy

To accurately estimate the impact of shock scenarios, we require a reliable baseline representation of the economy. The objective here is twofold: first, to accurately capture the fundamental structure of the current economy in response to potential shocks, and second, to ensure this baseline incorporates the most recent suitable data available. In this context, our baseline for the Ethiopian economy is the structure presented in the 2019 Ethiopian Social Accounting Matrix (SAM), compiled by IFPRI (2023). Although more recent SAM data (e.g., 2021–2022) are available, we deliberately avoid using them. This decision reflects our judgment that the Ethiopian economy and its structural composition during that period had not yet fully recovered from temporary distortions caused by the COVID-19 pandemic and civil conflict, making these newer data unsuitable as a stable reference point for shock analysis. We intend to update our analysis as soon as more stable and representative data, such as the forthcoming 2024 SAM, becomes available.

Ethiopia is a low-income African country with a GDP per capita of 828.71 USD (in 2019), a national poverty headcount rate of 23.5% (in 2015), and an undernourishment rate of 20.7% (in 2019) (World Bank, 2024a). Accordingly, the sectoral structure is typical of low-income countries (Table 1). Primary agriculture accounts for a large share of economic activity (35.2 percent of GDP and 67.9 percent of employment). The manufacturing sector is relatively underdeveloped, with agroprocessing at 2.6 percent of GDP and other manufacturing at 3.2 percent of GDP. Manufacturing goods constitute the largest share of imports (76.3 percent), of which 6.1 percent is processed agricultural products (milled grains, processed fats and oils, etc.), while other industrial products account for 70.2 percent of the country’s total imports. Oilseed and beverage crops are the most export-intensive sectors (in terms of export share of output), but their share in the value of exports is much smaller when compared to services, making up 66.3 percent of the country’s total export (the majority being transport services).

On the demand side, the Ethiopian economy exhibits some distinct characteristics not typical for low-income countries (Figure 2). Notably, the country has a high share of investment demand (33.3 percent of GDP, primarily for construction goods and imported machinery), a significant share of net import expenditures (exports account for 6.4 percent of GDP, while imports represent 18.4 percent of GDP), and a substantial public sector, with government consumption expenditure amounting to approximately 9.3 percent of GDP.

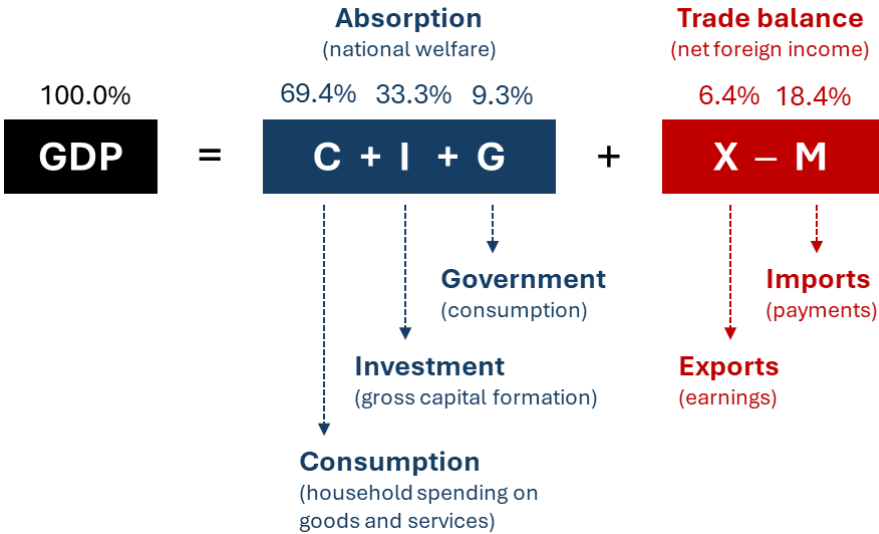
In sum, Ethiopia’s economy displays structural characteristics that predefines its vulnerability to both world market and domestic production shocks. However, a snapshot of the current economic structure does not provide sufficient detail. The SRP analysis, with its specification of exogenous shock sizes and economic linkages—captured in the CGE model—offers a more comprehensive foundation for developing Ethiopia’s economic risk profile.

Table 1. Composition of Ethiopian economy by sectors

	% of total GDP	% of employment	% of total demand	Export		Import	
				% of sectoral output	% of total export	% of sectoral demand	% of total import
Primary Agriculture	35.2	67.9	22.6	4.7	27.2	0.2	0.3
Crops	22.5	43.4	12.8	7.7	25.1	0.3	0.3
Cereals	12.9	25.0	8.6				
Oilseeds	1.0	1.9	0.1	83.2	12.0		
Beverage crops	0.8	1.5	0.4	51.5	8.5		
Livestock	9.7	18.7	7.0	1.2	2.1		
Forestry	2.9	5.6	2.6				
Fishing	0.1	0.2	0.2				
Mining	0.2	0.0	0.5	5.7	0.7	11.9	0.5
Manufacturing	5.9	4.2	19.1	2.5	5.8	52.8	76.3
Agroprocessing	2.6	2.1	5.9	2.2	2.9	13.7	6.1
Other manufact.	3.2	2.1	13.2	3.0	2.9	70.2	70.2
Utilities	0.8	0.1	2.1				
Construction	21.4	3.3	20.4			1.3	2.0
Services	36.6	24.4	35.3	6.5	66.3	7.8	20.9
Food services	2.5	1.2	2.3	4.2	3.0		
Social services	7.9	5.4	6.0	1.8	3.1	0.8	0.4
Other services	26.1	17.8	26.9	7.8	60.2	10.1	20.5
Total	100.0	100.0	100.0	4.0	100.0	13.2	100.0

Source: Own calculations based on official national accounts data as reported in the Ethiopian 2019 Social Accounting Matrix (IFPRI 2023).

Figure 2. Composition of Ethiopian economy by expenditure



Source: Own calculations based on official national accounts data as reported in the Ethiopian 2019 Social Accounting Matrix (IFPRI 2023).

