“Accelerating Poverty Reduction in Mozambique: Challenges and Opportunities”

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WORLD BANK GROUP
Poverty

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Acknowledgements

This study was led by Javier E. Baez and Pedro Olinto. The core team included Carlos Da Maia, Alessia Thiebaud, Jan Joost Nijhoff, Ghada Elabed, Klaus Deininger, Eduardo Cenci, Thiago de Lucena, German Caruso, Siobhan Murray and Niu Chiyu. The team thanks Mark Lundell, Ruth Hill, Victor Sulla and Carolina Diaz-Bonilla for sharing thoughtful comments on an earlier version of this report. The team also thanks Peter Frisk, Michel Matera and Bontje M. Zangerling for providing access to data used in the elaboration of some of the background papers. The work was conducted under the general guidance of Pablo Fajnzylber (Practice Manager, Poverty and Equity Global Practice, Africa Region).

Background papers

"Oaxaca-Blinder Decompositions: Explaining Welfare in Mozambique" by Pedro Olinto, Carlos da Maia, and Thiago de Lucena.

"Why is Agriculture not More Effective in Reducing Poverty in Mozambique? Understanding the Constraints to Productivity and Marked-Based Agriculture" by Javier E. Baez, Jan Joost Nijhoff, Ghada Elabed, Alessia Thiebaud and Carlos Da Maia.

"Identifying Promising Interventions in Mozambique's Agriculture" by Eduardo Cenci

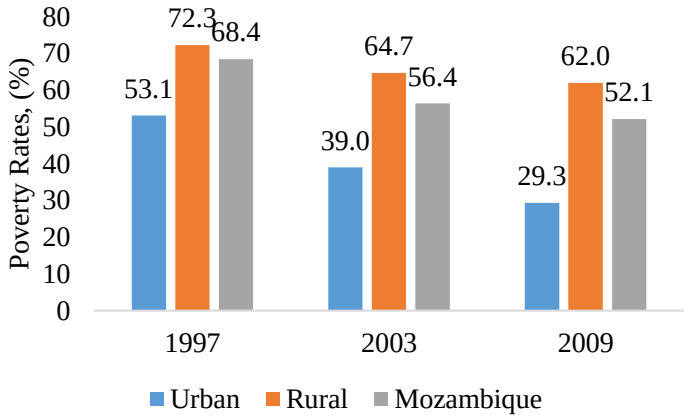
"Do Weather Shocks Influence Long-Term Household Well-being in Mozambique? by Javier E. Baez, German Caruso, Niu Chiyu and Siobhan Murray

1. Overview

Mozambique has recorded modest and geographically uneven poverty reduction in spite of strong economic growth

1. Over the past two decades Mozambique enjoyed robust and accelerating economic growth, yet strong economic progress only translated into modest poverty reduction. The economy grew by an average of 7.9 percent per year from 1993 to 2014, an impressive rate by regional and global standards. However, Mozambique has struggled to translate this stellar growth into poverty reduction. The national headcount poverty rate dropped by 12 percentage points between 1997 and 2003, from 68 to 56 percent. However, poverty declined at a much slower pace since 2003, falling by only 4 percentage points to reach 52 percent in 2009.[1] Between 1997 and 2009, for each percent increase in Sub Saharan Africa's per capita GDP, poverty fell by 0.5 percent in the region. Over the same period, for each percent of growth in Mozambique, poverty fell by only 0.26 percent in the country, nearly half as fast. Consequently, Mozambique still ranks among the countries with the highest levels of poverty (69 percent at the $1.9 2011PPP line), alongside countries such as Liberia, Guinea-Bissau, Malawi, Democratic Republic of Congo, Burundi and Madagascar.

Figure 1.1. The pace of poverty reduction has slowed down in Mozambique



Source: World Bank

2. Performance in poverty reduction is uneven across regions, with some parts of the country –especially the center and the north– accounting for a disproportionate share of the poor. The distribution of poverty in Mozambique varies significantly by region. Overall, urban provinces tend to have lower poverty rates than rural provinces, particularly those in the central and northern parts of the country. At 10 percent, Maputo City has the country's lowest poverty rate. At the other end of the distribution, Zambezia has a poverty rate of 73 percent. Rather than falling as in the rest of the country, poverty increased between 2003 and 2009 in the provinces of Zambezia, Sofala, Manica, and Gaza. As a result, these five provinces together accounted for

[1] The poverty figures discussed in this note are based on Mozambique's national poverty line, which in 2009 was approximately 16 meticais per capita per day, or approximately US$0.90 per day in 2005 PPP terms. This is 28% lower than the international extreme poverty line of US$1.25 per day used by the World Bank. The terms "poverty" and "extreme poverty" are used in this report interchangeably, since all of the poor in Mozambique live below the international extreme poverty line.

approximately 70 percent of the poor in 2009, up from 59 percent in 2003. Zambezia and Nampula alone accounted for almost half of the poor in the country in 2009 (48 percent), increasing from 42 percent in 2003.

Growth has benefited mostly the non-poor, signaling low inclusiveness.

3. Mozambique's poor performance in translating mean per capita consumption growth into poverty reduction is largely attributable to increased inequality in the country. Inequality indicators in Mozambique worsened considerably between 1997 and 2003 and remained elevated through 2009. The Gini index rose from 0.44 in 1997 to 0.50 in 2003, then slid to 0.48 in 2009, remaining well above the level recorded in the late 1990s. In general, high levels of inequality tend to lessen the impact of economic growth on income growth for those in the bottom of the distribution. Growth could have had a much larger impact on poverty reduction in Mozambique if its effects had not been offset by the observed increase in inequality. Poverty declined by 16.3 percentage points between 1997 and 2009; if inequality had not increased, the observed growth would have led to a decline in poverty of about 26.8 percentage points. In turn, the poverty rate would have dropped to 41.6 percent instead of the observed 52 percent (table 1.1).

Table 1.1. The increase in inequality undermined poverty reduction

	1997	2009	1997-2009
Headcount poverty rate	68.4 %	52.1 %	
Change in poverty			- 16.3%
Growth component			-26.8%
Redistribution component			3.2%
Residual			7.3%

Source: World Bank based on IAF1996/7 and IOF2008/9

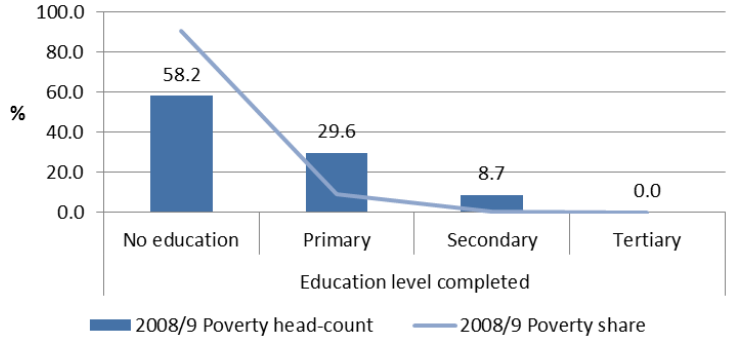
4. Consequently, the lack of inclusive growth has undermined the enhancement of shared prosperity. The enhancement of shared prosperity requires a growing economy that benefits the bottom of the distribution relatively more than the rest of the population.[2] The Mozambican economy has been growing continuously since the middle of the 1990's. Yet, the bottom 40 percent of the population in Mozambique grew at a slower pace than the overall Mozambican population. This means that the poor did not benefit as much from growth as the more affluent. Between 2002/3 and 2008/9, the annual growth rate of per capita expenditure of the whole Mozambican population was greater than that of the bottom 40% of the population. While it grew by 2.3 percent per annum for the whole population, per capita consumption expenditure grew by 2 per annum among the bottom 40% of the population.

Underlying the limited equity outcomes in Mozambique is a significant gap in the endowments and economic opportunities of the poor relative to the non-poor

[2] In 2014 the World Bank Group introduced the so called twin goals. The first pledges to end extreme poverty. The percentage of people living with less than US$ 1.9 a day should fall to 3 percent by 2030. The second goal is related to the promotion of shared prosperity. It pledges to foster real income growth of the bottom 40 percent of the population in every country. This section discusses how Mozambique fared with respect to the latter goal between 2002/3 and 2008/9

5. Poor households are characterized by having lower human capital, jobs of lower quality and higher dependency ratios. Illiteracy rates, for instance, have fallen moderately except for the poor. The national illiteracy rate was 62.3 percent in 1997 and declined to 57.7 percent by 2009. The trend is similar for the non-poor. Among the poor, however, the illiteracy rate increased from 67.6 percent to 69.2 percent over the same period. Related to this, the poverty status of an individual is related to the educational background of the household head. The more educated the head is the lower are the chances of poverty and poverty reduces faster in households with more educated heads (figure 1.2). And while Mozambique's labor market is typical of a low income country (in other words, high employment and underemployment rates), most of the jobs where the poor work are of low quality. Demographics has a negative impact on the dependency ratios of the poor since the size of poor families is close to one person bigger compared to that of non-poor families (5.16 and 4.23, respectively).

Figure 1.2. Human capital is strongly correlated with poverty status



Source: World Bank based on IOF2008/9

Some of the regions, particularly those in the northern and center parts of the country, are lagging behind the rest of the country

6. The low responsive of poverty to economic growth in Mozambique is partly driven by the fact that the provinces of Nampula and Zambezia have been lagging behind the rest of the country, particularly between 2003 and 2009. In Nampula and Zambezia, the poverty rate increased by more than 5 percent over the period, while it dropped by 17.3 percent in the rest of the country. In 2003, Nampula and Zambezia jointly represented 38 percent of the population and 42 percent of the country's poor. In 2009, their share of total population had remained the same, while their share of the poor had increased to 48 percent. The growth elasticity of poverty reduction (GEPR), a measured to gauge the ability of the country to convert economic expansion into poverty reduction, would be much higher if it were to be computed without the Nampula and Zambezia provinces. Indeeed, Mozambique's GEPR could have more than doubled from 2003 to 2009, improving from -0.54 to -1.18, higher than the regional average (Table 1.2).

Table 1.2. Nampula and Zambezia have been holding back poverty reduction in Mozambique

2003 - 2009	Change in Poverty		Per Capita Expenditure Growth		GEPR	P-value
	Counterfactual	%	Counterfactual	%	Counterfactual	%
Mozambique	-0.044	-7.7	3.072	14.4	-0.537	0.0000
Nampula and Zambezia	-0.091	-17.3	3.747	14.6	-1.178	0.0000

Source: World Bank based on IAF2002/3, and IOF2008/9

7. Differences in the changes in returns to assets, rather than changes in asset endowments, which contributed to the widening of poverty differences between Nampula and Zambezia and the rest of the country. While individuals in these two provinces tend to live in households with lower asset endowments than the rest of the country, there is no evidence that the population in the rest of the country has been accumulating assets at a faster pace. Results of Oaxaca-Binder decompositions show that differences in endowments (demographics, human capital and sector composition of the labor force, among others) explained about half of the differences in poverty rates in 2003. In 2009, they explained only 28 percent. Instead, if mean returns to asset endowments had increased in Nampula and Zambezia at the same pace as in the rest of the country, poverty would have fallen by almost a half in these two provinces. One of the possible factors contributing to these differences could reside in the fact that households in the provinces of Nampula and Zambezia are on average more isolated than households in the rest of the country. Returns to assets, especially education and land, appear to be lower in these provinces, especially for rural households. Remotely located rural households are likely to receive lower prices for their crops, pay higher prices for inputs and have fewer non-farm income generating opportunities.

Low productivity and limited market-based growth in agriculture are major contributors to sluggish poverty reduction

8. Agriculture is a key sector to accelerate poverty reduction as it makes up over a quarter of Mozambique's economy and employs the vast majority of the population. The agricultural sector accounts for 25 percent of Mozambique's GDP, and employs about 75 percent of the population. Yet, Mozambique has a vast agro-geological potential, which is still largely untapped. In rural areas, more than 90 percent of household heads are engaged in agricultural activities. Despite its key role as a fundamental source of livelihoods, the agricultural sector has not been growing at a steady pace in recent years. Annual growth of the sector fell from 7 to 2 percent between 2008 and 2012. Over the past three years, the growth of commercialized agriculture has picked up again, counterbalancing reduced growth in the resources sector, but medium-scale and small-scale agriculture have lagged behind, only growing at an average of 4 percent.

9. The influence of the agricultural sector in the economy is constrained by low levels of productivity. In Mozambique, maize yields averaged 1.0 ton per hectare in 2013, while they averaged 2.2 tons per hectare in Malawi, 3.8 in South Africa, and 2.5 in Zambia. Large productivity gaps with respect to neighboring countries were also observed in terms of rice, millet, sorghum, and wheat yields, as illustrated in Table 13 (World Bank 2015) (table 1.3)**.** In 2009, labor productivity was almost seven times higher in the tertiary sector and ten times higher in the secondary sector than in the primary sector (Jones and Tarp 2013).

