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Papua New Guinea Agri-food Trade Trends

Dietary Change and Obesity

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ABSTRACT

The onset of the COVID-19 pandemic has presented a unique challenge to governments across the globe, reinforcing the need to improve understanding of domestic and international trade trends to provide more informed options for policy response. During the last several months, IFPRI has been analyzing a variety of Papua New Guinea (PNG) national and global datasets with the goal of expanding analytical tools to evaluate potential production shortfalls and food price shocks, and their associated impacts on household food security and livelihoods. This research note focuses on agri-food import and export trends during the last two decades to better evaluate potential changes in related import demand and export potential in PNG. In doing so, this research note informs an upcoming economy-wide multi market model analysis that will model a variety of potential shocks to household welfare to identify policies to manage potential ensuing food security threats.

PNG's growth in international agri-food trade (both export and import) will continue to be important to overall food security outcomes among rural and urban households. Rural households that produce key export cash-crops (e.g., coffee, cocoa, palm oil) depend on the cash economy to supplement overall food consumption, while urban households depend on rice and other agri-food imports (as well as domestic goods) for consumption. Agri-food imports are also contributing to important increases in the availability of protein-dense foods, with the value of poultry imports growing, on average, 30 percent per capita per year from 2001 – 2016. Although PNG's agri-food import data suggest a greater demand for higher value food items such as animal-sourced foods, the total import value of ultra-processed foods, such as sugary drinks, are also increasing rapidly within PNG.

The profitability and growth of agricultural exports and imports are driven by several factors, including levels of public investment in infrastructure, weather and climate shocks, security and political stability, and conditions in the world market. Government economic policies, including exchange rate, trade and price policies, also heavily influence agricultural trade. Policy to promote and facilitate domestic movement of goods, as well as macro-economic policies that influence the relative price of tradable to non-tradable goods (the real exchange rate) should be managed appropriately to support and incentivize greater agri-food production and trade. These policies could also be paired with an expanded set of education programs that integrate nutrition-sensitive information to address current increases in demand and consumption of high-saturated and sugary processed goods, of which total import values are rapidly increasing in PNG. Finally, a greater portfolio of organized databases, analytical tools and policy resources are warranted to facilitate real-time policy analysis that can inform key development investments and initiatives.

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I. INTRODUCTION

Papua New Guinea has experienced positive GDP growth, at approximately 4.3 percent per year for the last decade and more than 5 percent during the last 5 years (World Development Indicators, World Bank - 2019). However, this growth has not led to an economic structural transformation seen in other lower-middle income countries. Rather, fluctuations in the overall economy mirror increases in output and changes in prices within the mining sector. Although PNG does not seem to be shifting to higher-value manufacturing and income employment via a structural transformation, PNG continues to expand its agri-food (including agricultural food and livestock products) trade.

Recent research suggests that with greater productivity output (and associated higher household incomes) comes greater consumption demand for higher value food, particularly in developing countries (Diao and Li, 2020; Muyanga et al. 2019; Reardon et al. 2019; Hernandez et al. 2017; Popkin 2017). Changes in PNG's trade-trends suggest a shift in demand (increased imports) of protein-rich and processed foods. We use the BACI International trade database at the product level to evaluate the trend in agri-food trade trends in Papua New Guinea between 2001 – 2016. Agri-food imports in PNG have broadened and increased both healthy and unhealthy food consumption. For example, agri-food imports of protein-rich, animal-sourced foods have grown by 8 percent per capita per year since 2001. This is a positive transition given that PNG has a limited livestock sector and low levels of protein consumption across poor and non-poor households (Schmidt et al., 2019). However, agri-food imports of sugary soft drinks have increased by almost 12 percent per capita per year since 2001 as well, representing the largest growth in processed agri-food imports over the analysis period.

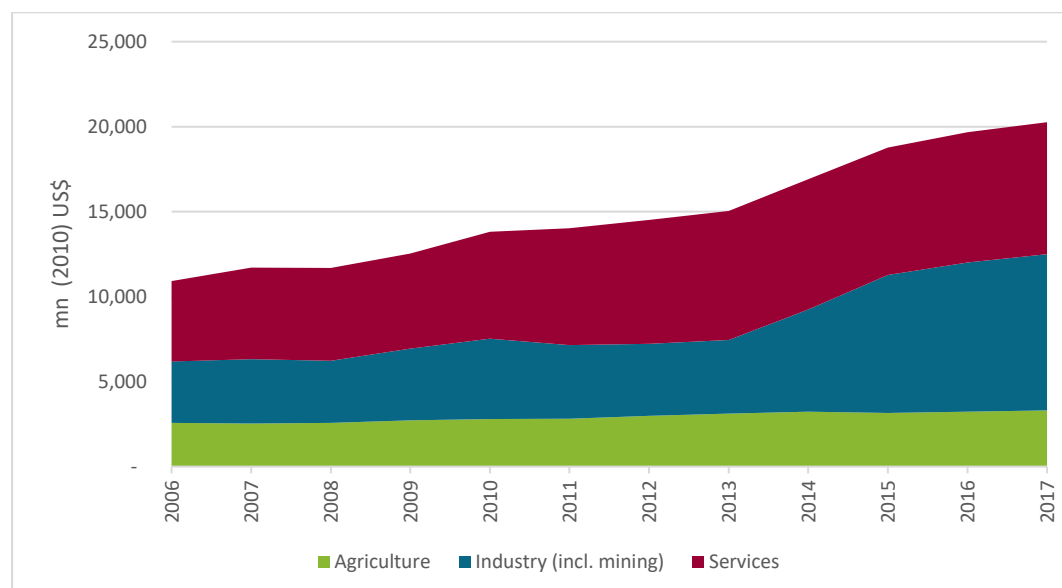
The remainder of this research note is organized into 5 sections. The following section gives a brief overview of GDP growth and macro-economic policy in PNG and its effect on agri-food trade opportunities. Section 3 evaluates changes in overall agri-food trade from 2001 through 2016 using the BACI International trade database at the product level, which attempts to reconcile export and import data from national data sources (Guillaume and Zignago, 2010). We first focus on rice and wheat imports which are important to food security outcomes, and then evaluate imports of other agri-food commodities such as poultry and fish that have experienced significant growth in value over recent years and are important to nutritional objectives put forth by the government of PNG (GoPNG, 2019). Section 4 focusses on the change in imports of processed goods and identifies less healthy, ultra-processed agri-food imports to understand how consumer demand of processed goods continues to change over time. Finally, section 5 concludes.

2. ECONOMIC GROWTH AND MACRO-ECONOMIC POLICY IN PNG

Economic growth in PNG

During the last decade, growth in PNG's industry (including mining) and service sectors have been the main contributors to overall economic expansion. Annual GDP per capita (real 2010 values) grew 2.3 percent per year, increasing from approximately 1,700 to almost 2,500 USD from 2006 to 2017, respectively (World Development Indicators – World Bank, 2019). PNG continues to develop its mining sector, which has driven most of GDP growth since 2013. Growth in the service and agriculture sectors grew at a slower rate, with the service sector increasing from 4,700 to 7,700 million and agriculture increasing from 2,500 to 3,300 million (real US dollars) between 2006 – 2017 (Figure 1).

