The Impact of Exogenous Shocks on Households in the Pacific

A Micro-Simulation Analysis

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Abstract

This paper seeks to provide evidence on the extent of household vulnerability to exogenous economic shocks in the Pacific region and consider policy options that help to manage this risk. Characteristics of the region such as remoteness, small size, dispersion, and urbanizing populations lead to pronounced vulnerabilities. The paper presents macroeconomic and distributional analysis and complements it with results of a micro-simulation model customized for this work based on a model used previously by the World Bank to analyze the impacts of the Food and Fuel Price Crisis. The results of micro-simulations serve to highlight the very high levels of economic vulnerability faced in the region. Impacts of economic shocks are not confined to well-off individuals, but have major impacts on the poor. Even moderate shocks are likely to push sizeable

fractions of the population below the poverty line. The shocks considered are not worst case scenarios, but those that can and have occurred frequently. The results show that households are hard hit by increases in oil prices, especially in remote islands where freight costs are higher, while countries on aggregate, and individual households, are exposed to volatility in the prices of the one or two imported food commodities that they depend on. Livelihoods are also often driven by external demand. In particular, many poor households in countries like Papua New Guinea have livelihood strategies centered on cash crops. The results point to the importance of helping households of the Pacific to manage the risk inherent in their lives while prudently using macroeconomic tools at the disposal of the government.

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The Impact of Exogenous Shocks on Households in the Pacific: A Micro-Simulation Analysis

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INTRODUCTION

Countries of the Pacific include some of the smallest independent states in the world and most have a population far below one million. They are also some of the most remote from centers of economic activity. Geographic and demographic settings have a significant bearing on the economic characteristics of the region, and via that, on the vulnerability profile of households.

Source: World Bank World Development Indicators and CEPII

Very small, low-income populations provide an insufficient base for the development and growth of domestic demand-serving industries. Small markets mean that firms cannot achieve economies of scale, and industries lack the benefits of agglomeration. As a result, lack of scale contributes to a higher price environment. So too does the extreme geographical remoteness that elevates the costs of international trade. The added costs of trade (see Figure 14) along with lack of domestic economies of scale constitute severe constraints on the ability of business to engage in competitive export markets.

The more limited set of economic growth strategies available in Pacific islands is evident in historical economic performance. Figure 2 illustrates the fact that that average growth rates of developing countries in the Pacific have consistently lagged behind the rest of the world over each of the last three decades. While GDP per capita growth in developing countries stepped up in recent decades to reach an average of 5 percent a year since 2000, growth in the Pacific has remained stagnant, averaging one percent. As well as being low on average, growth is more volatile than developing countries, particularly those in the rest of East Asia (Figure 3). The variation of growth rates against own country averages over time shows that all Pacific countries are more volatile than the mean for countries in the EAP region.

A decomposition of growth in the Pacific over a ten year period (Figure 4) reveals that those countries that have achieved significant and sustained increases in income have done so based on a few externally-driven sectors: Firstly, natural resource exploitation, including mineral extraction, logging and fishing can sustain high rates of growth so long as the resources last. The clearest example of a resource-rich economy in the region, and indeed the world, is Timor-Leste, with large oil and natural gas fields. Secondly, tourism growth has been a major factor in growth over the period, particularly in Samoa, Vanuatu, Fiji and Palau. Thirdly, cash crop agriculture can offer income growth, as it has done in countries like Papua New Guinea and Solomon Islands. Finally, where limited other opportunity exists, foreign aid-funded public sector growth has helped maintain the economies of the smallest and most remote countries, such as Tuvalu, Kiribati and FSM. Growth in the construction sector is in turn driven by similar factors – the natural resource sector in PNG and public sector in Samoa and Tuvalu.

Figure 2: Small Pacific Island long term growth averages relative to benchmarks

Figure 3: Pacific island growth volatility relative to benchmarks

Source: World Bank World Development Indicators

Note: Annualized growth rates in real per capita GDP (constant US\$). 00s covers 2000 to 2012

Such successful growth strategies tend to rely on economic rents derived from overseas demand that enable countries to derive value in spite of the added costs of doing business. This points to the critical role that these external sources play in supporting growth in the Pacific, as well as the need to address the volatility that is inherent to each of these sectors.

Figure 4: Sectoral breakdown of cumulative real GDP growth over a decade (2000s)

Source: World Bank Staff estimates based on country sources

ECONOMIC SHOCKS IN THE PACIFIC ISLANDS

What kind of shocks matter?

While persistent, gradual inflation can slowly erode living standards, large, rapid changes can be even more detrimental. The effect of a shock is determined by both the absolute size of the shock relative to the household's budget and the household's exposure to it. For example, if rice makes for a large proportion of the household's total expenditure, an increase in its price may have a large impact on the household's ability to make ends meet. An equivalent shock would be less significant for households where rice expenditure is a lower proportion of their budget, either because they do not consume it as much rice, or have higher overall income and expenditure.

Unexpected price changes are much more harmful than predictable ones. Based on known seasonal variation of prices, households can anticipate price changes and adjust their behavior or develop mitigation strategies in advance. Similarly, slow predictable increases in price are less harmful as households are able to gradually adjust their behavior.

Finally, the capacity of actors to mitigate risks as they emerge is important, yet the poorest in developing countries are the least able to do so. Risk mitigation requires information to be able to appraise options. But it also requires resources – human, financial and physical capital will likely need to be invested in, for instance moving to different livelihood strategies. There also need to be viable alternative strategies. In an urbanized

atoll island like South Tarawa, there is little choice but to rely on imported food, whereas there may be more outside options in rural areas with good agricultural land.

Imports of basic commodities

During the food and fuel price crisis of 2007-2008, commodity prices increased sharply, and in some cases the average price in 2008 was more than double the level in 2006 (Figure 5), and they have since spiked again. The impacts were felt across the world in higher food and fuel prices that fed into consumer inflation, but the scale of price rises was especially high in the Pacific. Figure 6 shows that the size of the increase in peak annual average inflation compared to the six years before and after in most Pacific islands was markedly above both the world and developing country averages. These sharp price rises in domestic prices in the Pacific were driven by their high level of dependence on imports.

Countries in the Pacific, which tend to have either very limited land mass available for agriculture or underdeveloped and undiversified agriculture sectors, are more heavily reliant on imports of food than other developing countries. The picture is particularly stark for small island nations which include agriculturally-unproductive coral atolls, such as Kiribati, Tuvalu and Micronesia, where the ratio of food imports to GDP is between three and five times higher than the developing country average (Figure 7) and arable land is far below average (Figure 8).

Figure 5: International food commodity price trends

Figure 6: Peak inflation during food and fuel price crisis difference to non-peak average

Source: IMF Commodity Prices and World Economic Outlook, World Bank World Development indicators

Notes: Ten-year average food imports. Non-peak average inflation is average of three years either side of peak year

As a result, these countries are highly exposed to swings in the price of imported staple foods. As in many parts of the world, poor households spend a larger fraction of their budget on food – but in the Pacific, this often means that the poor spend more on imported food, which is less common. Even though rural households in hardship do tend to self-produce more of their food (Figure 9), dependence on imports remains very high, so that in most countries the net effect is that poor households spend a larger proportion on imported food (Figure 10).