Table 1.3. There are large productivity gaps with respect to other countries in the region

	Maize	Rice	Pulses	Wheat	Millet	Sorghum	Roots and tubers
				Yields in 2013 (Ton/Ha)			
Mozambique	1.0	1.2	0.6	1.7	0.5	0.3	7.2
Malawi	2.2	1.9	-	1.4	0.9	1.1	-
South Africa	3.8	2.6	0-	3.6	0.5	2.8	-

Zambia	2.5	1.2	0.5	6.5	0.8	0.7	-
Zimbabwe	0.9	2.3	0.9	2.5	0.3	0.3	10.0
				Average annual yield growth 2000-2013 (%)			
Mozambique	0.2	1.4	1.4	4.0	-1	-4	2.8
Malawi	1.7	1.2	-	4.5	5	12	-
South Africa	2.3	-0.9	-	2.6	0	0	-
Zambia	2.8	0.2	0.9	0.4	4	7	-
Zimbabwe	-3.9	0.9	2.8	-5.8	18	3	3.3

Source: FAOSTAT (2015)

10. The rural economy is characterized by a large number of gaps in productive endowments, production support services and market orientation. A large urban-rural gap emerges when comparing the endowment levels of rural and urban households across a wide range of assets and access to services. Rural are largely in disadvantage in terms of human capital, nutrition, access to basic services, housing quality, ownership of durable goods, sector and type of employment, connectivity, and migration patterns. On the production side, the overwhelming majority of rural households cultivate small plots for subsistence farming and exhibit low rates of adoption of productivity-enhancing inputs and technologies, and limited access to production support services (extension, credit, etc.), which together result in low levels of productivity. Market orientation in agriculture is small, constrained by lack of connectivity and limited access to input and output market information.

11. Improved access and use of inputs as well as a deeper commercialization focus are strongly associated with significantly higher crop yields. Econometric analysis, which control for the influence of several factors, indicate that farmers who adopt technologies such as improved seeds, irrigation, fertilizer, and pesticides, are more productive than those who do not. For instance, keeping everything else constant, the adoption of at least one these agricultural technologies is correlated with a 14.8 percent increase in average cereal equivalent yields (coefficient 0.138 in column 5 of table 1.4). Similarly, farmers who sell a portion of their production are on average more productive than those who do not. The former, for instance, produced 1,007 kilograms per hectare of cereal equivalent crops whereas the latter only obtained an average of 795 kilograms per hectare (figure 1.3).

Table 1.4. The use of technological inputs is correlated with higher agricultural yields after controlling for factors such as household characteristics, access to services and climatic shocks

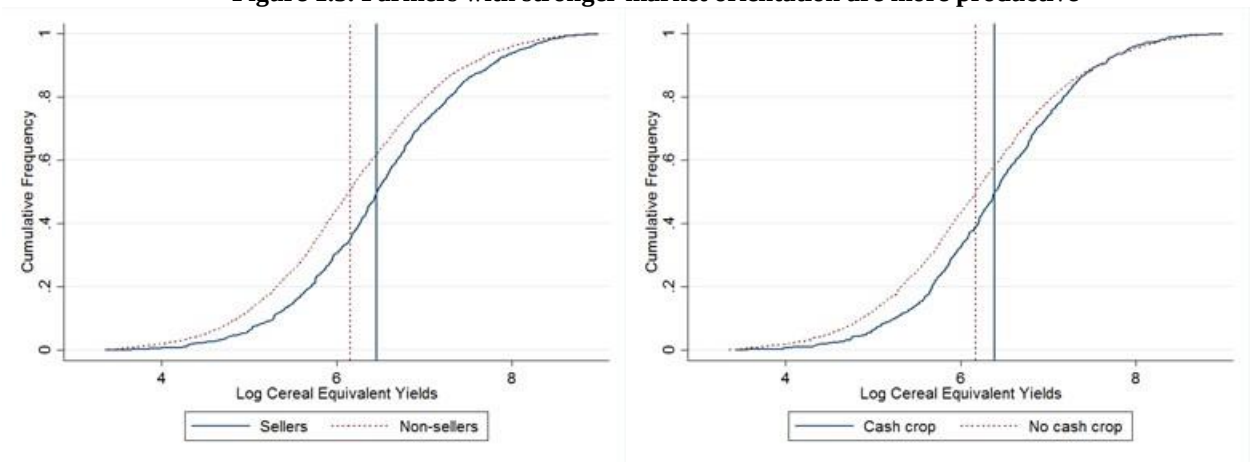
Dependent Variable:	**Cereal Equivalent Yield (Log)**				
	(1)	(2)	(3)	(4)	(5)
Drought	-0.108	-0.105	-0.101	-0.109	-0.106
	(0.037)**	(0.037)**	(0.037)**	(0.037)**	(0.037)**
Flood	0.004	0.007	0.003	0.003	0.004
	(0.064)	(0.064)	(0.064)	(0.064)	(0.064)
Cyclone	-0.126	-0.124	-0.118	-0.124	-0.127
	(0.058)*	(0.058)*	(0.059)*	(0.058)*	(0.058)*
Fire	0.216	0.213	0.217	0.218	0.213
	(0.042)**	(0.042)**	(0.042)**	(0.042)**	(0.041)**
Used Improved Seeds	0.082				
	(0.063)				
Used Irrigation		0.287			
		(0.071)**			
Used Fertilizer			0.341		

			(0.088)**		
Used Pesticide				0.149	
				(0.064)*	
Used Any Technology					0.138
					(0.039)**
Constant	6.533	6.532	6.502	6.523	6.512
	(0.124)**	(0.123)**	(0.129)**	(0.126)**	(0.126)**
R^2	0.07	0.07	0.07	0.07	0.07
N	6,049	6,049	6,049	6,049	6,049

Source: World Bank using AIS (2012).

Notes: Results from an OLS Regression of Cereal Equivalent Yields (Log) on Access to Services, Adoption of Agricultural Technologies, Climatic Shocks, and Household Characteristics Standard errors clustered at the district level shown in parentheses. *** denotes significance at the 1% level, ** denotes significance at the 5% level and * denotes significance at the 10% level. Controls included in all regressions include dummies for characteristics of the household's head (age, gender, education level), dummies for access to services (extension services, membership in agricultural associations, agricultural credit), and province dummies.

Figure 1.3. Farmers with stronger market orientation are more productive



Source: World Bank based on AIS 2012

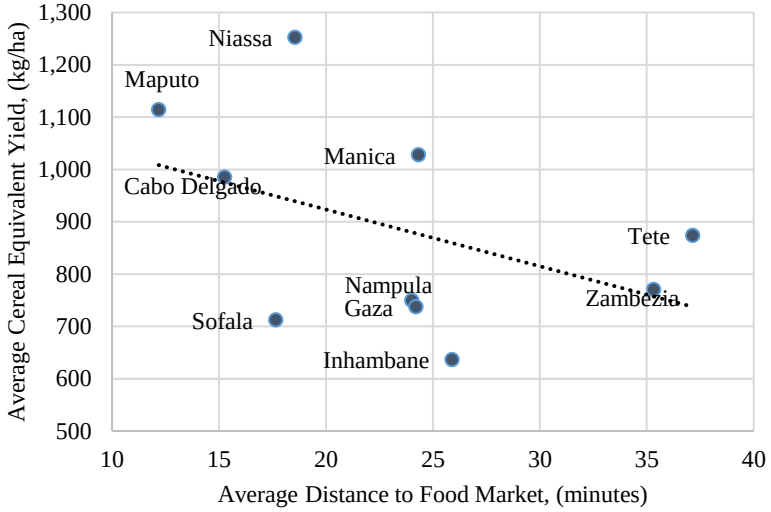
Note: Cumulative distribution functions trimmed at 1st and 99th percentiles Vertical lines show median values.

12. Similarly, access to credit, extension services, and participation in farmers' cooperatives are positively correlated with uptake of enhanced agricultural inputs and technologies, whereas high incidence of natural shocks reduces agricultural output. Low accessibility and demand for agricultural production support services, including little participation in agricultural associations, may be undermining technology adoption and economic opportunities. Indeed, multivariate econometric analysis indicates that farmers are significantly more likely to have adopted any agricultural technology (among improved seeds, irrigation, fertilizer, and pesticides) if they had either accessed credit, joined an agricultural association, or received extension services. Natural shocks also affect a large share of farmers, exerting both direct and indirect effects on agricultural output and rural livelihoods. In 2012, about 73.6 percent of farmers lost part of their crops, animals, or implements due to weather shocks. In trying to self-insure against these shocks, Mozambican farmers prefer to adopt low-risk, low-return crops, forgoing sizable economic returns.

13. Isolation and limited access to information hinder market-based agriculture. Transport networks are critical for agricultural development, yet the road system of Mozambique appears to lag behind that of neighboring countries in terms of both coverage and quality. The

shortage is more pronounced in rural areas, especially in the poorest parts of the country. Around 81 percent of rural residents are still disconnected from reliable all-weather road networks. Road quality is also a concern, particularly in rural areas, where most roads connecting villages to district centers remain unpaved and in poor condition. Transport connectivity is particularly weak in the northern and inland provinces (such as Niassa, Sofala, Nampula, Zambezia, and Tete) where poverty is also the highest. Consequently, transport costs are also highest in these provinces. In turn, low agricultural productivity and high transportation costs appear to be associated with the low connectivity of farmers. Farmers in more isolated provinces tend to have, on average, lower levels of cereal equivalent yields (figure 1.4). Moreover, a strong negative correlation between productivity and transport costs also exists. Average maize productivity, for instance, is estimated at about 1.2 tons per hectare in the districts that have close access to markets, namely where transport costs are lower than US$2 per ton. Conversely, where transport costs exceed US$20 per ton, maize productivity appears to be nearly 20 percent lower (Iimi and Rao, 2015). Another factor constraining market accessibility is that farmers face significant obstacles in gathering input and output market information. Farmers that received price information were more likely to sell some of their production.

Figure 1.4. Agricultural productivity falls as the distance to food market increases



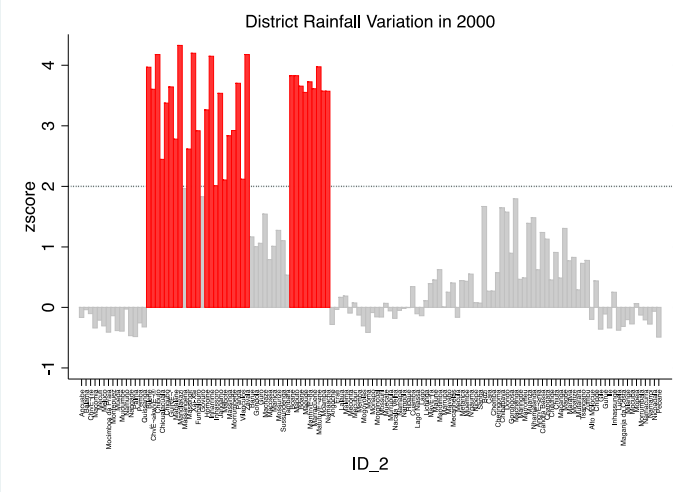
Mozambique is highly exposed to frequent and strong weather shocks

14. Mozambique is among the countries in the region with the largest exposure to various types of natural hazards. Mozambique is ranked higher than other neighboring countries in terms of exposure to floods, cyclones, droughts, and all natural hazards combined (which also include earthquakes and tsunamis). Long and severe droughts constitute a recurring threat, which are experienced in 7 out of 10 years in the Southern regions, and in 4 out of 10 years in the Central regions (GFDRR, 2012). Lower-intensity droughts occur even more frequently. Mozambique is also particularly exposed to cyclones and floods. The coastline, home to over 60 percent of the population, borders one of the most active basins of tropical cyclones, the Southwest Indian Ocean. Each year, on average, Mozambique is hit by one tropical storm or cyclone, and by three or four additional tropical disturbances (UN-Habitat, 2015). Tropical cyclones have produced devastating effects in the country, with five tropical cyclones (of category 1 to 4) making landfall between

2000 and 2008. Frequent floods tend to result from the high winds and heavy rain associated with cyclones, but also from a combination of excess rainfall, upstream discharges from major river basins, and poor drainage infrastructure. Floods generally occur every two or three years. While relatively low, some degree of exposure to geological hazards is also present.

