IFPRI PAPUA NEW GUINEA

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PAPUA NEW GUINEA

Systematic Analysis of Domestic Production and World Market Shocks

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Abstract

Using an economy-wide, multi-sectoral model, this study explores potential vulnerability of Papua New Guinea (PNG) to economic shocks and identifies factors that contribute most to economic uncertainty. Economic scenarios were developed using historical data on volatile domestic sectors (e.g., primary agriculture and hydropower electricity generation) and world prices of goods and services in which PNG trades. The Computable General Equilibrium (CGE) model of PNG was used to simulate a range of potential economic outcomes under these scenarios. In addition, data mining and machine learning methods were applied to quantify the contribution of each shock to the uncertainty of economic outcomes. Key findings suggest that Papua New Guinea's economy is predominantly exposed to external risks, with world prices and foreign capital volatility together accounting for approximately two-thirds of the potential variation in GDP and three-fourths of the potential variation in private consumption, poverty, and undernourishment (domestic production volatility contributes the remaining one-third and one-fourth, respectively). The current structure of the PNG economy underpins these results. While agriculture is the most uncertain sector, it is relatively less important compared to the overall economy; export earnings from energy and metals, as well as volatile foreign exchange capital inflows, play a much more significant role in the country's current economic risks. Understanding how potential shocks might impact various segments of the PNG economy and population is a critical first step in facilitating discussions on relevant risk mitigation strategies, such as increasing sectoral productivity or diversifying production away from high-risk sectors.

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

1. Analyzing the impacts of simultaneous variability of exogenous shocks

Since gaining independence from Australia in 1975, Papua New Guinea (PNG) has experienced both opportunities and challenges in its economic development. A brief overview of the historical dynamics of the country's key indicators is presented in Figure 1, with some of the key features outlined below:

- Reliance of economy on natural resources rents: Historically, the backbone of PNG's economy has been the extraction of natural resources (Figure 1b). In the 1980s, copper mining was the key commodity; in the 1990s, gold mining projects were added; and by the 2000s, energy mining—particularly Liquefied Natural Gas (LNG) - became significant. Due to the volatility of global commodity prices (Figure 1c) and internal factors affecting mining operations (e.g., the closure of the Panguna mine on Bougainville Island in 1989), the country's economic growth has been volatile, characterized by alternating periods of rapid growth and sharp declines (Figure 1a).
- Structural adjustment programs: In the second half of the 1990s, PNG faced an economic crisis caused by low commodity prices (Figures 1a-e), and the country undertook a series of structural adjustment programs with the IMF and World Bank aimed to restore macroeconomic stability.
- Recent Commodity Boom: The early 2000s brought a commodities boom that bolstered PNG's economy, driven by soaring prices for gold, copper, and energy. Major LNG projects completed by 2014 marked a turning point for GDP growth. By the early 2020s, GDP per capita reached levels comparable to those of the early 1990s (Figure 1a).
- Primary Agriculture: Although the share of agriculture in GDP decreased from 33 percent in 1980 to 18 percent in 2019, the sector remains vital for employment, accounting for 65 percent of total employment in 2019 (Table 1). However, agricultural productivity has steadily declined since independence (Figure 1f). In response, PNG introduced the National Agriculture Development Plan in 2007, aiming to modernize agriculture, increase productivity, and improve market access for smallholder farmers. Despite these efforts, implementation challenges have prevented a reversal of the declining trend in agricultural productivity.

According to the Systematic Country Diagnostic by the World Bank (2018), PNG's current economy is particularly vulnerable to three types of risks:

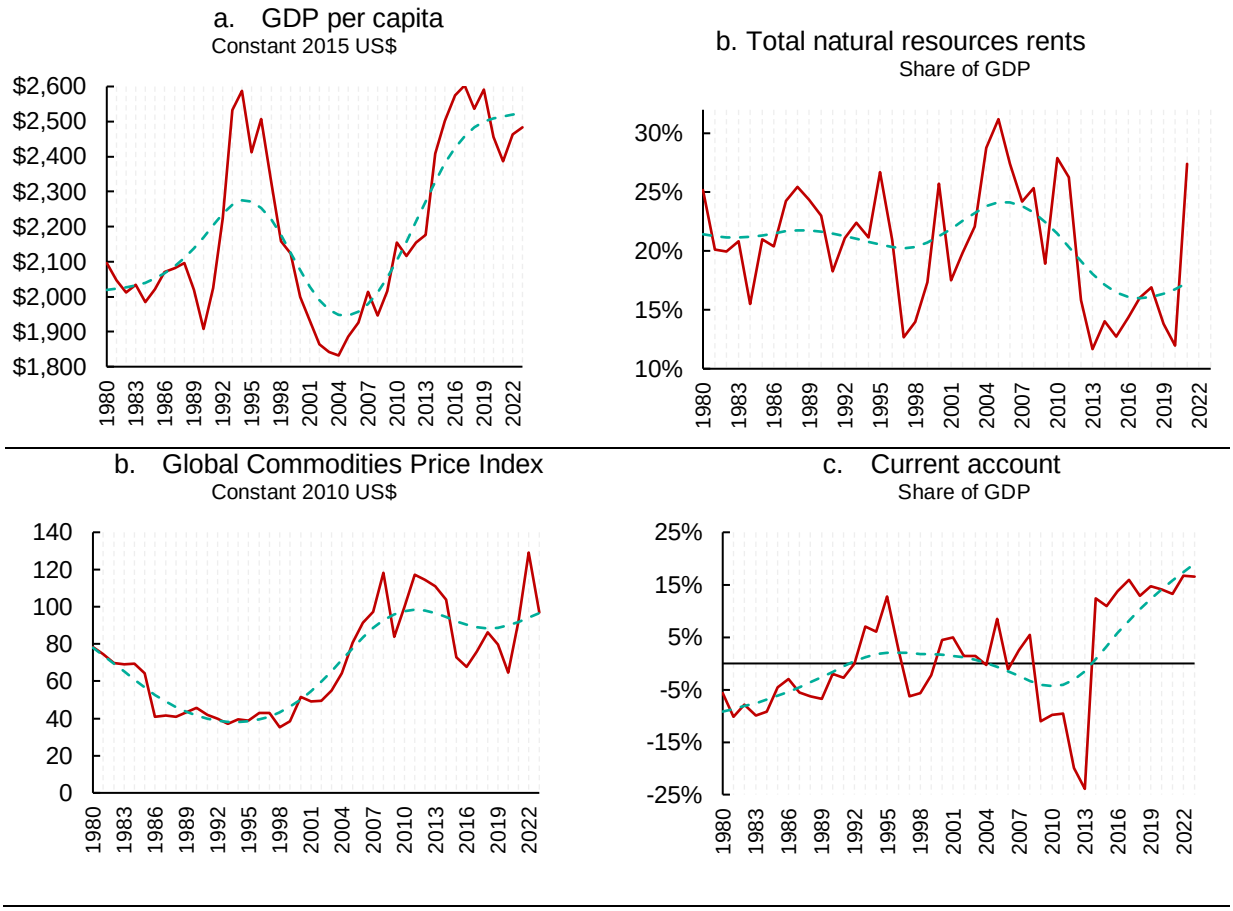
- Resource Dependence: Reliance on resources like metals and LNG exposes the economy to volatile global commodity prices.
- Natural disasters: Key hazards include floods, droughts, landslides, earthquakes all impacting the agriculture and fisheries sectors critical to rural livelihoods.
- Social and political risks: The rapid modernization of PNG's society, combined with high youth unemployment, has led to tensions within urban and rural areas. Urbanization stresses traditional social structures, resulting in increased social strife and risks of entrenched poverty in informal settlements. Historical tensions, such as those seen in Bougainville, reveal the risks associated with unresolved compensation and benefit-sharing disputes in resource-rich regions. High fragmentation of political loyalty and dependence on patronage have led to regular government instability and risks of disenfranchisement among citizens.

