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Agricultural development, trade, and income distribution

A 2015 social accounting matrix multiplier decomposition approach for Mozambique

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Abstract: This paper considers the impact of agriculture and international trade development on income distribution and economic activity in Mozambique. A social accounting matrix multiplier decomposition model is used—in particular, an extension of the standard model that details the process of income distribution through the economy's institutions. When we focus on the impact on rural low-income households, the emphasis is on the food crop and food-processing sectors. The results suggest surprisingly that such households do not benefit much from exogenous increases in agricultural crops; high-income rural and urban households benefit more. A full decomposition of the multipliers suggests that rural low-income households link strongly to food-processing, but that the latter is not very prominent in the Mozambican economy due to high import penetration. The second focus is therefore on international trade, which reveals that the high rates of imports regarding food-processing are mainly sourced from South Africa.

Key words: Agriculture, income distribution, multipliers, multiplier decomposition, social accounting matrix, structure of production, trade.

JEL classification: C67, D31, D33, Q17.

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1 Introduction

When one is designing policies and assessing their impacts on any economy, it is important to consider not only the direct but also the indirect effects of the economic linkages and possible trade-offs that exist in the economy concerned. Various tools can be utilized for these purposes by policy analysts. In this paper we utilize a social accounting matrix (SAM) for its ability to explore linkages throughout the entire Mozambican economic system and its agents.

Much has been made of the role of extractive resource industries in the Mozambican economy (see e.g., Cruz and Mafambissa 2016; Dietsche and Esteves 2018) and what this may mean for development and international trade. However, the largest part of the population lives in rural areas and is engaged in agriculture. Therefore, we want to analyse the role of agriculture in the country's economic development in general, and in income generation and distribution among rural low-income households in particular. In addition, we consider the role of international trade and how it impacts on income distribution in this economy.

Agriculture is the main source of income in Mozambique, providing income for more than 70 per cent of the population. It contributes 31.8 per cent of Mozambique's gross domestic product (GDP) and absorbs 81 per cent of the total workforce. In terms of exports, however, agriculture plays a minor role, representing just over four per cent of total exports, while only about five per cent of total output is exported. Mining and manufacturing other than food-processing, on the other hand, rely far more on foreign demand. Close to 90 per cent of all mining output is exported, as is 58 per cent of the broad category of 'other manufacturing'. These figures represent 27 per cent and 36 per cent of total exports respectively. Total exports only constitute five per cent of the gross value of production and six per cent of GDP at basic prices (Cammaer 2016).

While the Mozambican economy appears to be recovering from a downturn that started in 2015, and may yet return to the stellar growth rates of the decade before, the question remains: what will this do to income distribution, and to the most vulnerable rural low-income households? Most of the growth in the past was realized by expansion in the extractive industries, such as coal and natural gas. More of this is expected, in particular regarding foreign direct investment and strong exports rates growth (African Development Bank 2017) going forward. But as was mentioned more than 15 years ago by Tarp et al. (2002), welfare gains at the macro level may not tell the full story when compositional shifts are not distributed equally. Agricultural development is thought to be an important contributor to higher growth in the medium term, although not necessarily at the same growth rates as one sees with an extractive export growth strategy; but in the context of a highly unequal income distribution, this approach could shift distributional impacts more in the desired direction, given that the agriculture sector is the main source of income in Mozambique.

In order to examine the distributional impacts of policies and exogenous shocks, it is useful to employ an analytical framework that identifies aspects of income distribution that are linked to productive industry and goods and factor markets. An economy-wide policy analysis modelling framework is thus called for, mapping down-linkages between industries (activities), factor and goods markets, and institutions—particularly households—in at least some detail. Moreover, it would be useful to be able to disentangle the channels through which the impacts play themselves out, so as to determine which part of the impact journey is important, and any kinds of inequality.

A SAM is the data framework of choice for such analyses, and decomposition methods can help shed light on the paths of the impacts. In particular, we are interested in breaking up the standard multipliers by means of an extension of the decomposition method, allowing a more detailed look into the multiplier process.

For this purpose, we employ a set of decomposition models based on a recent 2015 SAM for Mozambique (Cruz et al. 2018) to examine the income distribution implications of expanded agricultural production as well as growth in trade with the rest of the world. We proceed in the next section by describing the general features of income distribution in Mozambique and trade with the rest of the world through the lens of the 2015 SAM. This is followed by a brief exposition of the decomposition methods employed in this paper. Results for two decomposition methods are discussed in section 4. We close with policy recommendations and conclusions.

2 A Mozambique 2015 SAM

2.1 Description of the SAM data and dimensions

In a SAM, the transfers and transactions of an economy are represented in some detail. A SAM is an economy-wide accounting framework that aims to portray the real economy of a single country. It is presented as a square matrix composed of the different accounts that constitute the economy's agents and institutions. Each cell represents the payment made by the account labelled in the column heading to the account labelled in the heading of the relevant row. A SAM typically distinguishes activities from commodities. Activities refer to the production of goods and services in the market. They also include a number of production factors used to produce goods and services. They earn income that is distributed to households, enterprises, government, and the rest of the world (Cruz et al. 2018).

The data used for the construction of the Mozambican SAM used here is based on unpublished Mozambican National Institute of Statistics industry-level production accounts, commodity-level supply-demand balance, and a supply matrix for 2015, together with National Directorate of Planning and Budget statistics, and International Monetary Fund balance-of-payment statistics for 2015. To this is added unpublished National Institute of Statistics household and labour market survey data for 2014–15, and a use matrix from a 2007 Mozambique SAM. The 2015 SAM for Mozambique that we use identifies 55 industries (entities responsible for the production processes of goods and services) as well as commodities (the goods and services produced by the activities). There are also three production factors identified: capital, land, and labour, with the latter disaggregated into education attainment levels and by urban and rural areas. Four main institutions (enterprises, households, government, and the rest of the world) are distinguished, where households are disaggregated by income levels and rural versus urban residence. The government represents the main government expenditure account and various taxes accounts. Finally, a savings = investment account shows how the four institutions mentioned above retain (collected) savings (including the current account balance as the negative of savings by the rest of the world) that are made available for investment demand (including change in stocks).

Table 1: An aggregated activity-only 2015 SAM for Mozambique

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
		acrps	aoagr	aming	aomnf	afood	autil	acnst	aserv	mlnd	mliv	flab	mcap	ent	hhd-rl	hhd-ru	hhd-ul	hhd-uu	gov	s-i	row	**Totals**
acrps	crops	4,149	663	0	1,781	6,831	0	0	851	0	0	0	0	0	23,320	17,278	12,637	36,000	1,479	0	5,989	**110,980**
aoagr	other agr	0	21	148	1,364	0	0	285	883	0	0	0	0	0	810	14,170	1,731	23,743	1,172	122	2,050	**46,497**
aming	mining	0	7	0	2,221	1	1,105	2,176	9	0	0	0	0	0	0	0	0	0	2,104	0	51,743	**59,366**
aomnf	other manuf	160	775	1,455	4,958	110	288	9,317	10,669	0	0	0	0	0	2,247	4,882	598	11,059	-1,188	4,580	68,914	**118,825**
afood	crop process	0	566	0	947	127	0	0	5,777	0	0	0	0	0	2,604	4,426	1,746	11,194	0	0	6,723	**34,110**
autil	utilities	213	171	760	8,944	34	1,470	131	5,402	0	0	0	0	0	297	389	148	1,934	0	0	10,798	**30,692**
acnst	construct	0	0	59	419	20	230	0	1,415	0	0	0	0	0	0	0	0	0	0	50,992	0	**53,135**
aserv	services	2,435	7,411	8,066	23,945	5,060	2,761	9,456	124,157	0	0	0	0	0	8,475	25,075	4,214	91,542	174,485	19,231	44,400	**550,714**
mlnd	land	19,337	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**19,337**
mliv	livestock	0	6,552	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**6,552**
flab	labour	74,503	9,891	7,823	17,192	4,885	8,956	12,304	186,060	0	0	0	0	0	0	0	0	0	0	0	2,100	**323,713**
mcap	capital	7,501	11,495	28,087	24,205	9,819	11,731	1,544	96,899	0	0	0	0	0	0	0	0	0	0	0	2,205	**193,487**
ent	enterprises	0	0	0	0	0	0	0	0	0	0	0	176,888	0	0	0	0	0	5,083	0	11,871	**193,842**
hhd-rl	hh rur low inc	0	0	0	0	0	0	0	0	6,943	2,097	34,511	0	13,026	0	0	0	0	1,301	0	433	**58,312**
hhd-ru	hh rur hi inc	0	0	0	0	0	0	0	0	9,199	3,413	68,338	0	20,680	0	0	0	0	3,163	0	1,937	**106,729**
hhd-ul	hh urb low inc	0	0	0	0	0	0	0	0	1,544	255	13,322	0	15,288	0	0	0	0	1,413	0	313	**32,135**
hhd-uu	hh urb hi inc	0	0	0	0	0	0	0	0	1,651	788	205,462	0	66,170	0	0	0	0	10,085	0	2,703	**286,858**
gov	government	166	1,410	975	3,493	153	284	1,981	10,469	0	0	0	5,810	58,639	3,442	9,485	1,263	33,159	116,409	89,620	20,678	**357,436**
s-i	savings=inv	0	0	0	0	0	0	0	0	0	0	0	0	20,039	8,865	10,971	6,884	34,982	-23,809	0	210,250	**268,182**
row	rest of world	2,514	7,535	11,994	29,357	7,069	3,866	15,942	108,123	0	0	2,081	10,788	0	8,252	20,054	2,914	43,245	65,738	103,636	0	**443,107**
Totals		**110,980**	**46,497**	**59,366**	**118,825**	**34,110**	**30,692**	**53,135**	**550,714**	**19,337**	**6,552**	**323,713**	**193,487**	**193,842**	**58,312**	**106,729**	**32,135**	**286,858**	**357,436**	**268,182**	**443,107**	**3,294,008**

Note: For key to codes, see Table A1 in Appendix.

Source: data from Cruz et al. (2018) and authors' calculations.

For reasons of convenience, we adjust the 2015 SAM for Mozambique so that there is no distinction between activities and commodities. Activities are therefore assumed to produce homogenous products. This is already the case in the original 2015 SAM for Mozambique (Cruz et al. 2018). Thus, the supply matrix is merged into the use matrix. The original SAM's use matrix is in market prices, while the supply matrix is in basic prices. To merge activities and commodities, we need to change the use matrix data in the original SAM from market prices to basic prices. We do this by applying demand shares in the use matrix to subtract indirect taxes on products, imports, and margins. The sum of the latter is reallocated to trade and transport activities in the new SAM based on their overall row (or demand) shares in the original SAM, while product taxes and imports are reallocated as new accounts so that they become separate items in the cost structures of the activities and expenditure patterns of institutions (such as households, government, and investment demand). In addition, we merge marketed and non-marketed (own) consumption by households as marketed consumption only. A highly aggregated version of the new SAM is shown for illustration purposes in Table 1.