15. The costs of weather-related disasters are remarkably high given the country's heavy reliance on the agricultural sector for providing livelihoods to the vast majority of its population. The potential for disaster losses in the agricultural sector is extremely high in Mozambique. In fact, the almost totality of production (97 percent) comes from rain-fed agriculture, which is particularly vulnerable to extreme weather events. A 2009 estimate of drought and flood costs places average annual losses of maize and sorghum at 9 percent and 7 percent of each crop, respectively. Further losses of around 20 percent of crops are also estimated to occur once every ten years (GFDRR, 2012). Climate shocks do not impose costs solely on the agricultural sector, but also on buildings and physical infrastructure. It has been estimated that an average of 100km of roads and 33,000 households are impacted by flooding every year in Mozambique. The high concentration of population and economic activities in coastal areas predisposes the country to large losses in case of extreme weather events. For example, in 2000, cyclone Eline, which resulted in record-high levels of rainfall (figure 1.5), imposed an estimated cost equal to 20 percent of GDP (GFDRR, 2012).

Figure 1.5. Large rainfall anomalies were caused by cyclones Eline and Judah in 2000



Source: World Bank staff calculations using CRU-TS data
Note: red bars show districts where cumulative rainfall was two or more standard deviation away from the district-level historical mean

Extreme weather variability reduces human welfare in the short- and long-term

16. Individuals that were heavily affected by floods early in life have weaker labor market and consumption outcomes in adulthood, raising their vulnerability to poverty. Econometric analysis that combines household surveys, censuses and highly disaggregated satellite weather data shows that individuals that were affected by extreme rainfall (droughts or floods) while in utero or during their first year of life are less likely to participate in the labor market as adults. Affected individuals exhibit on average a participation rate that is 6 percent lower compared to unaffected individuals. Similarly, floods are associated with a lower level of expenditures per

capita –approximately 14 percent less– and higher likelihood of households to be poor –nearly 18 percent more. This evidence suggests that effects of uninsured weather shocks that occurred decades ago show strong persistence over time and are still felt by affected individuals and their families to this day (table 1.5).

Table 1.5. Early rainfall anomalies also increase the risk of poverty

	Expenditure per capita				Probability of being poor			
	All		Rural		All		Rural	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lack of rain utero	0.177	-1.370	-0.173	-1.181	0.070	0.020	0.092	0.039
	(4.693)	(5.389)	(4.799)	(5.652)	(0.101)	(0.098)	(0.101)	(0.099)
Lack of rain 1st year	-0.245	-1.484	0.221	-2.107	0.069	-0.010	0.066	-0.009
	(4.168)	(4.895)	(4.171)	(4.889)	(0.083)	(0.077)	(0.083)	(0.077)
Excess of rain utero	-7.309*	-5.017	-6.359*	-4.742	-0.005	-0.027	-0.008	-0.028
	(3.819)	(4.968)	(3.794)	(4.975)	(0.040)	(0.038)	(0.040)	(0.038)
Excess of rain 1st year	-8.097***	-4.429*	-7.045**	-3.990	0.099**	0.093**	0.095**	0.092**
	(2.860)	(2.693)	(2.809)	(2.674)	(0.042)	(0.039)	(0.042)	(0.039)
R-squared	0.011	0.038	0.011	0.033	0.015	0.084	0.015	0.083
Control Mean	27.744	27.744	27.110	27.110	0.498	0.498	0.500	0.500
Observations	6,321	6,321	6,228	6,228	6,321	6,321	6,228	6,228
District FE	no	yes	no	yes	no	yes	no	yes

Note: Robust standard errors in parenthesis clustered at the birthyear-district level. Rainfall shocks are defined as two standard deviations below (drought) or above (floods) the historical mean for the district. *** p<0.01, ** p<0.05, * p<0.1.
Source: World Bank staff calculations using IOF-2008/09

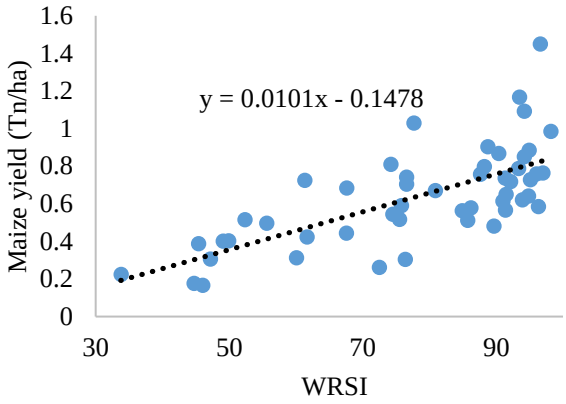
17. Partly driving the vulnerability of household welfare to weather shocks is the negative burden placed by these phenomena on agricultural output and the affordability of investments in the human capital of children. Severe droughts or floods can exert a negative impact on agricultural yields and, in turn, on household income, consumption and food security. In the case of droughts, for example, a measure that examines the relationship between water conditions and agricultural output (the Water Requirement Satisfaction Index, also known as WRSI[3]) reveals the high sensitivity of agricultural yields in Mozambique to extreme weather. While data on yields at the province level is patchy, looking at the unconditional correlation between the WRSI for maize and their corresponding yields reveals evidence of a positive relation between water supply during the growing season and crop performance (figure 1.6). A ten-unit reduction in the cumulative crop water requirement index is shown to reduce maize yields by 0.1 tons per hectare.

18. Consequently, lower crop yields can reduce household incomes and consumption, and significantly affect parents' ability to afford nutritional inputs for their young children. When confronted with floods or droughts, households may be forced to cut basic investments in the nutrition and human capital of their children. As a result, the underlying mechanism which causes the effects of rainfall shocks to persist over time is arguably their influence on critical endowments of affected individuals, such as their health during a crucial period of physical development (i.e. the nutritional environment in the womb and in the first year of life). Econometric analysis that tests this hypothesis investigate the short-term impacts of floods and droughts on the anthropometrics of children (0-4 years old), more specifically on the height-for-age z-score, a strong predictor of height in adulthood. The results show that after a strong drought,

[3] The Water Requirement Satisfaction Index is defined as the ratio of seasonal actual crop evapotranspiration to the seasonal crop water requirement, and captures the expected impact of water deficits on harvest at different points in time over the growing season.

for instance, affected children are about 0.6 standard deviations smaller than unaffected children, whose mean before the shock is -1.89 standard deviations below the World Health Organization international reference group. Further analysis provides suggestive evidence that children affected by shocks are found to perform more poorly in terms of schooling indicators (such as school participation and attainment) and exhibit lags in physical development, with adult women (anthropometrics data for men are not available) being 0.5-0.7 centimeters shorter than unaffected adult women. And physical development matters in agriculture settings. Results for Mozambique show a positive relationship between women's height and human capital and wealth accumulation.

Figure 1.6. Maize yields in Mozambique are highly sensitive to lack of rainfall



Source: World Bank staff calculations using FEWS NET and FAO Agromaps
Note: WRSI provincial average from posto levels measured on X-axis. Maize yields at the provincial level measure in tons per hectare on the Y-axis Provinces: Cabo Delgado, Gaza, Inhambane, Maputo, Manica, Nampula, Nassa, Sofala, Tete and Zambezia. Years: 2002, 2005, 2006, 2007 and 2008.

Tackling the lack of inclusiveness requires broad-based policies that address structural factors in three major areas

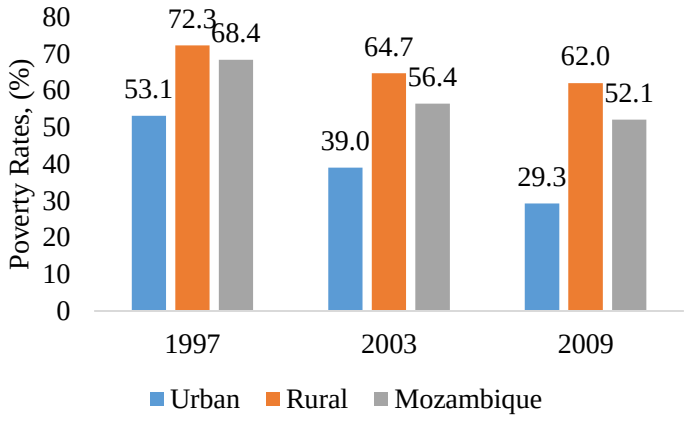
19. Sustaining growth and sharing their benefits more evenly requires addressing structural factors that are worsening regional inequalities, constraining productivity and market-based growth in agriculture and keeping people highly vulnerable to weather shocks. The returns to growth have to be distributed more widely to invest in the most isolated parts of the country in for these regions to be able to seize the economic opportunities brought about by economic expansion and close the gap with the rest of the country. Efforts to promote economic diversification and accelerate private sector growth – necessary for an economy that is highly dependent on its natural resource wealth– should contribute to support more equitable progress. Considering the importance of agriculture for poverty reduction, higher productivity in this sector needs to happen alongside with higher connectivity to markets. Policies efforts to achieve those goals also need to recognize the factors that constrain farmers with potential to develop commercially-oriented production that feeds into value chains from those that constrain farmers focused on subsistence-oriented production with limited potential to commercialize. Underlying these objectives is the need to deepen the investments in the human, physical and institutional capital of the country. Finally, given the high exposure of Mozambique to natural disasters, it is necessary to strengthen formal and informal risk management systems to avoid that the living standards of the population are highly influenced by major shocks out of their control.

2. Mozambique's Progress in Poverty Reduction

2.1 The Evolution and Regional Distribution of Poverty

20. The poverty rate fell sharply in Mozambique in the years following the end of the civil war but the pace of poverty reduction slowed in the early 2000s. The Mozambican economy grew by an average of 7.9 percent per year from 1993 to 2014, an impressive rate compared to nonoil economies in Sub-Saharan Africa (4.4 percent), low-income countries (4.7 percent), upper-middle-income countries (5.4 percent) and the world economy (2.8 percent). Despite stellar growth performance over the past decades, Mozambique has not been successful in translating this high growth into poverty reduction. The national headcount poverty rate dropped by 12 percentage points between 1997 and 2003, from 68 to 56 percent. Poverty declined at a much slower pace since 2003, falling by only 4 percentage points to reach 52 percent in 2009.[4] Looking across regions, poverty rates in rural and urban areas followed a similar pattern, showing a sharp reduction in the period 1997-2003 but followed by a more modest reduction afterwards (figure 2.1). Between 1997 and 2009 population growth outpaced poverty reduction, increasing the number of Mozambicans living in extreme poverty by 400,000 to a total of 11.2 million. To reach the goal of ending extreme poverty by 2030, the pace of poverty reduction in Mozambique will have to increase substantially.

Figure 2.1. The pace of poverty reduction has slowed down in Mozambique



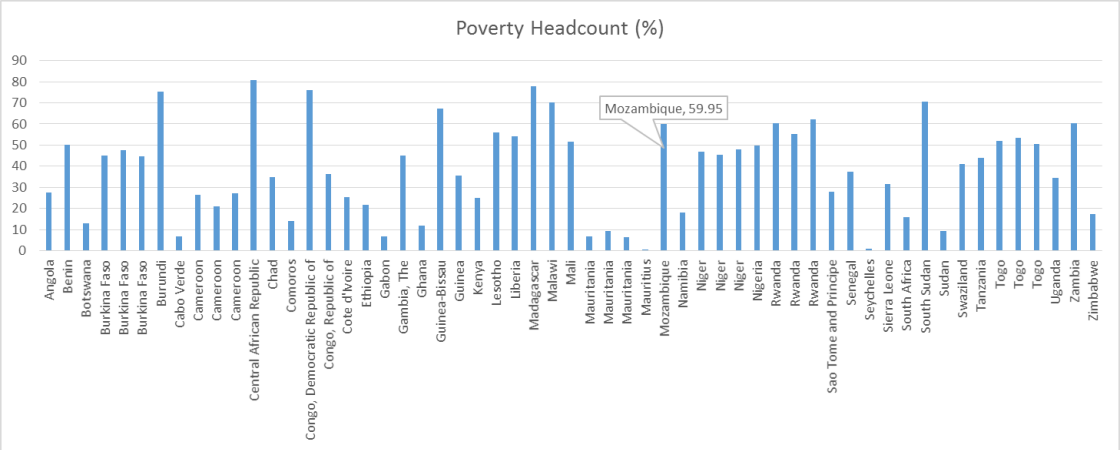
Source: World Bank

21. Despite achieving progress in reducing poverty in the last two decades, poverty in Mozambique remains high both at global and regional levels. The $1.9 per day per capita poverty line, evaluated at 2011 purchasing power parity, allows making meaningful international comparisons of poverty levels across countries. After the end of the civil war in 1993, Mozambique was the third poorest country in the world. By 2013 it was the 13th poorest, signaling progress in poverty reduction. Yet, at 69 percent, Mozambique ranks among the countries with the highest

[4] The poverty figures discussed in this note are based on Mozambique's national poverty line, which in 2009 was approximately 16 meticais per capita per day, or approximately US$0.90 per day in 2005 PPP terms. This is 28% lower than the international extreme poverty line of US$1.25 per day used by the World Bank. The terms "poverty" and "extreme poverty" are used in this report interchangeably, since all of the poor in Mozambique live below the international extreme poverty line.

levels of poverty, alongside countries such as Liberia, Guinea-Bissau, Malawi, Democratic Republic of Congo, Burundi and Madagascar (figure 2.2).