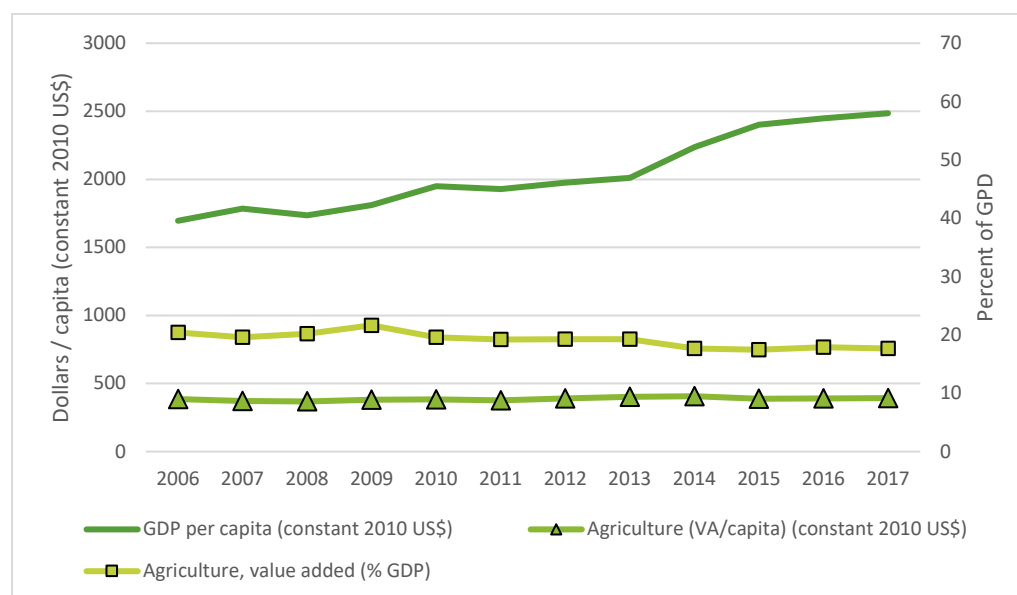
Figure 1: Real (2010) GDP by sector (2006-2017) in PNG



Source: Authors' calculations using World Development Indicators (World Bank, 2020)

Economic growth is often accompanied by structural transformation, whereby a country transitions from lower-productivity agriculture labor and output to higher-value manufacturing and services output, displacing agricultural GDP as the primary economic driver. However, this transformation is not yet occurring in PNG. This may reflect the high capital (and relatively low labor) intensity of the extractive resources sector, resulting in few rural households diversifying out of the agriculture sector. Although the share of agriculture contributing to the overall economy decreased from 21.6 percent in 2009 to 17.6 percent in 2017, the rural sector is not transforming to fill higher-value labor and productivity demand (Figure 2).

Figure 2: Agriculture contribution to GDP per capita (2006-2017) in PNG



Source: Authors' calculations using World Development Indicators

Although a large share of economic growth in PNG has been through the extractive industries sector, agriculture remains an important sector for 80 percent of the total population living in rural areas. Agri-food trade continues to increase and comprises over 10 percent of total export earnings. PNG continues to develop its agri-food export potential through investments in cocoa, coffee and palm oil crops, resulting in PNG being a net exporter of agricultural goods. However, macro-economic policies are also important to incentivizing export-oriented farmers to maintain and increase agricultural output growth.

Real Exchange Rate Appreciation and Incentives for PNG's Agricultural Trade

Profitability and growth of agricultural exports and imports are driven by several factors, including levels of public investment in infrastructure, weather and climate shocks, security and political stability, and conditions in the world market. Government economic policies, including exchange rate, trade and price policies, also heavily influence agricultural trade.

Under World Trade Organization (WTO) rules, developed countries are limited in their policy support to agriculture, particularly, in terms of interventions that distort agricultural prices and affect international trade. Developing countries are generally exempt from these limitations on various types of agricultural subsidies. Nonetheless, it is important to understand the magnitude of price distortions in the economy, some of which may be unrecognized. In particular, trade and macro-economic policies that influence the relative price of tradable to non-tradable goods (the real

exchange rate) often have far-reaching effects on agriculture.¹

Real exchange rates in PNG are heavily influenced by natural resource (oil and gas) exports, which account for nearly 90 percent of export earnings.² These exports, while providing government revenues and foreign exchange to finance imports, can also distort prices in the broader economy. To the extent these export earnings are spent on local (non-tradable) goods and services (including root crops, housing rents, transport, domestic labor, material costs of large investment projects, etc.), their prices tend to rise. Prices of non-oil and gas export goods (such as coffee, cocoa, palm oil, etc.) and import substitutes (including domestically-produced rice), which are determined by world prices, nominal exchange rates and trade policies (e.g. import tariffs and export taxes), tend to remain stable, however. As a result, incentives for producing non-tradable goods and services improve while incentives for producing non-oil and gas export goods decline.³

To a large extent, PNG has avoided major movements in the real exchange rate through careful management of macro-economic policy. Nonetheless, the real exchange rate has appreciated by about 20 percent between 2010 and 2019, reducing the real (macro-inflation adjusted) price of agricultural exports by that amount. During this period, the nominal exchange rate depreciated from 2.72 to 3.39 PNG Kina / US dollar (a 24.6 percent depreciation). Thus, the Consumer Price Index in PNG (a measure of domestic inflation) rose by 56.0 percent. Apart from changes in world prices of tradable goods, the price of tradables relative to the price of non-tradables would have fallen by 20.1 percent. In other words, export-oriented agriculture has tended to become less profitable (per unit) in real terms over the last decade. If not managed properly, farmer incentive to produce export-oriented crops may decrease resulting in decreased total production (and export) volumes. On average, world prices (in US dollar terms) rose by less than 1 percent. Thus, the real exchange rate, as measured by the IMF also appreciated by a similar amount (19.8 percent) (Figure 3).