Figure 7: Food imports as a proportion of GDP

Figure 8: Arable land per person

Source: World Bank World Development indicators

Figure 9: Food expenditure of households in hardship by source and rural/urban

Figure 10: Household food expenditure by source and hardship

Source: Household Income and Expenditure surveys

The direct and indirect costs of oil are another important component of poor households' consumption bundle in the Pacific. Despite the potential for renewable energy in many countries, oil-burning plants remain the primary source of electricity (Figure 13). Exposure to oil markets is increased because of the very high transportation costs to the Pacific islands (Figure 14). In addition many countries, notably Kiribati and Solomon Islands have populations that are highly dispersed, adding further to domestic transportation costs. Dispersion and lack of scale also combine to increase the cost of travelling and running infrastructure services like electricity. Added together, these factors lead to a high dependence on oil, which makes up a substantial fraction of embedded costs of the majority of goods and services in Pacific islands. Figure 15 shows that the urban poor in all countries spend a large considerable fraction of their budget on transport and energy costs which have a high oil content, indicating the urban poor are likely to be vulnerable to an oil price shock. However, to a varying extent between countries, poor households in rural areas are also exposed to high fuel costs, for instance in Fiji, Samoa and Tonga as well as in remote archipelagos such as Kiribati and Solomon Islands via heightened transport costs for imported goods.

The micro-simulation analysis will be carried out for Papua New Guinea, Kiribati and Tonga, for which detailed data is available. Papua New Guinea, with a population of over seven million is the largest developing country in the region, and along with Timor-Leste, has the highest proportion of households living in extreme poverty. Kiribati is an archipelago of mostly coral atoll islands, with a population of about 90,000 that is highly dispersed across 33 islands in an area of 3.5 million kilometers of sea. Tonga is a small island nation of just over 100,000 population, which is particularly heavily reliant on private remittances from overseas.

Figure 11: International crude oil price trend

Figure 12: Mineral fuel imports as a proportion of GDP

Source: IMF Commodity Prices and World Bank World Development Indicators

Figure 13: Oil-based electricity generation capacity as proportion of total

Figure 14: International shipping costs

Source: Household Income and Expenditure surveys. World Bank Logistics Performance Index 2012 and Asian Development Bank (2007)

Figure 16 through Figure 21 summarize major imported and domestic components of expenditure for poor households in the three countries. In each of these, red and green segments illustrate food and oil commodities with a high import content. It is important to note that overall import consumption is considerably higher, as large proportions of ‘other consumption’ will also be on imported goods. In both PNG and Kiribati, households spend a sizeable share of their expenditure on imported basics like rice. As expected, dependence on imported foods is particularly high in Kiribati. More than 25 percent of household expenditure in the outer islands is on three imported items alone – rice, sugar and wheat. The vast majority of the rest of food consumption is also imported. Expenditure patterns look somewhat different in Tonga, where the dominant imported foodstuff is wheat, not rice. Tongan households also consume a large amount of meat, much of which will be imported.

Figure 15: Household energy and transport expenditure, by hardship and rural/urban

Source: Household Income and Expenditure surveys

Note: Does not account for oil costs embedded in manufactured goods and transportation costs of goods.

Expenditure on fuel-intensive sectors is high for the urban poor in PNG, but limited for the rural poor reflecting the fact that urban households are more likely to use these services. Some urban poor households will have electricity connections, while there is almost no coverage in rural areas. Urban households are more likely to need to purchase cooking fuel than to gather firewood, and to pay for transport to go about their daily life in the city, compared to rural populations who spend less on transport as well. Similarly in Kiribati, energy costs are a significant proportion of urban poor spending, but not on the outer islands.

Figure 16: PNG rural poor expenditure

Figure 17: PNG urban poor expenditure

Source: Household Income and Expenditure surveys

Figure 18: Kiribati rural poor expenditure

Figure 19: Kiribati urban poor expenditure

Source: Household Income and Expenditure surveys

Figure 20: Tonga rural poor expenditure

Figure 21: Tonga urban poor expenditure

Source: Household Income and Expenditure surveys

Cash crop income

In countries where formal employment opportunities are very scarce, crops grown for export can provide a critical source of cash. This is particularly the case in the Melanesian countries, where cash crop exports constitute a sizeable proportion of GDP. While the compositions of cash crop sectors vary, they can often support a large number of households. For instance in PNG, while oil palm exports are equivalent to more than 10 percent of GDP, only around 16,000 households cultivate their own crops. In contrast, coffee exports are 2 percent of GDP, yet provide income to an estimated 400,000 households. Whilst providing an important source of income, cash crops prices are volatile and expose households to significant income risk. Households growing cash crops tend to be poorer than the average rural household. These are households that generally have fewer alternatives or sources of income, and in both PNG and Kiribati cash crops are an important source of cash for the poorest households.

Figure 22: International cash crop commodity price trends

Figure 23: Cash crop exports as a proportion of GDP

Source: IMF Commodity Prices and World Bank Staff estimates based on country sources

Note: Does not include some small-scale exports (e.g. beef and kava in Vanuatu, both <1% GDP)

Figure 24: Proportion of households growing cash crops in PNG

Source: Household Income and Expenditure survey and PNG 2000 Census

Figure 25: Rural households growing cash crops by expenditure decile

Source: Household Income and Expenditure surveys

Figure 26: Cash crop income, Kiribati

Figure 27: Cash income source of the poor, Kiribati

Source: Household Income and Expenditure surveys

Note: Cash crop income in Kiribati includes all agriculture and fish cash sales

Remittance income

In countries such as Tonga, Samoa, Fiji and Kiribati, remitted income and transfers from overseas workers and family are a significant source of income for many households. At their peak, remittances, including overseas labor earnings of residents and private transfers have reached 35 percent of GDP in Tonga and 25 percent in Samoa. As Figure 29 shows, remittances are received by both poor and non-poor households, but are relatively more important for poor receiving households. Remittances are mostly received from a small number of countries which have bilateral overseas work agreements and where expatriate communities are concentrated. In some countries, overseas work is concentrated in particular sectors, such as sea-faring in Kiribati. Remittances incomes are therefore vulnerable to downturns in destination countries and sectors. They are also highly dependent on a facilitating policy environment in destination countries, and changes to visa and international work schemes can have a dramatic impact. This can be seen in Tonga for instance, where remittances that had averaged over 34 percent of GDP in the decade to 2007 halved as a proportion of GDP to 15.8 percent in 2012 as a result of sharply falling remittances from the United States and New Zealand².

Figure 28: International remittance flows

Figure 29: Households receiving remittances

Source: World Bank Global Economic Prospects and Samoa Bureau of Statistics, Household Income and Expenditure Surveys

MODELING THE IMPACT OF EXOGENOUS ECONOMIC SHOCKS ON HOUSEHOLDS

Household welfare

The focus of this section is to assess the possible effect of price shocks on household welfare, and on indicators of poverty. Although measures of extreme poverty are close to zero in many of the Pacific islands, there are higher levels of material poverty, as measured by national poverty lines. The situation is markedly

² Remittance data for Tonga is under review by the Tongan authorities, because of concerns around data quality.

different in Timor-Leste and PNG, where they are far more people living in extreme poverty, with about one in five in each country surviving on less than US\$ 1.25 a day.