The first eight rows and columns in Table 1 represent the activities identified in the SAM aggregated into the eight sectors of production (*afood* (crop processing) excludes meat processing, which is covered under *aomnf* (other manufacturing)), while rows and columns nine to 12 show the incomes received by the factors of production: land, livestock, labour, and capital. Rows and columns 13 to 17 report the institutions of enterprises rural and urban low- and high-income households. The last three rows and columns are exogenous institutions to the standard decomposition model. Here they represent the government and savings = investment accounts, as well as the rest of the world.

For the trade decomposition model (see section 3.4), we create an additional set of endogenous accounts so that only the rest of the world is exogenous. The implication is that as part of the multiplier process, incomes to the public sector and receipts in the savings = investment account are assumed to be spent on goods and services, for current and capital expenditure respectively. Moreover, trade is disaggregated by four broad regions of source and destination for Mozambique's imports and exports respectively. The regions are South Africa, the rest of sub-Saharan Africa, the European Union (EU), and the rest of the world. For this purpose, mirror trade data was downloaded from the World Bank's (n.d.) World Integrated Trade Solutions (WITS) and mapped from the 2012 six-digit Harmonized System to the four-digit International Standard Industrial Classification Revision 3 (also available from WITS), and subsequently to the 2015 SAM products/activities. All non-merchandise receipts and payments are disaggregated across the four regions based on the distribution of total merchandise receipts and payments respectively.

2.2 Income distribution and consumption patterns in Mozambique through the 2015 SAM lens

With the SAM data—shown highly aggregated for illustrative purposes in Table 1—it is possible to analyse the distribution of household incomes so as to take a broad view on income inequality. A further minor disaggregation is added to the SAM in Table 2 so as to add more nuance to this part of the analysis. We also take a look at household expenditures.

Starting with the household income distribution, Table 2 illustrates the shares of household income by source. Across the top of Table 2 it can be seen that household incomes consist of earnings from crop land, livestock, labour payments, income from enterprises, government transfers, and transfers from the rest of the world. It is no surprise that the share of income from the crop land production factor is higher in rural areas, while the lowest shares are found in urban areas for high-income households. The same appears to be the case with the livestock production factor, for similar reasons. A relatively high share of income for low-income rural households is from land and livestock. Higher-income rural households have a more diverse set of income sources.

The main income source for all rural households is wage earnings from labour, in particular labour with low education (*flab-rn* and *flab-rp*). Somewhat surprisingly, the second highest share is for income derived from enterprises. For all rural households the average share is 20.4 per cent, but it is higher for low-income households. The technical reason here is that shares have to add up to 100 per cent, and if higher-income households derive a higher share from labour, their share from other sources is scaled down.

There is no income derived from the capital production factor, as all of it is distributed to enterprises, which in turn distribute part of it to households, while transferring some to the rest of the world and to the government as taxes, and retaining the residual as savings to fund investment.

The income shares from government transfers vary across households. Among rural households, the highest shares are reported for the third and fourth quintiles. The rural households with the lowest incomes are less dependent on this income source. In urban areas these shares are generally much higher, which suggests that there is an urban bias; in rural areas the bias is towards higher-income households. The highest shares of income from transfers from the rest of the world are found in the fourth and fifth quintiles of rural households.

Table 2: Household income source shares according to 2015 SAM for Mozambique

hh income group		mlnd	mliv	flab-n	flab-p	flab-s	flab-t	flab-all	mcap	ent	gov	row	total
1 hhd-r1	rural_q1	15.0%	4.2%	40.9%	10.4%	0.6%		51.9%		27.4%	0.9%	0.6%	100.0%
2 hhd-r2	rural_q2	12.7%	4.5%	36.5%	21.6%	1.1%		59.2%		21.5%	1.5%	0.6%	100.0%
3 hhd-r3	rural_q3	9.8%	2.7%	45.7%	13.1%	3.3%	0.6%	62.7%		20.5%	3.4%	0.9%	100.0%
4 hhd-r4	rural_q4	10.7%	3.6%	37.1%	17.0%	7.9%	0.5%	62.5%		18.2%	3.6%	1.5%	100.0%
5 hhd-r5	rural_q5	7.6%	3.0%	22.6%	16.5%	13.7%	12.0%	64.8%		20.0%	2.6%	2.0%	100.0%
hhd-r	rural	9.8%	3.3%	32.4%	16.2%	8.3%	5.4%	62.3%		20.4%	2.7%	1.4%	100.0%
6 hhd-u1	urban_q1	9.4%	1.0%	34.3%	12.6%	2.6%		49.6%		34.3%	5.2%	0.4%	100.0%
7 hhd-u2	urban_q2	5.1%	0.7%	16.4%	16.7%	5.3%	0.5%	38.9%		50.8%	3.4%	1.2%	100.0%
8 hhd-u3	urban_q3	3.3%	0.8%	14.0%	16.2%	9.0%	1.4%	40.6%		49.6%	4.8%	1.0%	100.0%
9 hhd-u4	urban_q4	1.6%	0.2%	13.1%	21.0%	11.0%	5.9%	50.9%		38.9%	7.5%	0.9%	100.0%
10 hhd-u5	urban_q5	0.4%	0.3%	7.2%	17.1%	17.0%	33.7%	75.0%		20.5%	2.9%	1.0%	100.0%
hhd-u	urban	7.0%	2.4%	17.1%	8.5%	4.4%	2.8%	68.6%		62.1%	8.7%	2.7%	100.0%

Source: authors' calculations based on 2015 SAM for Mozambique.

Next we analyse household expenditure patterns. Table 3 shows that rural households' overall expenditure concentrates mostly on crop products, services, and products produced by other agricultural sectors, at 39 per cent, 32.3 per cent, and 14.4 per cent respectively. For urban households the main products are the same, but in a slightly different order: services are the most important, followed by crop products and other agricultural products, at 48.7 per cent, 24.7 per cent, and 13 per cent respectively. Note that processed (crop) foods are not very popular, with shares of less than 10 per cent across all income groups.

Table 3: Household expenditure patterns according to 2015 SAM for Mozambique

Products	hhd-r1	hhd-r2	hhd-r3	hhd-r4	hhd-r5	RURAL	hhd-u1	hhd-u2	hhd-u3	hhd-u4	hhd-u5	URBAN	TOTAL
1 Crop products	73.5%	63.3%	54.3%	44.2%	17.1%	39.0%	70.3%	62.0%	54.9%	39.9%	17.3%	24.7%	29.7%
2 Other Agriculture	0.5%	2.5%	2.8%	7.1%	28.5%	14.4%	4.7%	7.7%	9.9%	16.1%	13.1%	13.0%	13.5%
3 Mining	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
4 Other Manufacturing	3.6%	5.5%	7.6%	8.1%	7.0%	6.9%	1.8%	2.7%	3.3%	4.5%	6.6%	5.9%	6.3%
5 Crop Food Processing	4.9%	6.6%	8.2%	9.1%	5.5%	6.8%	6.4%	8.0%	9.2%	9.9%	5.8%	6.6%	6.6%
6 Utilities	0.6%	0.7%	0.9%	0.9%	0.5%	0.7%	0.6%	0.7%	0.7%	0.9%	1.1%	1.1%	0.9%
7 Construction	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
8 Services	16.8%	21.4%	26.3%	30.6%	41.5%	32.3%	16.2%	19.0%	22.1%	28.8%	56.0%	48.7%	43.0%
9 TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: authors' calculations based on 2015 SAM for Mozambique.

Next, we report on the SAM data as it relates to international trade in goods and services. Table 4 shows imports and exports of goods and services by broad trading regions and by broad industries (this is not shown in Table 2). In tableau 2 it can be seen that South Africa is the main source of total intermediate imports of goods and services at 41 per cent, followed by the rest of the world. The EU and the rest of sub-Saharan Africa play a minor role in exporting goods and services to Mozambique in 2015. Even more striking is that more than 90 per cent of processed food imports are from South Africa.

Table 4: Mozambique trade in goods and services by broad trading regions and industries