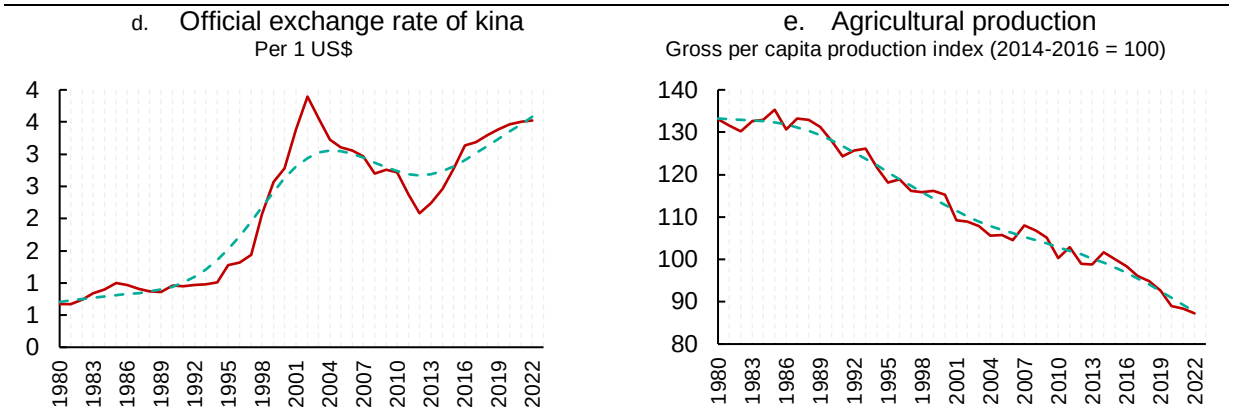
Due to data limitations, we are unable to quantify the impact of social and political challenges on PNG's economy or model the country's long-term development trajectories. Instead, this analysis focuses exclusively on the first two risks of a short-term or temporary nature: world market price fluctuations and yield and production volatilities. Our goal is to combine available historical information to address the following questions:

- What is the country's current vulnerability to historically consistent world market prices and domestic yield and production shocks?
- Which of these shocks contribute the most to economic uncertainty?

To answer these and related questions, we use a novel methodology for country Systematic Risk Profiling (SRP). The method employs machine learning and data mining techniques to analyze complex relationships between sampled shocks (e.g., declines in oil and metal prices or crop yields) and outcome variables (e.g., their impacts on household consumption and poverty) in an economy-wide Computable General Equilibrium (CGE) model constructed for PNG. 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 PNG 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 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, total natural resources rents, official exchange rate); World Bank (2024b) data (global commodities price index), IMF (2024) data (current account) and FAO (2024) data (agricultural production).

2. Current economic structure and shock scenarios

2.1 The Structure of the Economy

PNG is a lower-middle-income country with a GDP per capita of 2,593 USD (2019), a national poverty rate of 39.9 percent (based on the most recent nationally representative household survey in 2009), and an undernourishment rate[1] of 23.1 percent (based on the most recent FAO estimate in 2019) (World Bank, 2024a).

The sectoral decomposition of PNG's economy (Table 1a) exhibits features typical of low and lower-middle-income countries. The primary sectors—agriculture and mining—constitute a significant share of economic activity (agriculture: 18.0 percent of GDP and 64.6 percent of employment; mining: 29.8 percent of GDP and 2.4 percent of employment). The secondary sector remains underdeveloped, with non-food manufacturing contributing only 0.6 percent to GDP, despite comprising 10.3 percent of total domestic demand and 37.5 percent of total imports. Additionally, the country's agro-processing sector is also underdeveloped (2.4 percent of GDP and 2.3 percent of employment). PNG relies heavily on food imports (particularly urban populations), with 66.4 percent of the nation's agro-processing demand being imported (e.g., milled grains and other processed agricultural products), and food constituting 25.7 percent of total imports. PNG primarily exports mining commodities—metals and energy (88.5 percent of total exports).

The decomposition of GDP by expenditure (Table 1b) also highlights some distinct features of the PNG economy. In particular, the country is characterized by a high trade intensity (exports are 44 percent of GDP, imports are 38 percent of GDP);[2] government consumption is also relatively large (23 percent of GDP).

1 Share of the population whose adult-equivalent daily consumption is below the minimum calorie requirement defined by the Food and Agriculture Organization of the United Nations (approximately 1,800 kilocalories per person per day).

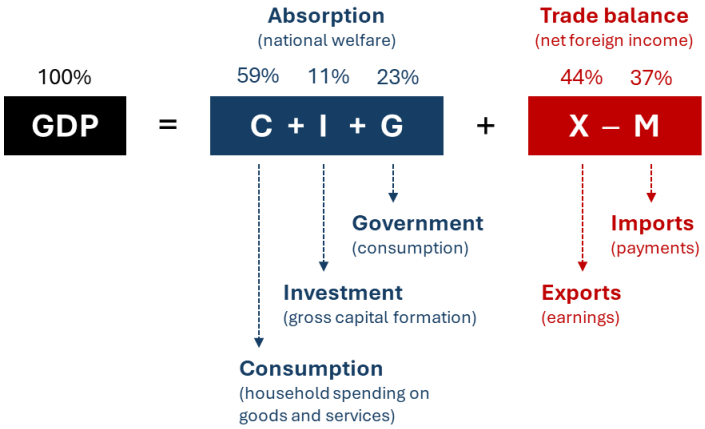
2 For comparison, in 2019, lower-middle-income countries had average exports equivalent to 27.8 percent of GDP, imports at 24.1 percent of GDP, and government consumption at 11.2 percent of GDP (World Bank, 2024a).

