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ZAMBIA

Systematic Analysis of Domestic Production and World Market 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 in countries and across key population groups to answer two questions: (1) What is the country's current vulnerability to world market prices and domestic production risks that are consistent with historical data? (2) How much do these shocks contribute to the country's current vulnerability, and which shocks contribute most to economic uncertainty?

Abstract

This study explores Zambia's vulnerability to economic shocks and identifies those contributing most to economic uncertainty. The Zambian Computable General Equilibrium (CGE) model was employed to simulate a range of potential economic outcomes under various sampled shock scenarios developed using historical data on domestic agricultural yield volatilities and world market prices for traded goods. Data mining and machine learning methods were applied to quantify the contribution of each shock to the uncertainty of these outcomes. We find that Zambia's economy is predominantly exposed to external risks, with foreign capital flows and world market price volatility together accounting for approximately three-fourths of potential variations in GDP, private consumption, poverty, and undernourishment. Domestic agricultural yield volatilities contribute the remaining one-fourth. The current structure of the Zambian economy underpins these results. While agriculture is the most uncertain sector, its relatively small contribution to GDP limits its economywide and macroeconomic impacts. Instead, export earnings from copper and foreign exchange capital flows play a much more significant role in shaping Zambia's economic risks and their social and economic impacts. Understanding how potential shocks might impact various segments of the Zambian economy and population is a critical first step in facilitating a discussion on risk mitigation strategies that include increasing sectoral productivity or diversifying production to reduce reliance on high-risk sectors.

Keywords: risk profiling; yield volatility; world market uncertainty; CGE modeling, machine learning.

1. Analyzing the impacts of simultaneous variability of exogenous shocks

Zambia is a highly natural resource-dependent country, and its numerous economic challenges are closely tied to this economic structure. A brief overview of the historical dynamics of the country's key indicators is presented in Figure 1. Key features of these dynamics are outlined below (based on the Systematic Country Diagnostic by the World Bank, 2018).

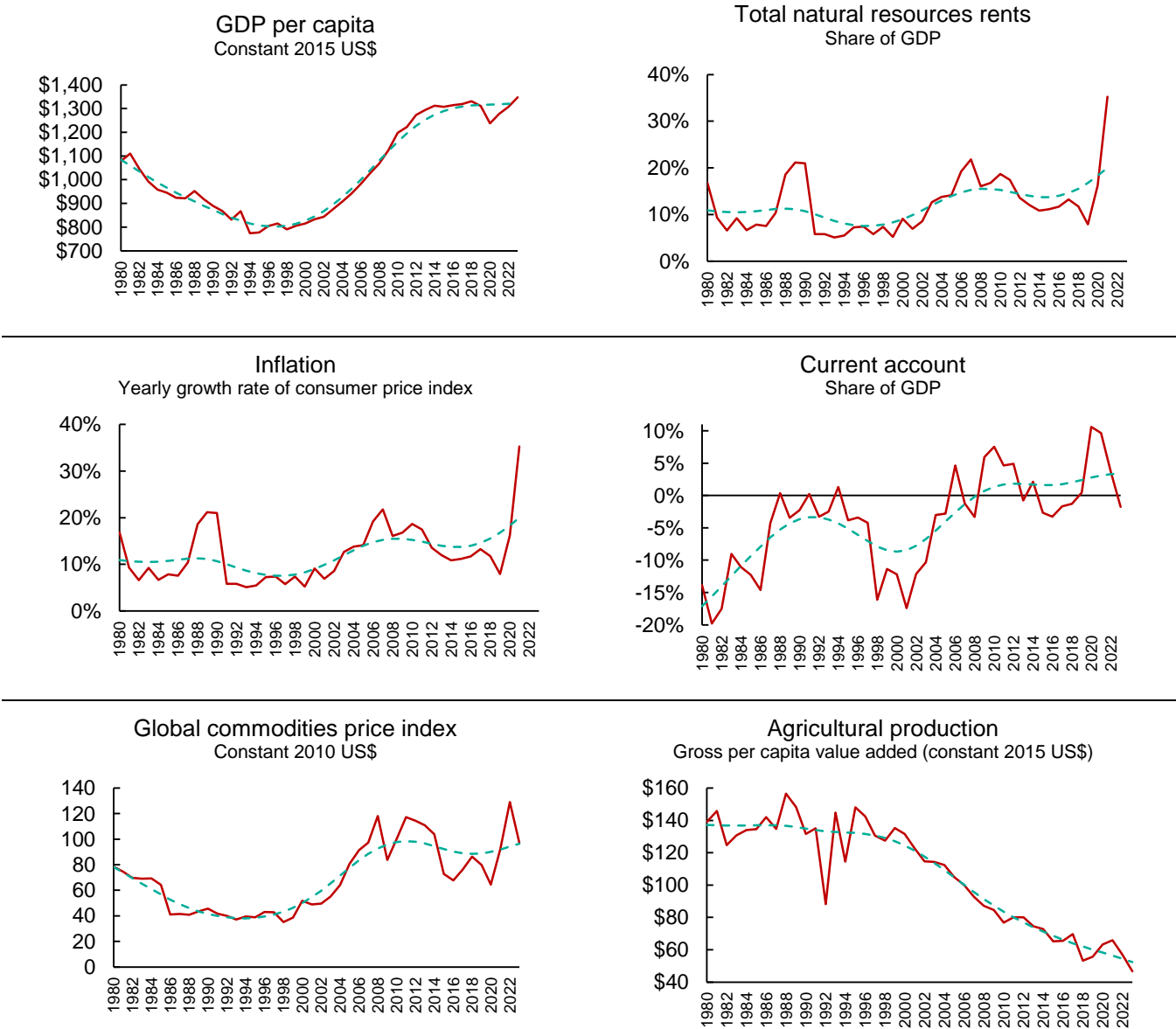
- **Reliance on natural resources:** Historically, Zambia's economy has relied heavily on the copper sector. Following independence, the government began nationalizing this industry, culminating in the establishment of Zambia Consolidated Copper Mines in 1982, which centralized control under state ownership. At the same time, in response to persistent economic challenges in the mid-1980s, Zambia entered a series of structural adjustment programs with the IMF and the World Bank.
- **Recent commodity boom:** The privatization of the copper sector in the late 1990s, combined with a global commodities boom in the early 2000s, led to increased foreign investment in the copper industry. This investment helped drive an economic revival, reversing the declining GDP per capita trend. From 2004 until 2014, GDP grew at 7.4 percent per annum.
- **Current macroeconomic instability:** The global decline in copper prices after 2014 severely impacted Zambia's export earnings, government revenues, and foreign direct investment. During the copper boom, Zambia financed ambitious public investment programs in infrastructure, health, and education through extensive external borrowing. This borrowing continued even after the decline in copper prices, eventually leading to unsustainable fiscal deficits and a recent foreign debt crisis.
- **Agriculture:** Agricultural productivity in the country has been steadily declining. Similar to other non-mining sectors, agriculture faces structural constraints such as inadequate infrastructure and weak land tenure systems. At the same time, it remains vulnerable to frequent droughts and floods, which explains its short-term volatility.