4. Exogenous Shocks

In the first step of our SRP analysis, we use historical time-series data and data mining methods to simultaneously sample world market and domestic production shocks.

World market shocks consist of international commodity price shocks and foreign capital flow shocks. International commodity price shocks are changes in export and import prices of the goods and services in which Ethiopia trades. Volatility of these prices is typically driven by global economic and financial market conditions. Foreign capital flow shocks are changes in the flow of foreign capital into the national economy. These capital inflows (comprising foreign direct investment, government and private borrowing abroad, and central bank operations) finance Ethiopia's trade deficit.² The volatility of foreign capital inflows is influenced by both Ethiopia's attractiveness to foreign investors and global financial market conditions.

Domestic production shocks represent productivity changes in primary agriculture and hydropower electricity generation. These sectors are most susceptible to extreme weather events (particularly droughts and river floods in the case of Ethiopia) and other natural hazards (such as crop pest infestations and livestock diseases).³

The time-series data consists of 28 shock variables over the period of 1980 - 2023. These include international commodity prices, foreign capital flow, agricultural production activities, and power electricity generation.

All observations form the dataset from which we randomly sample 10,000 shock scenarios.⁴ These shock scenarios together provide a realistic representation of Ethiopia's economic volatility at the present and in the future, as they capture all possible combinations of all observed exogenous shocks, as well as the shocks' size and direction.

The procedure involves three steps:

- 1) **Trend Calculation:** for each shock variable, we calculate the long-term trend over the 44-years period that is represented by a smoothed curve (shown as a dashed blue line in the graphs of Figure 1).⁵
- 2) **Shock Derivation:** We derive the shocks for each variable by calculating the relative deviations of the annual observations from the long-term trend.
- 3) **Multivariate Estimation:** From the relative deviations of all shock variables, we estimate a multivariate normal distribution and sample 10,000 multivariate shock scenarios. By randomly drawing

² The link of foreign capital flows to international trade flows, as well as the implications of both flows for Ethiopia's exchange rate, relates shocks in foreign capital flows to international commodity price shocks, but the different mechanisms of the two shock categories make them distinct. We therefore combine international commodity price shocks and foreign capital flow shocks in our simulations of world market shocks but discuss the two shock categories and the related risks separately.

³ Domestic production shocks enter the CGE model as sector-specific total factor productivity (TFP) changes. We therefore use productivity metrics (e.g., agricultural yields) as TFP proxy indicators, whenever possible. For some (sub)sectors for which productivity metrics unavailable (that are meat and milk production, forestry, and hydropower electricity generation), we use per capita production as a proxy. See Mukashov et al. (2024) for details.

⁴ The configuration of our data mining exercise to 28 shock variables and 10,000 shock scenarios is chosen to balance tradeoffs between data availability and computational intensity. It ensures that shock sampling and scenario building are well-supported by the historical data while keeping simulation and post-simulation calculations computationally feasible.

⁵ To calculate the long-term trend, we use the Hodrick-Prescott filter for annual data (Hodrick & Prescott 1997). The resulting smoothed curve is less sensitive to short-term than long-term fluctuations.

shocks from this distribution (with assumed zero means and an estimated variance-covariance matrix), our analysis remains agnostic about future shocks, as the deviations found in the historical data are not strictly symmetric around zero.

Figure 3 shows the estimated marginal distributions for the 28 shock variables as box plots in Panel A, and the variables' correlation structure as heatmaps in Panel B. Hence, the graphs in Figure 3A compare the scales of the sample shocks, highlighting the most and least volatile shock variables, and the graphs in Figure 3B illustrate which shocks are most and least likely to occur at the same time. In the following, we discuss the results of the first step of our SRP analysis organized by shock category.

International commodity price shocks

Our analysis of international commodity price shocks, derived from data from World Bank (2024b) and other public databases, reveals *significant differences in volatility across sectors*. Primary commodities show particularly high volatility. Fertilizer, energy, and metal and mineral prices are most volatile (in respective order). Within agricultural commodities, prices of beverage crops (coffee, cocoa, and tea), followed by grain prices, are most volatile. In contrast, prices of manufactured goods and services exhibit greater stability (Figure 3A).

International price shocks for energy, metals and minerals, and fertilizers are strongly, positively correlated (Figure 3B), as global production of these commodities is interconnected. Energy and fertilizer are critical inputs into the production and processing of main agricultural crops such as grains and oilseeds, which explains the strong and positive correlation between the price shocks for these primary commodities. Similarly, the correlations between grain and oilseed price shocks and price shocks for livestock products (meat and milk and dairy products) are strong and positive, because grains and oilseeds are used for animal feed in addition to direct human consumption. Altogether the correlation patterns suggest that international price shocks are likely to affect multiple primary commodities simultaneously, which is mainly due to their joint dependence on global business cycles (Erten and Ocampo 2013). The international price shocks for all goods are negatively correlated with the international price shocks for services. Thus, when the prices of goods in global markets rise above their long-term averages, the price of services tends to drop below its long-term average. Price fluctuations for services, however, are small (Figure 3A).

Foreign capital flow shocks

For most years, Ethiopia has been faced with a current account deficit (Figure 1E), financed through inflows of foreign capital. For our analysis, we assume that these flows enter the economy as foreign savings denominated in foreign currency, influencing both the exchange rate and investment demand, particularly in the construction sector.

Based on current account data from IMF (2024), fluctuations in estimated foreign savings can reach up to \pm US\$ 5.0 billion around the long-term average, equivalent to about 4.9 percent of total GDP (Figure 3A). Despite the link between foreign capital flows and international trade flows, *correlations between shocks in foreign capital flows and international prices of traded commodities are weak for Ethiopia* (Figure 3B).