	Tableau 1: Values in Millions of Meticals					Tableau 2: Shares across Broad Trading Regions					Tableau 3: Shares across Broad Industries				
Imports	EU	SA	RoSSA	RoW	Total	EU	SA	RoSSA	RoW	Total	EU	SA	RoSSA	RoW	Total
1 Crops	344	1,366	45	759	2,514	13.7%	54.3%	1.8%	30.2%	100.0%	0.5%	0.8%	0.2%	0.4%	0.6%
2 Oth Agri	1,028	2,522	379	3,606	7,535	13.6%	33.5%	5.0%	47.9%	100.0%	1.6%	1.4%	2.1%	2.1%	1.8%
3 Mining	1,710	4,670	549	5,065	11,994	14.3%	38.9%	4.6%	42.2%	100.0%	2.7%	2.7%	3.0%	3.0%	2.8%
4 Oth Manf	3,510	12,321	1,558	11,968	29,357	12.0%	42.0%	5.3%	40.8%	100.0%	5.6%	7.0%	8.6%	7.1%	6.9%
5 Food procc	152	6,549	46	323	7,069	2.2%	92.6%	0.7%	4.6%	100.0%	0.2%	3.7%	0.3%	0.2%	1.7%
6 Utilities	467	1,959	144	1,295	3,866	12.1%	50.7%	3.7%	33.5%	100.0%	0.7%	1.1%	0.8%	0.8%	0.9%
7 Construction	2,106	3,249	744	9,844	15,942	13.2%	20.4%	4.7%	61.7%	100.0%	3.3%	1.8%	4.1%	5.8%	3.7%
8 Services	15,559	43,914	5,591	43,059	108,123	14.4%	40.6%	5.2%	39.8%	100.0%	24.6%	25.0%	30.7%	25.5%	25.4%
9 Total Intm	**24,876**	**76,549**	**9,057**	**75,919**	**186,400**	**13.3%**	**41.1%**	**4.9%**	**40.7%**	**100.0%**	**39.4%**	**43.5%**	**49.7%**	**45.0%**	**43.8%**
10 Households	9,274	20,664	7,102	37,424	74,464	12.5%	27.8%	9.5%	50.3%	100.0%	14.7%	11.8%	39.0%	22.2%	17.5%
11 Gvt (ex trnsf)	51	102	15	177	345	14.9%	29.5%	4.3%	51.2%	100.0%	0.1%	0.1%	0.1%	0.1%	0.1%
12 Inv demand	28,926	78,459	2,051	55,301	164,738	17.6%	47.6%	1.2%	33.6%	100.0%	45.8%	44.6%	11.3%	32.8%	38.7%
Total	**63,128**	**175,774**	**18,225**	**168,821**	**425,947**	**14.8%**	**41.3%**	**4.3%**	**39.6%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
	Tableau 4: Values in Millions of Meticals					Tableau 5: Shares across Broad Trading Regions					Tableau 5: Shares across Broad Industries				
Exports	EU	SA	RoSSA	RoW	Total	EU	SA	RoSSA	RoW	Total	EU	SA	RoSSA	RoW	Total
1 Crops	1,548	861	2,032	1,548	5,989	25.9%	14.4%	33.9%	25.9%	100.0%	2.3%	1.3%	10.3%	4.0%	3.1%
2 Oth Agri	5	49	51	1,945	2,050	0.2%	2.4%	2.5%	94.9%	100.0%	0.0%	0.1%	0.3%	5.0%	1.1%
3 Mining	3,066	39,935	417	8,326	51,743	5.9%	77.2%	0.8%	16.1%	100.0%	4.5%	62.1%	2.1%	21.5%	27.1%
4 Oth Manf	45,846	2,680	5,083	15,305	68,914	66.5%	3.9%	7.4%	22.2%	100.0%	67.4%	4.2%	25.9%	39.6%	36.2%
5 Food procc	2,743	730	1,042	2,208	6,723	40.8%	10.9%	15.5%	32.8%	100.0%	4.0%	1.1%	5.3%	5.7%	3.5%
6 Utilities	0	9,307	1,491	0	10,798	0.0%	86.2%	13.8%	0.0%	100.0%	0.0%	14.5%	7.6%	0.0%	5.7%
7 Construction	0	0	0	0	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
8 Services	14,785	10,769	9,520	9,327	44,400	33.3%	24.3%	21.4%	21.0%	100.0%	21.7%	16.7%	48.5%	24.1%	23.3%
9 Total	**67,992**	**64,330**	**19,636**	**38,659**	**190,616**	**35.7%**	**33.7%**	**10.3%**	**20.3%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Note: There appear to be imports of utilities from the EU. This should be interpreted as intermediate inputs by the utilities industries (electricity and water).

Source: authors' calculations based on 2015 SAM for Mozambique and additional trade data from WITS.

Direct imports related to household demand are largely (50 per cent) sourced from the rest of the world, somewhat surprisingly, followed by South Africa at 30 per cent, although imported investment demand from this source carries a higher weight at 48 per cent.

In terms of exports, the main markets are the EU followed by South Africa and the rest of the world. Most crops are actually exported to the rest of sub-Saharan Africa, but the value is low. Other manufacturing (including fabricated metals such as aluminium) is mainly destined for the EU, while most mining and utilities (electricity) exports seem to go to South Africa.

3 Methodology

The task of analysing the distributional impacts of policies and exogenous shocks can be achieved by employing an analytical framework that identifies aspects of income distribution that are linked to industry, goods, and factor markets. Moreover, we want to disentangle the channels through which the impacts play themselves out. We use a SAM-based decomposition method that helps shed light on the paths of the impacts. In particular, we are interested in breaking up the standard multipliers into various effects.

A SAM is essentially a simplified representation of transactions and transfers in an economy, and it is not by itself a model. However, due to its capacity to illustrate the circular flow of an entire economy, and thanks to the many diverse sources of data it contains, it is an important tool to analyse the socio-economic structure of an economy in general, and in particular the relationship between the structure of production and the distribution of income. The usual approach is to use the SAM-based multiplier model and produce a multiplier matrix (Round 2003).

In this section, we start with a discussion of the standard multiplier model, followed by a standard type of decomposition. We then add an extension to the standard decomposition model, as well as a diversion into trade analysis.

3.1 Standard multiplier model

The standard SAM multiplier model is based on the Leontief input-output economic model. This model was first created in the 1930s; it is used to understand the functioning and relationships of the various industries in an economy, and the impact of interventions in the economy. If we use a SAM, the system is extended beyond the standard input-output industry format to include a range of additional endogenous accounts, such as factors of production, enterprises, and households.

The model is based on a number of assumptions. One of these is that it includes the existence of excess productive capacity and underemployed labour resources. If this is the case, any exogenous change in demand can be satisfied through a corresponding increase in supply, with no effect on price. The multiplier model is therefore a fixed-price model.

Key to understanding the indirect effects is that not only additional supply is required to produce the initial exogenous increase. Further inputs are required, which in turn need yet more inputs in other sectors, albeit at a decreasing rate.

Given the basic principles of the SAM-based multiplier model outlined above, the next step is to proceed towards a decomposition of multipliers by identifying endogenous and exogenous accounts. In our first model we focus on the impact of agriculture. Here, the endogenous accounts are productive activities, factors of production (labour, land, and capital), and institutions (households and enterprises). The exogenous accounts are the accounts of government, savings and investment, and the rest of the world. Government expenses or outlays are essentially policy-determined; the external sector (rest of the world) is outside domestic control; and as the model lacks dynamic features, savings and investment are exogenously determined (Round 2003).

Table 5: Simplified representations of endogenous and exogenous accounts in a SAM

	Activities	Factors	Private institutions	Exogenous accounts	Total receipts
Activities	$\mathbf{Z_{aa}}$		$\mathbf{Z_{ai}}$	$\mathbf{x_a}$	$\mathbf{y_a}$
Factors	$\mathbf{Z_{fa}}$	Z		$\mathbf{x_f}$ x	$\mathbf{y_f}$ y
Private institutions		$\mathbf{Z_{if}}$	$\mathbf{Z_{ii}}$	$\mathbf{x_i}$	$\mathbf{y_i}$
Exogenous accounts	$\mathbf{m_a^p}$	$\mathbf{m_f^p}$	$\mathbf{m_i^p}$	$\mathbf{x^p}$	$\mathbf{y_x}$
Total expenditure	$\mathbf{y_a^p}$	$\mathbf{y_f^p}$	$\mathbf{y_i^p}$	$\mathbf{y_x^p}$	

Source: Pansini (2008).

In Table 5, we show a simplified representation of the endogenous and exogenous accounts. For analytical purposes, the endogenous accounts are represented as the matrix **Z**, the exogenous accounts are represented by the column vector **x**, and the total expenditures and receipts are represented by the column vector **y**. Subscripts **a** stand for activities, **f** for factors of production, and **i** for institutions. Each account's receipts must be equal to its expenditures. The latter are represented in the last row, where the superscript **p** refers to prime (the transpose).

Table 5 allows a number of identities to be expressed. They focus on the use and generation of gross value of production, the generation and distribution of value added, and the sources and destinations of disposable income respectively.

In the first row, sub-vector $\mathbf{y_a} = \mathbf{Z_{aa}} \cdot \mathbf{i_a} + \mathbf{Z_{ai}} \cdot \mathbf{i_i} + \mathbf{x_a}$ describes how the total value of goods and services produced and sold by activities must be equal to the row sum of intermediate demand $\mathbf{Z_{aa}}$ (by matrix multiplying with a unit column vector $\mathbf{i_a}$ of appropriate size), plus the row sum of final demand of commodities produced by activities from private institutions ($\mathbf{Z_{ai}}$), and the residual component of the vector $\mathbf{x_a}$, consisting of the sum of government demand, investment demand, and exports. In order to produce this output, activities require the sums of $\mathbf{Z_{aa}}$ intermediate inputs, the sums of $\mathbf{Z_{fa}}$ primary inputs from the factors of production, and a $\mathbf{m_a^p}$ row vector of other (exogenous) inputs (where **p** stands for the prime or transpose). Internal consistency requires that the costs of production must be equal to what the productive industries sell:

$$\mathbf{y_a^p} = \mathbf{i_a^p} \cdot \mathbf{Z_{aa}} + \mathbf{i_f^p} \cdot \mathbf{Z_{fa}} + \mathbf{m_a^p} \qquad [1]$$

$\mathbf{y_f} = \mathbf{Z_{fa}} \cdot \mathbf{i_a} + \mathbf{x_f}$ indicates that total income by the factors of production consists of earnings paid by domestic activities $\mathbf{Z_{fa}}$ plus primary income transfers received from the rest of the world $\mathbf{x_f}$. This should be equal to what is distributed to domestic private institutions $\mathbf{Z_{if}}$ and foreign owners of the factors of production employed in the local economy $\mathbf{m_f^p}$. This can be written as:

$$\mathbf{y_f^p} = \mathbf{i_i^p} \cdot \mathbf{Z_{if}} + \mathbf{m_f^p} \qquad [2]$$

The final set of identities, $\mathbf{y_i} = \mathbf{Z_{if}} \cdot \mathbf{i_f} + \mathbf{Z_{ii}} \cdot \mathbf{i_i} + \mathbf{x_i}$, specifies that total disposable income from the primary and secondary distribution processes consists of income received by private institutions both from factors of production ($\mathbf{Z_{if}}$) and transfers within endogenous institutions ($\mathbf{Z_{ii}}$), plus income from exogenous institutions $\mathbf{x_i}$ (Pansini 2008). This income is used to buy goods and services ($\mathbf{Z_{ai}}$) and make transfers to other endogenous institutions ($\mathbf{Z_{ii}}$), with a proportion going to exogenous accounts (government taxes, savings, and transfers to the rest of the world), such that:

$$\mathbf{y_i^p} = \mathbf{i_a^p} \cdot \mathbf{Z_{ai}} + \mathbf{i_i^p} \cdot \mathbf{Z_{ii}} + \mathbf{m_i^p} \qquad [3]$$

The final goal of the above system of accounts is to develop the global matrix multiplier **M**, which captures the effects of exogenous injections on endogenous accounts, or the overall change expected in endogenous accounts due to an exogenous injection. The global multiplier matrix shows effects resulting from the direct transfer, indirect transfer, and closed-loop process generated by the initial exogenous injection into the system (Thorbecke 2000). To derive the multiplier matrix **M**, we write the **Z** matrix as follows:

$$\mathbf{Z} = \begin{bmatrix} \mathbf{Z_{11}} & \mathbf{0} & \mathbf{Z_{13}} \\ \mathbf{Z_{21}} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{Z_{32}} & \mathbf{Z_{33}} \end{bmatrix}, \text{ vector } \mathbf{y} = \begin{bmatrix} \mathbf{y_a} \\ \mathbf{y_f} \\ \mathbf{y_i} \end{bmatrix} \text{ and } \mathbf{x} = \begin{bmatrix} \mathbf{x_a} \\ \mathbf{x_f} \\ \mathbf{x_i} \end{bmatrix}$$