¹ The real exchange rate is an indicator of the relative price of tradable goods (importables and exportables) to non-tradables. A basic measure of the real exchange rate is the nominal exchange rate adjusted for inflation in the domestic economy and the international economy:

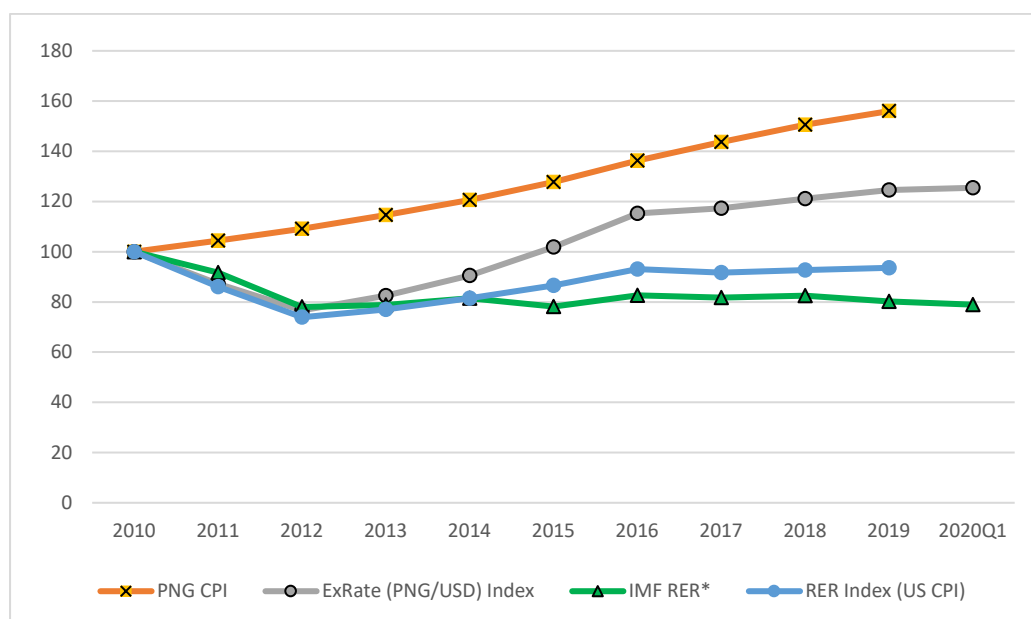
$$RER = ER * CPI^w / CPI^d,$$

where RER is the real exchange rate, ER is the nominal exchange rate measured as domestic currency per unit of foreign currency (e.g. kina/USD), and CPI^w and CPI^d are consumer price indices in the world and domestic economies. See Anderson and Masters (2009) and Dornbusch and Helmers (1988) for detailed discussions.

² IMF estimates for resource exports in 2019 were 9.65 billion US dollars, 89.5 percent of total exports. The current account balance of 6.1 billion US dollars was 24.2 percent of GDP (IMF, 2020).

³ The resulting stagnation is known as the “Dutch Disease”, named after a stagnation of the Netherlands’ economy following the discovery development of oil and natural gas in the North Sea in the 1970s (Fardmanesh, 1991).

Figure 3: PNG Nominal and Real Exchange Rates, 2010-2020



Source: Authors' calculations from IMF International Financial Statistics data.

Changes in the real exchange rate over time are not necessarily bad. Over time, the equilibrium level of a country's real exchange rate changes because of changes in world prices, technical change in various sectors, developments in major trading partner countries and other factors. Taking into account a similar broad range of factors, the IMF estimated that the PNG kina is over-valued by around 11 to 18 percent (IMF, 2020).

Thus, changes in the macro-economic incentives for production of tradable goods in PNG over the past decade have reduced the profitability of agricultural exports (e.g. cocoa, coffee, palm oil, etc.) and of production of import-substitutes (e.g. domestically produced rice). Appropriate non-price distorting PNG government interventions such as investments in road, power and ports can help address the disincentives faced by agricultural tradable sectors. Notwithstanding, PNG has experienced growth in its agri-food trade, with agri-food exports increasing by 8 percent, and agri-food imports increasing by 13 percent between 2001-2016. The following section reviews overall trends in agri-food exports and imports during the last 2 decades, underlining the need to facilitate and maintain domestic logistics and value chains to enable buoyant economic trade and ensure food security among export-oriented smallholder farmers and households dependent on staple food imports. This is particularly important during the current COVID-19 pandemic, whereby unpredictable international and domestic trade policies are being implemented to curb virus spread.

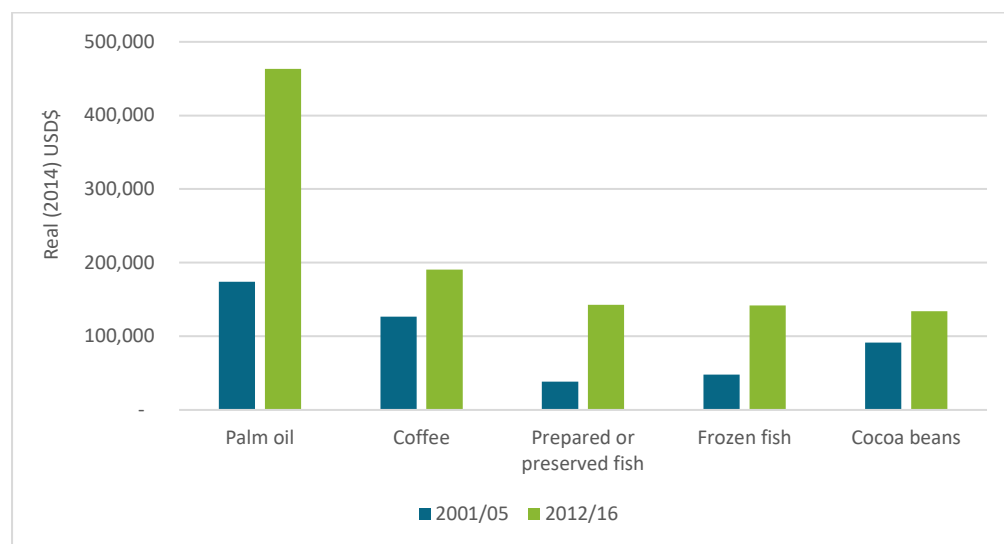
3. OVERVIEW OF PNG AGRI-FOOD TRADE

Agri-food exports

Although the extractive industry is the main driver of economic growth in PNG, agri-food trade makes up an important share of the economy accounting for more than 10 percent of total exports between 2012-2016. Overall, PNG is a net exporter of agri-food amounting to 1.26 billion USD\$ of exports compared to 0.81 billion USD\$ of imports in agri-food trade in 2016-2017. Over the last several decades, PNG invested in key agri-food export commodities including palm oil, coffee and cocoa beans.

In order to evaluate changes in trade over time, we disaggregate the BACI 6-digit trade database by food type, and average volumes and values over two five-year periods (2001-05 and 2012-16).⁴ In terms of overall value, palm oil exports experienced the largest increase, growing on average 9 percent per year (real 2014 USD) from 2001 to 2016 (Figure 4 and Table 1). Coffee and cocoa bean export value grew by 4 percent per year on average between 2001-2016. This increase in cash-crop exports is reflected in production patterns within the country. Over time, rural farmers have shifted their production patterns to take advantage of export markets, for example palm oil farmers expanded area planted by 6% per year on average between 2001-2016 (FAOSTAT, 2017).

Figure 4: Real value of largest agri-food exports in 2012-2016 (Real 2014 USD)



Source: Authors' calculations using BACI International trade database at the product level (2019)

⁴ This allows for a smoothing of yearly import fluctuations and inconsistencies in the import and export data reported by country and compiled within the BACI dataset.