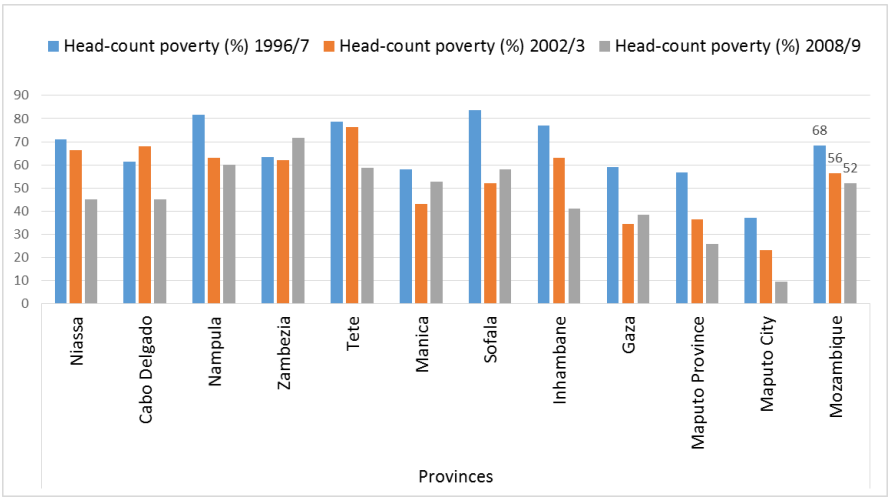
Figure 2.2. Poverty in Mozambique remains high at a regional context



Source: World Bank PovCalNet

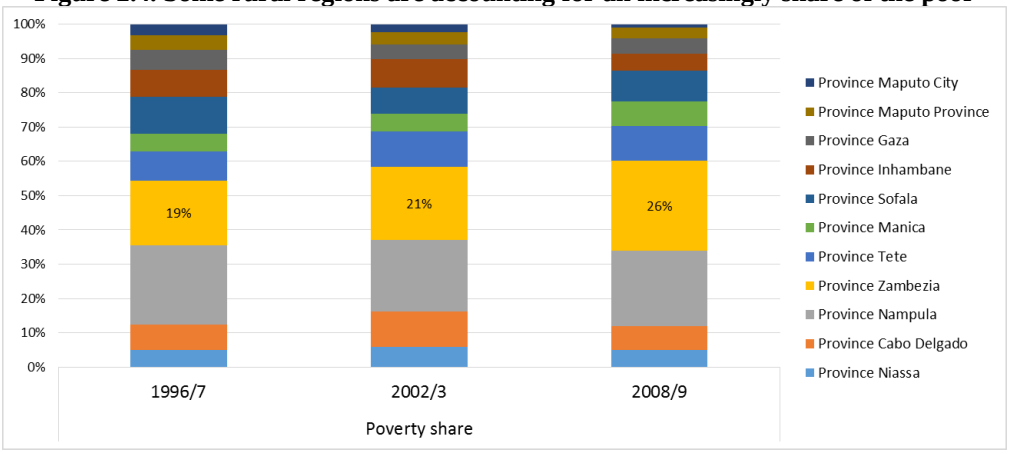
22. Performance in poverty reduction is uneven across regions, with some parts of the country –especially the center and the north– accounting for a disproportionate share of the poor. The distribution of poverty in Mozambique varies significantly by region. Overall, urban provinces tend to have lower poverty rates than rural provinces, particularly those in the central and northern parts of the country. At 10 percent, Maputo City has the country's lowest poverty rate. At the other end of the distribution, Zambezia has a poverty rate in the order of 73 percent. Rather than falling as in the rest of the country, poverty increased between 2003 and 2009 in the provinces of Zambezia, Sofala, Manica, and Gaza. The number of poor people in these four provinces and in Nampula – another province experiencing a slow rate of poverty reduction – increased by 1.6 million (2.4 percent per annum) between 2003 and 2009 (as shown in figure 2.3). As a result, in 2009 these five provinces together accounted for approximately 70 percent of the poor, a considerable increase from 59 percent in 2003. Zambezia and Nampula alone accounted for almost half of the poor in the country in 2009 (48 percent), up from 42 percent in 2003 (figure 2.4).

Figure 2.3. Uneven poverty reduction across regions in Mozambique



Source: World Bank based on IAF1996/7, IAF2002/3, and IOF2008/9

Figure 2.4. Some rural regions are accounting for an increasingly share of the poor



Source: World Bank based on IAF1996/7, IAF2002/3, and IOF2008/9

23. From 1997 to 2009, the poverty gap, which measures the depth of poverty, remained practically unchanged, roaming between 57 and 59 percent of the poverty line. Headcount poverty rates capture the proportion of people living below the poverty line, but do not provide information on the depth of poverty. The poverty gap indicates how far the average poor person is from escaping poverty. In Mozambique, the daily consumption of the average person living in poverty was slightly over half of the national poverty line, hovering around 58 percent in 1997, 2003 and in 2009 (57.2, 59 and 58.5 percent, respectively). The largest contribution to the drop in the depth of poverty, particularly between 2003 and 2009, came from the Maputo province, where the average consumption of a poor individual increased from 62 percent to 66 percent of the poverty line between 1997 and 2009. In the rest of the country, instead, individuals living in poverty today appear to be as poor as those living in poverty 20 years ago. In Zambezia, for instance, the average consumption of a poor individual decreased from 65 percent of the poverty line in 1997 to 60 percent of the poverty line in 2009.

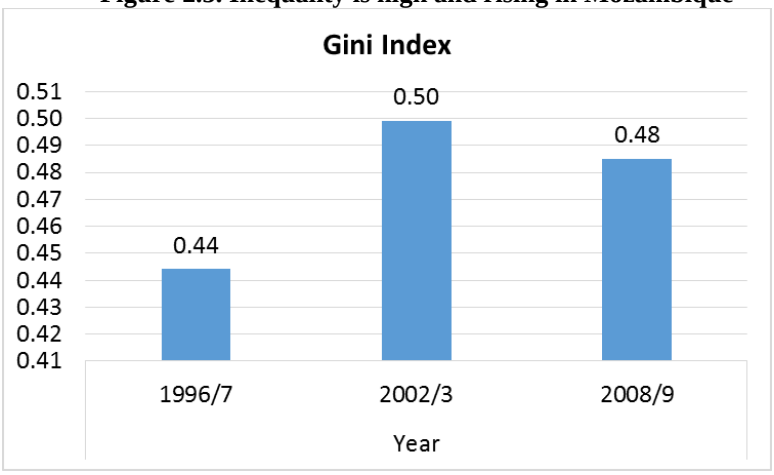
24. Given the persistent depth of poverty in Mozambique, the amount of resources needed to lift every individual our poverty has increased in absolute terms but has fallen as proportion of the GDP. The Poverty Deficit, or Aggregate Poverty Gap, is the aggregate annual

income needed to move every individual right above the poverty line.[5] For Mozambique, the Poverty Deficit initially decreased between 1997 and 2003, dropping from $1,072 million to $910 million. From 2003 to 2009, however, the Poverty Deficit of Mozambique grew again, reaching $987 million in 2009.[6] As a share of Mozambique's GDP, however, the Poverty Deficit has been falling steadily since 1997, going from 18 percent of GDP in 1997, to 15 percent in 2003, and to 9 percent in 2009. Despite having decreased significantly, Mozambique's Poverty Deficit as a share of GDP is still about 18 times higher than the average for all developing countries (0.5 percent). However, it is comparable to the average for low income countries, estimated to be approximately 8 percent of GDP (Olinto et al., 2013)[7].

2.2 Inequality and Shared Prosperity

25. Inequality is not only high but also shows an increasing trend in the long term. Inequality indicators in Mozambique worsened considerably between 1997 and 2003 and remained elevated through 2009. The Gini index rose from 0.44 in 1997 to 0.50 in 2003, then slid to 0.48 in 2009, remaining well above the level recorded in the late 1990s (figure 2.5). In general, high levels of inequality tend to lessen the impact of economic growth on income growth for those in the bottom of the distribution. In fact, as it will be discussed in the next section, high and rising levels of inequality between 1997 and 2009 partially explain the relatively modest decline in poverty despite the rapid growth of GDP and mean per capita consumption observed during the period. Inequality in also high at a global level. Mozambique belongs to a group of countries where both poverty and inequality are high (figure 2.6).

Figure 2.5. Inequality is high and rising in Mozambique



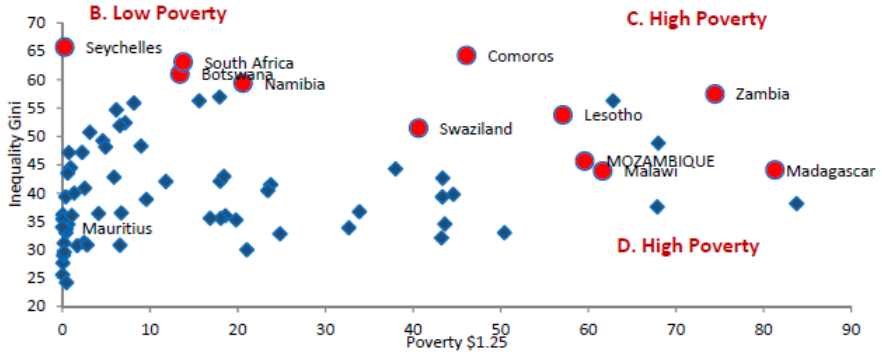
Source: World Bank based on IAF1996/7, IAF2002/3, and IOF2008/9

[5] Poverty deficit = (1-P_1) x poverty line x the number of poor. P_1 is part of the FGT poverty measures and stands for poverty gap ratio. It measures the depth of poverty.

[6] In other words, if we had a magic wand and could perfectly target every poor individual, and magically raise their incomes to the poverty line, in 2009 Mozambique would have needed approximately $987 million dollars per year (in 2009 dollars) to end poverty. The value of the Poverty deficit, however, is not the same as the cost of ending extreme poverty. It is the size of the problem, which is different from the size (cost) of the solution.

[7] The 2009 poverty line for Mozambique is approximately 16 Meticais per capita per day, i.e.: approximately 0.90 PPP dollars per day. The ratio of the Poverty Deficit to GDP for the developing world and low income countries was instead computed with the $1.25 PPP poverty line. Therefore, it is likely that the Poverty Deficit of Mozambique with the international $1.25 PPP line will be larger than the presently estimated 9 percent of GDP.

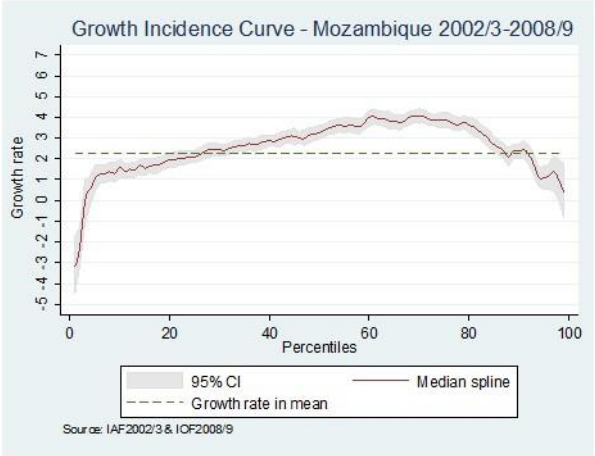
Figure 2.6. Mozambique belongs to the group of high-poverty, high-inequality countries



Source: World Bank

26. Impressive growth has not translated into enhancement of shared prosperity but rather benefited more the better off. The enhancement of shared prosperity requires a growing economy that benefits the bottom of the distribution relatively more than the rest of the population.[8] In other words, it requires expanding the size of the pie continuously and sharing it to reduce inequality. The Mozambican economy has been growing continuously since the middle of the 1990's. Yet, the growth incidence curve suggests that the bottom 40 percent of the population in Mozambique grew at a slower pace than the overall Mozambican population. This means that the poor did not benefit as much from growth as the more affluent. Between 2002/3 and 2008/9, the annual growth rate of per capita expenditure of the whole Mozambican population was greater than that of the bottom 40% of the population. While it grew by 2.3 percent per annum for the whole population, per capita consumption expenditure grew by 2 per annum among the bottom 40% of the population (figure 2.7).