After we have identified the endogenous (**Z**) and exogenous (**x**) accounts, it is possible to calculate the matrix of average expenditure propensities—which will be represented here as matrix **A**—by dividing the elements in each column of matrix **Z** by its column total, or the transpose of column vector **y**. In matrix algebra, we prefer to make use of a diagonal matrix $\hat{\mathbf{Y}}$ which has the entries of column vector **y** on its main diagonal. This allows us to post-matrix multiply its inverse with **Z** to arrive at **A**, or:

$$\mathbf{A} = \mathbf{Z} \cdot \hat{\mathbf{Y}}^{-1} \qquad [4]$$

The material balance identity can then be written as:

$$\mathbf{y} = \mathbf{A} \cdot \mathbf{y} + \mathbf{x} \qquad [5]$$

in which

$$\mathbf{A} = \begin{bmatrix} \mathbf{A_{aa}} & \mathbf{0} & \mathbf{A_{ai}} \\ \mathbf{A_{fa}} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{A_{fi}} & \mathbf{A_{ii}} \end{bmatrix}$$

Rearranging equation [5]:

$$\mathbf{y} = \left(\mathbf{I} - \mathbf{A}\right)^{-1} \cdot \mathbf{x} \qquad [6]$$

Therefore, if

$$\mathbf{M} = \left(\mathbf{I} - \mathbf{A}\right)^{-1} \qquad [7]$$

we can write:

$$\mathbf{y} = \mathbf{M} \cdot \mathbf{x} \qquad [8]$$

M is the global multiplier matrix that constitutes the basis of the standard multiplier model. It allows us to relate the exogenous injections to the endogenous accounts. The global multiplier matrix gives us the overall effects resulting from the initial exogenous injection; it includes all the effects we aim to decompose below, such as the direct transfers, indirect transfers, and closed-loop effects in the final endogenous account (Gakuru and Mathenge 2012).

3.2 Standard multiplier decomposition

While the multiplier model described above shows the final impact of an exogenous change, it is possible to dig deeper and expose some of the transmissions that make up the multiplier process. In particular, we are interested in very specific components of the multiplier model: those that consider the impact of exogenous changes in agriculture on rural households. In order to achieve this, we need to open up the general multiplier model and peel off certain layers.

The model used here for analysing the impact of agriculture on rural households is based on Pyatt and Round (2006). Their method decomposes matrix **M** for a more detailed view of the multipliers, offering a more comprehensive analysis of the impacts of exogenous injections and how they are transmitted throughout the entire system, ultimately affecting the endogenous accounts. This allows the SAM to be used for policy analysis at many levels, as it can give indications of the possible outcomes of an exogenous shock in the endogenous accounts of an economy.

Following the generalised outline by Tarp et al. (2002), the global multiplier matrix **M** can be decomposed by starting to rewrite equation [5] as:

$$\mathbf{y} = \mathbf{B} \cdot \mathbf{y} + \mathbf{C} \cdot \mathbf{y} + \mathbf{x} \qquad [9]$$

in which **B** is a matrix with the diagonal submatrices of **A**, and **C** is a matrix with the off-diagonal submatrices:

$$\mathbf{B} = \begin{bmatrix} \mathbf{A_{aa}} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{0} & \mathbf{A_{ii}} \end{bmatrix} \text{ and } \mathbf{C} = \begin{bmatrix} \mathbf{0} & \mathbf{0} & \mathbf{A_{ai}} \\ \mathbf{A_{fa}} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{A_{if}} & \mathbf{0} \end{bmatrix}$$

rewriting equation [9] as:

$$\mathbf{y} = (\mathbf{I} - \mathbf{B})^{-1} \cdot \mathbf{C} \cdot \mathbf{y} + (\mathbf{I} - \mathbf{B})^{-1} \cdot \mathbf{x}$$

$$\mathbf{y} = \left[\mathbf{I} - (\mathbf{I} - \mathbf{B})^{-1} \cdot \mathbf{C}\right]^{-1} \cdot (\mathbf{I} - \mathbf{B})^{-1} \cdot \mathbf{x}$$

$$\mathbf{y} = (\mathbf{I} - \mathbf{D})^{-1} \cdot (\mathbf{I} - \mathbf{B})^{-1} \cdot \mathbf{x} \text{ in which } \mathbf{D} = (\mathbf{I} - \mathbf{B})^{-1} \cdot \mathbf{C}$$

$$\mathbf{y} = (\mathbf{I} - \mathbf{D}^2)^{-1} \cdot (\mathbf{I} + \mathbf{D}) \cdot (\mathbf{I} - \mathbf{B})^{-1} \cdot \mathbf{x}$$

$$\mathbf{y} = \mathbf{M_3} \cdot \mathbf{M_2} \cdot \mathbf{M_1} \cdot \mathbf{x} \qquad [10]$$

in which

$$\mathbf{M_3} = (\mathbf{I} - \mathbf{D}^2)^{-1}$$

$$\mathbf{M_2} = (\mathbf{I} + \mathbf{D})$$

$$\mathbf{M_1} = (\mathbf{I} - \mathbf{B})^{-1}$$

If we take a closer look at the submatrices of **B** and **C**, it appears that **B** contains submatrices $\mathbf{A_{aa}}$ and $\mathbf{A_{ii}}$. They represent the transfers within a given class of accounts: matrix $\mathbf{A_{aa}}$ captures inter-industry transactions, while submatrix $\mathbf{A_{ii}}$ captures the current transfers between institutions (enterprises and households, in our case). The remaining three submatrices are $\mathbf{A_{ai}}$, $\mathbf{A_{fa}}$, and $\mathbf{A_{if}}$ of matrix **C**, and they represent the circular flow of incomes and outlays. We can note here that any increase in expenditures by institutions (households) generates extra demand for products via $\mathbf{A_{ai}}$. As a result, we can expect a supply response to this increase in demand for products, which generates an increase in demand for factor services via $\mathbf{A_{fa}}$, and hence an extra income for institutions via $\mathbf{A_{if}}$. This creation of extra income for institutions generates a further increase in institutions' consumption expenditures, thereby triggering further rounds of the multiplier process, the size of which will depend on whether the elements of **B** remain constant as effective demand increases within the system (Pyatt and Round 2006).

The $\mathbf{M_1}$ multiplier matrix captures the effects *within* each endogenous account only, and is referred to as within-group transfers. This component is therefore a diagonal block matrix, since there are no spillovers to other account groups. The first diagonal block expresses the multiplier effects among activities, and it is the same as the traditional Leontief inverse matrix. Since factors do not transfer to each other, the second diagonal block in $\mathbf{M_1}$ is an identity matrix, **I**. The block in the bottom right-hand corner captures the multiplier effects of transfers between endogenous institutions (Pansini 2008). For example, enterprises may receive an exogenous increase in income due to a policy intervention. The rise in income is partly transferred to the owners of enterprises and to households, and these households may make additional transfers to enterprises, and the latter's income will rise further, etc.

$\mathbf{M_2}$ describes the spillover effects that were mentioned above as being ignored in $\mathbf{M_1}$. These effects are from an exogenous injection into an account of one block (for example, into households), which is then transmitted to other blocks of endogenous accounts (for example, activities). This could be associated with higher demand for goods or services. $\mathbf{M_2}$ is also referred to as the open-loop multiplier. This matrix explains why and how the stimulation of one part of the system has repercussions for all the others (Pyatt and Round 2006).

Finally, $\mathbf{M_3}$ is the matrix that captures the feedback effects generated at the end of the circular flow of funds. These effects are often noted as the closed-loop multiplier effects (Pyatt and Round 2006), since they 'close the loop' and return to the account where it all started as an exogenous stimulus. In our case, this is the exogenous increase in demand for goods produced by agriculture.

Instead of a multiplicative decomposition, a perhaps more intuitive way is to consider an additive set-up with the same interpretation. This can be achieved by means of the following transformation:

$$\mathbf{N_1} = \mathbf{M_2}$$
$$\mathbf{N_2} = (\mathbf{M_2} - \mathbf{I}) \cdot \mathbf{M_1}$$
$$\mathbf{N_3} = (\mathbf{M_3} - \mathbf{I}) \cdot \mathbf{M_2 M_1}$$
such that
$$\mathbf{M} = \mathbf{N_1} + \mathbf{N_2} + \mathbf{N_3} \qquad [11]$$

3.3 Extension: decomposition of individual multipliers

Pyatt and Round (2006) have taken the above decomposition one step further by focusing on a single element of the multiplier matrix **M**. As with any SAM entry, a cell in **M** has a row and a column coordinate, a destination, and an exogenous source of the direct and indirect multiplier effects. It is possible to select a particular element of **M** by premultiplying it with a row vector of an appropriate dimension (i.e. with the same number of entries as rows in **M**) that contains zeros except for the element with the corresponding row dimension, and post-multiplying the product with a column vector (again, of an appropriate dimension) of zeros except for the corresponding column dimension of the particular **M** matrix element. For example, the element $\boldsymbol{m_{2,1}}$ can be located in the following way:

$$m_{2,1} = \begin{bmatrix} 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} m_{1,1} & m_{1,2} \\ m_{2,1} & m_{2,2} \end{bmatrix} \cdot \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

Thus, if the row vector is labelled d_i^p, where **p** stands again for the transpose and contains zeros except the unit value for the ***i***th element, and the column vector is d_j containing zeros except the unit value for the ***j***th element, we can write in general terms:

$$m_{ij} = \mathbf{d_i^p} \cdot \mathbf{M} \cdot \mathbf{d_j} \qquad [12]$$

Now substituting the general decomposition results of equation [10], we get:

$$m_{ij} = \mathbf{d_i^p} \cdot \mathbf{M_3} \cdot \mathbf{M_2} \cdot \mathbf{M_1} \cdot \mathbf{d_j} = \mathbf{r^p} \cdot \mathbf{M_2} \cdot \mathbf{s}$$

in which

$$\mathbf{r^p} = \mathbf{d_i^p} \cdot \mathbf{M_3}$$
$$\mathbf{s} = \mathbf{M_1} \cdot \mathbf{d_j} \qquad [13]$$

Thus, a single cell in the general multiplier matrix **M**, which represents the impact on **i** of an exogenous change in **j**, can be decomposed in the three elements in which $\mathbf{r^p}$ represents the feedback effect, **s** the closed-loop effect, and **M2** the spillover effect. The last step is to create a full matrix:

$$\mathbf{F^d} = \mathbf{\hat{R}^p} \cdot \mathbf{M_2} \cdot \mathbf{\hat{S}} \qquad [14]$$

in which $\mathbf{\hat{R}^p}$ contains the feedback effect and $\mathbf{\hat{S}}$ the closed-loop effect on their respective main diagonals. The sum of all elements of the matrix $\mathbf{F^d}$ specific to the combination of the exogenous change in the *j*th account and the impact on the endogenous account ***i*** is equal to m_{ij} of the full multiplier matrix **M** in equation [12].