Increases in the cost of items that feature in consumption baskets of lower income households will increase their cost of living and reduce their real expenditure. Similarly, a drop in income, be it from cash crop earnings, remittances or another source, will also tend to lead to a fall in real expenditure. The simulation exercise illustrates changes in real expenditure relative to the locally-determined poverty line that indicates what level of real spending would be needed to cover basic requirements.

Figure 30: Poverty headcount ratio, absolute poverty

Figure 31: Poverty headcount ratio, national poverty line

Source: Household Income and Expenditure surveys

Figure 32: Household expenditure distribution, PNG

Figure 33: Household expenditure distribution, Kiribati

Source: Household Income and Expenditure surveys

Exogenous shocks

The preceding analysis shows that countries in the region are particularly highly exposed to a variety of economic shocks, especially price rises of imported basic foodstuffs and oil, price falls in cash crops and falls in incoming overseas remittances. However, this aggregate analysis can only provide an indication of

household vulnerability. To assess this in more detail, it is necessary to conduct analysis with household-level data that will reveal the distribution of expenditure and income patterns based on a nationally-representative sample. Specifically a micro-simulation approach is taken that traces the impacts of an assumed level of shocks on different types of households.

The simulated price shocks will be based on specific commodities, selected as those which Pacific countries are particularly highly exposed: Kiribati, Vanuatu, Tonga and Papua New Guinea. As with many Pacific countries, the major basic imported food commodity is rice. Wheat is also an important imported basic good. On the export side, in PNG, coffee, cocoa and oil palm prices will be shocked together, and in Kiribati the price shock will be for copra.

The simulations will seek to model price and income shocks of a magnitude than can and have occurred relatively frequently. Therefore, the results are not meant to describe extremes which are unlikely to occur, but scenarios which have a roughly one in three chance of occurring in any given year. Figure 34 to Figure 39 describe international price trends of some of the most important commodities for the Pacific and their volatility. The intervals are based on one standard deviation bounds on annual variation over the last 20 years, which means that a year-to-year variation of this magnitude has occurred over the last 20 years with probability of about 30 percent. Most of the commodities considered have a coefficient of variation (standard deviation over mean) of around 20% over the period, with oil price volatility higher at 30%³. This volatility is also highly covariate. Correlation matrices for import and export commodities are presented in Table 1, which show that, especially for imports, prices tend to move together, magnifying the aggregate impacts further.

Source: IMF Commodity Prices

³ Results are similar for a sensitivity analysis that cuts the data off at 2007.

Figure 36: International oil price volatility

Source: IMF Commodity Prices

Figure 37: International coffee price volatility

Figure 38: International cocoa price volatility

Source: IMF Commodity Prices

Figure 39: International copra price volatility

Table 1: Correlation matrix for import and export commodity price changes

Import commodities				Export commodities			
	Oil	Rice	Wheat		Coffee	Copra	Cocoa
Oil	1.0			Coffee	1.0		
Rice	0.31	1.0	1.0	Copra	0.46	1.0	
Wheat	0.39	0.49	1.0	Cocoa	0.16	0.25	1.0

Modeling and data

The primary data source is anonymized all-unit record household income and expenditure surveys. For PNG this survey was carried out in 2009/10, for Kiribati in 2006 and Tonga in 2009⁴. The sample size of the surveys varies between 1,000 in Kiribati and 4,000 in PNG. The model uses a micro-simulation approach to assess the impacts of macro-shocks on households. The model is based on the World Bank Poverty Reduction and

⁴ It has not been possible to get full individualized data for Tonga, so for this country simulations have been carried out on a household basis, and extrapolated to per capita terms (overlooking any differences in household size).

Economic Management Food and Fuel Simulation model that is publically available⁵, although it has been significantly customized for the purposes of this exercise. Similar approaches have been used in recent papers on the simulated impacts of commodity price shocks, for instance Anderson, et al., 2013, Wodon & Zaman, 2008.

The model is based on a partial equilibrium approach. Therefore, it does not require data and assumptions that establish the inter-relationships between sectors and actors in an economy, which makes it more readily usable in data-poor environments such as encountered in many countries in the Pacific. Assessment of changes in a narrowly defined selection of prices is generally more suited to this kind of modeling approach. Direct effects on households will tend to dominate in the rice sector, where there is negligible domestic production. Cash crops are primarily exported, so have limited impact outside their direct impact on growers. Oil price shocks are felt in a more diffuse way, which is reflected in the simulation of this shock as will be described below.

The model assesses impact effects only, and does not incorporate any substitution by households away from higher priced food items or lower value crops. In this respect, the estimates represent an upper bound on the possible impact for a given household since to the extent possible; households will rationally substitute away from higher priced goods to reduce the welfare impact of a price shock. However, for the kind of shocks we look at, the ability of households to substitute in many cases is likely to be relatively limited. In many parts of the Pacific there is limited domestic agricultural supply, and limited potential to raise production in the short-term, so households have little choice but to rely on imported food. This is particularly the case in urban areas, and on atoll islands such as in the archipelago of Kiribati. But as authors such as Gibson (2013) have pointed out, most poor or nearly-poor households may have a capacity to switch to cheaper and lower quality foods in response to a price shock. In rural areas, there may be more alternative 'hungry time' food sources.

It is also unlikely that households can easily switch from cash sources such as cash crops or remittances. Mature trees represent a significant fixed asset for households, and they are unlikely to remove plantations to grow other crops in response to year to year price variations. In the extreme, households may abandon cash crops if prices fall too low to try to gather food. Similarly, since coffee and cocoa plants take 15 to 20 years to mature, additional supply responds only very slowly to price incentives. These limited supply responses are borne out by recent research which suggested that the supply elasticity for various cash crops in Papua New Guinea is negligible in the short to medium term (Aba et al, 2012; Aipi et al 2012).

⁵ <http://go.worldbank.org/3C2XG5B1G0>

By considering the pre-substitution effects of shocks, this analysis seeks to identify households that are likely to be adversely affected, and the extent of harm to households such shocks could cause. Seeking to predict actual behavioral changes would be complex, and require more information than is currently available for Pacific islands. Final changes in welfare might also warrant a more nuanced view of household welfare than the relatively simple approach of food and basic needs poverty. For instance, switching to lower-quality or 'hungry time' foods might provide cheaper calories but leave people deficient in micro-nutrients.

Model structure

The model calculates a range of parameters and estimates for three scenarios: the previous period, the baseline, and the simulation scenario. The baseline and simulation scenarios are compared to consider the effects of a shock. In addition to the standard sectoral breakdown of agriculture, industry and services, the model breaks down the economy into further sectors, guided by the commodity groupings that are directly affected by the shocks. These include: Coffee; cocoa; coconut and derivatives; palm oil; rice; wheat products; fruit and vegetables; fats and oil; fish; meat; other food and drink; fuel, energy and electricity, transport, other expenditure.