Table 1: Values of top 10 agri-food exports of 2012/16 compared with 2001/05 (Real 2014 USD)

Agri-food exports	2001/05	2012/16	% annual growth rate 2001-2016
Palm oil	173,892	463,150	9.3%
Coffee beans	126,893	190,812	3.8%
Prepared or preserved fish	38,318	142,996	12.7%
Frozen fish	47,772	141,976	10.4%
Cocoa beans	91,590	134,234	3.5%
Coconut and copra	58,322	106,793	5.7%
Fresh fish	18,683	13,403	-3.0%
Natural rubber	6,557	12,294	5.9%
Other seafood	12,838	9,027	-3.2%
Raw hides	3,802	7,040	5.8%
Sub-total of top 10	578,667	1,221,725	7.0%
Total	688,127	1,270,643	6%
Share of top 10 in agri-food exports	84.1%	96.2%	

Source: Authors' calculations using BACI International trade database at the product level (2019)

Note: The Consumer Prices Food Indices of Papua New Guinea from FAOSTAT is used to convert the values of each year to the 2014 price level

In addition to cash-crop development, agri-food exports benefit from PNG's strategic geographic location for maritime fishing. Exports of prepared or preserved fish increased between 2001/05 and 2012/16 by 13 percent per year, with the majority of exports destined to Europe, Thailand and the United States between 2012-2016. Large increases in export value were also experienced in frozen fish, increasing by 10 percent per year.

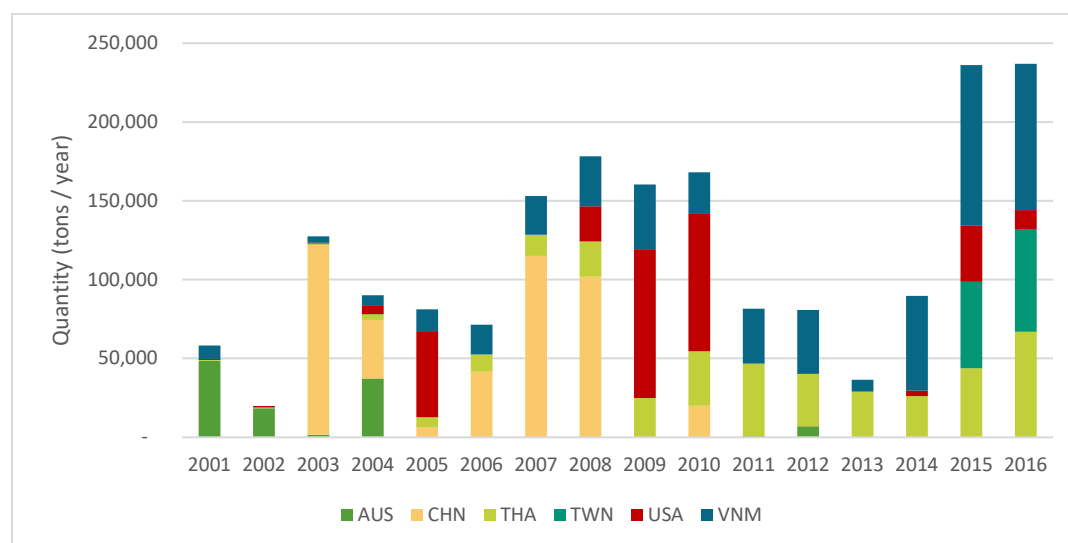
The shift towards export-oriented agri-food production has benefitted not only large commercial farming operations, but smallholder farming as well. According to Aipi (2012), smallholder farmers accounted for over 85 percent of coffee production in PNG in 2012. Approximately 20 percent of the labor force is engaged in smallholder cocoa production, which comprises 90 percent of total output (World Bank, 2014). Maintaining market functionality along each link in the domestic logistics chain is critical to ensuring food security among these farmers that depend on the cash economy for their livelihood. Although social distancing and quarantine policies are important for containing virus spread (policy regulations with regards to COVID-19 and African Swine Flu have significantly affected domestic trade and person / goods movement within rural areas), mechanisms to maintain unhindered marketing of agri-food goods from rural to urban areas is necessary to maintain economic buoyancy in areas focused on cash-crop production.

Agri-food imports

Agri-food imports comprised 14 percent of total imports between 2012-2016, and are important to maintaining food security and supporting dietary diversity. Rice and wheat (flour) combined

comprised 22 percent of total agri-food imports between 2012-2016, with rice imports making up the largest share (15 percent) of overall agri-food imports on average between 2012-16. The quantity of rice imports show a long-term upward trend over time (Figure 5). The quantity of wheat imports in PNG has also grown over the last decade, with the largest increase in wheat imports occurring in 2009/10, following the global food price shock of 2007-08. Since 2010, wheat imports have fluctuated between 150 – 200,000 tons per year, with Australia supplying almost all of PNG wheat imports (Figure 6).

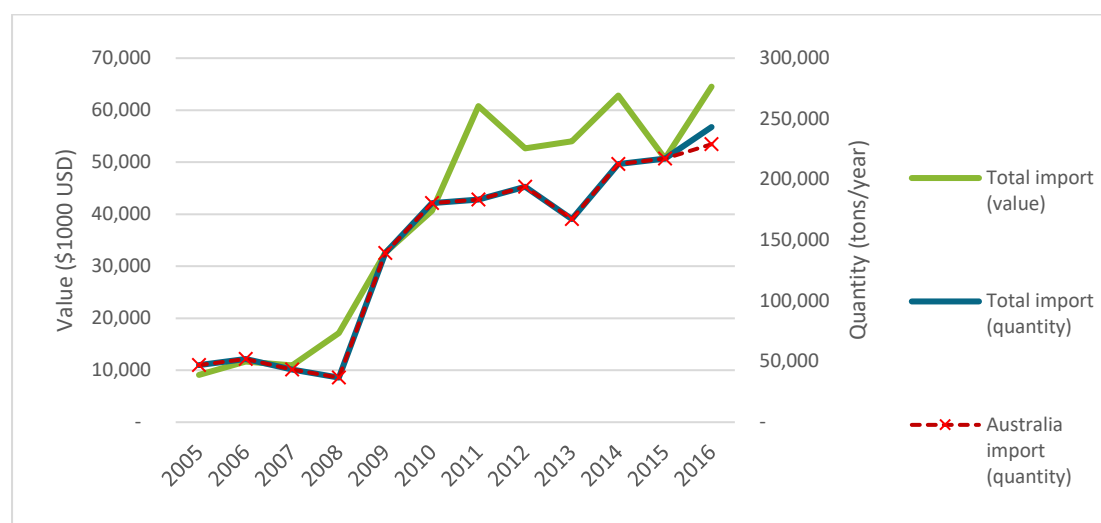
Figure 5: Quantity of milled rice imports (2001-2016) by exporting country (tons / year)



Source: Authors' calculations using BACI International trade database at the product level (2019)

Note: The lower rice import volumes reflected in 2011-2014 likely reflects a lack of data of export to and import from PNG during those years.