Domestic production shocks

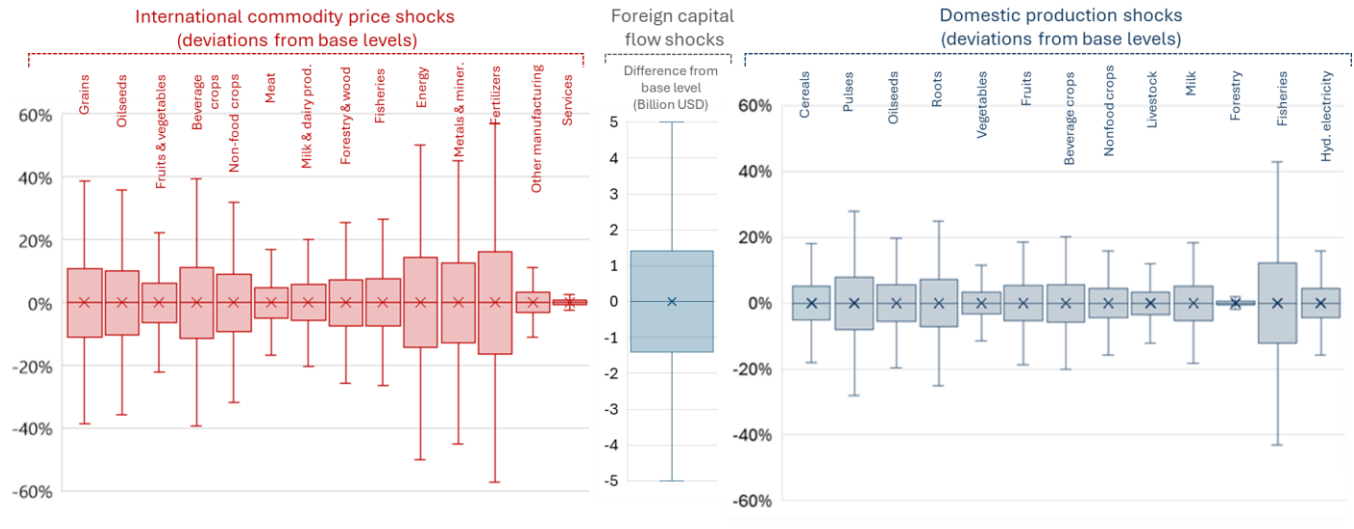
Based on agricultural production data from FAO (2024) and World Bank (2024a), the fisheries sector in Ethiopia has exhibited the highest production volatility, with annual variations of approximately \pm 40 percent relative to long-term averages (Figure 3A). This is followed by pulses (\pm 30 percent), roots (\pm 25 percent), and beverage crops (\pm 20 percent). However, it should be noted that these sectors are relatively small

in Ethiopia (Table 1), and unlike the significantly important cereals sector (whose yields can change ± 18 percent), their variation is unlikely to have a substantial impact on the overall economy or household welfare.

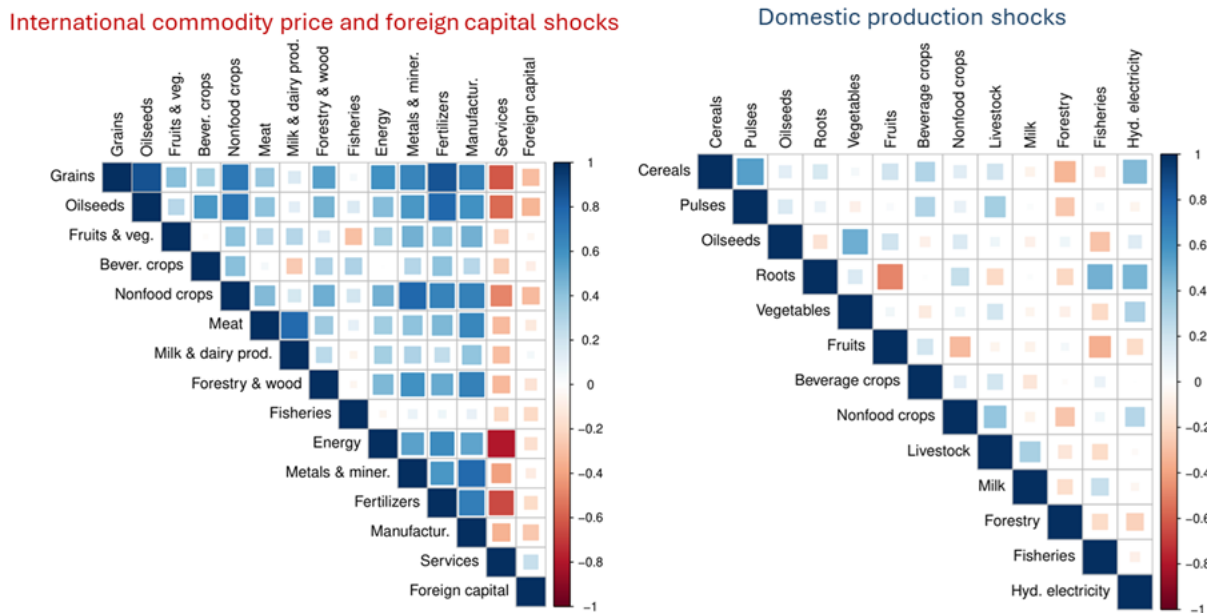
The correlations between the outputs of most studied domestic production activities are weak, with no clear directional pattern (Figure 3B). The only notable exceptions are moderate positive correlations between cereals and pulses as well as oilseeds and vegetables.

Figure 3. Descriptive statistics of the sampled shocks for all shock variables

A. Marginal distributions



B. Correlations



Note: The cells in the correlation heatmaps in Panel B show the strength and direction of the correlations between two variables. The sizes of the squares indicate the strength of the correlations, with non-colored cells indicating no or near zero correlations and full-colored cells indicating perfect or near perfect correlation. Blue-colored squares indicate positive correlations, and red-colored squares indicate negative correlations.

Because of missing data, the international prices for some commodities are approximated using related price indexes or prices of similar commodities as available from the World Bank's Commodity Price Outlook Database (World Bank 2024b): The grain price index is used as a proxy for cereal, pulse, root, and milled grain prices. Orange and banana prices are used as proxies for all fresh fruit and vegetable prices (while international vegetable prices are unavailable). Energy and metal price indexes are used as proxies for all energy and metal prices, respectively. For prices of all other (non-agricultural/energy/metal) manufacturing goods, the manufacturing unit value index is used as a proxy. Additionally, the United States consumer price index for services from FRED (2024) is used as price proxy for all internationally traded services in Ethiopia.