Table 1. Structure of PNG'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	18.0	64.6	8.8	14.0	4.1	1.8	0.6
Crops	13.4	51.2	4.1	14.6	1.9	3.8	0.6
Roots and tubers	4.5	20.6	0.7				
Fruits	3.2	6.9	1.1	2.8	0.1	4.0	0.2
Beverage crops	0.8	1.6	0.1	80.3	1.6	3.9	0.0
Livestock	2.0	4.7	1.4				
Forestry	1.1	3.6	2.0	24.5	2.2		
Fishing	1.5	5.1	1.3				
Mining	29.8	2.4	9.0	81.1	88.5	28.2	10.1
Manufacturing	3.0	3.4	21.3	18.7	3.9	78.2	63.2
Agroprocessing	2.4	2.3	11.0	12.8	1.9	66.4	25.7
Other manufact.	0.7	1.1	10.3	34.6	2.0	90.9	37.5
Utilities	0.9	0.4	1.4				
Construction	4.9	4.2	6.9			18.8	5.5
Services	43.5	24.9	52.6	2.3	3.6	8.9	20.6
Food services	1.8	1.3	1.9	0.7	0.0	10.9	0.9
Social services	9.6	2.7	11.1				
Other services	32.1	20.9	39.6	3.1	3.6	11.3	19.7
Total	**100**	**100**	**100**	**28.4**	**100**	**25.3**	**100**

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 2019 (IFPRI 2022).

2.2 Characteristics of sampled shocks

The first step of SRP—estimating the historical volatility of shocks—helps us understand the scale of potential shocks that the *current* economy potentially faces. We consider three categories of risk factors: (1) changes in world prices of goods and services that PNG trades, which are significantly affected by global business cycles; (2) changes in foreign capital flows that finance the country's current account deficit; and (3) abrupt shifts in domestic production[3] 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* and so we randomly draw shocks

3 Whenever possible, we use 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).

from a multivariate normal distribution with zero means 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).

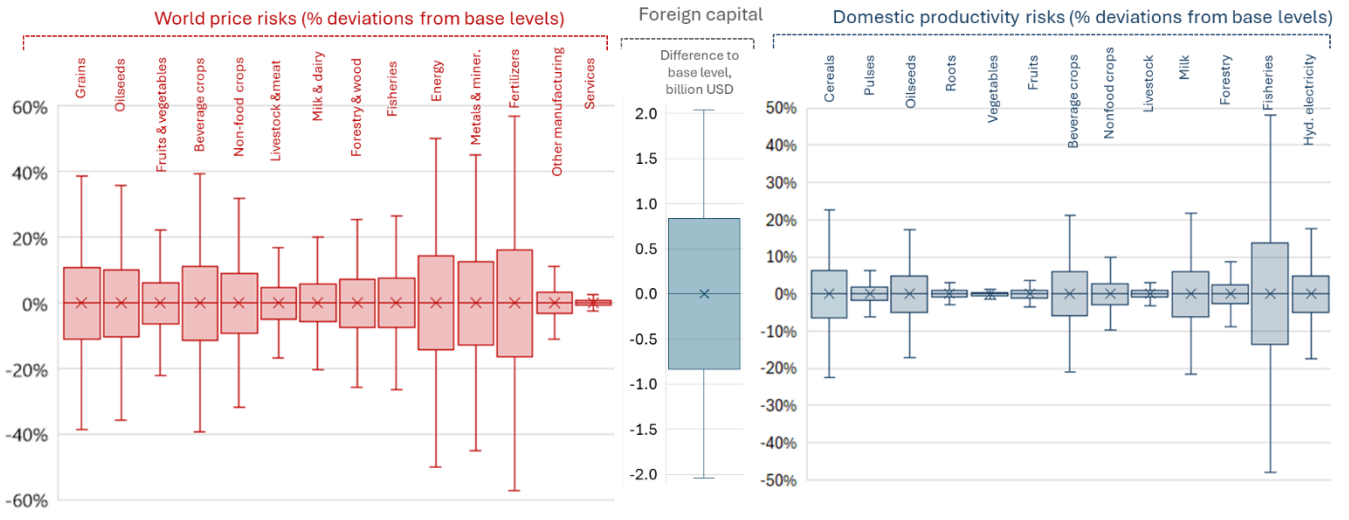
World price volatility: World prices of primary commodities are highly volatile, whereas manufactured goods and services exhibit greater stability. Within agricultural commodities, prices of beverage crops such as coffee, cocoa, and tea are the most volatile, followed by prices of grains (Figure 2a). The world prices of primary commodities also show strong positive correlation (Figure 2b), suggesting that shocks to prices of multiple primary commodities are likely to occur simultaneously due to their dependence on global business cycles (see Erten and Ocampo, 2013). For example, fertilizer prices are the most volatile (Figure 2a) and are strongly associated with volatility of grain and oilseed prices (Figure 2b). This is not surprising given that fertilizer is an important input for agricultural production of a portfolio of crops. At the same time, 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 extremely low, see Figure 2a).

Volatility of foreign capital flows: A country's current account deficit must be financed through financial account operations, which include foreign direct investment (FDI), where foreign investors purchase businesses, factories, and real estate; portfolio investments, where foreigners buy government bonds, stocks, or other financial assets; foreign borrowing, where the government or companies obtain loans from foreign banks or issue bonds; and reserves usage, where the central bank may use foreign exchange reserves if other inflows are insufficient to cover the deficit. In this context, we assume that financial account operations enter the economy as foreign savings are denominated in a foreign currency, impacting both the exchange rate and investment demand (primarily in the construction sector). To estimate changes in foreign savings, we use current account data from the IMF (2024), which suggests that foreign savings fluctuations in PNG can reach approximately 8 percent of GDP, equivalent to ±2 billion USD.