Figure 2.7. Income growth in Mozambique has benefited mostly the non-poor



Source: World Bank based on IAF2002/3 and IOF2008/9

[8] In 2014 the World Bank Group introduced the so called twin goals. The first pledges to end extreme poverty. The percentage of people living with less than US$ 1.9 a day should fall to 3 percent by 2030. The second goal is related to the promotion of shared prosperity. It pledges to foster real income growth of the bottom 40 percent of the population in every country. This section discusses how Mozambique fared with respect to the latter goal between 2002/3 and 2008/9

2.3 Who are the Poor?

Demographic characteristics

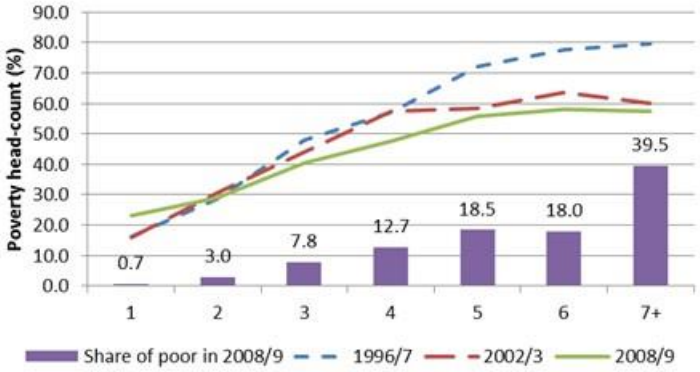
27. The demographic structure of Mozambican households has remained largely unchanged in the last two decade and, on average, larger households are poorer. Household demographic characteristics such as family size and structure have an important role in the determination of the socio-economic status and level of poverty of the households. In the case of Mozambique, large families with children prevail. The average household size was 4.8 persons per household in both 1997 and 2003, and by 2009 stayed almost constant at 4.7 (table 2.1). The size of non-poor families is close to one person smaller compared to that of poor families (4.23 and 5.16, respectively), and this pattern is consistent over time. This difference is chiefly explained by the higher number of children in ages 0 to 7 and 7 to 14 among poor families. On the contrary, the number of adults is smaller in poor households. This demographic structure has adverse implications on the dependency ratios of low-income families. In 2009, single member households contributed to less than 1 percent of total poverty, while households with 7 or more members contributed to up to almost 40 percent of poverty (figure 2.8). The average age of household heads is around 42 years, relatively similar between non-poor and poor households.

Table 2.1. The poor live in bigger households with more children

	Poor			Non-Poor			Total Population		
	1997	**2003**	**2009**	**1997**	**2003**	**2009**	**1997**	**2003**	**2009**
Household size	5.51	5.28	5.16	3.75	4.30	4.23	4.80	4.81	4.67
N. of children under 7	1.32	1.44	1.50	0.69	0.90	0.92	1.06	1.18	1.19
N. of children aged 7-14	1.43	1.27	1.28	0.72	0.84	0.89	1.14	1.06	1.07
N. of adults aged 15+	2.77	2.57	2.38	2.35	2.56	2.42	2.60	2.56	2.40
Average age of h.h. head	42.97	42.54	42.49	41.12	42.91	42.02	42.22	42.72	42.24

Source: World Bank based on IAF1996/7, IAF2002/3, and IOF2008/9

Figure 2.8. Larger households contribute more to the poverty headcount

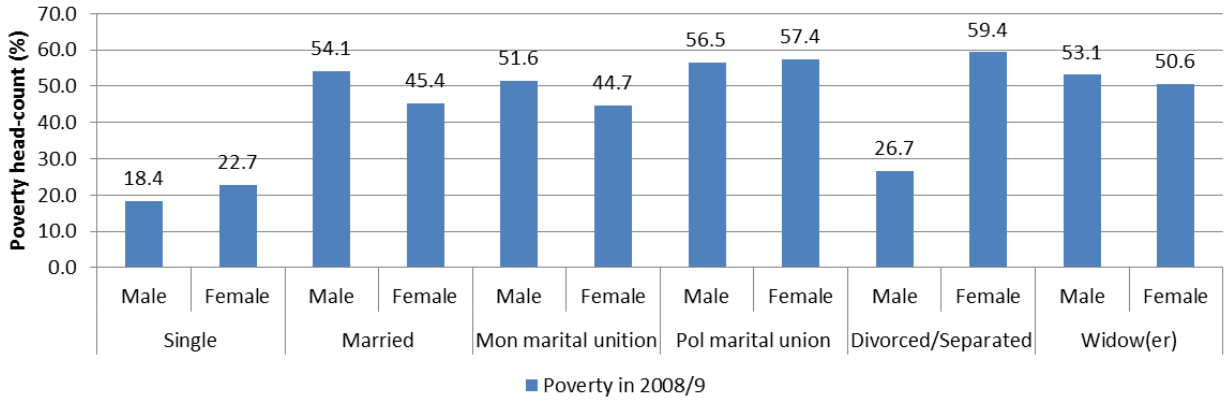


Source: World Bank based on IAF1996/7, IAF2002/3, and IOF2008/9

28. Other factors of the household structure such as the gender and marital status of the head are also associated with the level of poverty. People living in female-headed households

were initially poorer than those in male-headed households. However, the gap has narrowed over time. In 1997, 64.1 percent of people living in male-headed households were poor. The figure for the female-headed counterpart was 65 percent. By 2009 people living in female-headed households were less poor (51.8 percent) than those living in male-headed households (52.2 percent) (though the difference was not statistically significant). Female-headed households whose head was single or divorced experienced higher levels of poverty. In 2009, people living in single female-headed households experienced higher levels of poverty (22.7 percent) than those living in in single male-headed households (18.4). The gender gap in poverty was alarming for divorced or separated household heads: the headcount poverty rate for male-headed households was 26.7 percent, while it was 59.4 percent for female-headed households (figure 2.9).

Figure 2.9. The gender and marital status of household heads are correlated with poverty levels

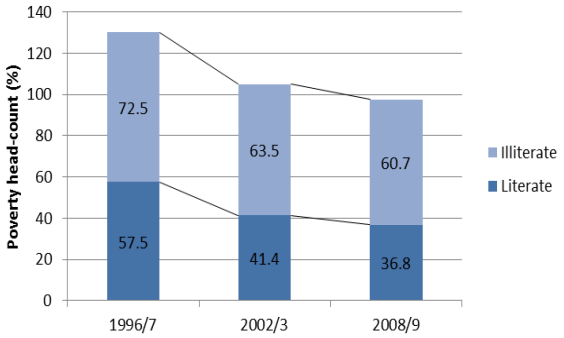


Source: World Bank based on IOF2008/9

Human capital

29. Illiteracy rates in Mozambique have fallen moderately except for the poor. The national illiteracy rate was 62.3 percent in 1997 and declined to 57.7 percent by 2009. The trend is similar for the non-poor. Among the poor, however, the illiteracy rate increased from 67.6 percent to 69.2 percent over the same period. Access to education increased substantially during the last decade, but its quality among the poor has worsened. In 1997, poverty was 72.5 percent among the illiterate and 57.5 percent among the literate. By 2009, poverty declined for both groups, but the decline was faster among the literate people (figure 2.10). Illiteracy rates also vary across other socioeconomic groups being lowest among the youth (aged 15 to 24 years old), the educated, and the urban population. There is also remarkable spatial variation across regions. Illiteracy rates are highest in rural areas. In 2009, over 65 percent of rural people were illiterate, while the urban figure was 36 percent.

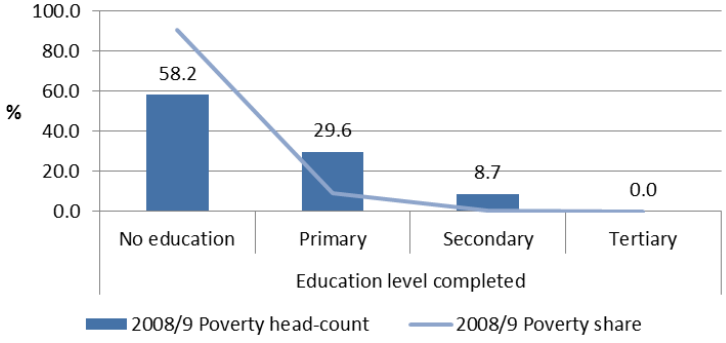
Figure 2.10. The illiterate have experienced slower poverty reduction



Source: World Bank based on IAF1996/7, IAF2002/3, and IOF2008/9

30. The poverty status of an individual in Mozambique is related to the educational background of the household head. The more educated the head is the lower are the chances of poverty and poverty reduces faster in households with more educated heads. Poverty was highest for individuals whose heads had no school education and lowest among people whose heads had tertiary education. In 2009, for instance, the poverty headcount rate among people living with uneducated heads was 58.2 percent, 29.6 percent for those living with heads who completed primary education, and 8.7 percent if the head completed secondary school (figure 2.11). There was no poverty among those living with heads who completed tertiary education. In addition, between 1997 and 2009, poverty declined by 14.7 percent among people living with uneducated heads, but by 49 percent among those whose heads completed secondary education. While access to education has been increasing fast in the last decade, most people (80 percent) still live in families headed by individuals with no formal education. Over 80 percent of the Mozambican population lives with uneducated household heads. This situation is a core socio-economic problem in Mozambique and is most likely associated with low labor productivity and low earnings.

Figure 2.11. Human capital is strongly correlated with poverty status



Source: World Bank based on IOF2008/9

Labor markets

31. Mozambique's labor market is typical of a low income country. Wage employment is rare. Most people are self-employed in subsistence agriculture or in household enterprises. Unpaid

family workers make up a large share of the labor force. Judging by the ILO unemployment definition, Mozambique has very low unemployment levels. But underemployment is widespread and the quality of jobs is low. When one considers unpaid family workers as unemployed (the national definition), the unemployment rates in 2009 jump to 38.6 percent. Further, as mentioned, large part of those who are deemed employed are in low productivity self-employment and informal jobs in agriculture and household enterprises (table 2.2).

32. About 81 percent of the working-age population was employed in 1997. The figure remained roughly the same in 2003, at 81.5 percent, but increased to 86.4 percent in 2009. The working-age population as a proportion of total population seems to have declined over time, from 54.1 percent in 1997 to 51.5 percent in 2009. The weight of the youth in total and working-age populations remained fairly stable between 1997 and 2003, but declined slightly in 2009. As for the child labor rate, it has declined between 1997 and 2003, but increased subsequently during the next period.

Table 2.2. Underemployment is widespread and the quality of jobs is low

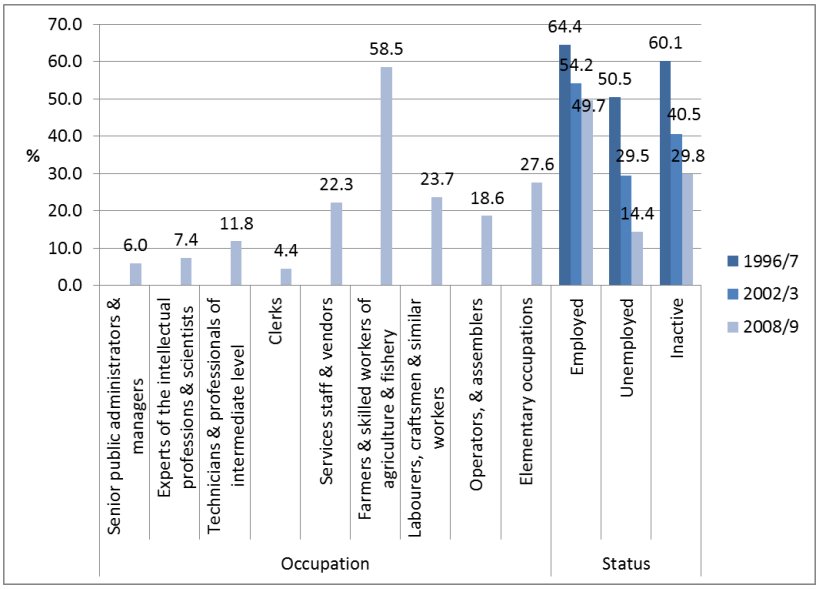
	Labor Market Indicators (%)		
	1997	**2003**	**2009**
Unemployment rate (ILO definition)[9]	0.6	1.9	2.0
Unemployment rate (Mozambique definition)[10]	24.7	37.9	38.6
Employment to working-age-population ratio	81.3	81.5	86.4
Working-age population as a fraction of total population	54.1	53.4	51.5
Youth (aged 25-24) as a fraction of total population	18.6	18.3	16.7
Youth to working-age population ratio	34.4	34.3	32.4
Child labor rate	19.2	10.3	31.5

Source: World Bank based on IAF1996/7, IAF2002/3, and IOF2008/9

33. Poverty rates vary across types of jobs and occupations. When one looks at poverty by type and sector of employment, the heterogeneity observed is clearer. Overall, those working as unpaid family workers, those self-employed (without employees), those working as domestic workers, and those working in agriculture present the highest head-count poverty rates (above 50 percent). Those in the formal public and private sectors, and those self-employed with employees present the lowest poverty incidence (figure 2.12). Individuals working as farmers experienced high poverty levels, reaching a head-count poverty rate of 58.5 percent. Those well positioned in occupations such as senior managers, professionals, technicians, and clerks experienced low poverty levels (under 12 percent).