Source: Own calculation based on data from World Bank (2024a, 2024b), FRED (2024), FAO (2024), and IMF (2024).

5. Risk Profiles

In the second step of our SRP analysis, we feed the shock scenarios into an **economywide CGE model** for Ethiopia to simulate their impacts on various (sub)sector-specific economic outcomes.

We use IFPRI's standard CGE model, which forms part of the larger Rural Investment and Policy Analysis (RIAPA) modeling system (IFPRI 2025a). The model is calibrated to a Social Accounting Matrix (SAM) for Ethiopia for 2019 (IFPRI 2023; 2025b). The SAM has 46 separate domestic production activities and an equal number of separate commodity groups. A survey-based microsimulation module is linked to the CGE model to translate the simulation results into changes in household-level development outcomes such as poverty or undernourishment.

In the third step of the SRP analysis, we apply **data mining and machine learning** to:

- 1) Quantify how individual shocks contribute to volatility of our four key economic and development outcomes⁶
- 2) Rank risk factors by their importance for overall economic performance, private consumption, poverty, undernourishment

The resulting risk profiles are discussed in the following.

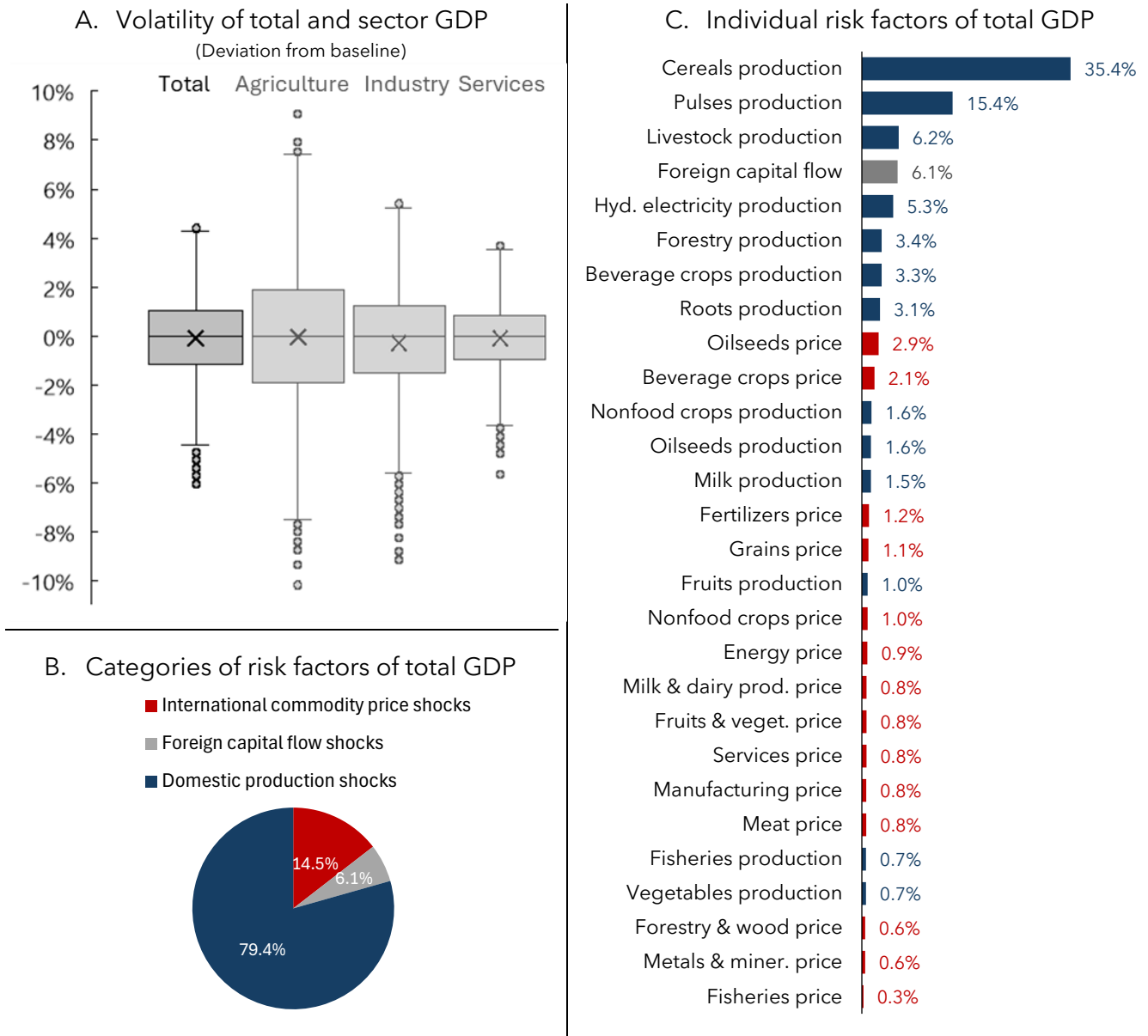
Risk profile for overall economic performance

The results of our SRP analysis show that exogenous shocks can lead to an increase of Ethiopia's total GDP by 4.6 percent from baseline in the *best-case scenario*, and a reduction by 6.1 percent in the *worst-case scenario* (Figure 4A) (the baseline reflects a situation in which exogenous shocks are absent). At the sector level, agriculture, directly exposed to productivity shocks, is the most volatile sector, with growth ranging from -10.2 percent to +9.2 percent relative to the sector's base year value.

The domestic production volatility of cereals and pulses are the *most significant risk factors*, accounting for 34.4 percent and 15.4 percent of total GDP volatility, respectively (Figure 4C). Overall, domestic production risks account for 79.4 percent of total GDP volatility, with external risks contributing the remaining 20.6 percent (world market prices account for 14.5 percent, and foreign capital flows for the remaining 6.1 percent) (Figure 4A).

⁶ We use relative importance methods by Lindeman et al. (1980) and Random Forest methods (Breiman 2001), as described in Mukashov et al. (2024) in detail.