Figure 6: Value (Real 2014 USD) and quantity of wheat imports (2005-2016)



Source: Authors' calculations using BACI International trade database at the product level (2019)

Compared to other countries in Southeast Asia and the Pacific, PNG imports a relatively small quantity of rice (Appendix Table 1). Nevertheless, rice imports are important to maintaining food security, primarily in peri-urban and urban areas. Households living in urban areas depend more on rice for overall consumption, whereby urban per capita consumption was nearly 2.5 times that of rural areas (59.2 kg/capita and 24.0 kg/capita, respectively) in 2009/10 (HIES, 2009/10). According to recent estimates reported by Schmidt et al. (2021), PNG will import approximately 300,000 tons of rice in 2020 (consistent with the upward trend shown in Figure 5), amounting to approximately 34 kgs/person/year for the estimated 8.95 million residents of PNG. Since only about half of PNG households consume rice, estimated rice consumption for those that do consume rice is relatively high: 67.0 kgs/capita/year, comprising about 30 percent of the minimum daily calorie requirement of 2,250 calories per adult equivalent (Schmidt et al., 2021).

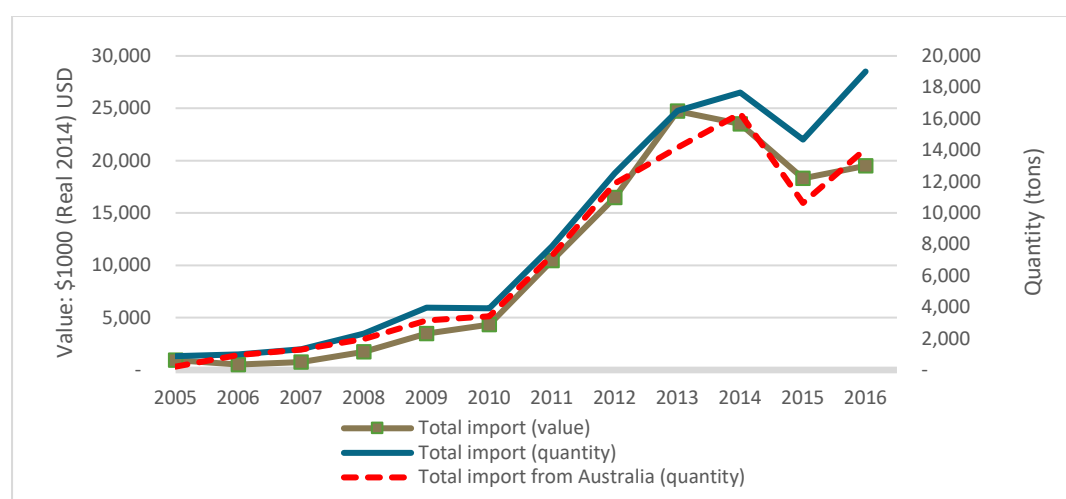
Growth in other agri-food imports reflects a shift in demand towards increased consumption of protein-rich foods. Poultry imports (primarily from Australia) increased, from a low base, more than 30-fold (Real 2014 USD) on average between 2001-05 and 2012-16, growing at 34 percent per capita per year (Table 2 and Figure 7). Preserved and prepared fish imports also increased substantially by 21 percent per capita per year between 2001 and 2016 with Thailand supplying the largest share of demand in the form of tinned mackerel for domestic consumption, which is less expensive than the tinned tuna that PNG directs towards the export market. Sheep and goat meat is the second highest value import in PNG after rice, growing on average 4 percent per capita between 2001 - 2016. Import data also suggest that domestic availability of animal-sourced protein is increasing given that the total quantity of animal feed preparations increased from 18,185 tons on average in 2001-05 to 50,289 tons in 2012-16. The total imported value of animal feed increased 11 percent per year (on average) over the same period.

Table 2: Values of top 10 agri-food imports of 2012/16 and their values in 2001/05 (Real 2014 USD)

Agri-food imports	2001/05	2012/16	% annual growth rate 2001-2016	% annual growth rate per capita
Rice	76,237	119,513	4.2%	1.9%
Sheep or goat meat	30,837	60,232	6.3%	3.9%
Bottled waters (natural, sweetened, aerated)*	2,529	58,838	33.1%	30.2%
Wheat and meslin	11,307	57,463	15.9%	13.4%
Food preparations**	10,669	56,813	16.4%	13.9%
Preserved fish	2,967	30,198	23.5%	20.8%
Palm oil	2,807	23,018	21.1%	18.4%
Animal feed preparations	7,168	21,886	10.7%	8.3%
Pasta	1,080	20,793	30.9%	28.0%
Poultry	649	20,593	36.9%	33.9%
Sub-total of top 10	146,250	469,348	11.2%	8.7%
Total value of agri-food imports	268,373	798,370	10.4%	8.0%
Top 10 commodities share of agri-food imports	54.5%	58.8%		

Source: Authors' calculations using BACI International trade database at the product level Note: *Bottled water includes flavored and sweetened water, and other non-alcoholic beverages such as soda, but does not include fruit juice. ** Food preparations are comprised of processed food items including: protein concentrates, products derived from dried milk, butter substitutes and syrups.

Figure 7: Value and quantity of poultry imports (2005-2016)



Source: Authors' calculations using BACI International trade database at the product level

Given that PNG has a small livestock sector largely void of bovine and small ruminants (higher concentrations of pig husbandry exist in the highland region of the country), increases in animal-sourced food imports (with 7 percent growth per capita in non- or minimally- processed meat imports) are a welcome change. Recent analysis from the IFPRI Rural household survey on food systems in PNG suggest that the protein content of poor and non-poor household diets is seriously deficient (Schmidt et al., 2019). A variety of studies evaluating protein consumption and dietary diversity have linked stunting rates to protein deficiency and lack of essential amino acids in young children (Esfarjani et al., 2013; Ghosh, 2016; Semba et al., 2016).

4. TRADE IN PROCESSED FOODS

We disaggregate agri-food imports into 4 categories following Monteiro (2019) that uses the NOVA classification system to classify agri-food process levels: 1) minimal processed or unprocessed; 2) processed culinary ingredients (e.g. oil, sugar); 3) processed food (e.g. preserved vegetable/fruit/fish/meat); 4) ultra-processed foods (e.g. pasta, sausages). Minimally processed foods in level 1 are treated to ensure stability for transport. We consider processed food imports to include levels 2 – 4 defined above. Processed foods accounted for 50 percent of total agri-food imports on average between 2012-2016 in Papua New Guinea (Table 3). Given PNG's limited portfolio of export trade items in processed goods, we will focus our discussion on processed food imports to evaluate dietary change and demand over time.⁵

Table 3: Imported processed foods by process level (\$1000 Real 2014 USD)

Processed food level	2001/05	2012/16	% annual growth rate 2001-16	% annual growth rate per capita	% of total processed import value in 2012/16
1) Minimal processed / unprocessed	185,261	398,358	7.2%	4.9%	
2) Processed culinary ingredients	22,864	77,412	11.7%	9.3%	19.4%
3) Processed food	14,360	67,737	15.1%	12.6%	16.9%
4) Ultra-processed food	45,887	254,864	16.9%	14.3%	63.7%
Total processed (levels 2-4)	83,112	400,012	15.4%	12.8%	100.0%
Total imports	268,373	798,370	10.4%	8.0%	
% of processed food in total imports	31.0%	50.1%			

Source: Authors' calculations using BACI International trade database at the product level

Overall, processed agri-food imports (levels 2-4 in Table 3) increased by 13 percent per capita per year between 2001-2016. Increases in demand for processed food has positive and negative externalities. For example, purchasing foodstuff in a processed form often saves time and labor in food production and preparation (particularly of female household members). However, greater access to ultra-processed food can introduce unhealthy over-consumption of high-fat, salt and sugar content foods, leading to associated nutritional challenges and higher prevalence of obesity and other non-communicable diseases (e.g., diabetes). Ultra-processed imports comprised almost 64 percent of processed imports and increased by 14 percent per capita per year from 2001-2016, representing the largest growth among processed goods, albeit from a low base (Table 3).