In addition to long-term developmental challenges such as governance, institutions, infrastructure, and demographic and social factors—common obstacles faced by many less developed countries—exogenous risks including world market price volatility and agricultural shocks remain highly significant for the Zambian economy. In this context, our goal is to create a realistic map of the country's exogenous shocks and develop a detailed risk profile of the country's baseline economic structure. The methods and analyses used in this note seek to answer two questions:

- What is the country's current vulnerability to world market prices and agricultural risks that are consistent with *historical data*?
- How much do these shocks contribute to the country's current vulnerability, and which shocks contribute most to economic uncertainty?

To answer these and related questions, we use a novel methodology for country Systematic Risk Profiling (SRP). The method uses machine-learning and data-mining techniques to dissect complex relationships between sampled shocks and outcome variables in an economywide Computable General Equilibrium (CGE) model constructed for Zambia. Our SRP approach consists of three sequential steps: (1) we first use historical data and sample scenarios that sufficiently and realistically represent the parameter space of potential exogenous shocks; (2) we then create potential shock scenarios and supply them to the CGE model of Zambia to estimate the economic outcomes corresponding to sampled shock scenarios; and (3) we use machine-learning and data-mining methods to quantify the contribution of each shock to the uncertainty of various economic outcomes. For details on SRP, see Mukashov et al. (2024).

Figure 1. Historical dynamics of key indicators (long term trend line in dashed blue)



Note: Trend calculation using Hodrick–Prescott filter for yearly data (see Hodrick and Prescott 1997).
Source: Own calculations using World Bank (2024a) data (GDP per capita, natural resources rents, agricultural production), IMF (2024) data (inflation, current account) and World Bank (2024b) data (global commodities price index).

2. Current economic structure and shock scenarios

2.1 The Structure of the Zambian Economy

As a lower middle-income country (LMIC), Zambia's GDP per capita was 1,268 USD in 2019 (World Bank, 2024a), remaining around this level in recent years. Zambia's national poverty and undernourishment¹ rates are high: according to the most recent household survey in 2015, the national poverty rate was 54.4 percent and the national undernourishment rate in 2019 was 29.2 percent (World Bank, 2024a). Considering the stagnation of GDP per capita after 2015, as shown in Figure 1, national poverty and undernourishment rates are likely to have remained high in subsequent years.

The structure of Zambia's economy presented in Table 1a shows features common to both LMICs and natural resource-dependent countries. In particular, the mining sector (mainly copper) made up a significant share of GDP (15.3 percent) while accounting for only 2.2 percent of total employment. At the same time, the share of primary agriculture in GDP of 3.1 percent is much smaller than that of other countries with similar income levels. This figure is likely an underestimate—especially since over one-third of the labor force (37.3 percent) is employed in agriculture—even considering Zambia's rapid urbanization. Due to data constraints, we rely on these official figures, but we note that this may lead to underestimation of the importance of domestic yield volatility for the entire economy. In turn, the agroprocessing sector, at 2.9 percent of total GDP, is relatively large compared to primary agriculture, but demand for processed agricultural products (5.8 percent of total demand) still surpasses domestic production capacity. Many processed foods rely on imports, which account for 7.5 percent of total imports—the third-largest import category after non-food manufacturing and services. The manufacturing sector (including agroprocessing) is underdeveloped, contributing 7.3 percent to total GDP, with copper smelting accounting for 2.1 percent of GDP. Smelted copper is Zambia's most important export product, making up 81.9 percent of the country's exports. On the other hand, most non-food manufacturing products—such as petroleum and machinery—are largely imported (other manufacturing is 67.0 percent of total imports).

On the demand side (Table 1b), Zambian economy exhibits several distinct features. First, the country has a large share of investment demand (39 percent of GDP, primarily construction and imported machinery). Second, the economy is highly trade-intensive, with exports at 28 percent of GDP (mainly copper) and imports at 27 percent of GDP (mainly industrial goods). These two factors reduce the share of consumption expenditure to only 41 percent of GDP. Finally, the country has a large public sector, with government consumption expenditure accounting for about 18 percent of GDP.

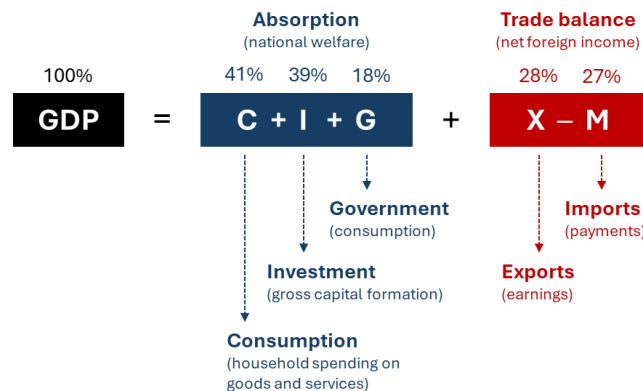
¹ Share of the population whose adult-equivalent daily consumption below the minimum calorie requirement defined by the Food and Agriculture Organization of the United Nations.