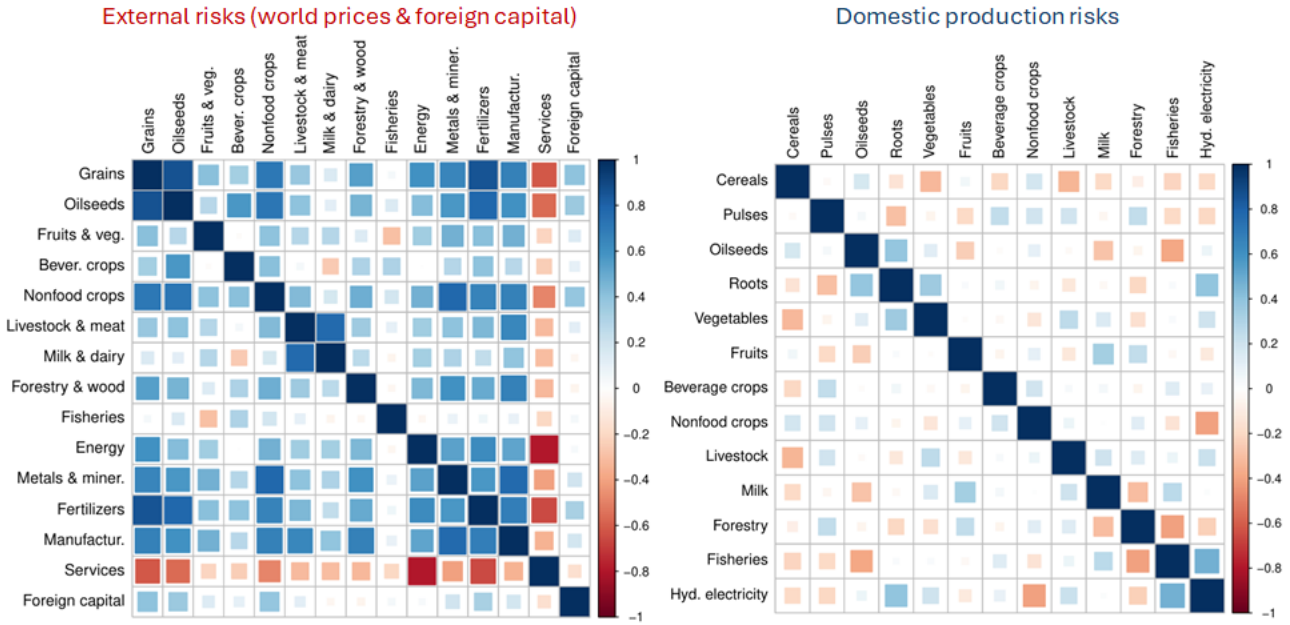
Domestic production volatility: According to our historical analysis of domestic production based on the World Bank (2024a) and FAO (2024), the fisheries sector in PNG has demonstrated the highest production volatility, with annual variations ranging from -50% to +50% relative to long-term averages. This significant fluctuation is, at least in part, attributable to the effects of El Niño on tuna migration in the Pacific region, which is a critical component of PNG's fisheries (Bell et al., 2021; Domokos, 2023). At the same time, it should be noted that FAO (2024) data on crop yield volatility is exclusively based on FAO staff estimates and lacks the official data typically provided to FAO by government officials in other countries. In this context, it is possible that our estimation of domestic crop yield volatility is imprecise—most likely underestimating volatility—because in a substantial number of instances, yield entries in FAO data do not change from year to year. Given the absence of alternative data sources, we have used this data for our analysis, which suggests that the yield volatilities of most crops in PNG do not exceed ±20% from long-term averages, even under the most extreme weather scenarios.

Figure 2. Sampled risks

a. Marginal distributions



b. Correlation structure



Notes:

- 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 (+).
- The price index of grains (by WB, 2024b) is used as a proxy for world prices of cereals, pulses, roots, and milled grains.
- WB (2024b) data on orange and banana prices is used to construct a proxy for world prices of fruits and vegetables.
- Price indices of energy and metals (by WB, 2024b) are used as proxies for all traded energy and metal sectors, respectively.
- The Manufacturing Unit Value Index (by WB, 2024b) is used as a proxy for world prices of other manufacturing sectors.
- The price index of services is based on the U.S. Services CPI and is used as a proxy for all traded services.

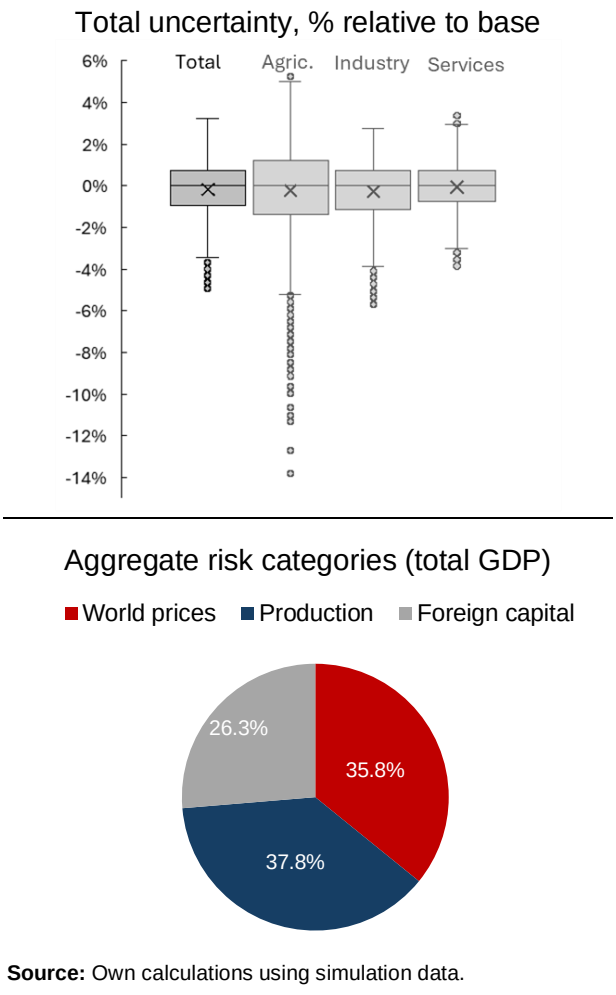
Source: Own calculations using World Bank (2024a, 2024b), FAO (2024), and IMF (2024) data.