Processed imports reflect a similar trend of increased demand for protein rich foods as data

⁵ Processed food exports also comprise an important share of agri-food exports, accounting for about 55 percent of agri-food exports in PNG between 2012-2016, but are limited to few products such as palm oil, prepared or preserved fish, and coconut comprising 66%, 20% and 11% of total exported processed foods.

discussed above on total agri-food imports (See Appendix Table 2 for a description of import items by food group). Processed animal meat and seafood imports increased by 12 and 21 percent per capita per year between 2001 and 2016 (Table 4). Processed grain imports increased dramatically over time as well, with pasta as the largest contributor to processed grain value import growth between 2001 – 2016, growing 19 percent per capita per year. Although increases in vegetables and fruits increased over time, the processed products within these groups are less appealing from a dietary enrichment perspective, comprising largely of ultra-processed food items (which we discuss in more detail below).

Table 4: Imported processed foods (level 2-4) by food group (\$1000 Real 2014 USD)

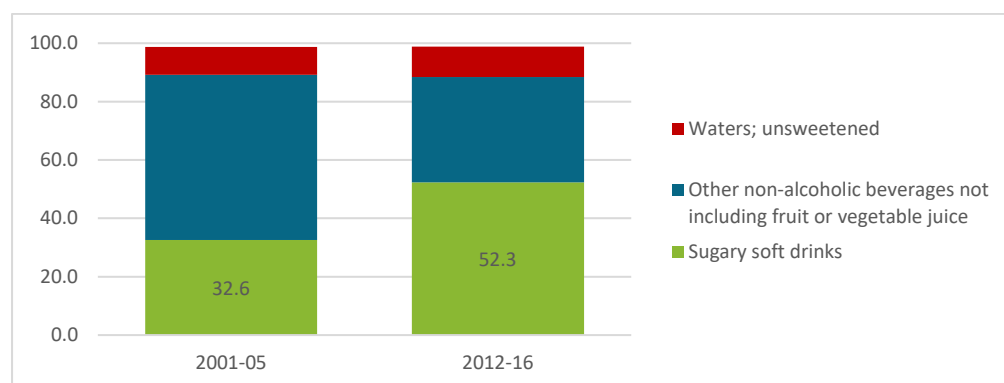
Food group	2001/05	2012/16	% annual growth rate per capita (2001-16)	% of processed in total agri-food import within food group 2012/16	% of total processed import value in 2012/16
Animal meat	3,907	17,713	12.2%	12%	4.4%
Fish and seafood	3,014	30,382	20.7%	67%	7.6%
Vegetable and legumes	3,726	9,560	6.6%	43%	2.4%
Fruit & nuts	3,853	13,921	9.9%	61%	3.5%
Grain (other than rice)	3,989	35,871	19.4%	32%	9.0%
Dairy	4,792	10,857	5.4%	42%	2.7%
Oil and fats	12,499	42,166	9.2%	83%	10.5%
Sweetener	4,406	22,335	13.4%	99%	5.6%
Alcohol	2,668	21,407	18.2%	100%	5.4%
Non-alcohol drinks	2,529	58,838	30.2%	88%	14.7%
Food preparations*	10,669	56,813	13.9%	100%	14.2%
Other	14,781	48,937	9.1%	94%	12.2%
Animal & plant byproduct	12,279	31,213	6.5%	87%	7.8%
Total agri-food processed imports	83,112	400,012	12.8%		100.0%
Total agri-food imports	268,373	798,370	8.0%		
Share of processed imports	31%	50%			

Source: Authors' calculations using BACI International trade database at the product level

Note: * Food preparations are categorized in a 6-digit code that cannot be disaggregated into respective food groups. It includes items such as: protein concentrates, products derived from dried milk, butter substitutes and syrups.

The largest growth in processed foods in terms of value imported occurred in non-alcoholic drinks growing 30 percent per capita per year between 2001-05 and 2012-16. Within the non-alcoholic drink category, sugary soft drinks (i.e. cola, etc.) experienced the largest growth. While in 2001-05, sugary soft drinks comprised about 33 percent of value of non-alcoholic imports, by 2012-16, sugary soft drinks comprised more than half of the value of non-alcoholic drinks, and 8 % of total processed imports (Figure 8).

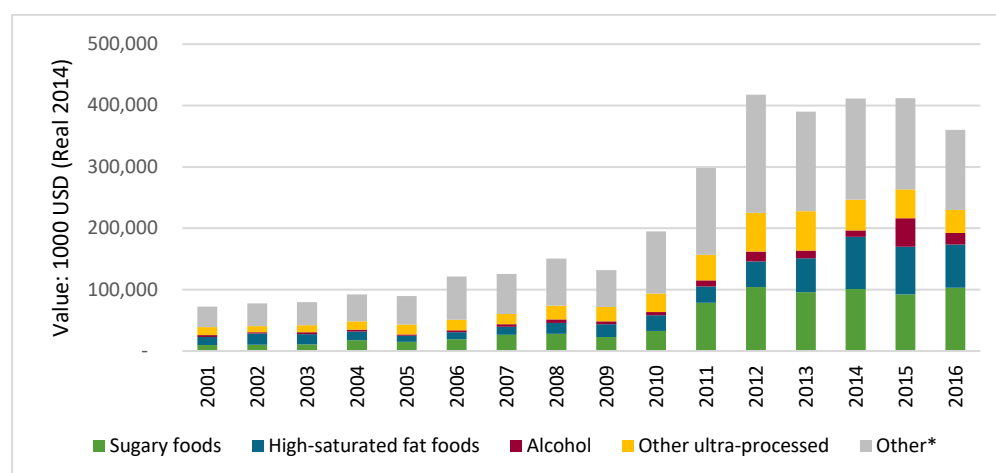
Figure 8: Increase in non-alcoholic drink import by drink type (2001-05 – 2012-16)



Source: Authors' calculations using BACI International trade database at the product level

Based on the detailed 6-digit Harmonized System (HS) codes in the BACI dataset, we further disaggregate ultra-processed foods into sweet foods, high-saturated fat foods, and alcohol (see Appendix Table 3 for a list of each ultra-processed food type within the food type). Figure 9 shows that the value of PNG imports of processed foods increased substantially from under 100 thousand (Real 2014) US\$ to over 400 thousand (Real 2014) US\$ between 2001 and 2016. Within the ultra-processed food categories, the value of sugary food imports increased by 18 percent per capita per year, while high-saturated, fatty foods increased 12 percent per capita per year.