Table 1. Structure of Zambia’s Economy

a. Sectoral decomposition

	% of total GDP	% of employment	% of total demand	Export		Import	
				% of sectoral output	% of total export	% of sectoral demand	% of total import
Primary Agriculture	3.1	37.3	3.2	5.3	1.3	4.5	0.9
Crops	1.4	17.1	1.1	15.1	1.3	11.0	0.8
Cereals	0.6	6.8	0.5	14.4	0.5	9.2	0.3
Roots	0.2	2.8	0.2			3.4	0.0
Vegetables	0.2	2.1	0.2	4.8	0.1	8.8	0.1
Non-food crops	0.1	1.6	0.1	57.0	0.5	32.1	0.1
Livestock	0.8	9.7	1.0				
Forestry	0.3	3.7	0.4				
Fishing	0.6	6.8	0.6			3.5	0.2
Mining	15.3	2.2	3.8	7.3	1.9	23.3	6.1
Manufacturing	7.3	4.5	31.5	46.3	87.9	53.6	74.6
Agroprocessing	2.9	2.2	31.5	9.2	3.5	21.4	7.5
Metals	2.1	1.1	2.9	78.9	81.9		
Other manufact.	2.3	1.2	22.8	4.3	2.5	68.6	67.0
Utilities	3.2	0.5	3.1				
Construction	11.9	1.7	13.5				
Services	59.1	53.7	44.9	2.7	9.0	5.3	18.4
Food services	0.8	2.1	0.4	24.6	1.1		
Social services	11.4	10.0	11.6	0.8	0.7	1.1	1.0
Other services	47.0	41.5	32.8	3.1	7.2	6.8	17.5
Total	100.0	100.0	100.0	12.9	100.0	20.3	100.0

b. GDP decomposition by expenditure



Source: Own calculations based on official national accounts data for 2019 presented in the form of the Social Accounting Matrix (for details, see IFPRI 2021).

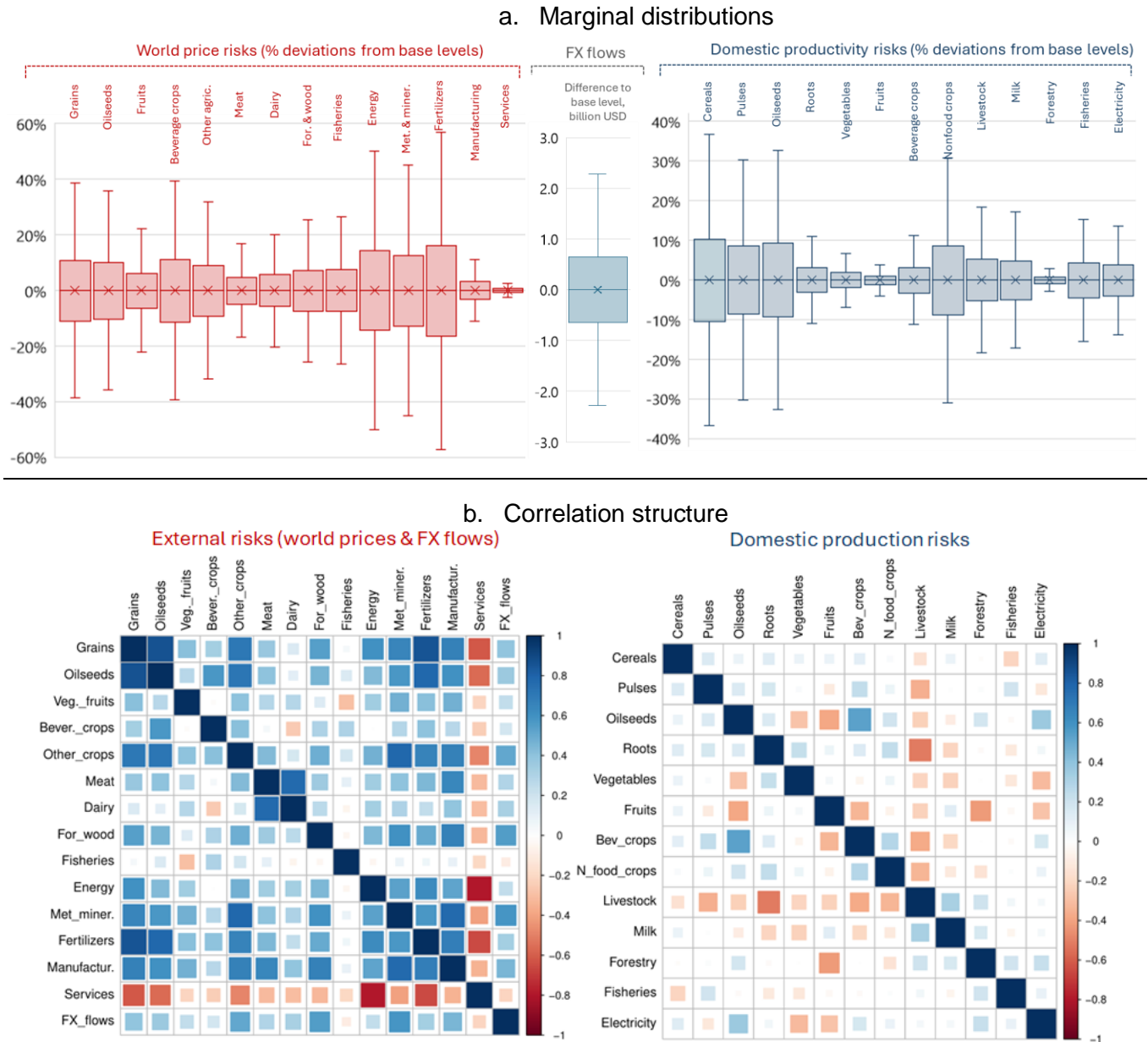
2.2 Characteristics of sampled shocks

In this context, the first step of the SRP—estimating the historical volatility of shocks—helps us understand the scale of potential shocks that the *current* Zambian economy faces. We consider two broad categories of shocks: (1) changes in world prices of goods and services in which Zambia trades and that are mostly affected by global business cycles; and (2) abrupt shifts in domestic production², often linked to droughts and other natural shocks such as pest infestations and diseases. Although the variation of shocks around historical trends is not strictly symmetric around zero, we remain agnostic about *future* shocks. We draw random hypothetical scenarios from a multivariate normal distribution with zero means

² Whenever possible, we use yields agricultural yield as a measure of productivity. For some sectors where historical yield data do not exist (livestock, milk, forestry, electricity), we use historical per capita production as a proxy for total factor productivity (see Mukashov et al. (2024) for details).

and a history-based estimated variance-covariance matrix depicted in Figure 2 (panel A shows the modeled individual (marginal) distributions of sampled shocks, and panel B shows correlation structure of sampled shocks).