Figure 4. Components of the risk profile for overall economic performance

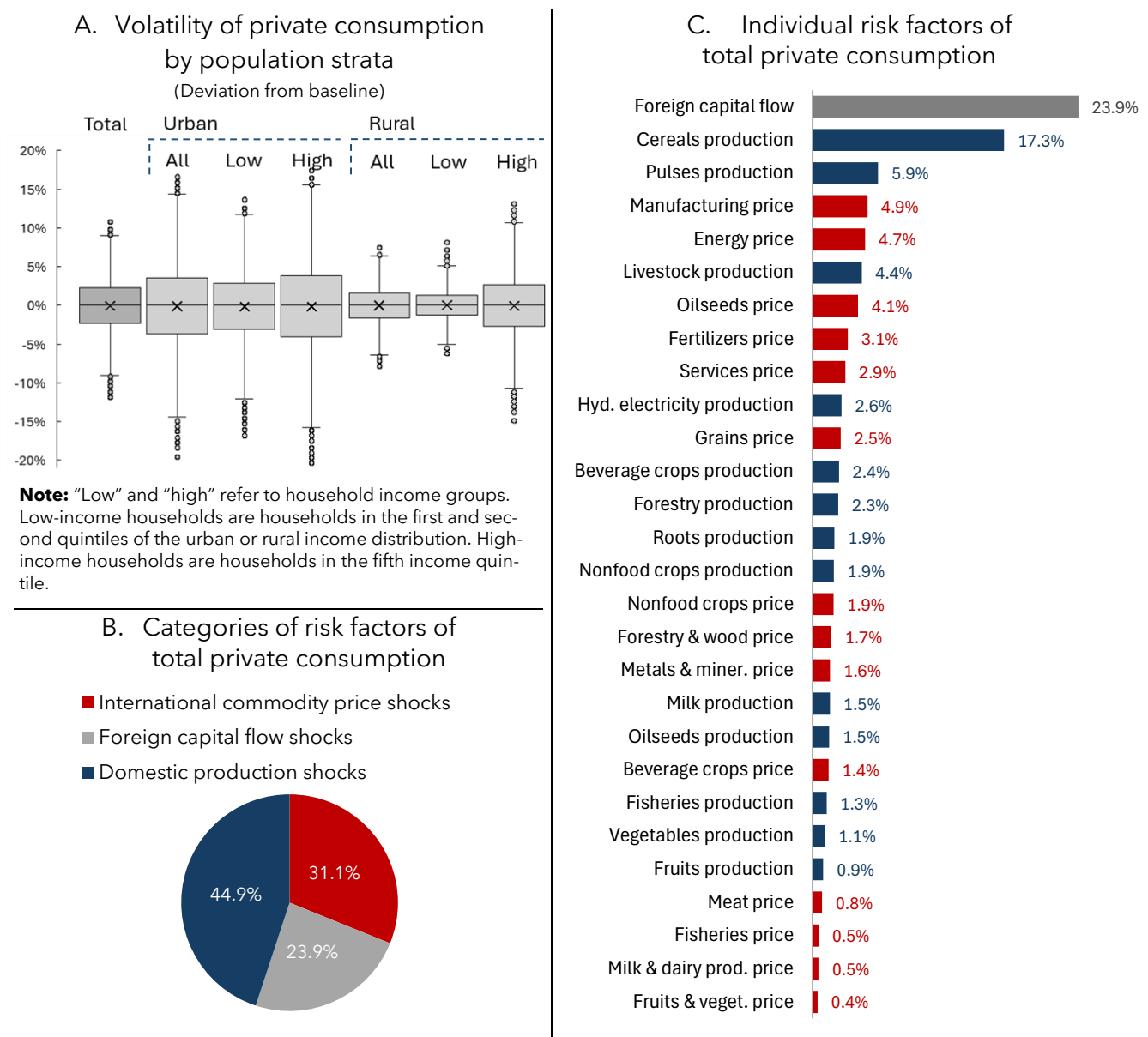


Note: The baseline reflects a situation in which exogenous shocks are absent.

Risk profile for private consumption

Total private consumption can fluctuate from +10.8 percent to -11.8 percent relative to base values (Figure 5A). Comparing standard deviations, private consumption in Ethiopia is twice as volatile as GDP, reflecting the higher trade dependency of household consumption. In total private consumption, *external risk factors dominate*, explaining two-thirds of the volatility (31.1 percent attributed to world prices and 23.9 percent to foreign capital flows, Figure 5B). Individually, the key risk factors for total private consumption are foreign capital flows (which affect the exchange rate and, therefore, import and export prices) and the yield volatility of staple crops, particularly cereals and pulses (Figure 5C). At the same time, urban consumption is more uncertain than rural consumption (for urban households, the range is from +16.6 percent to -19.5 percent, while for rural households, the range is ± 7.8 percent, Figure 5A). This disparity is explained by structural differences across household types (Table 2).

Figure 5 Components of the risk profile for private consumption



Note: The baseline reflects a situation in which exogenous shocks are absent.

For low- and middle-income urban households, domestic production volatility is a more significant risk factor, accounting for 58.8 percent and 54.2 percent of their consumption volatility, respectively (Table 2). High-income urban households, on the other hand, are more dependent on import prices, with external factors being the more important determinant of their consumption than domestic yields (57.6 percent for external factors versus 42.4 percent for domestic production). Cereal yield volatility is an important risk factor for all urban households, but its relative importance is highest for low-income (25.8 percent, 1st most important risk) and middle-income (22.5 percent, 1st most important risk), and lowest for high-income households (14.2 percent, 2nd most important risk after foreign capital flows). At the same time, the yield volatility of staple cereals is also significant risk factor for all rural households, but it is relatively less important for low- and middle-income rural households (12.4 percent for low-income and 12.5 percent for middle-income, which is half the level of their respective urban counterparts). Importantly, foreign capital flows, which influence the exchange rate of Birr, are the most significant risk factor for rural middle-income households. These households are engaged in farming export-oriented crops, making their incomes highly dependent on exchange rate fluctuations. Meanwhile, for rural high-income households, livestock production volatility represents an additional important risk factor, ranking as the third most significant factor after foreign capital flows and cereal yield volatility.