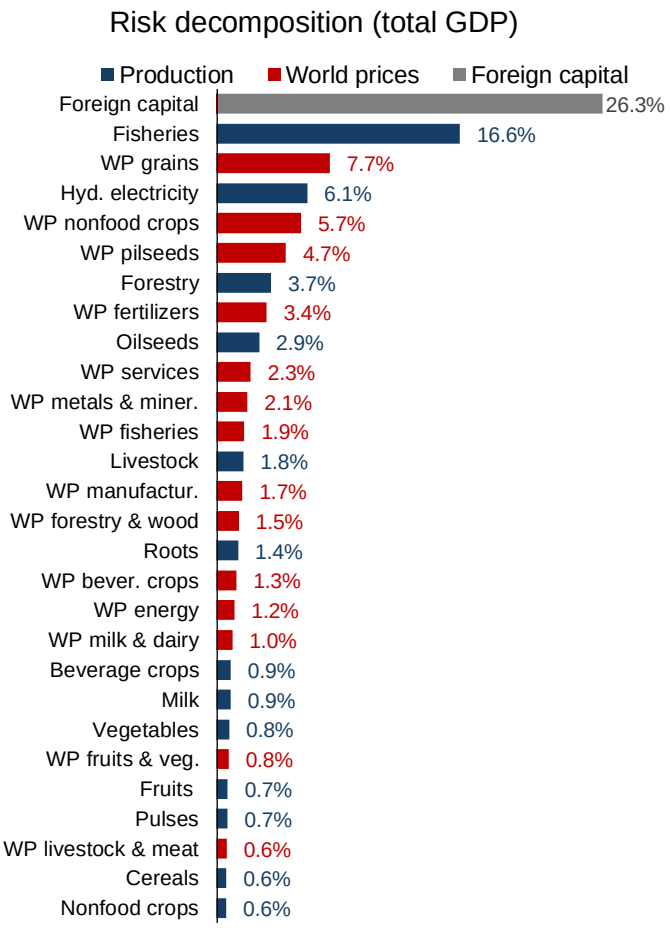
3. Measuring and understanding PNG's economic uncertainty

The second stage of the SRP models the economic uncertainty resulting from our random sample of the 10,000 scenarios (taken from historical price and weather anomalies dating back since 1980) described above using a CGE model of PNG. We then employ machine learning and data mining methods to quantify each shock's contribution to outcomes' uncertainty[4]. Figures 3 to 6 show the total uncertainty and the decomposition of total uncertainty for GDP, private consumption, poverty, and undernourishment.

Potential variation of GDP (Figure 3): Total GDP can fluctuate from -4.9 (worst case) to +3.2 percent (best case) relative to the base. Agriculture, which is directly exposed to sampled productivity shocks, is the riskiest sector. However, its variation is not significantly different from that of the industrial and service sectors (the area within the box – between the 1st and 3rd quartiles of the distribution - of the box and whiskers plot), except in extremely negative scenarios. Domestic production risks account for 37.8 percent of total GDP uncertainty, with volatility in fishery production being the most significant risk factor. Volatility in foreign capital flows, which directly influences the exchange rate and investment demand (primarily construction), explains 26.3 percent of total GDP uncertainty. Finally, world market uncertainty accounts for the remaining 35.8 percent.

Figure 3. Potential variation of GDP



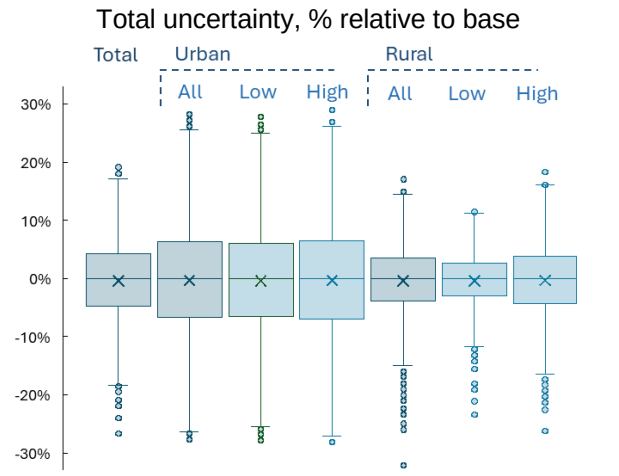


Source: Own calculations using simulation data.

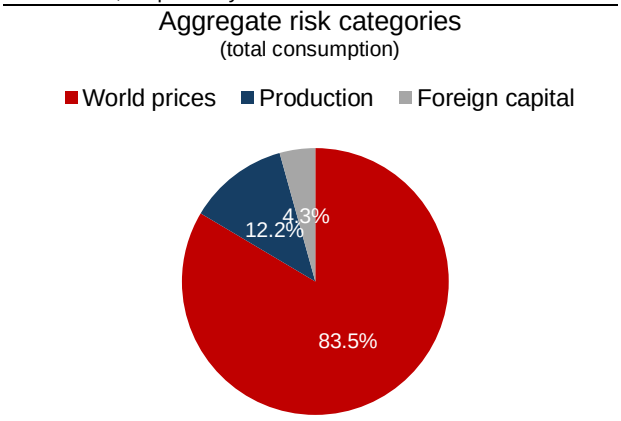
4 We use Random Forest and Lindeman, Merenda, and Gold relative importance metrics; for details, see Mukashov et al. (2024).

Potential variation of private consumption (Figure 4 and Table 2): Due to high trade dependence, private consumption is much more uncertain than GDP, with total consumption fluctuating from +19.5 to -26.7 percent relative to the base in the best- and worst-case scenarios (in terms of standard deviation, private consumption is 5.5 times more uncertain than GDP). Furthermore, urban households, which have a higher dependence on imported goods, have greater consumption uncertainty than rural households (in terms of standard deviation, urban consumption is 1.7 times more uncertain than rural). For total consumption, world prices are the primary source of uncertainty, accounting for 83.5 percent of consumption variability, with prices of the country's key export - energy and metals - being the main risks. However, there are notable differences across household types (Table 2).