Prices are set to a unitary value in the previous and baseline period. While active baseline forecasts can be incorporated, they have been excluded for the purposes of this modeling exercise. Prices for the relevant sectors are then altered in the simulation scenario to reflect the price shock, based on the following equation:

$$PC_i = PP_i \cdot (1 + itx_i + tm_i + trsp_i)$$

Where final consumer prices (PC) are comprised of producer prices, sales and excise tax rates (itx), import duties (tm) and transport costs ($trsp$). The change in transport cost for all sectors is linked to the price of the transport sector which is in turn affected by the world price of oil. A full set of parameters used to calibrate the model is provided in the appendix.

$$trsp_i^{SM} = trsp_i^{BL} \cdot \left(\frac{PC_{trsp}^{SM}}{PC_{trsp}^{BL}} \right)$$

Based on the analysis of historical volatility above, the size of a relatively likely shock for most commodities is around 20 percent, and 30 percent for oil given its higher price volatility. Changes in the international price of commodities may not necessarily feed through to the same price change for final consumption goods. To the extent that the consumer price is made up of other input costs and profit margins, these may dilute the impact. Pricing behavior, industrial organization of the sector and the sensitivity of suppliers and consumers to prices changes will all have an impact. However, it is difficult to quantify these effects with precision. In

this analysis, final markets prices are assumed to be determined by primary product and transport prices with full pass-through.

Table 2: Size of simulated shocks	
Commodity	Price shock
Rice	20 percent price increase
Wheat	20 percent price increase
Crude oil	30 percent price increase
Coffee	20 percent price decrease
Cocoa	20 percent price decrease
Copra	20 percent price decrease
Remittances	20 percent decrease

Baskets of consumption weights, $X_{i,t,k}$ are established for i sectors and k groups, which are: i) national; ii) below the appropriate regional poverty lines; iii) for specific sub-groups such as cash crop farmers below the poverty line. In line with assuming no substitution effects, the weights are unchanged between the baseline and simulation.

With the baseline poverty line decomposed into prices and weightings, the poverty line is then reaggregated in the simulation scenario. I.e.:

$$E_{t,k} = \sum_n^{i=1} PC_{i,t} X_{i,t,k}$$

where $\sum X_i = 1$ for n goods

In the final step of the poverty modeling, individual expenditure is assessed against both the baseline and simulation poverty lines, and the results presented as poverty headcount, gap and severity ratios. The impact on consumer inflation is also estimated.

Income shocks feed directly into the individual's real expenditure constraint, such that a change in total income has an equivalent proportional effect on total expenditure. E.g. if cash crop income drops by 20 percent, and made up half of total income, expenditure would fall by 10 percent.

Box 1: Poverty indicators

The simplest measurement of poverty, for a given poverty line, is to assess how many households or individuals fall below that line. Expressed as a proportion of the whole population this constitutes the poverty headcount ratio (p0). However, this measure overlooks how intense household's poverty is, and for instance does not differentiate between a household living just below the poverty line and another far below. A common measure to account for the intensity of poverty is the poverty gap (p1), which measures the average distance of poor households from the poverty line. Finally, a third measure is used to capture poverty severity index (p2) which captures the degree of inequality amongst the poor. All three measures are specific measures of the generalized Foster-Greer-Thorbecke (FGT) poverty metric, where alpha equals 0, 1 and 2 respectively.

$$FGT_{\alpha} = \frac{1}{N} \sum_{i=1}^H \left(\frac{z - y_i}{z} \right)^{\alpha}$$

Results for selected countries – cost of living shocks

In most cases, commodity price shocks are directly applied to the commodity-sector defined in the model⁶. An exception to this is an oil price shock which feeds through to a variety of different sectors. An adjustment is made to the price of the electricity sector in PNG to account for the significant hydroelectric generation capacity in that country.

Table 3: Sectoral price changes in response to oil price variation

In response to:	Papua New Guinea	Kiribati	Tonga
30% change in price of oil:			
Petroleum products	30%	30%	30%
Public transport	30%	30%	30%
Electricity	15%	30%	30%
Transport costs (all goods)	30%	30%	30%

⁶ As mentioned above, other than explicit assumptions about embedded transport costs and electricity generation mix, the model assumes full pass-through of modelled price changes into domestic prices.

Papua New Guinea

The micro-simulation modeling reveals that shocks to food commodity prices would push large numbers of people into hardship, and deeper into hardship, in Papua New Guinea. An increase in imported rice prices of 20 percent is likely to place about 35,000 more people (0.5% of the population) into poverty, with a total welfare loss to the poor of around US\$ 7.5million (in 2012 prices). In urban areas, where there are fewer alternatives to rice, 0.8 percent of the population would be made poor. Rural populations, including those living in peri-urban areas, are also affected. The majority of the country's less well-off population lives in rural areas, so 0.5 percent falling below the poverty line there translates to 28,000 people, compared to the 8,000 affected in urban areas. Households already in hardship in both rural and urban areas would also be adversely affected, and would have to find an additional 0.5 percent (urban) and 0.8 percent (rural) of their budgets to finance the same consumption basket. The increase of rice prices would be sufficient to push up national inflation by 1.4 percentage points, with the urban CPI likely to rise by more. A shock to wheat prices is predicted to have a smaller effect on poverty. Although there is significant consumption of bread and other wheat-based foods in urban areas, it is not as important a food as rice, and a shock to its price alone only leads to a relatively small number of people moving below the poverty line. Table 4 below summarizes the results of these, as well as the oil and combined shocks.

An increase in world oil prices is felt across a range of expenditure items by households, and is estimated to push the greatest number of people into hardship. An oil price shock leads directly to higher petrol and kerosene prices. It also increases the cost of public transport and electricity, and pushes up the cost of most goods by increasing the cost of transport both to and within the country. The large size of the shock and the diffused impacts via transportation costs of goods means that a price shock entails more severe impacts on the poor. The estimated impact of an increase in oil prices by 30 percent is to push 116,000 people below the poverty line – 1.6 percent of the total population. Again, urban populations would be the hardest hit, as they spend larger fractions of their budget on imported goods and transport to get around urban areas to access services and work opportunities. The amount that would be needed to compensate the poor for the price rise would be US\$ 26.7 million. Consumer prices are estimated to rise by 4.9 percent.

In recent years the prices of basic commodities including food and fuel have increased together, and a simulated simultaneous shock to oil, rice, and wheat is estimated to push 2.5% of the population into hardship. This is equivalent to moving 178,000 people into poverty, at a welfare cost of US 38.7 million. Many of those already below the line would fall deeper into poverty. A measure of the severity of poverty, which captures how far below the poverty line some households are, would increase by more than 10%. Finding the right policy levers to compensate people is a major challenge, but even if a perfect mechanism did exist, the government would struggle with the fiscal cost of alleviating this increase in hardship, with the

cost to the poor of a simultaneous shock being equivalent to about 3.4% of government discretionary spending.

Table 4: Summary results for Papua New Guinea cost of living simulations

	Increase in rice price (20%)	Increase in wheat price (20%)	Increase in oil price (30%)	All three commodity shocks
People made poor (% of population)	35,000 (0.5%)	4,000 (0.1%)	116,000 (1.6%)	178,000 (2.5%)
<i>Of which rural</i>	28,000 (0.5%)	2,000 (0.1%)	93,000 (1.6%)	143,000 (2.4%)
<i>Of which urban</i>	8,000 (0.8%)	2,000 (0.2%)	22,000 (2.2%)	35,000 (3.4%)
Annual welfare loss, total poor	US\$ 7.5m	US\$ 2.2m	US\$ 26.7m	US\$ 38.7m
Proportion of poor rural hhd budget	0.7%	0.2%	2.6%	3.6%
Proportion of poor urban hhd budget	0.4%	0.2%	1.3%	2.1%
Change in poverty severity	2.1%	0.8%	7.4%	10.5%
Inflation	1.4	0.6	4.9	6.9

Notes: Welfare loss is annualized, expressed in 2012 prices.