Figure 2. Sampled risks



Note: Each cell in the correlation figure is a correlation between two variables, with cell sizes ranging from empty (0 correlation) to full squares (max correlation=1) and colors ranging from red (-) to blue (+).

Source: Own calculations using World Bank (2024a, 2024b), FAO (2024), and IMF (2024) data.

World price volatility: World prices of primary commodities are highly volatile, whereas manufactured goods and services exhibit much greater stability (Figure 2a). Among agricultural commodities, beverage crop prices are the most volatile, followed by grains. The prices of primary commodities show a strong positive correlation (Figure 2b), suggesting that price shocks often occur simultaneously due to their dependence on global business cycles (see Erten and Ocampo, 2013). In contrast, services exhibit a

moderate negative correlation with most commodities, suggesting that when the prices of other commodities rise in real USD terms, the price of services in real USD may sometimes decline (however, the overall variation in service prices remains very low, see Figure 2a).

Volatility of FX flows: We assume that foreign exchange (FX) flows enter the economy as foreign savings denominated in USD, influencing both the exchange rate and investment demand (primarily in construction). To estimate changes in FX flows, we use current account data from the IMF (2024), which indicates that FX flows deviate by approximately ± 2.3 billion 2019 USD (equivalent to 9.8% of 2019 GDP).

Domestic production volatility: According to our analysis based on FAO data (2024), the yields of cereals, pulses, oilseeds and non-food crops historically have been the most uncertain (Figure 2a).

3. Measuring and understanding Zambia's economic uncertainty

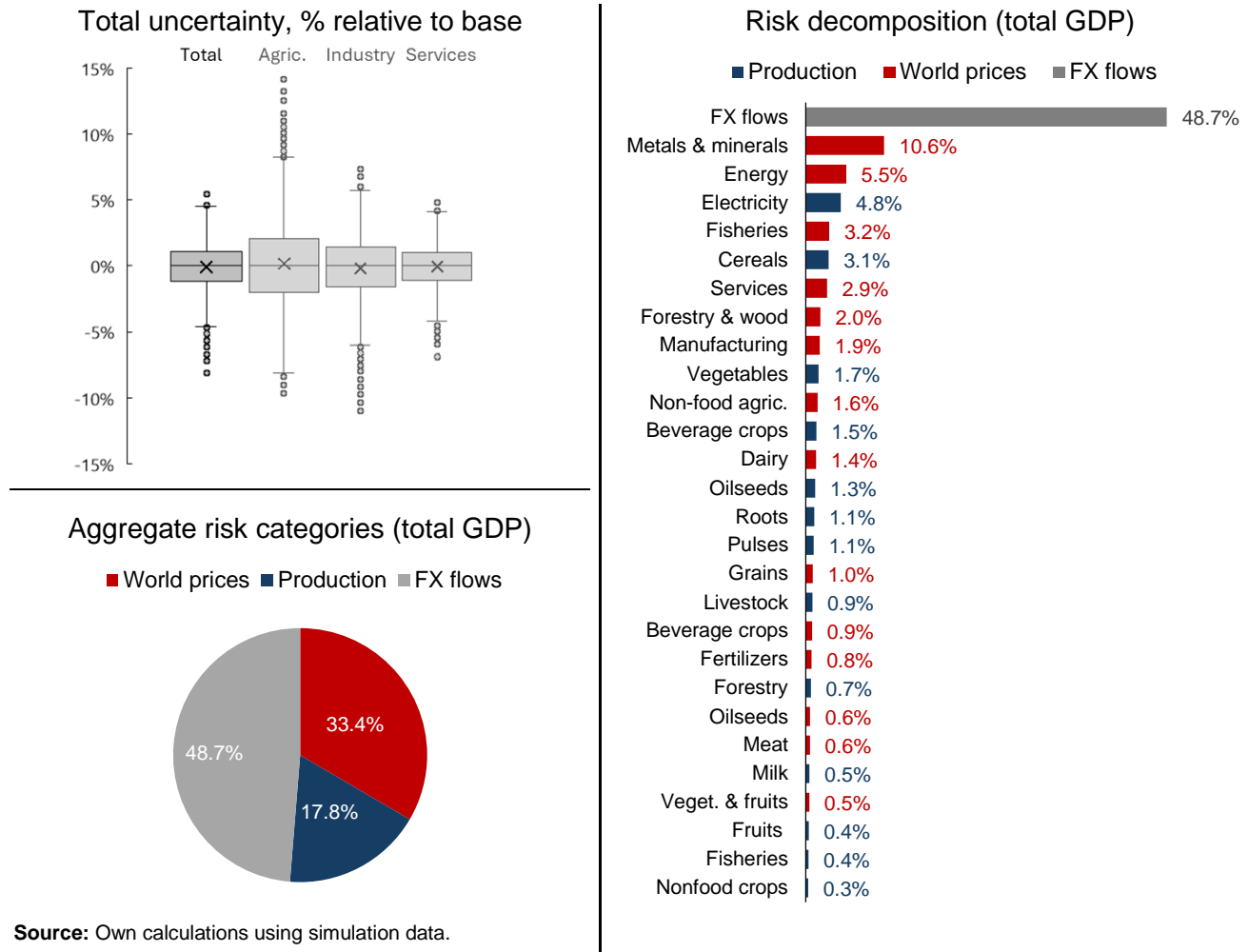
The second step of the SRP models the economic uncertainty resulting from the 10,000 sampled scenarios supplied to the CGE model of Zambia, while the third step employs machine-learning and data-mining methods to quantify each shock's contribution to outcomes' uncertainty³. Figures 3 to 6 represent the total uncertainty and its decomposition for GDP, private consumption, poverty, and undernourishment economic outcomes, respectively.