Table 6: Description of decomposed multiplier effects

1	Direct-direct effect	The direct effect of an injection in demand for (goods and services produced by) a production activity ***j*** on a household group ***i*** without considering any other indirect effect on other activity sectors or household groups. It is contained in the ***j***th column vector of the matrix $\mathbf{F^d}$.
2	Indirect-direct effect	The effect from a productive activity on the relevant household group ***i***, other than the activity impacted initially by the exogenous injection on a household group. It captures the intermediate knock-on effect of an increase in the demand for goods and services that the initial productive activity ***j*** has on other activities, and from the latter on household group ***i***. It is obtained as the difference between the row totals of matrix $\mathbf{F^d}$ and the direct-direct effect described in 1 above.
3	Direct-indirect effect	The effect from the ***j***th account of production affected by the exogenous injection on household groups other than the relevant ***i***th household account. It is obtained as the difference between the column total of matrix $\mathbf{F^d}$ for the ***j***th account of production (which captures the total effect of the ***j***th sector of production on all household accounts) and the direct-direct effect described in 1 above.
4	Indirect-indirect effect	The effect from accounts of production other than the ***j***th account that is impacted by the exogenous injection on household groups other than the ***i***th. It captures the effect that an increase in the demand for production of the ***j***th activity has on other sectors, and from those other sectors on other than the relevant household groups. It is calculated as the residual between the full multiplier effect and the three effects above.

Source: Pansini (2008).

There are too many elements m_{ij} to discuss here. Our interest, however, is more specifically focused on the impact of agriculture, and crops in particular, on rural low-income households.

From equation [14] the effects shown in Table 6 can, according to Pansini (2008), be derived on a particular household account when demand for goods and services produced by a particular (agricultural) activity increases exogenously.

3.4 Extension: focus on trade

In this section we aim to analyse the effects of growth in trade on Mozambican income, based on a similar study by Tarp et al. (2002). The study applies decomposition techniques based on a SAM to evaluate the effects of expanding Mozambican trade, with particular emphasis on household income distribution as well as government income-expenditure and the savings = investment account (Tarp et al. 2002). The SAM is organised around the blocks of transactions in the Mozambican economy shown in Table 7.

Table 7: SAM symbols for trade multiplier analysis

	Activities	Factors	Private institutions	Other domestic institutions	Foreign accounts	Total receipts
Activities	$\mathbf{Z_{aa}}$		$\mathbf{Z_{ai}}$	$\mathbf{Z_{ad}}$	$\mathbf{M_{am}}$	$\mathbf{y_a}$
Factors	$\mathbf{Z_{fa}}$				$\mathbf{M_{fm}}$	$\mathbf{y_f}$
Private institutions		$\mathbf{Z_{if}}$	$\mathbf{Z_{ii}}$	$\mathbf{Z_{id}}$	$\mathbf{M_{im}}$	$\mathbf{y_i}$
Other domestic institutions	$\mathbf{Z_{da}}$	$\mathbf{Z_{df}}$	$\mathbf{Z_{di}}$	$\mathbf{Z_{dd}}$	$\mathbf{M_{dm}}$	$\mathbf{y_d}$
Foreign accounts	$\mathbf{M_{ma}}$	$\mathbf{M_{mf}}$	$\mathbf{M_{mi}}$	$\mathbf{M_{md}}$		$\mathbf{y_m}$
Total expend	$\mathbf{y_a^p}$	$\mathbf{y_f^p}$	$\mathbf{y_i^p}$	$\mathbf{y_d^p}$	$\mathbf{y_m^p}$	

Notes: $\mathbf{Z_{aa}}$ Interindustry interactions. $\mathbf{Z_{fa}}$ Industry factor payments. $\mathbf{Z_{da}}$ Industry tax payments for product and production taxes. $\mathbf{M_{ma}}$ Industry imports. $\mathbf{Z_{if}}$ Distribution of factor incomes to private institutions. $\mathbf{Z_{df}}$ Distribution of factor incomes to other domestic institutions. $\mathbf{M_{mf}}$ Transfers of factor (primary) income to the rest of the world. $\mathbf{Z_{ai}}$ Demand for goods and services by private institutions. $\mathbf{Z_{ii}}$ Transfers by private institutions to private institutions. $\mathbf{Z_{di}}$ Transfers by private institutions to other domestic institutions (including income tax). $\mathbf{M_{mi}}$ Transfers by private institutions (of secondary income) to the rest of the world. $\mathbf{Z_{ad}}$ Demand for goods and services by other domestic institutions and savings = investment. $\mathbf{Z_{id}}$ Transfers by other domestic institutions to private institutions. $\mathbf{Z_{dd}}$ Transfers to and from other domestic institutions (including tax accounts to government). $\mathbf{M_{md}}$ Transfers by other domestic institutions (of secondary income) to the rest of the world. $\mathbf{M_{am}}$ Demand for goods and services by the rest of the world. $\mathbf{M_{fm}}$ Transfers of primary incomes from the rest of the world (to factor accounts). $\mathbf{M_{im}}$ Transfers of secondary incomes from the rest of the world to private institutions. $\mathbf{M_{dm}}$ Transfers of secondary incomes from the rest of the world to other domestic institutions.

Source: authors' compilation.

The critical difference between this SAM multiplier model and that described in the previous subsection on agricultural development and income distribution is that an additional set of endogenous accounts for 'other domestic institutions' is introduced. They include government expenditure and transfer accounts and various tax receipt accounts, as well as the savings = investment account. The assumption here is that if the government receives income from tax collection and/or from state-owned enterprises, it will use it on goods and services and for transfer payments in the same proportions as in the underlying SAM data. Moreover, domestic institutions will set aside a proportion of any additional income received for savings, which will then, as part of the multiplier process, be used to demand goods and services for investment purposes. Note that while investment will increase, there is no accounting for augmented capital stock and the associated supply of goods and services. The analytical framework remains static; there is no sense of dynamics.[1] The material balance of equation [5] remains the same, but matrix **A** can now be written as:

$$\mathbf{A} = \begin{bmatrix} \mathbf{A_{aa}} & & \mathbf{A_{ai}} & \mathbf{A_{ad}} \\ \mathbf{A_{fa}} & & & \\ & \mathbf{A_{if}} & \mathbf{A_{ii}} & \mathbf{A_{id}} \\ \mathbf{A_{da}} & \mathbf{A_{df}} & \mathbf{A_{di}} & \mathbf{A_{dd}} \end{bmatrix} \qquad [15]$$

while matrices **B** and **C** of equation [10] become

$$\mathbf{B} = \begin{bmatrix} \mathbf{A_{aa}} & & & \\ & & & \\ & & \mathbf{A_{ii}} & \\ & & & \mathbf{A_{dd}} \end{bmatrix} \text{ and } \mathbf{C} = \begin{bmatrix} & & \mathbf{A_{ai}} & \mathbf{A_{ad}} \\ \mathbf{A_{fa}} & & & \\ & \mathbf{A_{if}} & & \mathbf{A_{id}} \\ \mathbf{A_{da}} & \mathbf{A_{df}} & \mathbf{A_{di}} & \end{bmatrix} \qquad [16]$$

So, in addition to the earlier model, here demand for goods and services by the government, as well as investment demand ($\mathbf{A_{ad}}$), is accounted for, as well as transfers by government to private institutions ($\mathbf{A_{id}}$) and vice versa ($\mathbf{A_{di}}$), which includes savings. Moreover, factor payments to government from state-owned enterprises ($\mathbf{A_{df}}$), and tax payments on products and production by activities ($\mathbf{A_{da}}$), are now also considered as an endogenous account.

The rest of equation [10] remains the same in notational terms, as well as the interpretations of the general multiplier matrix **M**, the multiplicative decomposition matrices $\mathbf{M_1}$, $\mathbf{M_2}$, and $\mathbf{M_3}$, and the additive decomposition matrices $\mathbf{N_1}$, $\mathbf{N_2}$, and $\mathbf{N_3}$.

This is how far we take the essence of this multiplier decomposition model. To this we then bolt the trade perspective by defining the direct import dependency matrix $\mathbf{A_m}$ as the import shares:

$$\mathbf{A_m} = \left[\mathbf{M_{ma}} \cdot \hat{\mathbf{y}}_\mathbf{a}^{-1} \quad \mathbf{M_{mf}} \cdot \hat{\mathbf{y}}_\mathbf{f}^{-1} \quad \mathbf{M_{mi}} \cdot \hat{\mathbf{y}}_\mathbf{i}^{-1} \quad \mathbf{M_{md}} \cdot \hat{\mathbf{y}}_\mathbf{d}^{-1} \right] \qquad [17]$$

Note that import shares extend here to include not only imports of goods and services $\mathbf{M_{ma}} \cdot \hat{\mathbf{y}}_\mathbf{a}^{-1}$, but also primary $\mathbf{M_{mf}} \cdot \hat{\mathbf{y}}_\mathbf{f}^{-1}$, secondary $\mathbf{M_{mi}} \cdot \hat{\mathbf{y}}_\mathbf{i}^{-1}$, and $\mathbf{M_{md}} \cdot \hat{\mathbf{y}}_\mathbf{d}^{-1}$ cross-border outflows. The direct export shares $\mathbf{A_e}$ can be written as:

$$\mathbf{A_e} = \left[\mathbf{M_{am}} \cdot \hat{\mathbf{y}}_\mathbf{m}^{-1} \quad \mathbf{M_{fm}} \cdot \hat{\mathbf{y}}_\mathbf{m}^{-1} \quad \mathbf{M_{im}} \cdot \hat{\mathbf{y}}_\mathbf{m}^{-1} \quad \mathbf{M_{dm}} \cdot \hat{\mathbf{y}}_\mathbf{m}^{-1} \right] \qquad [18]$$

In principle, the export shares can be extended to include not only exports of goods and services $\mathbf{M_{am}} \cdot \hat{\mathbf{y}}_\mathbf{m}^{-1}$, but also foreign receipts by Mozambican factors of production $\mathbf{M_{fm}} \cdot \hat{\mathbf{y}}_\mathbf{m}^{-1}$, as well as