Kiribati

Table 5: Summary results for Kiribati cost of living simulations

	Increase in rice price (20%)	Increase in wheat price (20%)	Increase in oil price (30%)	All three commodity shocks
People made poor (% of population)	630 (0.7%)	170 (0.2%)	3,200 (3.7%)	5,200 (6.0%)
<i>Of which rural</i>	460 (1.0%)	170 (0.4%)	900 (1.9%)	1,200 (2.9%)
<i>Of which urban</i>	170 (0.4%)	-	2,300 (5.9%)	4,000 (10.2%)
Annual welfare loss, total poor	US\$ 92,000	US\$ 24,000	US\$ 323,000	US\$ 574,000
Proportion of poor rural hhd budget	0.5%	0.1%	0.9%	1.7%
Proportion of poor urban hhd budget	0.5%	0.2%	1.8%	2.8%
Change in poverty severity	3.9%	1.9%	18.6%	25.1%
Inflation	1.6	0.8	7.3	9.7

An oil price shock of 30% is estimated to push 3,000 people or 3.7% of the population into hardship. An increase in the price of rice is estimated to place around 600 people below the poverty line. A wheat price shock would have a moderate effect. Inter-island shipping costs are subsidized in Kiribati so higher costs may increase fiscal pressures. Even aside from domestic shipping, higher transport costs would still be felt by households from international shipping. An oil price shock would hit Kiribati particularly hard, given the higher shipping costs of reaching its remote location. A total of 3,200 people, 3.7 percent of the population, would fall into poverty as a result, with those in South Tarawa being hardest hit. Similarly, the adverse effect of urban households already in hardship is larger, with additional costs equating to nearly 2 percent of their

total expenditure, and poverty severity nationwide would increase sharply, by 18.6%. Table 5 summarizes these results, and the results of the following food commodity simulations.

A simultaneous shock to the three basic commodities (rice, wheat, and oil) in Kiribati is particularly harmful, pushing 6% of the population into hardship. The impact would be more severe than might be suggested by the sum of individual shocks – many more households who would just make ends meet if the price of one commodity rose on its own are pulled into poverty when faced with multiple price increases. 5,200 people would be expected to fall into poverty.

Tonga

Table 6: Summary results for Tonga cost of living simulations

	Increase in rice price (20%)	Increase in wheat price (20%)	Increase in oil price (30%)	All three commodity shocks
People made poor (% of population)	-	300 (0.4%)	1,200 (1.4%)	1,600 (1.9%)
<i>Of which rural</i>	-	250 (0.4%)	800 (1.0%)	1,200 (1.5%)
<i>Of which urban</i>	-	50 (0.2%)	400 (1.4%)	400 (1.7%)
Annual welfare loss, total poor	US\$ 0.04 million	US\$ 0.9 million	US\$ 1.8 million	US\$ 2.9 million
Proportion of poor rural hhd budget	-	0.3%	0.5%	0.8%
Proportion of poor urban hhd budget	-	0.2%	0.7%	1.0%
Change in poverty severity	-	2.6%	6.3%	9.1%
Inflation	-	0.9	3.2	4.2

Notes: Welfare loss is annualized, expressed in 2012 prices.

In Tonga, 1% of the population would be pushed into hardship from an oil price shock, while a simultaneous shock to oil, wheat, and rice prices would push about twice as many people into hardship. The types of imported food consumed in Tonga are markedly different from Papua New Guinea and Kiribati. Rice is not a major staple, with meat and wheat products being the mainstay of the diet, along with local vegetable produce. Therefore, a rice price shock has little impact, but an increase in wheat prices directly affects households, particularly in rural areas. Approximately 1,200 people would be expected to fall below the poverty line following an increase in oil prices, while 1,600 people would be affected by a simultaneous price shock to oil, wheat, and rice. These shocks would also push the existing poor further into poverty. Overall, the welfare cost to the poor would be US\$ 2.9 million for the simultaneous shock, equivalent to 1 percent of total consumption and expenditure of urban households and 0.8 percent for rural households, and 3.2 percent of government discretionary spending. These results are summarized in Table 6. It is worth noting that the analysis does not consider the indirect effects of changes in grain prices on meat, but since grain feed is an important input into livestock-rearing, prices often move together. The estimates are therefore likely to understate the overall effect of price shocks on household expenditure.

Box 2: Pacific countries face the equivalent of a Global Food and Fuel Crisis every few years

Although not on a strictly comparable basis, the results illustrate that Pacific island countries might expect to see the kind of impacts that are comparable to the Global Food and Fuel crisis in other countries every few years.

Papers such as Ivanic & Martin (2008), Dessus et al (2008) and de Hoyos & Medvedev (2011) have estimated the impact of the 2007-2008 spike in commodity prices on poverty in developing countries. De Hoyos & Medvedev estimate that the increase in food prices would put 2.38% of households below the poverty line. Ivanic et al estimate this to be 3%. Dessus et al indicate that for the 20 worst affected countries in the world, the equivalent increase in poverty headcount ratios is 5%.

<i>Paper</i>	<i>Change in headcount ratio</i>	<i>Assumptions</i>
de Hoyos & Medvedev	2.4%	Based on all food consumption, 21 low & middle income countries
Ivanic & Martin	3.0%	Based on major food commodities, 9 low income countries
Dessus et al	5.0%	Estimate for 20 worst affected countries from a dataset of 72 low and middle income countries
Current report (excl oil)	0.4 - 0.7%	Single commodity only. Five times smaller
Current report (incl oil)	1.9 – 6.0%	Four commodities including oil. Five times smaller

Prices of food and fuel increased by more than 100 percent over the period these papers look at, so it is important to note that these estimates are based on food price shocks more than 5 times greater than the ones presented in this report. The present estimates also only look at two food commodities whereas the global estimates look at a broader basket of goods. On the other hand, these global estimates do not generally estimate the impact of fuel price increases on transport and energy costs, as the current estimates do. Keeping in mind these methodological differences, the results for commodity price shocks are comparable to the global averages.

Results for selected countries – income shocks

It is not only via expenditure that households are exposed to external price shocks. In Pacific countries, many income sources are also highly dependent on external factors. Falls in the price that cash crops can be sold for can also be a major source of impoverishment in PNG. A third of households in PNG grow coffee, which is often the only source of cash income in a household. Cash-cropping households tend to be poorer than the average household with the poverty headcount ratio for cash-crop households at 45 percent compared to 40 percent for all households. A drop in coffee prices by 20 percent would force 230,000 people below the poverty line – 3.3 percent of the country's population. This is equivalent to one in every 20 people who are not already poor. The potential impacts on the already poor are particularly disastrous – with these households needing to find alternative income to finance 6.3% of expenditure, and poverty severity for cash

cropping households increasing by more than 50%⁷. The welfare cost borne by the poor is also large at US\$ 81.3 million, and amount in excess of 7 percent of the PNG government annual discretionary budget.