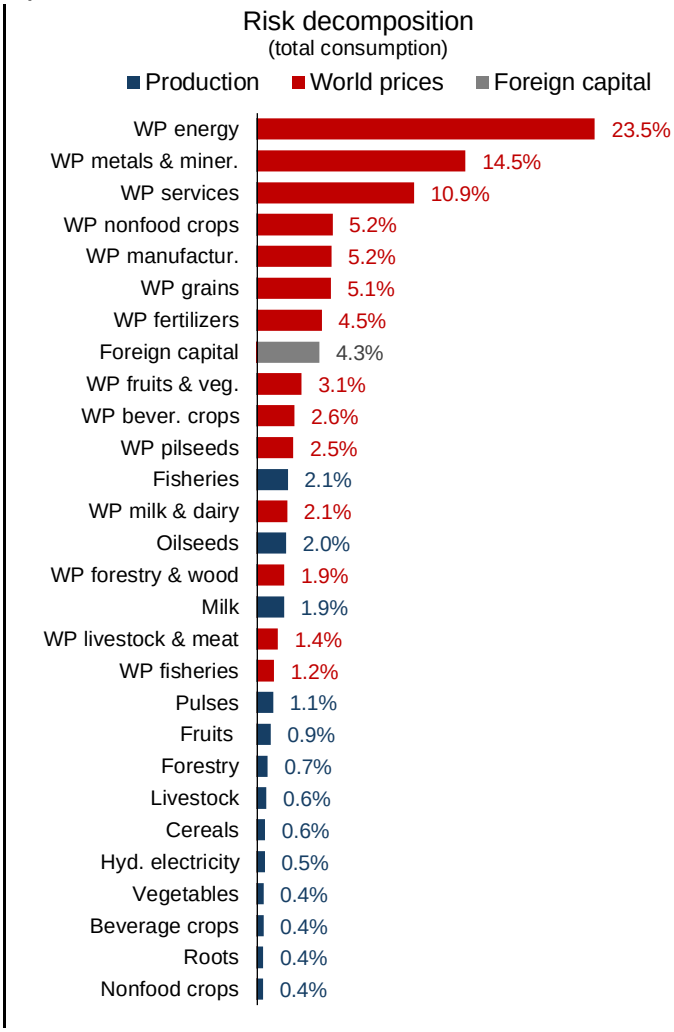
Figure 4. Potential variation of private consumption



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



Source: Own calculations using simulation data.



In particular, although world risks also dominate consumption uncertainty of all households, domestic agricultural production variation is a more significant risk factor for rural households (18.6 percent for total rural versus 10.4 percent for total urban). Notably, the production variability in the fishery sector is an especially important risk for rural middle-income households, resulting in the highest importance of domestic factors among all households (28.4 percent). At the same time, it is essential to remember that rural household consumption is 1.7 times less uncertain than that of urban households, meaning that turbulence in world markets essentially poses less risk to rural households. This is largely due to the subsistence agriculture economy in rural PNG, where more than 50 percent of household food consump-

tion is own-produced (Schmidt et al., 2024). In contrast, the greater uncertainty in urban household consumption is almost entirely attributed to world market factors, given their greater reliance on marketed food goods.

Table 2. Detailed risk decompositions of consumption uncertainty

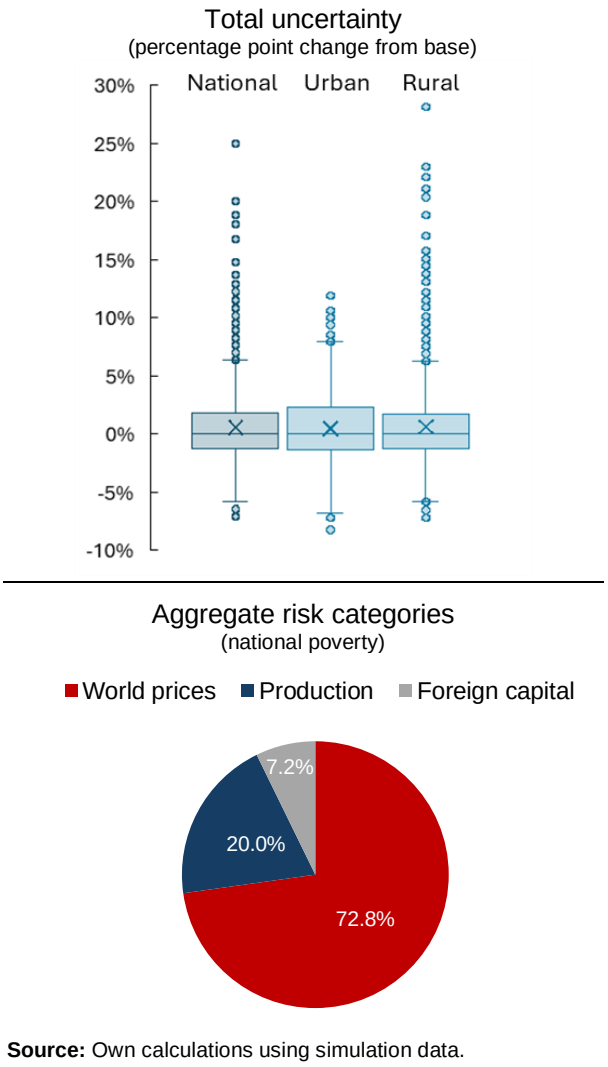
		Total	Urban				Rural			
			Total	Low	Middle	High	Total	Low	Middle	High
Total external		**87.8**	**89.6**	**88.9**	**89.4**	**89.6**	**81.4**	**85.8**	**71.6**	**85.3**
World prices	Grains	5.1	7.3	7.3	7.0	7.5	3.4	5.1	2.6	3.6
	Oilseeds	2.5	3.5	3.5	3.3	3.6	2.0	2.6	1.5	2.4
	Fruits & vegetables	3.1	2.1	1.8	1.9	2.1	3.9	3.0	4.6	3.5
	Beverage crops	2.6	2.3	3.3	3.2	1.9	2.7	2.6	2.7	2.6
	Nonfood crops	5.2	6.4	6.8	6.3	6.3	3.9	5.9	3.2	3.8
	Livestock & meat	1.4	1.2	1.4	1.3	1.2	1.6	1.9	1.8	1.3
	Milk & diary	2.1	1.5	1.6	1.7	1.4	2.5	2.2	2.6	2.4
	Forestry & wood	1.9	2.1	1.9	1.9	2.1	1.6	1.8	1.4	1.9
	Fish	1.2	0.5	0.4	0.4	0.5	2.1	1.2	2.8	1.8
	Energy	23.5	20.5	16.0	20.1	20.9	23.3	15.8	17.9	27.1
	Minerals	14.5	12.7	11.6	12.1	12.9	14.4	14.0	12.9	14.6
	Fertilizers	4.5	5.6	5.3	5.3	5.7	3.3	4.4	2.6	3.5
	Manufacturing	5.2	4.2	4.2	4.0	4.3	5.7	6.2	6.4	5.0
	Services	10.9	11.6	9.3	11.3	11.9	9.2	7.8	6.5	11.0
Foreign capital		4.3	8.2	14.4	9.7	7.3	1.8	11.5	2.0	0.9
Total domestic		**12.2**	**10.4**	**11.1**	**10.6**	**10.4**	**18.6**	**14.2**	**28.4**	**14.7**
Domestic productivity	Cereals	0.6	0.5	0.5	0.5	0.5	0.6	0.5	0.7	0.6
	Pulses	1.1	0.8	0.7	0.8	0.8	1.4	1.2	1.8	1.1
	Oilseeds	2.0	1.6	2.1	1.7	1.5	2.3	2.3	2.6	1.9
	Roots	0.4	0.4	0.4	0.4	0.4	0.4	0.9	0.6	0.4
	Vegetables	0.4	0.5	0.6	0.5	0.5	0.4	0.7	0.4	0.5
	Fruits	0.9	1.0	1.0	1.0	1.0	0.8	0.9	0.7	0.9
	Beverage crops	0.4	0.5	0.4	0.5	0.5	0.4	0.4	0.4	0.5
	Nonfood crops	0.4	0.5	0.5	0.4	0.5	0.3	0.5	0.3	0.3
	Livestock	0.6	0.6	0.7	0.6	0.6	0.7	0.7	0.6	0.8
	Milk	1.9	1.3	1.3	1.3	1.4	2.2	1.8	2.5	2.1
	Forestry	0.7	0.8	0.9	0.8	0.7	1.3	0.8	2.3	1.0
	Fisheries	2.1	0.9	1.1	1.1	0.8	7.1	3.1	14.4	4.2
	Hyd. electricity	0.5	1.0	1.0	0.9	1.1	0.6	0.5	1.1	0.5