Figure 2.12. Most of the jobs where the poor work are of low quality

[9] Unless otherwise indicated, this section will present ILO definition estimates of employment and unemployment.
[10] The main difference is that in the Mozambique definition unpaid family workers are treated as unemployed.



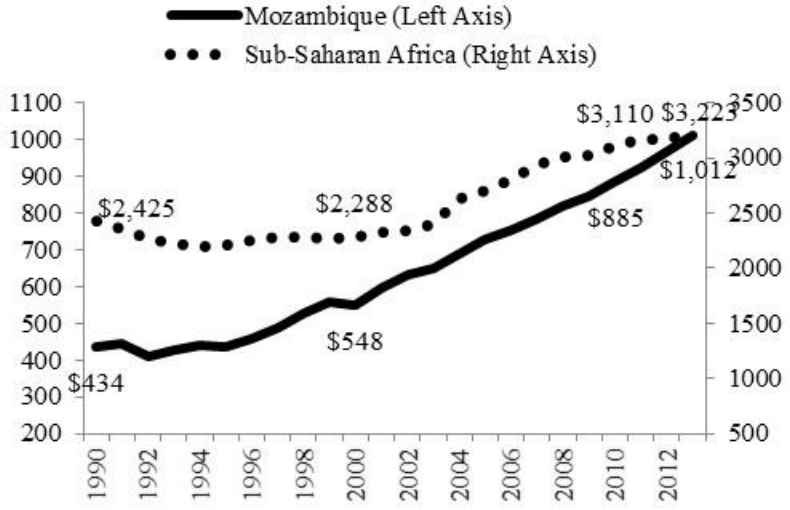
Source: World Bank based on IAF1996/7, IAF2002/3, and IOF2008/9

3. Growth, Inequality and Poverty Reduction: The Role of Lagging Provinces

3.1 The Growth Elasticity of Poverty Reduction

34. Mozambique is one of the fastest-growing economies in Sub-Saharan Africa but it has struggled to translate its strong GDP growth into poverty reduction. Over the past two decades, the annual growth rate averaged 7.4 percent in real terms. Since the end of the Civil War in 1992, the country's GDP per capita has more than doubled in real terms (figure 3.1). Yet, compared to the rest of SSA, poverty reduction in Mozambique has been considerably less responsive to growth. Between 1997 and 2009, for each percent increase in SSA's per capita GDP, poverty fell by 0.5 percent in the region. Over the same period, for each percent of growth in Mozambique, poverty fell by only 0.26 percent in the country, nearly half as fast as the pace of poverty reduction in the region (figure 3.2). This low Growth Elasticity of Poverty Reduction (GEPR) represents a major challenge that Mozambique will have to address in order to accelerate poverty reduction in the future.

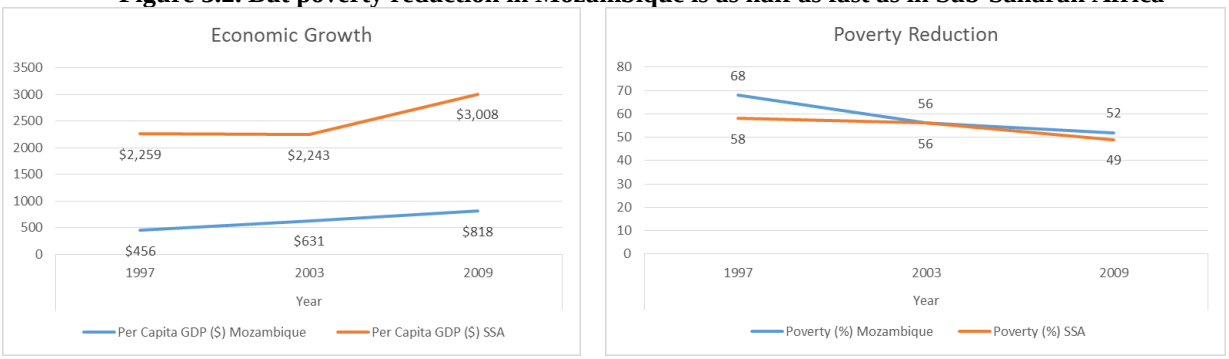
Figure 3.1. Mozambique is one of the fastest-growing economies in Sub-Saharan Africa



Source: World Development Indicators (2014), World Bank
Note: Constant 2011 international PPP $

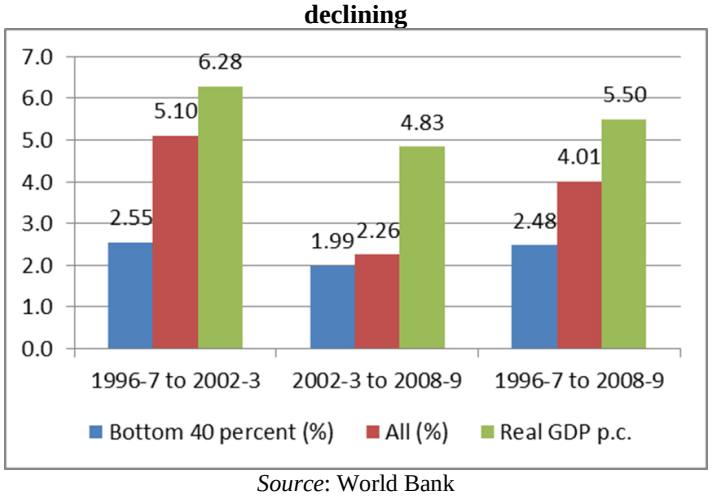
35. Two separate phenomena underlie the low per capita GEPR of Mozambique: firstly, a low per capita GDP growth elasticity of mean per capita consumption growth; and secondly, a low mean per capita consumption growth elasticity of poverty reduction. Between 1997 and 2009, for each percentage increase in the per capita GDP of Mozambique, mean per capita consumption increased only by 0.73 percent (figure 3.3) In particular, between 2003 and 2009, for each percent growth in per capita GDP, mean per capita consumption grew by 0.47 percent (as opposed to 0.81 percent between 1997 and 2003).

Figure 3.2. But poverty reduction in Mozambique is as half as fast as in Sub-Saharan Africa



Source: World Development Indicators (2014), World Bank
Note: Constant 2011 international PPP $

Figure 3.3. The per capita GDP growth elasticity of mean per capita consumption growth is low and declining



Source: World Bank

36. In addition to not fully translating its per capita GDP growth into mean per capita consumption growth, Mozambique has also struggled to translate the latter into poverty reduction. Between 1997 and 2009, for each one percent increase in mean per capita consumption, poverty dropped only by -0.44 percent, considerably less than the average for the SSA region estimated at -0.7 percent. This elasticity was lower (-0.50) during the period of highest growth (between 1997 and 2003), and highest (-0.54) during the period of slower growth (between 2003 and 2009).

37. The low GEPR of Mozambique is driven by a large extent by the fact that the provinces of Nampula and Zambezia have been lagging behind the rest of the country, particularly between 2003 and 2009. In Nampula and Zambezia, the poverty rate increased by more than 5 percent over the period, while it dropped by 17.3 percent in the rest of the country. In 2003, Nampula and Zambezia jointly represented 38 percent of the population and 42 percent of the country's poor. In 2009, their share of total population had remained the same, while their share of the poor had increased to 48 percent.

38. Mozambique's GEPR would be significantly higher than the SSA average of -0.7 if it were to be computed without the Nampula and Zambezia provinces. Nampula and Zambezia have been holding back poverty reduction and negatively affecting the GEPR of Mozambique between 2003 and 2009. To estimate the extent to which these two provinces have lagged behind, "counterfactual" indicators can be calculated to estimate the performance the country would have exhibited if it had not been for the negative impact of the Nampula and Zambezia provinces. Table 4.1 presents the "counterfactual" change in poverty rate, per capita expenditure and GEPR that would have been observed for Mozambique if the Nampula and Zambezia provinces were dropped from the calculations of these indicators. As shown, Nampula and Zambezia are the two provinces for which the counterfactual GEPR is the highest. If these provinces were excluded from the calculation of national indicators, Mozambique's GEPR could have more than doubled from 2003 to 2009, improving from -0.54 to -1.18, higher than the SSA average (table 3.1).

Table 3.1. Nampula and Zambezia have been holding back poverty reduction in Mozambique

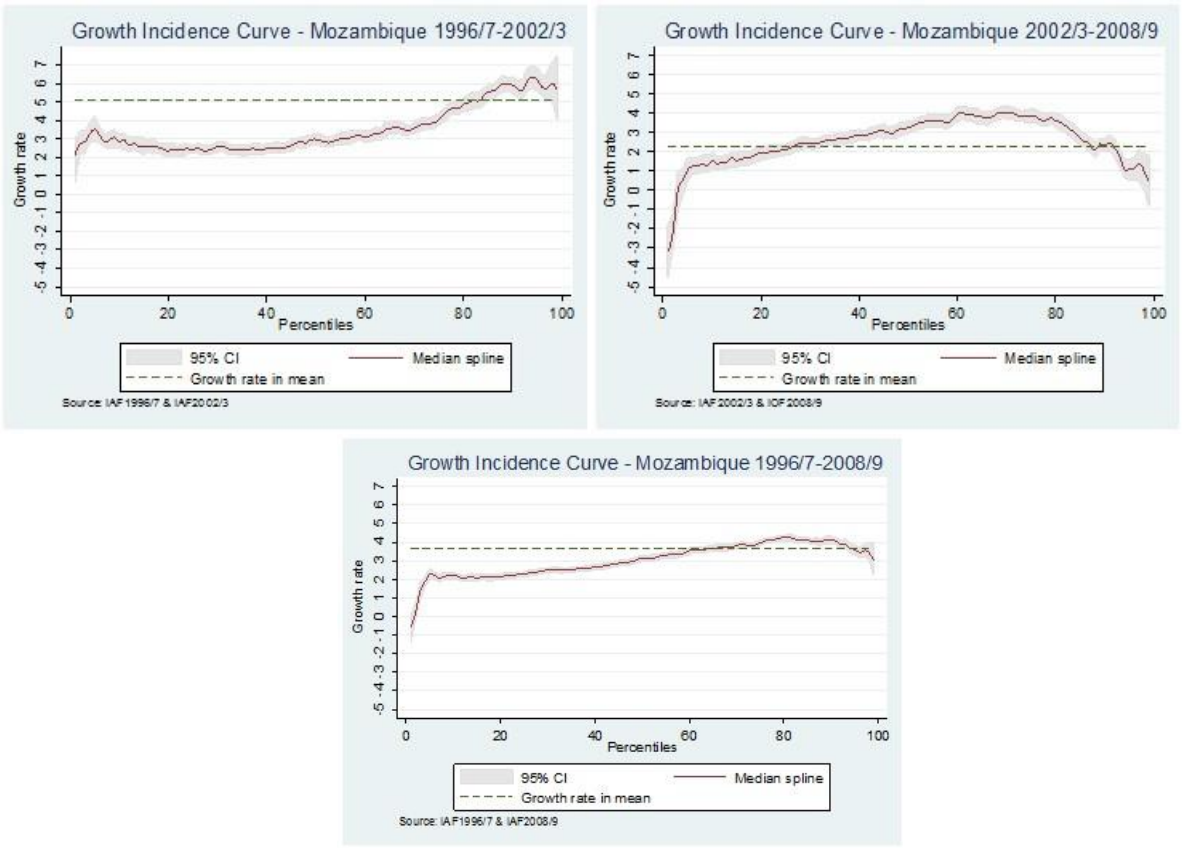
2003 - 2009	Change in Poverty		Per Capita Expenditure Growth		GEPR	P-value
	Counterfactual	%	Counterfactual	%	Counterfactual	%
Mozambique	**-0.044**	**-7.7**	**3.072**	**14.4**	**-0.537**	**0.0000**
Niassa	-0.034	-6.1	2.665	12.3	-0.490	0.0081
Cabo Delgado	-0.027	-4.9	3.034	14.1	-0.344	0.0000
Nampula	-0.047	-8.6	2.871	12.4	-0.691	0.0000
Zambezia	-0.076	-13.8	3.784	16.5	-0.835	0.0000
Tete	-0.034	-6.1	2.815	12.7	-0.480	0.0005
Manica	-0.054	-9.3	3.221	15.1	-0.620	0.0000
Sofala	-0.053	-9.3	3.544	16.6	-0.557	0.1242
Inhambane	-0.031	-5.6	2.678	12.2	-0.454	0.0000
Gaza	-0.051	-8.8	3.395	16.1	-0.545	0.5219
Maputo Province	-0.038	-6.5	2.920	14.3	-0.458	0.0000
Maputo City	-0.040	-6.9	2.966	15.9	-0.433	0.0000
Nampula and Zambezia	**-0.091**	**-17.3**	**3.747**	**14.6**	**-1.178**	**0.0000**

Source: World Bank based on IAF2002/3, and IOF2008/9

3.2 Inequality as a constraint to poverty reduction

39. Mozambique's poor performance in translating mean per capita consumption growth into poverty reduction is largely attributable to increased inequality in the country. Inequality increased significantly between 1997 and 2003, and declined only slightly between 2003 and 2009. The Gini index rose from 0.44 to 0.50 between 1997 and 2003, and then fell to 0.48 in 2009 (figure 3.5 in previous section). The Growth Incidence Curves (GICs) provide further evidence that the benefits of economic growth have not been equally distributed across Mozambique's population (as shown in Figure 3.4). Between 1997 and 2003, while the population as a whole experienced growth in consumption expenditure, those in the top 20 percent of the distribution benefited to a much larger extent than the remaining 80 percent. Between 2003 and 2009, overall growth in consumption expenditure decreased, and the poorest of the poor benefited the least from growth (followed by the better off). The middle income groups experienced the largest growth in consumption expenditure.