As in PNG, a large proportion of households outside the urban area rely on cash crop income in Kiribati. A major source of income in the outer islands is copra, which benefits from a guaranteed purchase scheme operated by government which in effect heavily subsidizes households to produce copra. Across all outer island households, agricultural cash incomes which are primarily copra, make up 37 percent of cash income (excluding non-monetized income like home-grown food). In response to a fall in copra prices, it is expected that 800 people, 1.2 percent of the population, would move below the poverty line in the absence of a increased government subsidy. Alternatively, the government would need to increase the already unsustainably high level of subsidy it shoulders.

In Tonga, remittances from overseas form an important source of household income. The results of the micro-simulations show that a 20 percent fall in remittances to households would put 1.1 percent of the population into poverty, of which more than half are based in the urban center of Nuku'alofa at a total welfare cost to the poor of US\$ 2.1 million, which is around 4 percent of government discretionary spending.

Table 7: Summary results for income simulations

	Decrease in coffee price: PNG (20%)	Decrease in copra price: Kiribati (20%)	Decrease in remittances: Tonga (20%)
People made poor (% of population)	230,000 (3.3%)	800 (0.9%)	900 (1.1%)
<i>Of which rural</i>	230,000 (3.7%)	800 (1.6%)	400 (1.0%)
<i>Of which urban</i>	-	-	500 (1.4%)
<i>Of which affected hhlds</i>	230,000 (9.8%)	800 (2.2%)	
Annual welfare loss, total poor	US\$ 81.3m	US\$ 62,000	US\$ 2.1 million
Change in poverty severity¹	50.7%	17.0%	2.3%

¹ Poverty severity for affected households only.

Notes: Welfare loss is annualized, expressed in 2012 prices. 'Affected households are those receiving income from these sources.

⁷ Although as mentioned earlier, including behavioral effect the impact may be somewhat smaller.

Figure 41: Estimated impact of cost of living shocks

Figure 42: Estimated impact of income shocks

Source: Microsimulation results

OVERVIEW OF POLICY OPTIONS

High and volatile prices for a range of agricultural commodities have been a reality for more than five years. This global phenomenon has affected almost all countries around the world and led to a wide range of policy responses which have met with varying degrees of success. Pacific countries are uniformly small players in agricultural import and export markets, so local demand and supply conditions have no discernible impact on international prices. Based on the framework of the WDR 2014, feasible policy options can then be thought of as: i) Seeking to reduce the short-term impact of international price volatility on households (via protection or insurance); ii) supporting households to cope with the impacts; or iii) addressing longer-term issues to reduce vulnerability, including increased availability of risk management tools, diversification and productivity improvements.

Macroeconomic policies to mitigate the impact of shocks

Governments and their development partners are increasingly pursuing active strategies to manage the risks associated with the most important aggregate natural and economic shocks. As detailed in Chapter 3, people in the Pacific are vulnerable to a range of aggregate economic and natural shocks because of the region's unique features. Policy responses in the Pacific to commodity price shocks in recent years have tended to focus on coping with the effects ex-post at the macroeconomic and aggregate fiscal level. Although to some extent effective in reducing the impact on households, these measures may be poorly targeted, expensive and have adverse consequences on fiscal sustainability and economic prospects.

Exchange rates: For those Pacific countries that have independent monetary policy, exchange rate movements can act to help to cushion the effects of adverse terms of trade shocks, and indeed during the food and fuel price crisis, the exchange rates of many Pacific island countries appreciated notably. Figure 44 shows that real effective exchange rates in Pacific countries appreciated on average by more than 10 percent

between 2006 and 2009, with the exception of Fiji. However, exchange rate policy is a blunt tool that results in winners and losers with exporters losing competitiveness and is unlikely to be an effective in addressing shocks that disproportionately fall on sub-groups within a country, such as lower income households.

Tax policy: A common policy response to increases in imported commodity prices in the region has been to reduce rates of taxation on these goods. Figure 45 shows that revenues from taxes on products less subsidies fell in real terms in both 2007 and 2008 on average across the Pacific. Tonga, Samoa, Solomon Islands, the Marshall Islands and Vanuatu have all reduced import duties on certain food and fuel commodities as prices have spiked over the past five years. But these tax changes have only partially offset price rises. Existing taxes on basic imported goods tend to low and will quickly reach a lower bound of zero, whereas prices increases for some goods have exceeded 100 percent in recent years. Reducing taxes can also exacerbate problems of fiscal sustainability which are already a major challenge for many Pacific countries. Even when tax reductions are intended to be temporary, it can be politically difficult to raise them again at a later date, and such measures can easily become permanent.

Subsidies: Some countries have used subsidies to producers in a bid to avoid increased fuel costs passing through to higher final prices, notably to electricity utilities in Samoa, Fiji and Kiribati amongst others in the region. To the extent that these subsidies are targeted for specific import usages – in this case electricity generation – and are provided on a clearly defined basis, they can be effective in lowering the impact of shocks on households although as with tax reductions, they can be difficult to withdraw. They are also often poorly targeted on those most in need. For example, households in hardship are less likely to use electricity than better-off households. As a result subsidy programs are costly relative to the very limited fiscal resources of small Pacific islands. Similar arguments can be made for subsidies that protect primary, e.g. cash crop, producers from market prices. They can easily become a major burden on the budget (see Box xx on Kiribati copra subsidy) and government resources might be better used to fund other policies that are less distortionary and less costly.

Figure 43: Current account balance – peak year compared to median

Figure 44: Real effective exchange rate trends

Source: World Bank World Development Indicators

Figure 45: Change in net taxes on products

Figure 46: Change in Government expenditure 2006-2008 and 2009-2011

Source: IMF World Economic Outlook

Notes: Change in net taxes on products averaged over countries with data available: Fiji; Kiribati; FSM; Palau; PNG; Tonga, and in constant domestic prices.

Price controls: Countries such as Fiji and Kiribati regulate prices on a wide variety of commodities. Other countries in the region, including Tuvalu, Solomon Islands and Tonga have price controls on a small number or basic goods, mostly petroleum and staple food imports. Around the world, price monitoring and regulation is common in markets where there are natural monopolies or a lack of competition. If it is based on strong evidence of monopolistic price behavior, the regulation of a small number of commodities, such as imported food staples relied on by low-income households, can be justified on these grounds, and help to reduce prices and avoid unnecessary price spikes driven by firms' pricing behavior. However, prices monitoring is time-consuming, and can easily lead to unintended effects, like deterioration of quality. As a result, they should only be considered as a last resort where all other policy options have been fully explored.

Donors have also supported food assistance, such as PRC Province of Taipei providing a shipment of rice to Kiribati.

Table 8: Import duties on selected food imports

	Major rice import group	Major wheat import group
Kiribati	AUD 0.04 per kg	0%
Fiji	15%	0%
Papua New Guinea	0%	0%
Samoa	0%	0%
Solomon Islands	0%	5%
Tonga	15%	15%
Vanuatu	5%	0%

Box 3: Kiribati copra subsidy programme

Copra is the main cash crop produced in Kiribati. The Kiribati copra subsidy scheme has been in operation for more than thirty years and helps secure livelihoods and income to many I-Kiribati living on the outer islands. Under the scheme, the Government maintains a price floor at which it guarantees to purchase all copra purchased, also meeting the costs of processing and transportation of the copra from outer islands to the urban center. In most years, the purchase price (before shipping and processing) has been held above the international market price.