[1] The savings = investment account is strictly speaking not an institution. The accumulation of savings and investment demand is usually considered in a modelling framework in which investment demand in this period results in increased capital stock in the next period. Moreover, savings behaviour impacts on other macro variables, such as household consumption. We ignore this, but since we only consider the income-expenditure impacts of accounts here, we can treat this account as another 'institution'.

transfer receipts by private $\mathbf{M_{im}} \cdot \hat{\mathbf{y}}_{\mathbf{m}}^{-1}$ and other domestic $\mathbf{M_{dm}} \cdot \hat{\mathbf{y}}_{\mathbf{m}}^{-1}$ institutions. Following Tarp et al. (2002), we can write the (direct and indirect) import dependency multiplier matrix as:

$$\mathbf{M_m} = \left[\mathbf{M_{ma}} \cdot \hat{\mathbf{y}}_{\mathbf{a}}^{-1} \quad \mathbf{M_{mf}} \cdot \hat{\mathbf{y}}_{\mathbf{f}}^{-1} \quad \mathbf{M_{mi}} \cdot \hat{\mathbf{y}}_{\mathbf{i}}^{-1} \quad \mathbf{M_{md}} \cdot \hat{\mathbf{y}}_{\mathbf{d}}^{-1}\right] \cdot \mathbf{M} = \mathbf{A_m} \cdot \mathbf{M} \qquad [19]$$

which measures the direct and indirect import requirement or leakage following a one-unit exogenous increase in demand of any of the endogenous accounts. The exogenous increase can only arise from exports or any other foreign inflows. The export dependency multiplier matrix is:

$$\mathbf{M_e} = \mathbf{M} \cdot \left[\mathbf{M_{am}} \cdot \hat{\mathbf{y}}_{\mathbf{m}}^{-1} \quad \mathbf{M_{fm}} \cdot \hat{\mathbf{y}}_{\mathbf{m}}^{-1} \quad \mathbf{M_{im}} \cdot \hat{\mathbf{y}}_{\mathbf{m}}^{-1} \quad \mathbf{M_{dm}} \cdot \hat{\mathbf{y}}_{\mathbf{m}}^{-1}\right] = \mathbf{M} \cdot \mathbf{A_e} \qquad [20]$$

which represents the direct and indirect output and income effects of a one-unit increase in exports or any other foreign inflows.

By substituting in equation [11] it would be possible to break these foreign dependencies down into own-account or closed-loop effects $\mathbf{N_1} \cdot \mathbf{A_e}$, as well as spillover and feedback effects $\mathbf{N}_2 \cdot \mathbf{A_e}$ and $\mathbf{N}_3 \cdot \mathbf{A_e}$.

4 Results

Our presentation and discussion of some results of the methodologies outlined in the previous section follows the sequence of the models outlined in sections 3.1 to 3.3 above, which highlight the impact of agriculture on rural low-income households, followed by the model in section 3.4, which considers the impact of trade on rural low-income households.

4.1 Global multiplier analysis

The first step into analysing the results is to examine the global multiplier matrix **M**. The entries in this matrix represent the overall effects resulting from the direct transfer, indirect transfer, and closed-loop processes generated by an initial increase in any of the exogenous components on the endogenous accounts (Pansini 2008). We are particularly interested in exogenous increases in the demand for goods produced by agricultural subsectors.

For reasons of convenience of display, Table 8 shows general multipliers for selected agricultural subsectors and selected household groups. Thus, the first entry in Table 8 shows that an increase in demand for—and therefore production of—maize by one unit (or one million MZN, if you like) will lift the income of rural households in the lowest income bracket (quintile) by 0.085 units (or 0.085 million MZN).

Table 8: Full multipliers for selected activities on incomes of selected households

	Maize	Sorghum and millet	Cassava	Sugar cane	Cattle	Cereal and vegetable processing	Finance and insurance
Rural - quintile 1	0.0846	0.0829	0.0770	0.0774	0.0930	0.0273	0.0154
Rural - quintile 2	0.1274	0.1261	0.1163	0.1154	0.1416	0.0398	0.0226
Rural - quintile 5	0.3866	0.3881	0.3554	0.3510	0.3836	0.1189	0.0739
Urban - quintile 1	0.0194	0.0188	0.0178	0.0186	0.0147	0.0083	0.0059
Urban - quintile 5	0.4864	0.4956	0.4806	0.4736	0.4053	0.2627	0.5011
Other households	0.5690	0.5675	0.5255	0.5342	0.5325	0.2220	0.1549
Total all quintiles	1.6735	1.6790	1.5727	1.5702	1.5709	0.6790	0.7738

Source: authors' calculations based on 2015 SAM for Mozambique.

The table suggests that the lowest-income rural households benefit less from an exogenous increase in the demand for agricultural products than do higher-income rural households. Indeed, high-income urban households benefit the most. Thus, there seems to be a heavy high-income urban bias in the impact of agricultural development. While rural high-income households also benefit substantially, low-income urban households benefit less. This suggests that the urban-rural divide is more limited in explaining the bias of the impact than is the distribution of income.

It can also be seen that the impact of cattle is higher than that of crops for rural low-income households, but not for high-income households. The impact of exogenous expansion in non-agricultural activities on rural households in general is (as expected) very low, while it is higher for high-income urban households. This is even the case for grain and vegetable food-processing, which one would have expected to carry over into benefits for rural households through the backward linkages of this industry. There is little evidence of this happening on a substantial scale in Mozambique at this level of detail. Rural households do not seem to be significantly connected to the most obvious industry, i.e. food-processing. It can be seen that the same also applies to urban low-income households. Their multiplier for the selected crops, although very low, is still higher than for food-processing. In contrast, and as expected, urban high-income households are strongly connected to financial services, although not much more than to food crops. The latter suggests that urban high-income households have a significant handle on the direct and indirect income streams from crops.

It can also be seen that the total household income multiplier of agriculture is much higher than those of the two non-agriculture sectors shown in Table 8. This is typical of all other non-agricultural industries identified in the SAM (not shown here). In terms of household income generation, agriculture is more important than any other industry in Mozambique, in spite of the bias towards high-income households.

In what follows we present results for a highly aggregated model, for more convenient display purposes. Here:

1. Activities are aggregated up from those reported in Table A1 to the following eight: crops, other agriculture, mining, food-processing, other manufacturing, utilities, construction, and services.
2. Households are aggregated up to low-income (bottom three quintiles) and high-income households for both rural and urban areas.

The general multiplier matrix part that describes the impact of food crops and food-processing on households' incomes is shown in Table 9.

Table 9: Full multipliers for selected aggregated activities on income of aggregated households

	Crop production	Crop food-processing
Rural low-income	0.4076	0.1774
Rural high-income	0.6249	0.2813
Urban low-income	0.0829	0.0709
Urban high-income	0.5512	0.4886
Total	1.6666	1.0181

Source: authors' calculations based on 2015 SAM for Mozambique.

Table 9 repeats the main earlier message, in that low-income rural households benefit less from an exogenous increase in demand for agricultural crops than do higher-income rural households. Even high-income urban households benefit more. Thus, there seems to be a considerable bias against rural low-income households from agricultural development. Urban low-income households benefit the least. As before, this suggests that the urban-rural divide on its own is limited in explaining the bias of the impact compared with the distribution of income.

4.2 Further decomposition

Further decomposition of the overall multiplier effects of crops and crop food-processing using equations [12] to [14] are shown in Table 10. The direct effect includes the effect of an injection in (demand for goods and services produced by) a production activity on a household group, plus the intermediate knock-on effects that the initial productive activity has on other activities and from the latter onto households. They are the sum of the direct-direct and indirect-direct effects described in Table 6.

The indirect effect is the residual capturing the effects that are channelled through the other households, either directly or through the knock-on effects of the intermediate inputs from an exogenous increase in the relevant productive activity. The residual represents the sum of the direct-indirect and indirect-indirect effects described in Table 6.

Table 10: Decomposed shares of the general multipliers for selected activities on income of selected households

	Rural low-income	Rural high-income	Urban low-income	Urban high-income
		Crops		
Direct	78.6%	77.9%	52.6%	54.5%
Indirect	21.4%	22.1%	47.4%	45.5%
		Crop food-processing		
Direct	65.0%	64.7%	67.9%	78.8%
Indirect	35.0%	35.3%	32.1%	21.2%

Source: authors' calculations based on 2015 SAM for Mozambique.

The direct effect from an exogenous increase in demand for crops on the lowest-income rural households represents 79 per cent of the total impact on these households, while the impact of related food-processing is 65 per cent. The same shares apply to rural high-income households. As expected, the importance of the direct effects is reversed in the case of urban households. Direct effects represent 53 per cent and 55 per cent of the total impact on urban low- and high-income households of an exogenous increase in crops, and 68 per cent and 79 per cent of the total impact due to an exogenous change in related food-processing. Manufacturing (food-processing in this case) benefits urban households more than growing crops.

Thus, it is no surprise that the direct effect from crop production on rural households is higher than on urban households. What is interesting is that high-income rural households benefit directly in a similar way to low-income rural households. One would have expected higher-income households to have more diverse income sources than low-income households. It is also remarkable that both low- and high-income urban households still receive a substantial share of total effects from crops directly.

The higher direct effect of food-processing related to crop production for high-income urban households compared with low-income urban households and all rural household groups shown here suggests a systemic inequality in the distribution of income.

In Table 11 we show the full decomposition of the multiplier effect of an exogenous increase in processed food on rural low-income households. Here it can be seen that the indirect effect of crop food-processing on rural low-income households through intermediate inputs from crop production is higher than the direct effect. This suggests that food-processing can indeed be an important channel to lift rural low-income households' income.

Table 11: Decomposition of the multiplier effect of processed food on rural low-income households for selected aggregated activities on broad household income

	Crop production	Other agriculture	Mining	Other manufacturing	Crop food-processing	Utilities	Construction	Services	Total
Rural low-income	**0.0644**	0.0001	0.0000	0.0002	**0.0448**	0.0001	0.0000	0.0057	0.1153
Rural high-income	0.0107	0.0000	0.0000	0.0000	0.0074	0.0000	0.0000	0.0017	0.0199
Urban low-income	0.0016	0.0000	0.0000	0.0000	0.0063	0.0000	0.0000	0.0011	0.0091
Urban high-income	0.0049	0.0000	0.0000	0.0001	0.0204	0.0002	0.0000	0.0073	0.0330
Totals	0.0817	0.0001	0.0000	0.0004	0.0789	0.0004	0.0001	0.0158	0.1774

Note: **i** is low-income rural households; **j** is crop food-processing.