Table 2. Detailed decompositions of risk factors in consumption across household types

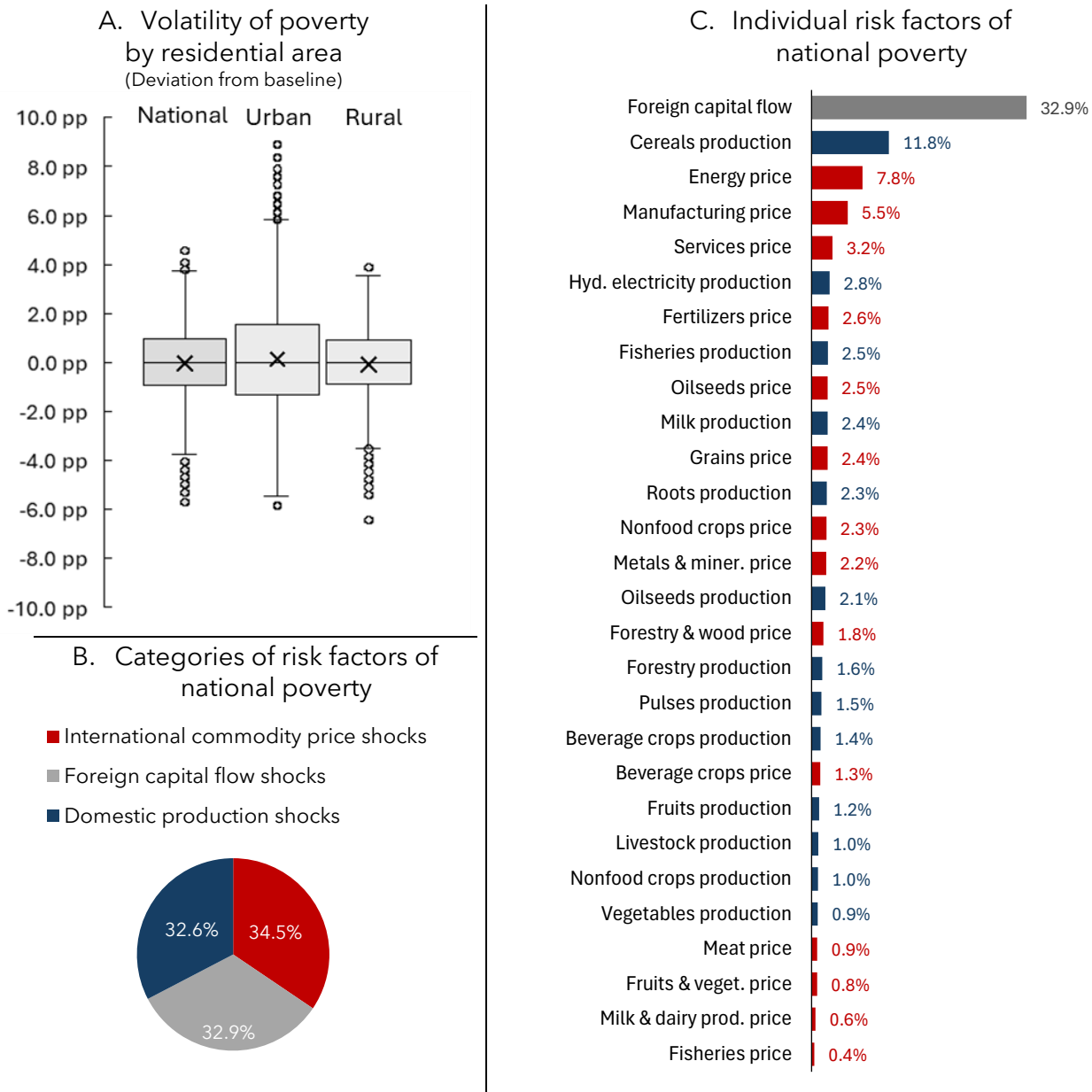
	Total	Urban				Rural			
		Total	Low	Middle	High	Total	Low	Middle	High
Total external	55.1	53.5	41.2	45.8	57.6	55.0	47.0	60.1	45.4
World prices									
Grains	2.5	2.5	2.0	2.1	2.7	2.4	1.3	2.8	2.4
Oilseeds	4.1	4.6	4.5	4.5	4.7	3.3	1.1	3.1	5.1
Fruits & vegetables	0.4	0.5	0.5	0.5	0.5	0.5	1.2	0.6	0.6
Beverage crops	1.4	1.5	1.8	1.6	1.5	1.3	1.2	1.2	1.7
Nonfood crops	1.9	1.9	1.3	1.5	2.1	1.8	1.0	2.1	1.7
Meat	0.8	0.9	0.7	0.7	1.0	0.8	0.6	0.8	0.8
Milk & dairy prod.	0.5	0.5	0.5	0.6	0.5	0.5	0.7	0.5	0.5
Forestry & wood	1.7	1.5	1.0	1.1	1.8	1.8	1.7	1.8	1.4
Fish	0.5	0.8	0.5	0.7	0.9	0.4	1.2	0.4	0.7
Energy	4.7	3.6	2.6	2.9	3.9	6.0	9.2	6.5	2.9
Minerals	1.6	1.3	0.9	1.0	1.4	1.9	2.4	2.3	1.2
Fertilizers	3.1	3.1	2.6	2.7	3.2	3.1	1.6	3.0	3.4
Manufacturing	4.9	5.1	3.5	4.0	5.6	4.6	2.8	4.9	4.0
Services	2.9	2.8	1.9	2.3	3.1	3.0	2.3	3.2	2.9
Foreign capital	23.9	23.0	17.0	19.5	24.7	23.6	18.8	26.8	15.9
Total domestic	44.9	46.5	58.8	54.2	42.4	45.0	53.0	39.9	54.6
Domestic productivity									
Cereals	17.3	17.0	25.8	22.5	14.2	16.5	12.4	12.5	17.2
Pulses	5.9	6.3	10.6	8.7	5.1	5.1	1.2	3.9	9.2
Oilseeds	1.5	1.2	1.2	1.2	1.2	1.8	2.1	2.0	1.1
Roots	1.9	0.8	1.4	1.0	0.7	4.4	7.0	6.1	1.5
Vegetables	1.1	1.0	0.8	0.9	1.0	1.2	0.8	1.4	1.1
Fruits	0.9	1.0	1.1	1.2	1.0	0.9	0.9	0.8	0.7
Beverage crops	2.4	2.7	2.8	2.8	2.5	1.9	0.7	1.7	2.8
Nonfood crops	1.9	2.1	1.4	1.8	2.3	1.6	0.7	1.4	3.0
Livestock	4.4	7.9	5.7	7.2	8.4	1.7	4.9	0.8	11.5
Milk	1.5	1.4	1.2	1.3	1.5	2.0	9.6	1.9	1.4
Forestry	2.3	2.2	2.9	2.6	2.0	2.3	2.1	1.6	2.4
Fisheries	1.3	0.8	0.7	0.6	0.9	2.0	5.4	2.3	0.6
Hyd. electricity	2.6	1.9	3.2	2.6	1.6	3.5	5.1	3.4	2.1