Figure 9: Value of processed food imports in 1000 USD (Real 2014)



Source: Authors' calculations using BACI International trade database at the product level

Note: *Other ultra-processed includes tobacco products, pasta, packaged soups/sauces, etc. *Other is equivalent to processed culinary ingredients imports (level 2, e.g. oil, sugar), and basic processed foods imports (level 3, e.g. preserved vegetable/fruit)

Comparing PNG's ultra-processed agri-food imports to other countries in the Pacific, using the same food category types (detailed in Appendix Table 3) suggests that greater education on dietary consumption choices could provide useful, especially for peri-urban and urban populations. Of the 14 countries included in Table 5, PNG is 6th in largest value of processed imports of ultra-processed foods. Overall, approximately 32 percent of the value of PNG's processed agri-food

imports were ultra-processed. Within the ultra-processed agri-food group, PNG imports the greatest share of sugary foods, comprising 38 percent of total ultra-processed agri-food imports

Table 5: Share of less-healthy food groups in total ultra-processed foods (2012-2016)

Country	Share of ultra-processed foods in total agri-food imports	Share of food type within ultra-processed agri-foods			
		High-saturated fat	Sugary foods	Alcohol	Other ultra-processed
Marshall Islands	45.3	54.1	14.6	6.6	24.7
Vanuatu	42.9	35.4	22.3	17.2	25.0
East Timor	40.2	14.0	28.1	15.4	42.5
French Polynesia	36.0	44.1	27.0	11.4	17.4
Tonga	32.5	32.7	25.9	8.7	32.7
Papua New Guinea	31.5	32.6	38.3	8.4	20.7
Kiribati	30.7	14.3	13.2	14.0	58.4
Solomon Islands	28.0	19.4	29.5	12.6	38.5
Micronesia	27.9	34.8	22.3	14.1	28.8
Samoa	27.5	30.0	25.8	5.8	38.4
Philippines	24.8	33.5	32.9	8.7	24.8
Malaysia	17.2	26.3	30.4	15.9	27.4
Fiji	15.1	29.6	27.0	24.5	18.9
Indonesia	13.3	27.4	28.4	3.8	40.4

Source: Authors' calculations using BACI International trade database at the product level

Note: *Other includes healthy processed goods such as processed chicken, fish, milk, etc. imports

Pacific island nations comprise 9 of the top 10 countries in the world with the greatest obesity prevalence (OECD/WHO, 2020). The WHO STEPwise Approach to Surveillance of NCD Risk Factors (STEPS) survey found that approximately 39 percent of the PNG adult population was overweight (32 percent) or obese (6.8 percent). The more recent PNG Demographic and Health Survey (2016-2018) collected child anthropometry data, however the results were not published due to inconsistency and error in data collection. A variety of studies have associated soft drink consumption with increased obesity rates among children and adults, including a recent study by Kessaram et al. (2015) focusing on Pacific Island youth (other studies include Beck et al. (2014) and Ludwig et al. (2001)). Benjamin (2007) and Pus et al. (2016) echoed Kessaram's work reporting that overweight and obesity prevalence is becoming a health concern in urban areas of PNG. Disaggregating consumption data from the 2009/10 HIES by food processing categories defined by Monteiro (2019) suggests that ultra-processed food consumption may lead to increased prevalence of overweight or obesity among children household members (Table 6), however more recent data collection and analysis is needed for robust estimates.

Table 6: Share of food expenditure on ultra-processed goods of households with at least one overweight or obese child

Share of total food expenditure	Not obese	Obese	t-test	Not overweight	Overweight ^a	t-test
<i>All households with children under 5 years old</i>						
All ultra-processed food	7.0%	8.2%		6.9%	8.0%	*
Sugar-sweetened food	0.5%	0.7%		0.5%	0.6%	
Sugar-sweetened beverage	2.5%	3.4%	**	2.4%	3.3%	***
High saturated fat food	3.0%	3.1%		3.0%	2.9%	
Other ultra-processed food	1.0%	1.1%		1.0%	1.2%	
Processed food	5.4%	6.6%	**	5.3%	6.1%	*
Processed culinary ingredients	4.6%	7.5%	***	4.5%	6.2%	***
Minimally or unprocessed	83.1%	77.8%	***	83.3%	79.7%	***
<i>Sample size</i>	<i>1601</i>	<i>121</i>		<i>1459</i>	<i>263</i>	

Source: Authors' calculation using HIES (2009/10). ^a Overweight includes obese.

5. CONCLUSION

Papua New Guinea has experienced positive GDP growth during the last decade, growing on average at 2.3 percent per year. Over time, PNG has increased overall agri-food imports and exports by approximately 10 and 6 percent per year, respectively, between 2001 and 2016. Agriculture remains an important sector of the economy, with agri-food exports comprising over 10 percent of total export earnings. However, the COVID-19 pandemic and associated domestic and international policies are disrupting trade flows within and between countries, respectively. To maintain agricultural output among export-oriented farmers and ensure food security among rural and urban populations within PNG, it is important that domestic trade, marketing and trader / foodstuff mobility is secured and facilitated within appropriate social distancing measures prescribed to reduce virus spread. Outside of the COVID-19 pandemic, macro-economic (e.g. exchange rate) policies should be reviewed to ensure that export-oriented agricultural production of smallholder farmers remains economically vibrant in order to incentivize yield-enhancing investments.

Previous studies have found that increases in household income among developing countries is often associated with increases in demand for higher-value food items, particularly for more protein-dense and processed foods. The analysis presented here suggests that the demand for a more diversified diet is increasing in PNG, potentially bringing greater access to animal-sourced foods via imports and greater domestic livestock production. However, potential gains in dietary diversity could be diminished if goods are unable to reach markets in a timely manner or price shocks due to market inefficiencies and trader immobility cause domestic and imported goods to be

financially infeasible for rural or urban household consumption.

Although PNG's agri-food import data suggest a greater demand for a more diversified consumption basket, with increases in protein-rich foods, there are signs that these improvements in dietary diversity could be side-tracked by greater demand for higher sugar- and saturated fat-foods (among peri-urban and urban populations in particular). The largest increase in value of overall processed imports between 2001-05 and 2012-16 was dominated by increases in imports of sugary soft drinks (increasing by 12 percent per capita per year between 2001-2016). Garcia-Dorado et al. (2019) argue that improved terms of trade do not fully explain the increase in ultra-processed foods, but rather foreign direct investment and its links to poor food marketing are also driving unhealthy food consumption in lower middle-income countries. Thow (2009) argues for greater participation of public health nutritionists to inform trade policy decisions to prevent and control diet-related chronic diseases such as diabetes related to obesity and poor diet choices.