While this subsidy scheme provides protection against adverse price shocks, it also comes with considerable drawbacks. The fiscal costs of the scheme are very high, accounting for between 5 and 7.5 percent of recurrent government revenue over recent years, and a recent review of the sector found that the scheme leads to substantial economic inefficiency. Labor and other inputs are used to produce copra when it is sold at a loss by the Government, when they could have been put to other productive uses. Even where formal work opportunity is very limited, these resources could be used for agriculture, fishing or provision of services.

Source: Government of Kiribati

Protection and insurance policies

Policies to reduce ex-ante vulnerability by increasing risk protection and insurance have been less widespread. Some such measures are costly, long-term undertakings, and as in the case of renewable energy. In other areas, there is potential for more widespread use of regional and/or innovative solutions.

Strategic fuel reserves: Few Pacific countries have strategic fuel storage facilities, which help reduce the risk of price spikes caused by shortages. Such storage facilities can be particularly important for small countries as they enable fuel shipments to be made in larger quantities and less frequently, making potential cost savings. Countries such as Samoa, Tonga and the Marshall Islands have or are presently in the process of developing fuel storage facilities.

Price hedging: Governments can help to reduce the high degree of uncertainty around future prices of major commodity imports by supporting the use of commodity price risk management – using derivative products to hedge against the risk of an unexpected price shock. Although not generally used in the Pacific, in the aftermath of the fuel price crisis, Tonga’s electricity utility has begun to make use of financial derivatives to hedge against variations in oil prices.

Joint purchasing: The small island nations of the Pacific purchase fuel and basic food stuffs independently. These relatively small shipments are more expensive on a unit basis, and there might be modest cost savings from clubbing together in some form of joint purchasing group. Although this idea has advantages in principle, it has not been successfully put into practice, with the details of logistics and coordination proving difficult to resolve at a regional level.

Diversification: In many respects, the potential for Pacific countries to diversify are severely restricted because of the limited set of viable economic livelihood strategies that are available. To the extent that it makes sense, government already do and should continue to facilitate the development of varied income sources as well as food resources. In energy generation on the other hand, Pacific countries possess considerable renewable energy potential, and diversification away from the predominantly oil-burning generators would offer protection from future oil price volatility. The challenge for countries is that renewable investments are costly, and they would likely require the support of international partners.

Supporting affected groups

Government policy can only go some way towards protecting households and instead needs to focus on helping them cope with the effects. Such support can be provided to affected group via targeted social protection programs for instance, of a variety of different forms. While the detail of social protection systems appropriate to the Pacific is outside of the scope of this paper, it is worth noting that such systems can range from purpose-built direct cash transfer systems to the use of pre-existing government programs, which may be scaled up or expanded in response to crises. Given the unanticipated nature of many exogenous shocks, to be effective, systems need to be ready to be rolled out rapidly, so this would point to the need to have operational systems already in place. In the short-run, the scaling up of existing government support systems is often the only viable way of providing assistance rapidly.

Whatever measures are taken to provide assistance to households, they will require funding. Many Pacific island countries have scaled up spending since 2008 in response to both commodity price shocks and adverse economic impacts of the global downturn (see Figure 46). For countries with a very limited domestic revenue base, many of these increases in expenditure are not sustainable unless supported by international development assistance. There is a role for international partners to play in both providing financial

assistance in response to shocks as well as bringing knowledge and solutions that can be appropriately applied in the Pacific context.

Reducing risk and vulnerability

In the longer term policy can aim to support gradual changes which will help to reduce household vulnerability. One of the surest ways of reducing vulnerability is to support increased incomes, better health and education outcomes and effective social and physical infrastructure. Specific measures can also be given increased focus if they will help to reduce vulnerability even at a given income level. However policy needs to remain realistic and appropriate to the setting. Given the size and location of countries in the Pacific, nations are likely to remain dependent on a small number of income sources, and don't have the necessary scale to diversify. Limited arable land makes the task of reducing import-dependence much more challenging. Similarly, supporting crops ill-suited to local conditions is unlikely to be cost-effective. There is a limit to what can be achieved in some countries, and it is at this stage that the role of the international community in support of risk reduction becomes particularly important. Having noted these points, there are a range of policies that can help to improve risk management, as outlined by the 2014 World Development Report, many of which are relevant to the Pacific.

- Ensure peoples' decisions are not constrained by lack of information about risks and opportunities.
- Providing work opportunities and education to utilize them.
- Improving market access, such as good road connections to regional markets, can help to lower the costs of trade to the benefit of consumers and local producers.
- Improved productivity, and supporting infrastructure and services, in the agriculture sector can help to boost both the incomes of cash cropping households and the availability of foodstuffs in the local market, which will in turn provide a cushion against imported food inflation.
- Supporting the development of financial markets for individuals and small businesses, including appropriate and affordable insurance which can help to reduce vulnerability to idiosyncratic shocks.
- Helping to make sure land tenure systems work effectively for communities.
- Do no harm: Making sure policy reforms do not unintentionally undermine informal and social systems that are used to reduce risk.

CONCLUSIONS

This paper provides evidence on some of the major sources of household-level economic vulnerability in the Pacific region. Several characteristics of the region; remoteness, small size and dispersion of countries and urbanizing populations lead to pronounced vulnerabilities to external factors, outside the control of the country. For example, high rates of import dependence for basic foods, oil costs embedded in transportation to and around remote archipelagos, dependence on cash crops, natural resources and remittances from a small number of overseas destinations are major risks. But these also constitute the realities of countries in the Pacific region, and the challenge for policy-makers is how to mitigate against risks that can and will arise, whilst accepting the economic framework, and set of opportunities and limitations, in which countries must operate.

The results of micro-simulations serve to highlight this economic vulnerability. The impacts are not confined to more well-off individuals, but have major impacts on the poor. Even moderate shocks are likely to push sizeable fractions of the population below the poverty line. The shocks considered are not worst case scenarios but those that can happen and should be planned for. Countries like Kiribati that are highly dependent on imports might expect to see more than 5 percent of the urban population and 4 percent nationwide fall into poverty following a moderate increase in the cost of oil. A simultaneous shock to a small number of basic food imports and fuel would be particularly devastating, pushing 10 percent of urban populations into poverty. There are similarly large impacts in Papua New Guinea, where close to 200,000 people might move into poverty at a welfare cost to the poor of US\$ 46 million. These results will hold true to a greater or lesser extent in almost all developing areas of the Pacific. Falls in externally-dependent income sources will also adversely affect the poor and vulnerable by squeezing what little income they have. Many cash crops livelihoods require significant cost investments and long lead times, so households are locked into livelihoods strategies. If prices fall, they have limited options but to try to manage with less income. In PNG, 230,000 people might move below the poverty line if coffee prices fell by 20 percent. A fall in remittances inflows would also have substantial adverse impacts in Tonga.