Source: authors' calculations based on 2015 SAM for Mozambique.

Having said that, the impact of a one-unit exogenous increase in demand for goods produced by food-processing remains very low, as can be seen in the bottom right-hand corner of Table 11. The reason why this general multiplier is so low is that the import propensity of goods produced by these activities is very high compared with food crops.

Thus, stimulating the development of this industry will impact positively on rural low-income households through increased demand for locally sourced intermediate food crop inputs. The feasibility of supporting the food-processing industry also depends on other factors, such as scale and the state of infrastructure to source locally produced crops. However, with continued economic growth, the market for processed food is likely to expand. Therefore, the public sector's role in upgrading infrastructure is likely to be of pivotal importance.

4.3 Trade

In this section we present the results regarding the trade part of the decomposition process. Now that the multiplier process has been extended to include government income and expenditure as well as savings = investment accounts, it may be interesting to check what this means for the general multipliers reported in Table 9. Table 12 makes a comparison.

It is no surprise that, given the additional income and expenditure loops, the extended multipliers are higher than the standard multipliers. Three observations can be made. The household income multipliers:

1. of processed food increase more than those of crops;
2. for higher-income households gain more compared with the standard multipliers;
3. for urban areas improve more in the extended case.

Table 12: Standard multipliers versus extended multipliers, for selected broad activities and broad household groups

	1. Standard multipliers		2. Extended multipliers		3. Extended - standard	
	Crops	Food-processing	Crops	Food-processing	Crops	Food-processing
Rural low-income	0.4076	0.1774	0.4732	0.2867	16.1%	61.6%
Rural high-income	0.6249	0.2813	0.7504	0.4741	20.1%	68.5%
Rural total	**1.0326**	**0.4587**	**1.2236**	**0.7608**	**18.5%**	**65.9%**
Urban low-income	0.0829	0.0709	0.1199	0.1026	44.7%	44.9%
Urban high-income	0.5512	0.4886	0.9054	0.8170	64.3%	67.2%
Urban total	**0.6341**	**0.5594**	**1.0253**	**0.9196**	**61.7%**	**64.4%**
Total	**1.6666**	**1.0181**	**2.2488**	**1.6804**	**34.9%**	**65.0%**

Source: authors' calculations based on 2015 SAM for Mozambique.

These results can be explained in that processing food crops adds value and raises more government income and savings, and therefore raises government expenditure and investment demand. It also takes place in urban areas, and requires more factor inputs that are biased towards higher-income households through production factors such as capital and higher-skilled labour.

Selected results of equation [19] for direct, indirect, and decomposed import requirements are reported in Table 13. Tableau 1 shows the direct import requirements for selected activities and for expenditure by the four broadly aggregated household groups. In row 2 of this tableau, it can be seen that import requirements from South Africa by the food-processing activity are relatively high at 0.19. This represents 39 per cent (row 6) of the total (direct and indirect) import requirements of 0.49 (row 2 of tableau 2) by this activity. Tableau 2 also shows that total (direct and indirect) import requirements are highest from South Africa and the rest of the world across the selected activities and broad household groups.

Closed-loop import requirements reported in tableau 3 are obtained by substituting $\mathbf{N_1}$ for $\mathbf{M}$ in equation [19]. Again, the one that stands out is the import requirement for food-processing from South Africa (row 2), representing 43 per cent of the overall import multiplier from that source. This suggests that if food-processing is to become a more important generator for rural low-income households, it and its intermediate inputs will need to compete with imports from South Africa. The same appears to be the case for other manufacturing, and to a lesser degree for services, although here all sources of imports are important, not just South Africa.

While spillover effects account for a relatively small share of the total (direct plus indirect) import requirements, the main share is accounted for by the feedback effects. Thus, through factor income earned and institutional expenditures by households, as well as government and investment demand, the lion's share of the total import requirements is explained.

A similar table with results can be drawn up for exports. Results are shown in Table 14. Here, we evaluate a one-unit increase in all exports to broad regions for selected activities and broad household groups.

In the first row of Table 14 it can be seen that exports of other manufacturing make up 67 per cent of total exports (of goods and services) to the EU. South Africa is an important destination for mining, which accounts for close to 60 per cent of all exports to this destination. It also makes up 98 per cent (row 6) of the total multiplier effect, as is reported in the next tableau. Hence, the backward linkages of these exports are not very important. The same can be said of other manufacturing exports to the EU (row 5). This is related to exports of aluminium.

Crop exports are not important in Mozambique's exports, as is reported in column 1 of tableau 1; neither is food-processing. However, the multiplier effect of exports on crop production to all but the rest of sub-Saharan Africa are relatively important, as can be seen in the first four rows of tableau 2. Further down the table, the decomposition suggests that this is mainly due to the feedback effect (see tableau 5, rows 1 and 2). Thus, the impact of exports (of all goods and services) on crops is important, but not so much because of the intermediate input (closed-loop) effects, but rather because of how crops link indirectly to institutional income generation and its transfers.

But do low-income households benefit from exports' significant impact on crop production? Columns 5 to 8 of tableau 2 suggest not. The full multiplier effect of all exports is biased towards urban and high-income households in particular through the spillover and also the feedback effects. But it is not only rural low-income households that are left behind; urban low-income households are biased against even more.

Finally—and to come back to our earlier discussion of food-processing, where we reported the high import content of this activity—it can be seen in column 4 of all tableaus that food-processing also does not feature much in Mozambique's exports. So, where we argued that this activity would benefit rural low-income households indirectly, in a relatively significant way, if it were to be given an opportunity, there is much scope to do so, not only in the local market but also beyond. A related observation is that urban low-income households are left out of the export benefits even more than their rural counterparts, as can be seen in column 7 of the relevant tableaus.

Table 13: Direct and total import requirements for broad regions, selected activities, and broad household groups, additively decomposed

		1	2	3	4	5	6	7	8
Tableau 1: Direct		Crops	Food-processing	Other manufacturing	Services	Rural low-income	Rural high- income	Urban low-income	Urban high-income
1	EU	0.003	0.004	0.030	0.028	0.017	0.025	0.009	0.018
2	SA	0.012	**0.192**	0.104	0.080	0.043	0.050	0.031	0.041
3	ROSSA	0.000	0.001	0.013	0.010	0.014	0.015	0.009	0.015
4	ROW	0.007	0.009	0.101	0.078	0.068	0.098	0.042	0.076
5	EU	2.2%	3.9%	22.1%	20.2%	**12.5%**	**18.2%**	**6.4%**	**13.3%**
6	SA	3.2%	**38.9%**	**26.5%**	**20.7%**	**11.2%**	**13.5%**	**7.8%**	**11.0%**
7	ROSSA	0.7%	2.9%	23.7%	18.2%	**23.6%**	**25.7%**	**17.4%**	**25.9%**
8	ROW	1.6%	2.7%	**24.0%**	18.7%	**16.1%**	**22.6%**	**10.0%**	**17.7%**
Tableau 2: Full									
1	EU	0.139	0.115	0.134	0.140	0.139	0.139	0.138	0.138
2	SA	**0.380**	**0.493**	0.392	0.386	0.383	0.369	0.393	0.376
3	ROSSA	0.057	0.046	0.055	0.056	0.057	0.057	0.054	0.060
4	ROW	**0.425**	0.346	0.419	0.419	0.421	0.435	0.414	0.427
5	EU	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
6	SA	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
7	ROSSA	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
8	ROW	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Tableau 3: Closed-loop									
1	EU	0.004	0.011	0.042	0.038	0.017	0.025	0.009	0.018
2	SA	0.016	**0.213**	0.143	0.111	0.043	0.050	0.031	0.041
3	ROSSA	0.001	0.004	0.018	0.014	0.014	0.015	0.009	0.015
4	ROW	0.010	0.028	0.137	0.107	0.068	0.098	0.042	0.076
5	EU	3.0%	9.8%	**31.4%**	27.4%	12.5%	18.2%	6.4%	13.3%
6	SA	4.1%	**43.2%**	**36.6%**	28.8%	11.2%	13.5%	7.8%	11.0%
7	ROSSA	1.4%	7.9%	**31.8%**	24.6%	23.6%	25.7%	17.4%	25.9%
8	ROW	2.3%	8.1%	**32.7%**	25.4%	16.1%	22.6%	10.0%	17.7%

Tableau 4: Spillover									
1	EU	0.020	0.014	0.013	0.014	0.031	0.032	0.039	0.037
2	SA	0.043	0.031	0.028	0.032	0.096	0.098	0.116	0.110
3	ROSSA	0.014	0.009	0.008	0.010	0.007	0.009	0.007	0.010
4	ROW	0.079	0.056	0.049	0.056	0.077	0.087	0.092	0.098
5	EU	14.4%	12.4%	9.4%	10.2%	22.6%	23.3%	27.8%	26.7%
6	SA	11.4%	**6.3%**	**7.2%**	**8.2%**	25.0%	26.5%	29.4%	29.2%
7	ROSSA	24.0%	20.4%	15.1%	17.7%	11.5%	15.5%	13.1%	16.8%
8	ROW	18.5%	16.1%	11.7%	13.4%	18.3%	20.1%	22.3%	23.0%
Tableau 5: Feedback									
1	EU	0.114	0.089	0.079	0.087	0.090	0.081	0.091	0.083
2	SA	0.321	**0.249**	0.220	0.243	0.244	0.221	0.247	0.225
3	ROSSA	0.042	0.033	0.029	0.032	0.037	0.034	0.038	0.034
4	ROW	0.337	0.262	0.233	0.256	0.276	0.250	0.280	0.253
5	EU	**82.5%**	**77.9%**	**59.2%**	**62.4%**	**64.8%**	**58.5%**	**65.7%**	**59.9%**
6	SA	**84.4%**	**50.5%**	**56.2%**	**63.0%**	**63.7%**	**60.0%**	**62.8%**	**59.8%**
7	ROSSA	**74.6%**	**71.7%**	**53.0%**	**57.7%**	**64.9%**	**58.8%**	**69.4%**	**57.3%**

Notes: SA: South Africa. ROSSA: rest of sub-Saharan Africa. ROW: rest of world.

Source: authors’ calculations based on 2015 SAM for Mozambique.