Potential variation of GDP (Figure 3): Total GDP can fluctuate between -8.1 percent (worst-case scenario) and +5.5 percent (best-case scenario) relative to base year GDP. Agriculture, which is directly exposed to the exogenous domestic productivity shocks (measured in yield volatility), is the most uncertain sector, with the potential growth rate ranging from -9.7 to +14.2 percent relative to the sector's base-year GDP. However, since agriculture constitutes only 3.1 percent of GDP, yield volatilities have a limited impact on the potential variation of total GDP.

Among the exogenous shocks, the largest contributor to GDP uncertainty is FX capital flows, accounting for 48.7 percent of total GDP uncertainty. This high importance stems from the structure of Zambia's economy (Table 1b). FX capital flows finance domestic investment, which represents 39 percent of GDP, and affect the exchange rate, which is a critical factor in Zambia's trade-intensive economy. Shocks from world market prices account for 33.4 percent of the potential uncertainty in the country's GDP, with world market prices for metals and minerals (proxy for copper prices) being the most significant risk factor (10.6 percent). Lastly, shocks from domestic production risks contribute 17.8 percent of total GDP uncertainty, with shock in the electricity sector being the largest domestic risk contributor (4.8 percent).

³ We use Random Forest and Lindeman, Merenda, and Gold relative importance metrics; for details, see Mukashov et al. (2024).

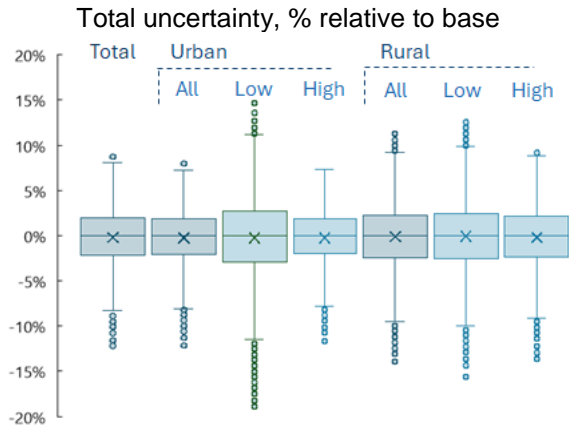
Figure 3. Potential variation of GDP



Potential variation of private consumption (Figure 4 and Table 2): Private consumption is more uncertain than GDP, with total consumption fluctuating from -12.2 to +8.7 percent relative to its base values. Comparing standard deviations, total private consumption is 1.8 times more uncertain than total GDP. In turn, consumption of low-income households is the most uncertain, indicating that they are the most vulnerable to economic shocks.

Similarly to the GDP uncertainty, the consumption risk is also highly affected by the structure of Zambia's economy. Given the high trade intensity of the economy (Table 1b), it is unsurprising that external factors are more important sources of consumption risk than domestic factors. World market prices and FX capital flow volatility together account for 75.6 percent of total consumption uncertainty. Individually, prices for dominant export products—world prices of metals and minerals (proxy for copper) and for other agriculture (proxy for tobacco and cotton)—as well as FX capital flow volatility (which affects the exchange rate) are the most important risk factors. Aggregate domestic yield volatility contributes only 24.4 percent to total consumption uncertainty, and cereal yield volatility is the most important domestic risk factor for all households.

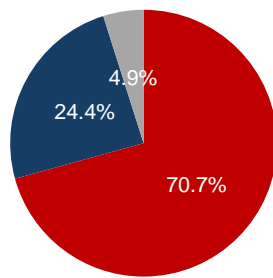
Figure 4. Potential variation of private consumption



Note: Low comprises the first- and second-income quintiles and high comprises the fifth income quintile of urban and rural households, respectively.

Aggregate risk categories
(total consumption)

■ World prices ■ Production ■ FX flows



Source: Own calculations using simulation data.

Risk decomposition
(total consumption)