Note: "Low", "Middle" and "high" refer to household income groups. Low comprises the first- and second-income quintiles, middle comprises the third- and fourth-income quintiles, and high comprises the fifth income quintile of urban and rural households, respectively.

Risk profile for poverty

Poverty fluctuates with low-income households' consumption, ranging from -5.7 to +4.6 percentage points (Figure 6A) relative to the baseline national poverty headcount rate of 23.5 percent. In absolute numbers, this equates to 6.4 million people above the poverty line in the best case and 5.1 million below the poverty line in the worst case. Nationally, the most significant risk factor is the volatility of foreign capital flows (32.9 percent), followed by the domestic yield volatility of cereals (11.8 percent), and the world prices of energy (7.8 percent) (Figure 6C). At the same time, there are notable differences in poverty risk factors across household types (Table 3).

Figure 6. Components of the risk profile for poverty



Note: The baseline reflects a situation in which exogenous shocks are absent.

Most importantly, rural poverty in Ethiopia is more dependent on external factors (69.3 percent), with foreign capital flows playing a central role (33.5 percent, ranked as the most important risk). Total domestic production accounts for only 30.4 percent, with the yield volatility of staple cereals being the biggest domestic risk (8.0 percent). Urban poverty, in contrast, is equally influenced by domestic and external factors (49.7 percent external factors, 50.3 percent domestic factors). While foreign capital flows are the most significant risk for urban poverty, their relative importance is much lower than for rural poverty (22.0 percent for urban households compared to 33.5 percent for rural households). This difference is because both expenditures and incomes of rural households are more directly tied to the exchange rate of the Birr, which in turn, in our model depends on foreign capital flows. Any change in the exchange rate significantly affects not only the expenditures of rural households on imported goods but also incomes of export-oriented farmers. At the same time, the volatility of domestic yields of cereals and pulses is much more important for the urban poor than for the rural poor. This is because urban households, unlike rural households, are net cereal consumers, and their incomes are not offset by higher prices when yields are low.

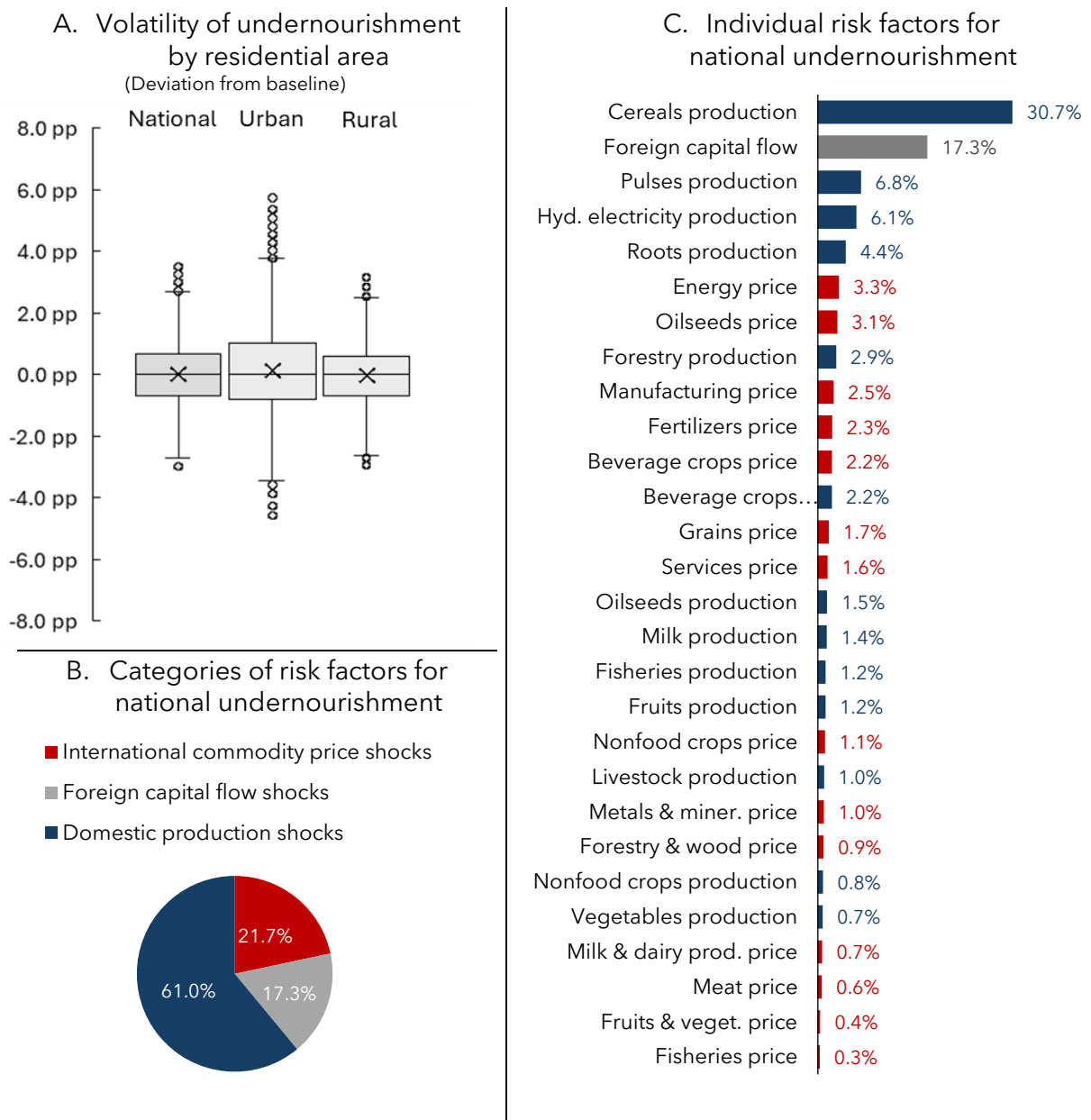
Table 3. Detailed decompositions of risk factors in poverty and undernourishment across household types