Table 14: Direct and total requirements of exports to broad regions, for selected activities and broad household groups, additively decomposed

		1	2	3	4	5	6	7	8
Tableau 1: Direct		Crops	Mining	Other manufacturing	Food-processing	Rural low-income	Rural high-income	Urban low-income	Urban high-income
1	EU	0.023	0.045	**0.674**	0.040	0.000	0.000	0.000	0.000
2	SA	0.013	**0.587**	0.039	0.011	0.000	0.000	0.000	0.000
3	ROSSA	0.030	0.006	0.075	0.015	0.000	0.000	0.000	0.000
4	ROW	0.023	**0.122**	**0.225**	0.032	0.000	0.000	0.000	0.000
5	EU	6.6%	67.5%	**83.1%**	32.1%	0.0%	0.0%	0.0%	0.0%
6	SA	4.0%	**97.8%**	24.4%	11.9%	0.0%	0.0%	0.0%	0.0%
7	ROSSA	**22.6%**	**57.2%**	**66.2%**	**36.7%**	0.0%	0.0%	0.0%	0.0%
8	ROW	10.6%	93.1%	74.8%	39.7%	0.0%	0.0%	0.0%	0.0%
Tableau 2: Full									
1	EU	**0.345**	0.067	**0.811**	**0.126**	**0.174**	**0.313**	**0.097**	**0.860**
2	SA	**0.318**	**0.601**	0.161	0.090	0.172	0.308	0.100	0.877
3	ROSSA	**0.132**	0.011	0.113	0.042	0.059	0.106	0.029	0.266
4	ROW	0.214	0.131	0.301	0.082	0.108	0.192	0.057	0.498
5	EU	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
6	SA	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
7	ROSSA	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
8	ROW	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Tableau 3: Close-loop									
1	EU	0.046	0.061	0.717	**0.052**	0.000	0.000	0.000	0.000
2	SA	0.018	0.594	0.066	**0.015**	0.000	0.000	0.000	0.000
3	ROSSA	**0.037**	0.009	**0.083**	**0.018**	0.000	0.000	0.000	0.000
4	ROW	0.036	0.128	0.245	**0.038**	0.000	0.000	0.000	0.000
5	EU	13.5%	91.2%	**88.4%**	41.1%	0.0%	0.0%	0.0%	0.0%
6	SA	5.6%	99.0%	40.7%	16.7%	0.0%	0.0%	0.0%	0.0%
7	ROSSA	27.6%	82.9%	73.7%	43.9%	0.0%	0.0%	0.0%	0.0%
8	ROW	16.9%	97.4%	81.5%	46.4%	0.0%	0.0%	0.0%	0.0%

Tableau 4: Spillover									
1	EU	0.000	0.000	0.001	0.000	0.045	0.085	0.040	**0.348**
2	SA	0.000	0.000	0.000	0.000	0.041	0.074	0.042	**0.346**
3	ROSSA	0.000	0.000	0.000	0.000	0.018	0.034	0.011	0.108
4	ROW	0.000	0.000	0.000	0.000	0.031	0.056	0.023	0.195
5	EU	0.0%	-0.1%	0.1%	0.3%	25.9%	27.1%	41.8%	40.5%
6	SA	0.0%	0.0%	0.2%	0.3%	23.7%	24.1%	41.6%	39.4%
7	ROSSA	0.0%	-0.1%	0.1%	0.2%	31.0%	32.2%	39.5%	40.6%
8	ROW	0.0%	0.0%	0.1%	0.3%	29.1%	29.3%	41.3%	39.2%
Tableau 5: Feedback									
1	EU	**0.298**	0.006	0.093	0.074	**0.129**	**0.229**	**0.056**	**0.512**
2	SA	**0.300**	0.006	0.095	0.075	**0.131**	**0.234**	**0.058**	**0.531**
3	ROSSA	0.096	0.002	0.030	0.023	0.041	0.072	0.017	0.158
4	ROW	0.178	0.004	0.055	0.044	0.077	0.136	0.033	0.303
5	EU	86.5%	8.8%	11.5%	58.6%	74.1%	72.9%	58.2%	59.5%
6	SA	94.3%	1.0%	59.1%	83.0%	76.3%	75.9%	58.4%	60.6%
7	ROSSA	72.4%	17.2%	26.2%	55.9%	69.0%	67.8%	60.5%	59.4%
8	ROW	83.0%	2.7%	18.4%	53.3%	70.9%	70.7%	58.7%	60.8%

Notes: SA: South Africa. ROSSA: rest of sub-Saharan Africa. ROW: rest of world.

Source: authors’ calculations based on 2015 SAM for Mozambique.

5 Conclusions

While aggregation matters to some degree in multiplier analysis, the reporting and discussion of the vast quantity of results is a challenge for the purposes of this paper. What has been presented can be considered illustrative of what can be achieved by decomposition analysis: one can go beyond the full multiplier analysis and dig deeper to find out what drives income generation.

In particular, this paper is concerned with rural low-income households and how they are impacted on by exogenous changes in agriculture (crop production) and international trade. Although the multiplier decomposition models in the previous sections are applied at a high level of aggregation, the main messages that appear from the results are still pertinent.

Exogenous improvement in crop production has remarkably little impact on rural low-income households. In contrast, it would appear that urban households, as well as rural high-income households, benefit more. It seems that rural low-income households are not quite part of the income-expenditure loop that is associated with the activity of crop production, which is presumably dominant in their local economy.

The multiplier decomposition reveals that food-processing has a relatively strong link to rural low-income households via the crop production activity's intermediate inputs. However, food-processing itself is of little importance in Mozambique's economic structure. Its multiplier is relatively low, mainly because of high import penetration.

The international trade analysis component then reveals that the high rates of imports regarding food-processing are mainly sourced from South Africa. This means that the development of local capacity in this activity will be competing with South African producers. Nonetheless, as Mozambique's economic growth is expected to continue, incomes will rise and markets expand, which may offer the scale that is required to become more competitive. Government investment in infrastructure may help to unlock potential crop production linkages to food-processing.

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Appendix

Table A1: Global set for a 2015 SAM for Mozambique

	Code	Model code		Code	Description		Code	Model code		Code	Description
1	amaiz	acrps	55	cmaiz	Maize	45	atran	aserv	99	ctran	Transportation and storage
2	asorg	acrps	56	csorg	Sorghum and millet	46	ahotl	aserv	100	chotl	Accommodation and food services
3	arice	acrps	57	crice	Rice	47	acomm	aserv	101	ccomm	Information and communication
4	aocer	acrps	58	cocer	Other cereals	48	afsrv	aserv	102	cfsrv	Finance and insurance
5	apuls	acrps	59	cpuls	Pulses	49	areal	aserv	103	creal	Real-estate activities
6	agnut	acrps	60	cgnut	Groundnuts	50	absrv	aserv	104	cbsrv	Business services
7	aoils	acrps	61	coils	Other oilseeds	51	apadm	aserv	105	cpadm	Public administration
8	acass	acrps	62	ccass	Cassava	52	aeduc	aserv	106	ceduc	Education
9	aroot	acrps	63	croot	Other roots	53	aheal	aserv	107	cheal	Health and social work
10	avege	acrps	64	cvege	Vegetables	54	aosrv	aserv	108	cosrv	Other services
11	asugr	acrps	65	csugr	Sugar cane			NA	109	trc	Transaction costs
12	atoba	acrps	66	ctoba	Tobacco			mlnd	110	mlnd	Crop land
13	acott	acrps	67	ccott	Cotton and fibres			mliv	111	mliv	Livestock
14	afrui	acrps	68	cfrui	Fruits and nuts			flab	112	flab-rn	Labour - rural not completed primary
15	acoco	acrps	69	ccoco	Cocoa			flab	113	flab-rp	Labour - rural completed primary
16	acoff	acrps	70	ccoff	Coffee and tea			flab	114	flab-rs	Labour - rural completed secondary
17	aocrp	aoagr	71	cocrp	Other crops			flab	115	flab-rt	Labour - rural completed tertiary
18	acatt	aoagr	72	ccatt	Cattle			flab	116	flab-un	Labour - urban not completed primary
19	apoul	aoagr	73	cpoul	Poultry			flab	117	flab-up	Labour - urban completed primary
20	aoliv	aoagr	74	coliv	Other livestock			flab	118	flab-us	Labour - urban completed secondary
21	afore	aoagr	75	cfore	Forestry			flab	119	flab-ut	Labour - urban completed tertiary
22	afish	aoag	76	cfish	Fishing			mcap	120	mcap	Capital
23	acoal	aming	77	ccoal	Coal and lignite			ent	121	ment	Enterprises
24	acoil	aming	78	ccoil	Crude oil			hhd-rl	122	hhd-r1	Rural - quintile 1
25	angas	aming	79	cngas	Natural gas			hhd-rl	123	hhd-r2	Rural - quintile 2
26	aomin	aming	80	comin	Other mining			hhd-rl	124	hhd-r3	Rural - quintile 3
27	ameat	aomnf	81	cmeat	Meat			hhd-ru	125	hhd-r4	Rural - quintile 4
28	acvgp	afood	82	ccvgp	Cereal and vegetable processing			hhd-ru	126	hhd-r5	Rural - quintile 5

29	afood	afood	83	cfood	Other foods	hhd-ul	127	hhd-u1	Urban - quintile 1
30	aptob	aomnf	84	cptob	Tobacco-processing	hhd-ul	128	hhd-u2	Urban - quintile 2
31	atext	aomnf	85	ctext	Textiles	hhd-ul	129	hhd-u3	Urban - quintile 3
32	aclth	aomnf	86	cclth	Clothing	hhd-uu	130	hhd-u4	Urban - quintile 4
33	aleat	aomnf	87	cleat	Leather and footwear	hhd-uu	131	hhd-u5	Urban - quintile 5
34	awood	aomnf	88	cwood	Wood and paper	gov	132	mgov	Government
35	apetr	aomnf	89	cpetr	Petroleum	gov	133	matx	Taxes - activity
36	achem	aomnf	90	cchem	Chemicals	gov	134	mftx	Taxes - factors
37	anmet	aomnf	91	cnmet	Non-metal minerals	gov	135	mstx	Taxes - sales
38	ametl	aomnf	92	cmetl	Metals and metal products	gov	136	mmtx	Taxes - import
39	amach	aomnf	93	cmach	Machinery and equipment	gov	137	metx	Taxes - export
40	aoman	aomnf	94	coman	Other manufacturing	gov	138	mdtx	Taxes - direct
41	aelec	autil	95	celec	Electricity, gas, and steam	gov	139	mstk	Change in stocks
42	awatr	autil	96	cwatr	Water supply and sewage	s-i	140	ms-i	Savings = investment
43	acons	acnst	97	ccons	Construction	row	141	mrow	Rest of world
44	atrad	aserv	98	ctrad	Wholesale and retail trade	aserv			

Note: Not all accounts contain data.

Source: authors' compilation.