■ Production ■ World prices ■ FX flows

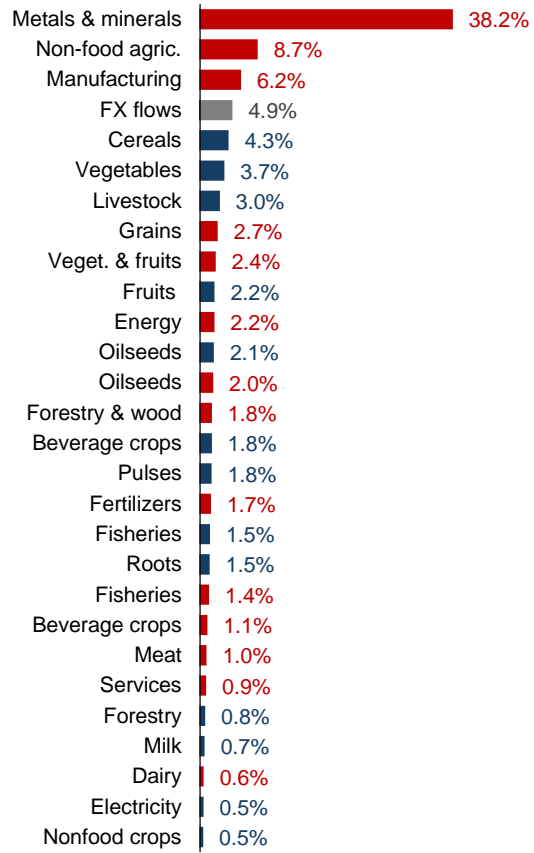


Table 2. Detailed risk decompositions of consumption uncertainty

	Total	Urban				Rural			
		Total	Low	Middle	High	Total	Low	Middle	High
Total external	75.6	77.0	68.6	73.4	78.4	73.6	74.9	73.6	73.6
World prices									
Grains	2.7	2.8	1.3	2.3	2.9	2.1	2.0	2.2	2.2
Oilseeds	2.0	2.0	1.2	1.6	2.1	1.8	2.3	1.9	1.6
Vegetables & fruits	2.4	2.4	1.1	2.0	2.6	1.9	1.2	2.0	2.3
Beverage crops	1.1	1.0	1.6	0.9	1.0	1.4	2.5	1.3	0.9
Other agriculture	8.7	9.0	4.4	7.1	9.4	6.8	5.2	6.7	7.9
Meat	1.0	1.1	0.7	1.0	1.2	0.7	0.7	0.7	0.9
Dairy	0.6	0.7	0.7	0.6	0.7	0.8	1.6	0.8	0.5
Forestry & wood	1.8	2.2	1.4	1.7	2.4	1.6	2.1	1.6	1.5
Fish	1.4	1.2	1.9	1.4	1.1	1.8	2.1	1.8	1.5
Energy	2.2	2.2	1.6	2.1	2.3	1.9	2.1	1.9	1.9
Metals & minerals	38.2	39.2	28.0	37.0	39.0	29.7	20.8	29.1	37.0
Fertilizers	1.7	1.7	1.0	1.5	1.8	1.2	1.0	1.2	1.5
Manufacturing	6.2	7.0	3.7	6.1	7.1	3.7	2.4	3.7	5.3
Services	0.9	1.0	0.7	0.8	1.0	0.8	0.8	0.8	0.8
FX flows	4.9	3.6	19.4	7.3	3.7	17.2	28.1	17.9	7.7
Total domestic	24.4	23.0	31.4	26.6	21.6	26.4	25.1	26.4	26.4
Domestic production									
Cereals	4.3	4.0	4.7	3.6	3.9	4.7	5.1	4.5	4.0
Pulses	1.8	1.8	2.3	2.0	1.7	1.4	1.0	1.4	1.9
Oilseeds	2.1	2.4	1.8	2.5	2.3	1.4	1.3	1.5	1.2
Roots	1.5	1.2	2.5	1.6	1.0	2.2	2.8	2.0	1.8
Vegetables	3.7	3.1	4.8	3.5	2.9	4.9	5.4	5.0	3.6
Fruits	2.2	2.3	1.8	2.4	2.2	1.7	1.1	1.7	2.2
Beverage crops	1.8	1.6	1.9	2.1	1.4	2.2	2.5	2.3	1.7
Nonfood crops	0.5	0.6	0.3	0.5	0.6	0.3	0.2	0.3	0.4
Livestock	3.0	2.6	4.1	3.0	2.4	3.8	3.3	3.7	3.8
Milk	0.7	0.7	4.3	2.2	0.4	0.6	0.2	0.6	1.3
Forestry	0.8	0.9	0.7	0.7	1.0	0.7	0.8	0.7	0.7
Fisheries	1.5	1.3	1.7	1.6	1.2	2.1	0.9	2.2	3.3
Electricity	0.5	0.5	0.7	0.8	0.5	0.5	0.6	0.5	0.5

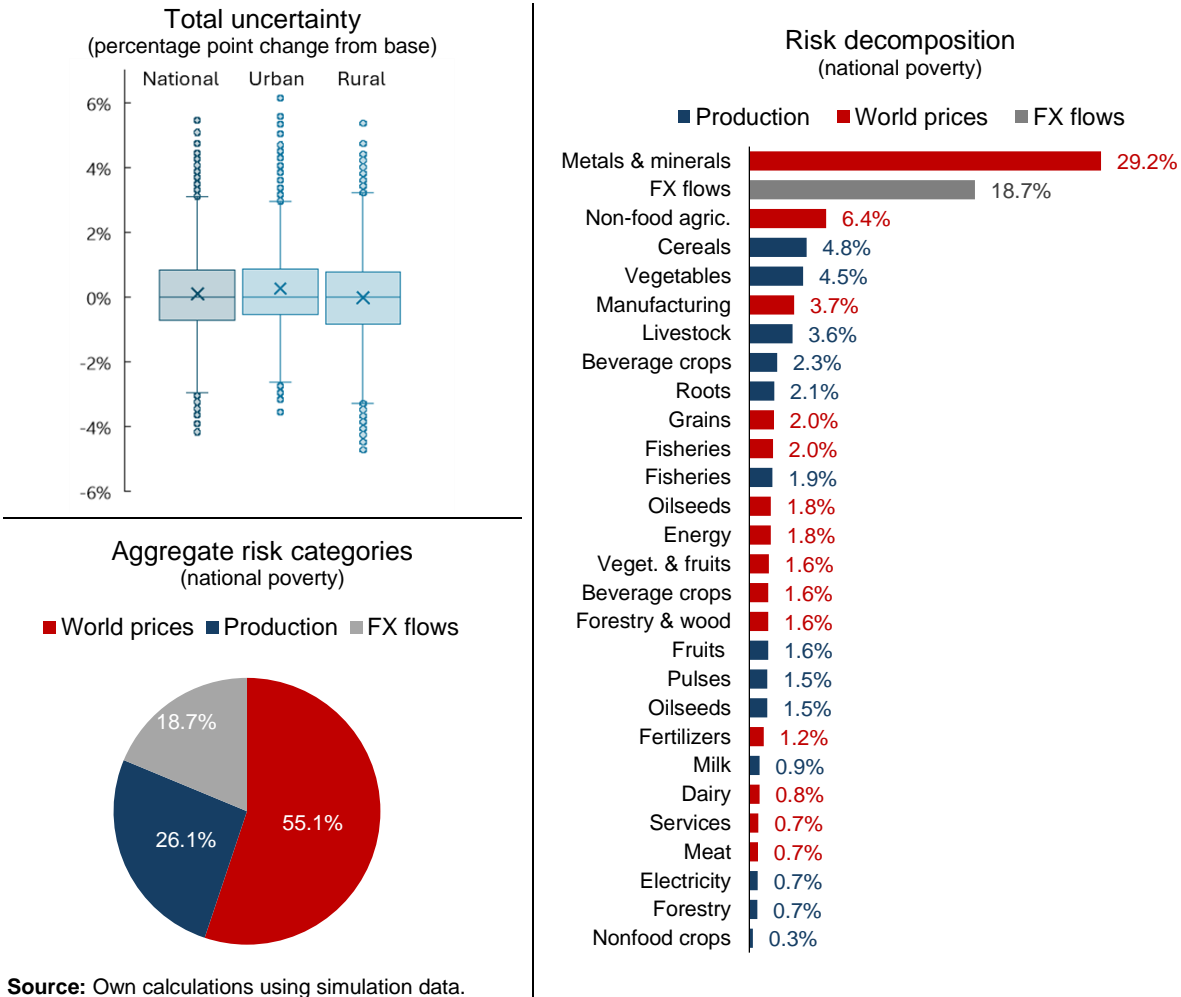
Note: Low comprises the first- and second-income quintiles, middle comprises the third- and fourth-income quintiles, and high comprises the fifth income quintile of urban and rural households, respectively.