Education programs that integrate nutrition and diet information will be important to curbing the growing incidence rate of obesity and diabetes in urban areas evaluated in recent studies. These education programs should not only be targeted at children in primary and secondary school, but also caretakers and adult populations, female and male, who often the primary decision-makers on household food expenditure and meal preparation. Finally, Snowden et al. (2013) identify the need for legislation and enforcement of good quality food safety and nutrition labelling throughout the Pacific Islands to curb the increasing incidence of non-communicable diseases related to obesity and over-nutrition.

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Appendix Table 1: Average annual rice imports of importing countries in Southeast Asia and Pacific

Country	Average value of total rice imports 2012-2016	Average annual rice import (tons) 2012-16	Total population in thousands (2014)	Rice import per capita (kg/capita) 2012-2016
Philippines	490,891	1,192,782	100,513.1	12
Malaysia	494,486	986,180	29,866.6	33
Indonesia	407,272	908,945	255,129.0	4
Papua New Guinea	108,773	136,842	7,946.7	17
East Timor	32,852	87,509	1,174.3	75
Laos	32,787	65,492	6,639.8	10
Solomon Islands	38,491	51,552	587.1	88
Fiji	17,470	36,848	866.5	43
Kiribati	7,198	11,295	109.4	103
French Polynesia	7,947	6,253	271.7	23
Micronesia	3,568	5,143	107.4	48
Vanuatu	2,718	4,562	263.9	17
Marshall Islands	1,941	3,966	57.2	69
Samoa	189	261	192.2	1
Tonga	137	158	101.0	2

Source: Authors' calculations using UN-COMTRADE BACI (2019); World Development Indicators (2019)

***Note:** Net rice exporting countries (Cambodia, Myanmar, Thailand and Vietnam) have been excluded from this table

Appendix Table 2: Import per capita (Real USD 2014) of top 10 commodities of selected food groups, and share of processed food in each food group (*processed food categories are in bold italics*)

Food group	2001/05	2012/16
Animal meat		
Sheep/goat	4.95	7.58
Poultry meat	0.10	2.59
Bovine frozen	1.57	2.33
<i>Prepared or preserved meat</i>	<i>0.61</i>	<i>2.06</i>
Edible offal	0.35	1.67
Swine	0.09	1.23
Other meat and edible offal	0.16	0.19
<i>Sausages</i>	<i>0.01</i>	<i>0.17</i>
Poultry live	0.06	0.16
Bovine fresh	0.03	0.13
Total meat	7.98	18.20
Share of processed meat in total meat imports	7.9%	12.2%
Vegetable & legumes		
Dried pepper	0.01	1.14
<i>Vegetables preparations n.e.s.</i>	<i>0.18</i>	<i>0.92</i>
<i>Soups and broths</i>	<i>0.23</i>	<i>0.56</i>
Alliaceous vegetables (e.g. onion)	0.13	0.51
Frozen vegetables	0.08	0.31
<i>Prepared or preserved vegetables</i>	<i>0.12</i>	<i>0.31</i>
Other vegetables	0.03	0.16
Brassicas vegetables (e.g. cabbage)	0.02	0.10
Root vegetables (e.g. carrot)	0.01	0.08
Potatoes	0.04	0.07
Total Vegetable & legumes	0.93	4.44
Share of processed vegetable/legume in total vegetable/legume imports	58.5%	65.9%
Fruit & nuts		
<i>Fruit juices</i>	<i>0.37</i>	<i>1.63</i>
<i>Prepared or preserved fruit or nuts</i>	<i>0.19</i>	<i>0.97</i>
Apples, pears and quinces	0.19	0.85
Citrus fruit	0.07	0.44
<i>Jams, fruit jellies</i>	<i>0.05</i>	<i>0.20</i>
Grapes	0.02	0.14
Nuts	0.01	0.09
Melons	0.01	0.07
Other fruits	0.01	0.06
Dried leguminous	0.01	0.03
Total Fruit & nuts	1.55	6.53
Share of processed fruit/nuts in total fruit/nuts imports	39.5%	42.9%

Note: Processed foods are in bold italics. Imports values are at 2014 real price.

Appendix Table 3: Share of ultra-processed food and processed food imports

Food category and type	4-digit HS code	Share in ultra-processed food imports			Share in total processed food imports		
		2001/05	2012/16	Difference	2001/05	2012/16	Difference
Sugary food							
Coffee mate	903	0.0	0.0	0.0	0.0	0.0	0.0
Sugar confectionery	1704	6.4	4.4	-2.0	3.5	2.8	-0.7
Chocolate	1806	2.5	1.1	-1.4	1.4	0.7	-0.7
Malt extract	1901	5.9	4.7	-1.3	3.3	3.0	-0.3
Jams, fruit puree	2007	0.7	0.4	-0.3	0.4	0.3	-0.1
Fruit/ vegetable juices	2009	5.1	3.2	-1.9	2.8	2.0	-0.8
Coffee concentrate, tea or mate	2101	1.8	2.3	0.6	1.0	1.5	0.5
Non-alcoholic drinks (including soft drinks)	2202	5.5	23.1	17.6	3.0	14.7	11.7
High saturated fat food							
Margarine	1517	7.5	2.9	-4.6	4.1	1.8	-2.3
Sausages and products	1601	0.2	0.5	0.3	0.1	0.3	0.2
Sweet biscuits, wafers	1905	4.6	5.1	0.5	2.5	3.2	0.7
Potato chips	2005	1.6	0.6	-1.0	0.9	0.4	-0.5
Ice cream	2105	0.9	0.7	-0.2	0.5	0.4	-0.1
Food preparations	2106	23.2	22.3	-1.0	12.8	14.2	1.4
Alcohol							
Malt Beer	2203	0.1	2.7	2.5	0.1	1.7	1.6
Wine	2204	3.1	2.0	-1.1	1.7	1.3	-0.4
Vermouth	2205	0.0	0.0	0.0	0.0	0.0	0.0
Fermented beverages	2206	0.0	0.1	0.1	0.0	0.1	0.0
Spirits, liqueurs	2208	2.5	3.6	1.1	1.4	2.3	0.9
Other ultra-processed							
Pasta	1902	2.4	8.2	5.8	1.3	5.2	3.9
Tapioca	1903	0.0	0.0	0.0	0.0	0.0	0.0
Cereal products	1904	1.8	0.8	-0.9	1.0	0.5	-0.4
Yeasts	2102	3.1	1.1	-2.0	1.7	0.7	-1.0
Sauces and preparations	2103	8.4	4.1	-4.3	4.6	2.6	-2.1
Soups and broths	2104	3.2	1.1	-2.1	1.8	0.7	-1.1
Vinegar	2209	0.1	0.1	0.0	0.0	0.0	0.0
Tobacco	2401	3.9	1.3	-2.6	2.1	0.8	-1.3
Cigars	2402	0.6	1.0	0.4	0.3	0.6	0.3
Manufactured tobacco	2403	4.9	2.8	-2.1	2.7	1.8	-0.9
Albumins	3502	0.0	0.0	0.0	0.0	0.0	0.0
Total shares		100	100		55.2	63.7	

Source: Authors' calculations using UN-COMTRADE BACI (2019); World Development Indicators (2019)

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