This paper considers only a small number of the many risks faced by households in the Pacific. The analytical approaches used are simple. It does not attempt to predict coping behavior that would be taken by affected households, and in this sense should be interpreted as estimating the scale of exposure to risks, rather than exactly how much worse off households may end up. However, taken together, these findings seem to constitute a strong case for the need to carefully monitor, and plan for ways to reduce, the vulnerability of households to external shocks.

An overview of policy responses illustrates the range and responsiveness of Pacific countries in the face of recent commodity price shocks. While some measures have been effective in mitigating the impacts of shocks, others may give rise to further problems, hampering fiscal sustainability and competitive markets. Where possible, governments can be effective in seeking to smooth the short-term impacts of shocks using macroeconomic instruments at their disposal. These include exchange rate adjustment, which has been used to good effect in

recent years, and ensuring that sufficient buffers exist to absorb temporary balance of payments and fiscal shocks. Targeted programs of support to vulnerable groups will help build resilience, and can be scaled up in the aftermath of a major shock. However, government will never be able to protect households fully, and efforts should also be made to support community and individual solutions, including insurance, risk-pooling and information services. Some of these policy solutions might exploit modern technology. Yet others will rely on the strong communal ties and traditional systems of risk-management that abound in the Pacific, and should be built on, rather than replaced.

Bibliography

Aba, L. A., Aipi, B. & Irau, T., 2012. *Supply response of coffee in Papua New Guinea*, s.l.: Bank of PNG Working Paper.

Aipi, B., Irau, T. & Aba, L. A., 2012. *Supply response of cocoa in Papua New Guinea*, s.l.: Bank of PNG Working Paper.

Anderson, K., Ivanic, M. & Martin, W., 2013. *Food price spikes, price insulation and poverty*, s.l.: World Bank Policy Research Working paper 6535.

Asian Development bank, 2007. *Oceanic voyages: Shipping in the Pacific*, s.l.: s.n.

Asian Development Bank, 2008. *Living with high prices: A policy brief*, Manila: Asian Development Bank.

Australian Aid, 2012. *Micro-simulation analysis of social protection interventions in Pacific Island Countries*, Canberra: Australian Government.

Australian Development Research Award, 2010. *Vulnerability and resilience to shocks in melanesia: Policy brief*, s.l.: s.n.

Brahmbhatt, M. & Christiaensen, L., 2008. *Rising food prices in East Asia: Challenges and policy options*, s.l.: s.n.

Christiaensen, L., Hoffmann, V. & Sarris, A., 2007. *Guaging the welfare effects of shocks in rural Tanzania*, s.l.: World Bank.

Davies, M. & Sugden, C., 2010. *Macroeconomic impacts of energy prices in the Pacific*. s.l., s.n.

de Hoyos, R. & Medvedev, D., 2011. Poverty effects of higher food prices: A global perspective. *Review of Development Economics*, 15(3), pp. 387-402.

Dessus, S., Herrera, S. & de Hoyos, R., 2008. The impact of food inflation on urban poverty and its monetary cost: Some back-of-the-envelope calculations. *Agricultural Economics*, Volume 39, pp. 417-429.

Food and Agriculture Organisation, 2011. *Addressing high food prices: A synthesis report of FAO policy consultations at regional and subregional level*, s.l.: s.n.

Friedman, J., Hong, S. Y. & Hou, X., 2011. *The impact of the food price crisis on consumption and calorific availability in Pakistan*, s.l.: s.n.

Friedman, J. & Levinsohn, J., n.d. The distributional impacts of indonesia's financial crisis on household welfare: A "rapid response" methodology. *World Bank Economic Review*, 16(3), pp. 397-423.

- Gibson, J., 2013. The crisis in food price data. *Global Food Security*.
- Gibson, J. & Kim, B., 2013. Quality, quantity and nutritional impacts of rice price changes in Vietnam. *World Development*, Volume 43, pp. 329-340.
- Gould, M., Dickenson-Jones, G. & Wood, R., 2011. *The second international food and fuel price shock and Forum island economies*, s.l.: Australian Treasury.
- Habib, B., Narayan, A., Olivieri, S. & Sanchez-Paramo, C., 2010. Assessing ex ante the poverty and distributional impacts of the Global Crisis in a developing country. *World Bank Policy Research Working Paper Series no 5238*.
- Hossain, N., King, R. & Kelbert, A., n.d. *Squeezed: Life in a time of food price volatility, year 1 results*, s.l.: Institute of Development Studies / Oxfam.
- Kshirsagar, V., Simler, K. & Zaman, H., 2009. *A simulation model for estimating the poverty impact of changes in food and fuel prices*, s.l.: World Bank mimeo.
- Mellor, D., 2010. *Social impact of commodity price volatility in Papua New Guinea*, s.l.: s.n.
- Narayan, A. & Sanchez-Paramo, C., 2012. *Knowing, when you do not know: Simulating the poverty and distributional impacts of an economic crisis*, Washington DC: World Bank.
- OECD, 2011. *Price volatility in food and agricultural markets: Policy responses*, s.l.: s.n.
- Rich, K. & Lundberg, M., 2002. *Multimarket models and policy analysis: An application to Madagascar*, s.l.: World Bank mimeo.
- Vu, L., n.d. *Poverty impact of the food crisis in Cambodia*, s.l.: Vietnam National University mimeo.
- Wodon, Q. & Zaman, H., 2008. *Rising food prices in Sub-Saharan Africa: Poverty Impact and Policy Responses*, s.l.: World Bank.
- World Bank Independent Evaluation Group, 2013. *The World Bank Group and the global food crisis*, s.l.: s.n.

APPENDIX: MODEL ASSUMPTIONS

Assumptions on prices, taxes, and parameters

	PW_i	PL_i	tm_i	itx_i	$trsp_i$	θ_i
Crops:						
Rice	1.00	1.00	0.10	0.10	0.15	0.90
Potato	1.00	1.00	0.10	0.10	0.15	0.05
Banana	1.00	1.00	0.10	0.10	0.15	0.05
Sago	1.00	1.00	0.10	0.10	0.15	0.05
Taro	1.00	1.00	0.10	0.10	0.15	0.05
Yam	1.00	1.00	0.10	0.10	0.15	0.05
Cassava	1.00	1.00	0.10	0.10	0.15	0.05
Sugar	1.00	1.00	0.10	0.10	0.15	0.05
Fruits and Vegetables	1.00	1.00	0.10	0.10	0.15	0.20
Cash crops:						
Coconut	1.00	1.00	0.10	0.10	0.15	0.05
Coffee	1.00	1.00	0.10	0.10	0.15	0.20
Palm oil and other oil	1.00	1.00	0.10	0.10	0.15	0.20
Fish	1.00	1.00	0.04	0.10	0.15	0.20
Meat	1.00	1.00	0.04	0.10	0.15	0.50
Wheat products (bread)	1.00	1.00	0.04	0.10	0.15	0.20
Other food	1.00	1.00	0.04	0.10	0.15	0.20
Transport	1.00	1.00	0.04	0.10	0.00	0.60
Energy	1.00	1.00	0.04	0.10	0.15	0.60
All others	1.00	1.00	0.04	0.10	0.15	0.20

Pw_i = world price

Pli = producer price

tm_i = tariff rate

itx_i = indirect tax

$trsp_i$ = transportation cost

θ_i = import share