Source: Own calculations using simulation data.

Potential variation of poverty headcount (Figure 5 and Table 3): The poverty rate can fluctuate from -4.2 to +5.5 percentage points relative to the baseline national poverty headcount rate of 54.4 percent. In absolute numbers, this equates to 0.7 million people being lifted above the poverty line in the best-case scenario and 1.0 million people falling below the poverty line in the worst-case scenario.

Similarly to private consumption, external factors—world market prices and FX capital flows—are much more important sources of risk than domestic yield volatility, accounting for about three-fourths of poverty uncertainty. Among domestic factors, cereal yield volatility is the most significant risk, but it accounts for only about 5 percent of poverty uncertainty.

Figure 5. Potential variation of poverty headcount rate



Source: Own calculations using simulation data.

Potential variation of undernourishment headcount (Figure 6 and Table 3): The national undernourishment rate can fluctuate from -4.7 to +5.5 percentage points relative to the baseline national undernourishment rate of 29.2 percent. This translates to 0.8 million people rising above the undernourishment line in the best-case scenario and 1.0 million sinking below it in the worst-case scenario.

Similarly to other outcomes, external factors are more significant sources of risk than domestic agricultural yield volatility, contributing about three-fourths to potential uncertainty in undernourishment rates. The three most important risks—world prices of metals and minerals (proxy for copper), FX capital flows,

and world prices of other agricultural products (proxy for tobacco and cotton)—define the country’s ability to finance imports, including imports of processed foods (see Section 2) that are crucial for calorie availability in the country. Among domestic production factors, cereal yield volatility is the most significant risk, followed by vegetable yield volatility and livestock production volatility.

Figure 6. Potential variation of undernourishment headcount rate

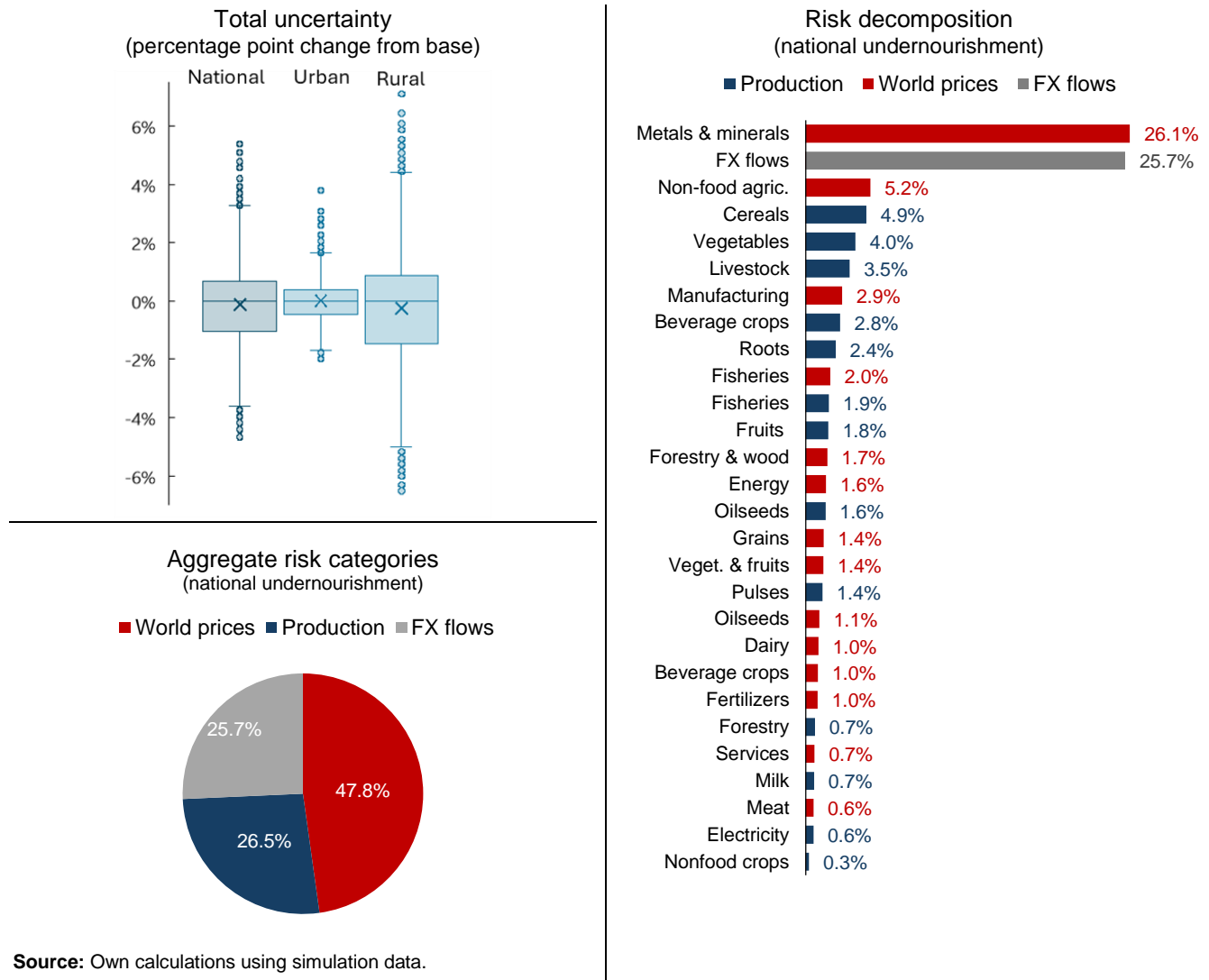


Table 3. Detailed risk decompositions of poverty and undernourishment uncertainty