Figure 3.4. The poor are not benefiting from income growth as the rest of the population



Source: World Bank based on IAF1996/7, IAF2002/3, and IOF2008/9
Note: Constant 2009 prices

40. Growth could have had a much larger impact on poverty reduction in Mozambique if its effects had not been offset by the observed increase in inequality. Poverty declined by 16.3 percentage points between 1997 and 2009; if inequality had not increased, the observed growth would have led to a decline in poverty of about 26.8 percentage points (table 3.2). In turn, the poverty rate would have dropped to 41.6 percent instead of the observed 52 percent. Had the economy not grown at all between 1997 and 2009, poverty would have increased by 3.2 percentage points exclusively as a result of the increase in inequality.

Table 3.2. The increase in inequality undermined poverty reduction

	1997	2009	1997-2009
Headcount poverty rate	68.4 %	52.1 %	
Change in poverty			- 16.3%
Growth component			-26.8%
Redistribution component			3.2%
Residual			7.3%

Source: World Bank based on IAF1996/7 and IOF2008/9

41. Increasing disparities across provinces –particularly between the provinces of Nampula and Zambezia and the rest of the country– and not within provinces contributed

to the increase in inequality in Mozambique. The country's inequality can be decomposed into two components: inequality within provinces and inequality across provinces (table 3.3). Between 1997 and 2009, the contribution to total inequality of the cross-province component appears to have increased relative to the within-province component. In particular, the contribution of Nampula and Zambezia to the increase in disparities with respect to the rest of the country increased. For these two provinces, the cross-province contribution rose from 3.9 to 6.8 percent of total inequality from 1997 to 2009.

Table 3.3. Cross-province inequality increased over time in Mozambique

Year		1997	2003	2009
Theil Inequality		**0.409**	**0.558**	**0.494**
Provinces	Within-group	79.0%	76.8%	76.9%
	Between-group	21.0%	23.2%	23.1%
Location	Within-group	84.5%	81.4%	81.3%
	Between-group	15.5%	18.6%	18.7%
Nampula & Zambezia, Rest of the country	Within-group	96.1%	94.1%	93.2%
	Between-group	3.9%	5.9%	6.8%

Source: World Bank based on IAF1996/7, IAF2002/3, and IOF2008/9

3.3 Understanding the Lagging Behind of Nampula and Zambezia: Isolation and Returns to Asset Endowments

42. Why did Nampula and Zambezia increasingly hold back poverty reduction in Mozambique between 2003 and 2009? Did households living in these provinces accumulated less assets than the households in the rest of the country? Or have the returns to these assets increased at a slower pace? To understand the relative role of changes in asset endowment levels and changes in returns to assets, an Oaxaca-Blinder decomposition of the differences in poverty rates and mean per capita consumption between Nampula and Zambezia and the rest of Mozambique is carried out.[11] The Oaxaca-Blinder decomposition technique allows us to decompose these differences in mean household per capita consumption and poverty rates to isolate the role of changes in household asset endowments from the role of changes in the returns to these endowments. Two components can be identified: the "explained" component of the difference in the per capita consumption or in the difference in poverty rates are attributed to changes in household assets, while the "unexplained" component is attributed to changes in the returns to these assets.[12] We start by comparing levels and the changes in the level of the endowments that are more likely to impact household per capita consumption and poverty.

[11] The data used for this decomposition comes from two different surveys, the 2002/2003 Inquérito aos Agregados Familiares (IAF) and the 2008/2009 Inquérito aos Agregados Familiares (IOF). Conducted by the Instituto Nacional de Estatística, IAF and IOF are Mozambique's national household consumption surveys and are designed to produce estimates of household expenditure, income and characteristics.

[12] The method used is the Recentered Influence Functions (RIF, Firpo et al. 2009) in which traditional Oaxaca-Blinder decompositions are applied to different percentiles of the consumption distribution. This allows an assessment of the amount of poverty reduction that can be accounted for by changes in the characteristics of households and individuals ('endowments')

43. There is no clear indication that households living in Nampula and Zambezia accumulated assets at a slower pace than the rest of the country between 2003 and 2009. While individuals in Nampula and Zambezia tend to live in households with less advantageous asset endowments than the rest of the country, there is no evidence that the population in the rest of the country has been accumulating assets at a faster pace. As shown in Table 4.4, households in Nampula and Zambezia are more likely to be located, on average, in rural areas than households in the rest of the country; they also tend to have a lower number of adults with primary or secondary education, a higher number of adults employed in the primary sector, and a lower number of adults working in the secondary, tertiary, health, education, and public administration sectors. However, in terms of changes between 2003 and 2009, it is hard to make any definitive claims on the overall pace of asset accumulation in these two provinces relative to the rest of the country. Households in Zambezia and Nampula have accumulated a number of valuable asset endowments at a faster pace (e.g.: in terms of the number of adults with complete primary education). However, they also performed worse than the rest of the country in terms of other assets (e.g.: in terms of the number of adults with complete secondary education), as shown in table 3.4.

Table 3.4. Asset holdings in Zambezia and Nampula grew at a similar rate than in the rest of the country

	Nampula & Zambezia				Rest of the country			
	2003	2009	Δ(2003-09)	% Δ	2003	2009	Δ(2003-09)	% Δ
Located in rural area	0.71	0.78	0.06	8.5%	0.58	0.65	0.07	11.7%
Average age, adults	28.97	29.12	0.15	0.5%	29.00	29.77	0.77	2.6%
N. of adult females	1.74	1.71	-0.03	-1.5%	2.46	2.11	-0.35	-14.2%
N. of adults with primary education	0.29	0.44	0.14	49.0%	0.65	0.84	0.19	29.6%
N. of adults with secondary education	0.03	0.03	0.00	-9.4%	0.08	0.10	0.02	20.0%
N. of adults	3.63	3.40	-0.24	-6.5%	4.63	3.90	-0.73	-15.7%
N. of adults employed in primary sector	2.07	2.55	0.48	23.3%	2.00	2.35	0.35	17.3%
N. of adults employed in secondary sector	0.04	0.06	0.02	42.9%	0.12	0.14	0.03	21.2%
N. of adults employed in tertiary sector	0.30	0.16	-0.14	-46.6%	0.53	0.39	-0.14	-26.3%
N. of adults employed in health/education	0.07	0.05	-0.02	-30.4%	0.07	0.06	-0.01	-19.2%
N. of adults employed in public administration	0.02	0.02	0.00	-19.0%	0.04	0.04	0.00	0.0%

Source: World Bank based on IAF2002/3 and IOF2008/9

44. Differences in asset endowments became significantly less important than differences in returns to endowments in determining the differences in mean per capita consumption and poverty rates between Nampula and Zambezia and the rest of the country. The results of the Oaxaca-Binder decomposition show that differences in endowments (demographics, human capital and sector composition of the labor force, among others) explained about 36 percent of the differences in per capita consumption in 2003. In 2009, they explained only 28 percent (table 3.5).

compared to the changing nature of the Mozambican economy and poverty. In the RIF analysis, the focus is on a counterfactual of a constant relationship between endowments and poverty in Mozambique over the period 2003-2009. This counterfactual is used to determine which changes in endowments could have contributed to poverty reduction, and how much poverty reduction could have changed because of a changing relationship between poverty and endowments. The latter is sometimes referred to as changes in the returns to endowments, but really it represents how the conditional correlation between a given endowment and consumption has changed.

In the case of poverty, the changes are even more startling. In 2003, differences in asset endowments explained approximately half of the differences in poverty rates between Nampula and Zambezia and the rest of the country. By 2009, only 28 percent of the differences were explained by differences in endowments (table 3.6).

Table 3.5. Differences in log per capita consumption are mostly driven by asset "returns"

	2003	2009
Nampula + Zambezia	2.436***	2.486***
Rest of the Country	2.762***	2.971***
Difference:	0.326***	0.484***
Explained Difference	0.117***	0.134***
Unexplained Difference	0.209***	0.350***
% Explained Difference	**35.8%**	**27.7%**
% Unexplained Difference	**64.2%**	**72.3%**

Source: World Bank based on IAF2002/3 and IOF2008/9

Table 3.6. Differences in poverty rates are mostly driven by asset "returns"

	2003	2009
Nampula + Zambezia	0.625***	0.658***
Rest of the Country	0.527***	0.436***
Difference:	-0.099***	-0.222***
Explained Difference	-0.050***	-0.063***
Unexplained Difference	-0.049**	0.159***
% Explained Difference	**50.96%**	**28.25%**
% Unexplained Difference	**49.04%**	**71.75%**

Source: World Bank based on IAF2002/3 and IOF2008/9

45. If the mean level of asset endowments of households living in Nampula and Zambezia had increased at exactly the same rate as households living in the rest of the country, poverty would still have increased in the two provinces. A counterfactual analysis can shed further light on the results obtained with the Oaxaca-Blinder decomposition. If households in Nampula and Zambezia had experienced the same percentage change in their level of assets as the observed in the rest of the country, poverty would have actually increased from 62.5 % in 2003 to 66.8 % to 2009.

46. On the other hand, if mean returns to asset endowments had increased in Nampula and Zambezia at the same pace as in the rest of the country, poverty would have fallen by almost a half in these two provinces. Poverty would have fallen in these two provinces from 62.5% in 2003 to 33.9% in 2009, as opposed to the observed increase from 62.5% in 2003 to 65.8% in 2009. The counterfactual analysis therefore provides further support for the hypothesis that it is

the differences in the changes in returns to assets, rather than changes in asset endowments, which contributed to the widening of poverty differences between Nampula and Zambezia and the rest of the country. Results of the counterfactual analysis show that Nampula and Zambezia could have accrued significant gains in terms of poverty reduction if they had experienced the same change in returns to assets that the rest of the country experienced between 2003 and 2009. In fact, poverty in Mozambique as a whole would have dropped to 40 percent in 2009, instead of the observed 52 percent. On the other hand if Nampula and Zambezia had the same asset accumulation rate as the rest of the country, poverty in the country would had been slightly higher at 52.4 percent, instead of 52 percent.

47. **Why did households living in Nampula and Zambezia experience lower increases in returns to assets than the rest of the country between 2003 and 2009?** One of the possible factors contributing to these differences could reside in the fact that households in the provinces of Nampula and Zambezia are on average more isolated than households in the rest of the country. In that case, returns to assets, especially education and land, are likely to be lower, especially for rural households. Remotely located rural households are likely to receive lower prices for their crops, pay higher prices for inputs and have fewer non-farm income generating opportunities.

48. **In fact, households in these two provinces are on average more isolated than households in the rest of the country.** Average walking distances to markets, bus stops, primary schools, police stations and health facilities are all significantly higher in Nampula and Zambezia than in the rest of the country. The proportion of households located more than one hour in terms of walking distance from the nearest food market, bus stop, primary school, police station, and health facility is shown in table 3.7. In 2009, a greater proportion of households were located at a walking distance of 60 minutes or more away from the nearest food market in Nampula and Zambezia (21%) than in the rest of the country (10.7%). The same pattern was observed for the distance to a bus stop (18.3% in Nampula and Zambezia, 14% in the rest of the country), to a primary school (18.8% and 13.7%, respectively), to a police station (75.7% and 59.6%, respectively), and to a health facility (68.0% and 51.5%, respectively).