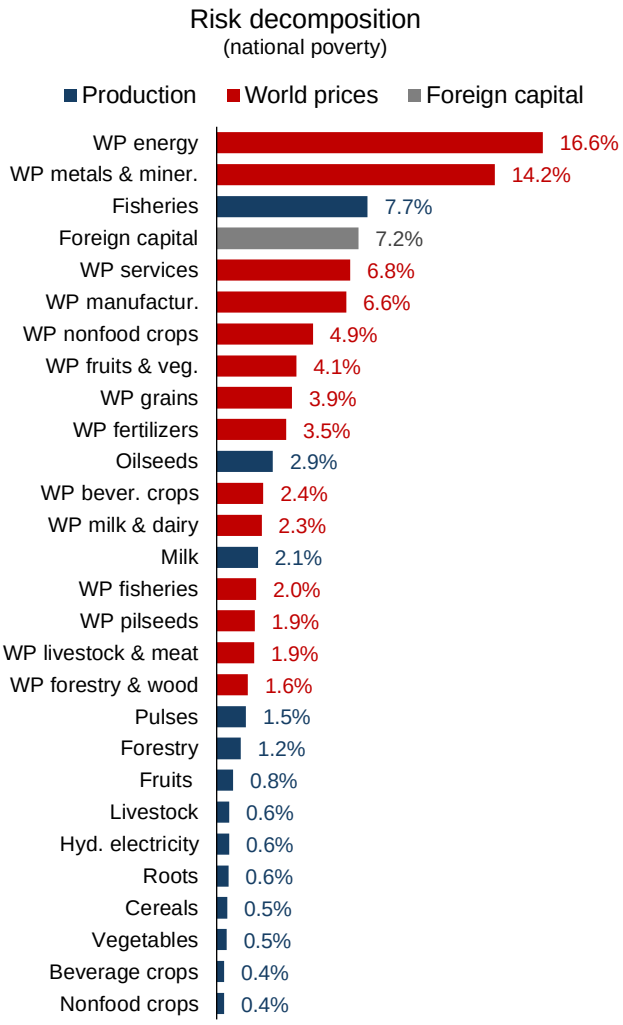
Note: Low comprises the first- and second-income quintiles, middle comprises the third- and fourth-income quintiles, and high comprises the fifth income quintile of urban and rural households, respectively.

Source: Own calculations using simulation data.

Potential variation of poverty headcount (Figure 5 and Table 3): The national poverty rate can fluctuate with the consumption of low-income households, ranging from -7.1 to +25.0 percentage points relative to the baseline national poverty headcount rate of 39.9 percent. In absolute terms, this translates to 0.6 million people possibly rising above the poverty line in the best-case scenario and 2.1 million people falling below it in the worst-case scenario (+25 percent of the total population). Nationally, external risks are the dominant factors, accounting for 80 percent of total poverty risk, though notable differences exist across household types (Table 3).

Figure 5. Potential variation of poverty headcount rate





Source: Own calculations using simulation data.

Similar to consumption uncertainty, the production variability in the highly volatile fishery sector is a significant risk factor for rural poverty, as middle-income rural households may be pushed below the poverty line if negative scenarios occur. Consequently, domestic productivity volatility factors (e.g., fishery, oilseeds, etc.) represent 23.8 percent of the total risk for rural poverty, which is more than two times higher than 11.0 percent risk for urban poverty.

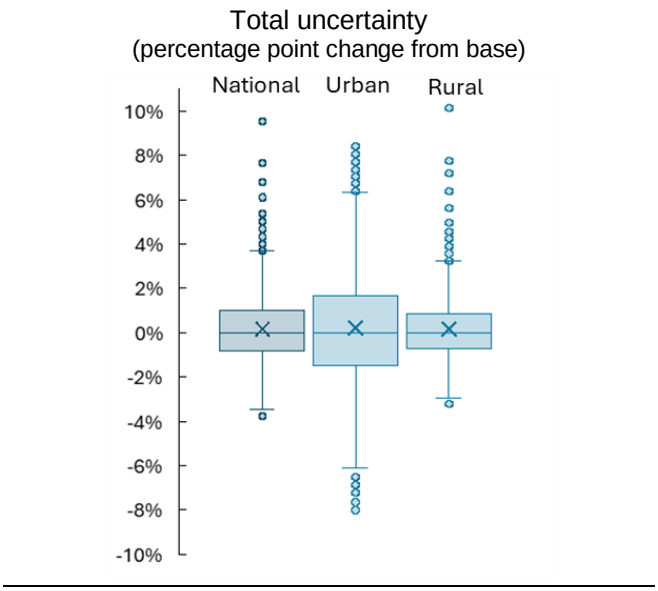
Table 3. Detailed risk decompositions of poverty and undernourishment uncertainty