	Poverty			Undernourishment		
	National	Urban	Rural	National	Urban	Rural
Total external	73.9	71.4	75.0	73.5	68.3	74.5
World prices						
Grains	2.0	1.8	2.3	1.4	1.4	1.5
Oilseeds	1.8	1.4	2.1	1.1	1.1	1.2
Vegetables & fruits	1.6	1.5	1.7	1.4	1.4	1.4
Beverage crops	1.6	1.2	1.8	1.0	0.7	1.1
Other agriculture	6.4	5.8	6.7	5.2	5.1	5.1
Meat	0.7	0.8	0.7	0.6	0.8	0.6
Dairy	0.8	0.6	1.1	1.0	0.6	1.3
Forestry & wood	1.6	1.5	1.8	1.7	1.4	2.0
Fish	2.0	1.7	2.0	2.0	1.5	2.0
Energy	1.8	1.8	1.9	1.6	1.9	1.7
Metals & minerals	29.2	33.1	26.3	26.1	33.2	23.8
Fertilizers	1.2	1.2	1.2	1.0	1.2	0.9
Manufacturing	3.7	4.9	3.2	2.9	5.0	2.6
Services	0.7	0.7	0.8	0.7	0.7	0.7
FX flows	18.7	13.4	21.6	25.7	12.2	28.7
Total domestic	26.1	28.6	25.0	26.5	31.7	25.5
Domestic production						
Cereals	4.8	4.1	5.1	4.9	5.0	5.0
Pulses	1.5	2.2	1.1	1.4	2.5	1.1
Oilseeds	1.5	1.9	1.3	1.6	2.2	1.4
Roots	2.1	2.2	1.9	2.4	2.1	2.4
Vegetables	4.5	3.9	4.6	4.0	3.7	4.0
Fruits	1.6	1.9	1.3	1.8	2.8	1.6
Beverage crops	2.3	2.0	2.4	2.8	2.1	2.9
Nonfood crops	0.3	0.4	0.3	0.3	0.4	0.2
Livestock	3.6	3.8	3.4	3.5	3.8	3.4
Milk	0.9	2.8	0.3	0.7	3.3	0.3
Forestry	0.7	0.6	0.7	0.7	0.6	0.8
Fisheries	1.9	1.9	1.9	1.9	2.6	1.7
Electricity	0.7	1.0	0.6	0.6	0.6	0.6

Source: Own calculations using simulation data.

4. Summary and next steps in the analysis

We utilize a new method to construct systematic risk profiling (SRP) for Zambia economy using the historical data of world market prices and domestic agricultural yields. The SRP measures different types of shocks' contribution to the country's current vulnerability and identifies the shocks most important to economic uncertainty. Analyzing historical data helps us derive a consistent parameter space for both world market and domestic production volatility, while sampling realistic shock scenarios is supplied to the Zambia CGE model to estimate social and economic uncertainty of the shocks. The decomposition methods are further used to identify the most important sources of uncertainty.

We find that Zambia's economy is predominantly exposed to external risks, with world prices of copper and FX capital flows being the most important contributors to potential uncertainties of GDP, private consumption, poverty, and undernourishment headcount rates. The current structure of the Zambia economy underpins these results. Export earnings from copper and foreign exchange capital flows play crucial roles in Zambia's economy characterized by high trade intensity (export is 28 percent of GDP, import is 27 percent of GDP), the large share of investment (39 percent of GDP), and a low share of agriculture (3.1 percent of GDP).

This study is part of a series that uses economy-wide models to provide detailed risk assessments of key economic indicators. The analysis presented here is an initial impact assessment aimed at gauging the vulnerability of countries and key population groups. Future analyses will focus on comparing different risk management strategies, such as increasing sectoral productivity to reduce the impact of negative

risks, adopting technologies and practices that narrow production uncertainty, or diversifying production toward less risky sectors.

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References

- Erten, B., and J. A. Ocampo. 2013. "Super Cycles of Commodity Prices Since the Mid-Nineteenth Century." *World Development*, 44: 14–30. doi:10.1016/j.worlddev.2012.11.013
- Food and Agriculture Organization of the United Nations (FAO). 2024. FAOSTAT. Database, Food and Agriculture Organization. Retrieved from <http://www.fao.org/faostat/en/#home>
- Hodrick, R. J., and E. C. Prescott. 1997. "Postwar U.S. Business Cycles: An Empirical Investigation." *Journal of Money, Credit and Banking*, 29: 1. doi:10.2307/2953682
- International Monetary Fund (IMF). 2024. *International Monetary Fund. World Economic Outlook Database April 2024 Edition*. Database. Retrieved from <https://www.imf.org/en/Publications/WEO/weo-database/2024/April>
- Mukashov, A., S. Robinson, J. Thurlow, C. Arndt, and T. Thomas. 2024. "Systematic Risk Profiling: A Novel Approach with Applications to Kenya, Rwanda, and Malawi." IFPRI Discussion Paper 02286, October 2024. <https://hdl.handle.net/10568/158180>
- International Food Policy Research Institute (IFPRI). 2021. 2019 Social Accounting Matrix for Zambia: A Nexus Project SAM. Washington, DC: IFPRI [Dataset]. <https://doi.org/10.2499/p15738coll2.134816>
- World Bank. (2018). Zambia - Systematic Country Diagnostic Retrieved from <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/290011522954283481/zambia-systematic-country-diagnostic>
- World Bank. (2024a). World Development Indicators. Database. Retrieved from <https://databank.worldbank.org/source/world-development-indicators>
- World Bank. (2024b). Commodity Markets Outlook. Database. Retrieved from <https://thedocs.worldbank.org/en/doc/5d903e848db1d1b83e0ec8f744e55570-0350012021/related/CMO-Historical-Data-Annual.xlsx>

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