	Poverty			Undernourishment		
	National	Urban	Rural	National	Urban	Rural
Total external	67.4	49.7	69.6	39.0	34.2	40.0
Grains	2.4	2.4	2.3	1.7	1.7	1.7
Oilseeds	2.5	4.5	1.9	3.1	4.5	2.6
Fruits & vegetables	0.8	0.4	1.2	0.4	0.4	0.5
Beverage crops	1.3	1.6	1.5	2.2	2.6	2.1
Nonfood crops	2.3	1.6	2.5	1.1	1.1	1.1
Meat	0.9	0.8	0.9	0.6	0.6	0.7
Milk & dairy prod.	0.6	0.5	0.7	0.7	0.8	0.6
Forestry & wood	1.8	1.2	1.9	0.9	0.8	1.0
Fish	0.4	0.7	0.5	0.3	0.5	0.4
Energy	7.8	3.2	9.1	3.3	1.7	3.9
Minerals	2.2	1.1	2.6	1.0	0.7	1.1
Fertilizers	2.6	2.8	2.4	2.3	2.3	2.2
Manufacturing	5.5	4.5	5.4	2.5	2.3	2.5
Services	3.2	2.3	3.3	1.6	1.3	1.6
Foreign capital	32.9	22.0	33.5	17.3	12.9	18.1
Total domestic	32.6	50.3	30.4	61.0	65.8	60.0
Cereals	11.8	21.8	8.0	30.7	32.7	28.7
Pulses	1.5	8.0	0.8	6.8	11.2	5.4
Oilseeds	2.1	1.3	2.3	1.5	1.0	1.6
Roots	2.3	1.2	2.7	4.4	1.6	5.6
Vegetables	0.9	0.9	0.9	0.7	0.6	0.8
Fruits	1.2	1.2	1.1	1.2	1.2	1.2
Beverage crops	1.4	2.7	1.0	2.2	3.0	1.9
Nonfood crops	1.0	1.5	0.8	0.8	1.3	0.8
Livestock	1.0	4.4	2.5	1.0	4.1	1.7
Milk	2.4	1.5	3.1	1.4	1.0	1.6
Forestry	1.6	2.4	1.3	2.9	3.2	2.7
Fisheries	2.5	0.7	3.3	1.2	0.5	1.6
Hyd. electricity	2.8	2.7	2.6	6.1	4.3	6.5

Risk profile for undernourishment

Undernourishment rate can fluctuate from -3.0 to +3.5 percentage points (Figure 7A) relative to the baseline national undernourishment rate of 20.7 percent. This translates to 3.3 million people above the undernourishment line in the best case and 3.9 million below in the worst-case scenario. Unlike poverty, undernourishment uncertainty is similar across households and is primarily driven by a narrow set of risk factors. Cereal yield volatility is the most significant risk factor for all households, followed by foreign capital flows (which determine price of imported food) and the yield of pulses (Figure 7C). Since the production of staple cereals and pulses, along with imported processed food, drives calorie supply in Ethiopia, it is unsurprising that these are the key risk factors for the nation's undernourishment level.

Figure 7. Risk profile for undernourishment



Note: The baseline reflects a situation in which exogenous shocks are absent.

6. Conclusions

Achieving development goals—like becoming a higher middle-income country or ending poverty and hunger by 2030—is subject to economic uncertainties. Yet policymaking rarely incorporates risk assessments, relying instead on deterministic trend projections.

To address this gap, inform national development strategies, and complement standard economic projections, *Systematic Risk Profiling* (SRP) provides a novel approach integrating CGE modeling, household microsimulation, and machine learning. Our SRP exercise for Ethiopia assesses the risks from exogenous shocks for the national economy and population and simulates the potential impacts of these shocks on the country's overall economic performance, private consumption, poverty, and undernourishment.

The results of our SRP analysis for Ethiopia indicate that domestic production volatility is the primary risk factor for GDP and undernourishment. External risks, particularly the volatility of foreign capital flows, play a central role in determining the exchange rate and, consequently, have significant implications for the country's exports and imports. In this context, foreign capital flows are pivotal in shaping households' consumption of imported commodities and the incomes of export-oriented farmers. Among domestic risk factors, the yield volatility of cereals stands out as the most important, influencing consumption, poverty, and undernourishment of both urban and rural households.

The analysis presented in this Country Brief provides an initial assessment of major economic risks in Ethiopia. Understanding these risks is a critical first step in facilitating discussions on potential risk management strategies such as promoting domestic productivity growth, adopting technologies and practices for reducing production uncertainty, and diversifying economic activity away from high-risk sectors. A next step would be for national policymakers or advisors to evaluate alternative risk management strategies

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Acknowledgments

This work was undertaken as part of the "Future Food Systems" project funded by the International Affairs Office at the Presidential Court of the United Arab Emirates and the Gates Foundation. The modeling and data systems and analytical techniques were developed with financial support from the CGIAR Science Program on Policy Innovations. We thank all funders who contribute to the CGIAR Trust Fund.

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