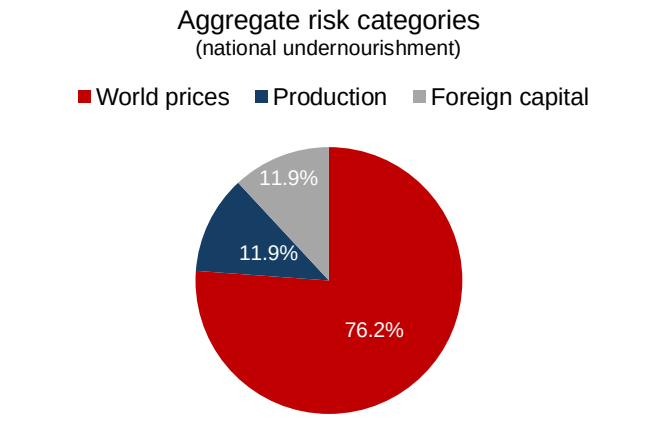
		Poverty			Undernourishment		
		National	Urban	Rural	National	Urban	Rural
Total external		80.0	89.0	76.2	88.1	89.3	86.0
World prices	Grains	3.9	7.0	3.3	4.9	6.2	4.4
	Oilseeds	1.9	3.4	1.7	2.5	3.0	2.3
	Fruits & vegetables	4.1	1.8	4.4	2.5	1.8	2.8
	Beverage crops	2.4	2.8	2.3	3.2	4.1	2.9
	Nonfood crops	4.9	6.8	4.4	5.6	6.0	5.3
	Livestock & meat	1.9	1.3	2.0	1.7	1.3	1.8
	Milk & diary	2.3	1.5	2.4	2.3	1.9	2.4
	Forestry & wood	1.6	2.0	1.6	1.8	1.9	1.7
	Fish	2.0	0.4	2.4	0.9	0.4	1.2
	Energy	16.6	17.3	15.7	18.3	19.5	17.3
	Minerals	14.2	12.0	13.9	13.4	12.1	13.5
	Fertilizers	3.5	5.3	3.2	4.4	4.8	4.1
	Manufacturing	6.6	4.2	6.9	5.6	4.2	6.2
	Services	6.8	9.9	6.1	9.1	10.5	8.4
Foreign capital		7.2	13.3	6.0	11.9	11.7	11.7
Total domestic		**20.0**	**11.0**	**23.8**	**11.9**	**10.7**	**14.0**
Domestic productivity	Cereals	0.5	0.5	0.6	0.5	0.5	0.5
	Pulses	1.5	0.7	1.6	1.2	0.8	1.3
	Oilseeds	2.9	2.0	3.0	1.8	1.8	1.8
	Roots	0.6	0.4	0.7	0.9	0.4	1.1
	Vegetables	0.5	0.6	0.5	0.7	0.6	0.7
	Fruits	0.8	1.0	0.8	0.9	1.0	0.9
	Beverage crops	0.4	0.4	0.4	0.4	0.5	0.4
	Nonfood crops	0.4	0.5	0.4	0.4	0.4	0.4
	Livestock	0.6	0.6	0.6	0.7	0.6	0.7
	Milk	2.1	1.2	2.2	1.6	1.3	1.7
	Forestry	1.2	1.0	1.6	0.7	0.9	0.8
	Fisheries	7.7	1.1	10.7	1.7	1.0	3.1
	Hyd. electricity	0.6	1.1	0.8	0.5	0.9	0.5

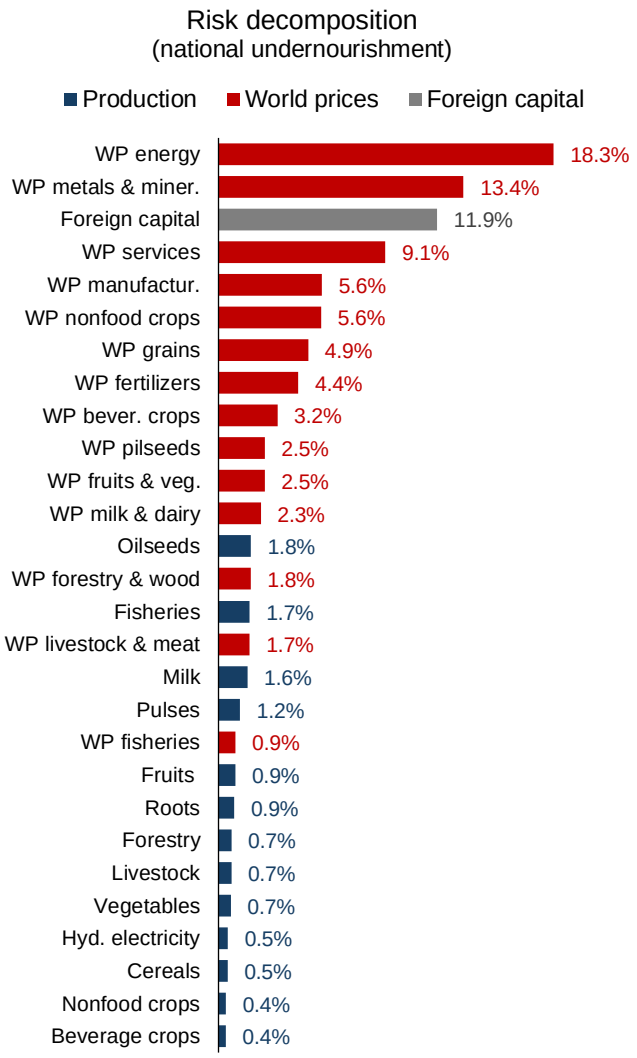
Source: Own calculations using simulation data.

Potential variation of undernourishment headcount (Figure 6 and Table 3): National undernourishment rate can fluctuate from -3.8 to +9.5 percentage points relative to the baseline national undernourishment headcount rate of 23.1 percent (using the global calorie threshold proposed by the FAO). This translates to 0.3 million people above the undernourishment line in the best-case scenario and 0.8 million below it in the worst-case scenario. Similar to other outcomes, external world market risks play the most critical role in undernourishment uncertainty. The country's ability to import food depends on both import prices and foreign exchange earnings (see Section 2.1), which, in turn, are influenced by global business cycles and commodity prices.

Figure 6. Potential variation of undernourishment headcount rate







Source: Own calculations using simulation data.

4. Summary and next steps in the analysis

In this paper, we utilized a new methodology (Systematic Risk Profiling, SRP) to assess the risks facing the PNG economy. By analyzing historical data, we derive a consistent parameter space for both world market and domestic production volatility, sampling realistic shock scenarios that may impact the economy. These scenarios are applied to the PNG CGE model to estimate economic uncertainty, and decomposition methods are used to identify the most important sources of uncertainty.

We find that, under PNG's current economic structure, household consumption (which is highly dependent on imports, particularly in urban areas) is 5.5 times more uncertain than GDP, indicating PNG's high vulnerability to import prices and foreign exchange export earnings from metal and energy commodities needed to finance imports. Overall, the country's high integration into world markets and significant trade intensity make PNG's economy more dependent on world markets than on domestic yield volatilities across all economic outcomes.

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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