Table 3.7. Households in Nampula and Zambezia are more isolated than the rest of the country

	Mozambique	Nampula & Zambezia	Rest of the country
Market			
0-60 minutes	85.7%	79.0%	89.3%
60+ minutes	14.3%	21.1%	10.7%
Bus stop			
0-60 minutes	84.6%	81.7%	86.0%
60+ minutes	15.4%	18.3%	14.0%
Primary School			
0-60 minutes	84.3%	81.2%	86.3%
60+ minutes	15.7%	18.8%	13.7%
Police Station			
0-60 minutes	34.3%	24.3%	40.4%
60+ minutes	65.7%	75.7%	59.6%
Health Facility			

0-60 minutes	42.2%	32.0%	48.5%
60+ minutes	57.8%	68.0%	51.5%

Source: World Bank based on IAF2002/3 and IOF2008/9

49. Most crop prices received by farmers in Nampula and Zambezia are lower than those received by farmers in the rest of the country, signaling issues with the functioning of markets. Farm gate prices in 2012 in Nampula and Zambezia were lower than those paid to farmers in the rest of the country for most of the main cash crops. This was not the case for all of these crops in 2008. Moreover, between 2008 and 2012, sale prices for several crops rose at a slower pace for Nampula and Zambezia than for the rest of the country (table 3.8). The price of cassava, for example, increased by 2.45 percent in the rest of the country but only by 0.39 percent in Nampula and Zambezia. In the rest of the country, the price went from 3.06 MZN/kg to 3.45 MZN/kg, while it went from 0.77 MZN/kg to 1.29 MZN/kg in Nampula and Zambezia. The same pattern was observed for maize, rice, sorghum, large groundnuts, kidney beans, cow peas, pigeon peas, and mung beans.

Table 3.8. Crop farm gate prices are lower in Nampula and Zambezia

	Nampula & Zambezia			Rest of the country		
	2008	**2012**	**%**	**2008**	**2012**	**%**
Maize	4.0	4.3	3.3%	4.0	4.5	3.5%
Rice	8.3	12.2	11.2%	11.2	12.4	11.4%
Sorghum	8.0	5.0	4.0%	4.0	5.2	4.2%
Millet	5.9	N/A	N/A	5.9	26.0	25.0%
Large groundnuts	12.5	20.2	19.2%	13.8	23.5	22.5%
Small groundnuts	11.2	19.2	18.2%	9.8	12.8	11.8%
Kidney bean	16.8	16.8	15.9%	16.8	17.6	16.6%
Cowpea	7.6	8.9	7.9%	7.5	9.2	8.2%
Jugo bean	5.4	9.9	8.9%	9.0	7.8	6.8%
Pigeon pea	5.4	7.8	6.8%	5.0	7.9	6.9%
Mung beans	5.5	10.0	9.0%	3.0	10.3	9.3%
Cassava	0.8	1.4	0.4%	1.9	3.5	2.5%
Sweet potato OF	2.4	6.9	5.9%	2.9	4.5	3.5%
Sweet potato WF	1.5	4.0	3.0%	3.1	3.0	2.0%

Source: World Bank based on TIA 2007/08, TIA 2011/12

50. Low levels of connectivity have likely contributed to keep returns to labor and land low in Nampula & Zambezia. However, in order for limited connectivity to be the explanation for the changes in returns over time, it should be that accessibility to markets and key public infrastructure increased more rapidly for less poor households over time. To test for this, additional Oaxaca-Blinder decompositions that include a connectivity variable (distance to a bus stop[13]) were run. When included into the models the connectivity variable is found to be statistically significant only in 2009.[14] In 2009, returns to this variable explain 23 percent of the difference in log of per

[13] Although the travel distance to a bus stop is not the only determinant of connectivity, it is the only reliable variable available over time.

[14] The dependent variables for these models are Log of per capita expenditure and poverty dummy as dependent variables

capita expenditure and 32 percent of the poverty rate difference between Nampula & Zambezia and the rest of the country. This provides an indication that returns to being more connected increased more rapidly for less poor households (i.e., for the rest of the country). Other possible factors driving the differences in returns (not explored in depth in this study) may include poor access to market information (prices, demand and supply), weak logistics to support rural economic activities or relatively lower quality of basic services (education, water, electricity, health, etc.).

51. Along the same lines, farm households in Nampula and Zambezia earn remarkably lower average incomes from farm and non-farm activities. As shown in table 3.9, the average yearly income from farm activities for a household in Nampula and Zambezia was around USD 51 in 2008 and USD 82.4 in 2012. In the rest of the country, it was equal to USD 201.9 in 2008 and 255.6 in 2012. They also report a significantly lower yearly income from non-farm activities than households in the rest of the country. The average yearly income from non-farm activities for a household in Nampula and Zambezia was around USD 110.4 in 2008 and USD 266 in 2012, compared to USD 467.89 in 2008 and 785.35 in 2012 in the rest of the country.

Table 3.9. Average earnings from farm and off-farm activities are lower in Nampula and Zambezia

	Nampula and Zambezia	Rest of the country	Mozambique
Farm income, 2008	51.0	201.9	163.0
Farm income, 2012	82.4	255.6	209.7
Non-farm income, 2008	110.4	467.9	375.7
Non-farm income, 2012	266.0	785.4	646.3

Source: Author's calculations using TIA 2007/08, TIA 2011/12

52. Finally, disparities in budget allocations across provinces can contribute to widen the gap between Nampula and Zambézia with respect to the rest of the country. In fact, accounting for population size, the budget share allocated to Nampula and Zambézia between 2009 and 2014 is the lowest. On average, Nampula received 7 percent of the per capita provincial budget and Zambézia received 5 percent, while the remainder of the provinces received larger shares. While these figures cover more recent years, they provide an indication of the gap in the regional allocation of funds from the central government to the provinces.

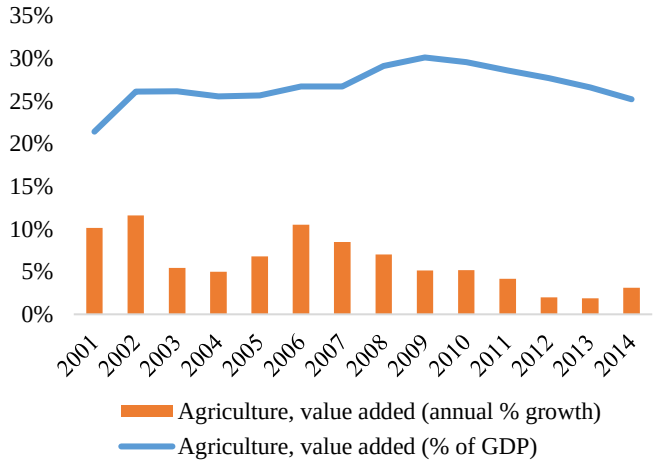
4. Why is Agriculture not More Effective in Reducing Poverty? Low Productivity and Limited Market-Based Growth

4.1 Overview of the Agricultural Sector

53. The agricultural sector makes up over a quarter of Mozambique's economy and employs the vast majority of the population. The agricultural sector accounts for 25 percent of Mozambique's GDP, and employs about 75 percent of the population. In rural areas, more than 90 percent of household heads are engaged in agricultural activities. Despite its key role as a fundamental source of livelihoods, the agricultural sector has not been growing at a steady pace in recent years. Annual growth of the sector fell from 7 to 2 percent between 2008 and 2012 (figure 4.1) (World Bank 2015). Over the past three years, the growth of commercialized agriculture has picked up again, counterbalancing reduced growth in the resources sector, but medium-scale and small-scale agriculture have lagged behind, only growing at an average of 4 percent.

54. Mozambique has a vast agro-geological potential, which is still largely untapped. It has been estimated that up to US$567 billion worth of agricultural production could be realized, assuming high commodity prices[15], and that the resulting gains would mostly accrue to the poorest and most rural provinces located in the central and northern parts of the country. At present, only about 5 out of 36 million hectares of arable land are currently cultivated, of which 90 percent is used for small-scale subsistence agriculture. Unlocking Mozambique's agricultural potential appears to be of particular importance in light of the fact that, while Mozambique currently produces about US$3 billion worth of agricultural crops, it also continues to import about US$600 million worth of food and agricultural products each year (Iimi and Rao 2015). Raising agricultural productivity would have positive implications in terms of food self-sufficiency and balance of payments, as well as contributing to poverty reduction and inclusive growth.

Figure 4.1. Agriculture is a key sector of the economy but its value added is falling



Source: World Bank, 2015

[15] These estimates were evaluated for the year 2010

55. Agro-ecological diversity is a prominent feature of Mozambique. The south and southwest regions, composed of arid and semiarid zones, tend to be prone to drought and are associated with lower soil fertility. The center and north regions, more than 1,000 km away from the capital, feature more sub-humid zones. They are therefore more suitable for rain-fed and irrigated agriculture. Transport costs remain high as links between the south and other regions continue to rely for the most part on a single road (Jones and Tarp 2013). Rain-fed agriculture is vastly predominant in the country: less than 0.5 percent of all cropland is irrigated, and almost exclusively for the purpose of sugar cane production (Salazar-Espinoza et al. 2015). As a result, the agricultural sector in Mozambique is very sensitive to climatic conditions. Droughts, floods, and other weather-related disasters are frequent. Climate change models indicate an increased risk of extreme weather events with potentially severe negative consequences for the agricultural sector (Suit and Choudhary 2015).

56. The contribution of the agricultural sector to the economy is constrained by low levels of productivity. In Mozambique, maize yields averaged 1.0 ton per hectare in 2013, while they averaged 2.2 tons per hectare in Malawi, 3.8 in South Africa, and 2.5 in Zambia. Large productivity gaps with respect to neighboring countries were also observed in terms of rice, millet, sorghum, and wheat yields, as illustrated in Table 13 (World Bank 2015) (table 4.1)**.** In 2009, labor productivity was almost seven times higher in the tertiary sector and ten times higher in the secondary sector than in the primary sector (Jones and Tarp 2013).

Table 4.1. There are large productivity gaps with respect to other countries in the region

	Maize	Rice	Pulses	Wheat	Millet	Sorghum	Roots and tubers
				Yields in 2013 (Ton/Ha)			
Mozambique	1.0	1.2	0.6	1.7	0.5	0.3	7.2
Malawi	2.2	1.9	-	1.4	0.9	1.1	-
South Africa	3.8	2.6	0-	3.6	0.5	2.8	-
Zambia	2.5	1.2	0.5	6.5	0.8	0.7	-
Zimbabwe	0.9	2.3	0.9	2.5	0.3	0.3	10.0
				Average annual yield growth 2000-2013 (%)			
Mozambique	0.2	1.4	1.4	4.0	-1	-4	2.8
Malawi	1.7	1.2	-	4.5	5	12	-
South Africa	2.3	-0.9	-	2.6	0	0	-
Zambia	2.8	0.2	0.9	0.4	4	7	-
Zimbabwe	-3.9	0.9	2.8	-5.8	18	3	3.3

Source: FAOSTAT (2015)

57. A number of additional factors have been hindering the agricultural sector. These include limited adoption of productivity-enhancing inputs and modern farming practices, unreliable supply of electricity, insecure land tenure, limited access to rural extension services, restricted access to credit, and poor infrastructure.

58. The majority of production generated by smallholders is destined to their own consumption, and staple crops account for a large share of total production. The value of retained food corresponds to more than half of total household income (Salazar-Espinoza et al. 2015). The vast majority (99 percent) of agricultural producers are subsistence farmers: in 2012, only 18 percent of smallholder farmers sold part of their maize production. Farmers tend to own small farms, cultivate small plots, employ mostly family labor, and have very limited access to

inputs and mechanization. In 2012, six main crops accounted for 85 percent of total crop area in 2012, as shown in table 4.2 (World Bank, 2015). All of them are staple crops: maize, pulses, cassava, groundnuts, rice, and sorghum.

59. The highest proportion of agricultural households is observed in the poorest provinces, where isolation is also the highest. Cumulatively, the Nampula and Zambezia provinces accounted for 43 percent of all agricultural households and for 48 percent of the country's poor in 2009, but were home to only 38 percent of the population. Together, these two provinces experienced an increase in poverty of more than 5 percent between 2003 and 2009, while the rest of the country experienced a 17.3 percent reduction (World Bank, 2015). In addition, rural households in Nampula and Zambezia are on average more isolated than households in the rest of the country. Average distances to food markets, bus stops, primary schools, police stations, and health facilities are significantly higher in these provinces than in the rest of the country**.**

Table 4.2. A few crops account for most of the agricultural produce

(First Crop Season, 2012)

Crop	Share of area
Maize	31.9%
Pulses	16.1%
Cassava	15.5%
Groundnuts	7.9%
Rice	7.4%
Sorghum	6.2%
Others	15.0%
Total	100.0%

Source: World Bank based on AIS 2012

4.2 A Profile of Rural Livelihoods in Mozambique

60. Poverty rates remain exceedingly high in Mozambique, and are significantly higher in rural areas than in urban areas. Progress towards poverty reduction has slowed down since 2003. Between 1997 and 2003, poverty rates declined rapidly, falling from 70 percent to 56 percent. After 2003, however, poverty reduction fell behind economic growth, and the headcount poverty rate decreased only slightly, reaching 52 percent in 2009. Overall, between 1997 and 2009, the growth elasticity of poverty reduction in Mozambique was only about half of the average for Sub-Saharan Africa. In addition, a stark rural-urban divide exists and has been widening in recent years: in 1997, urban poverty was estimated at 53.1 percent, and rural poverty at 72.3 percent. By 2009, however, urban poverty had dropped by 23.7 percentage points, but rural poverty had fallen by 10.3 percentage points only. As a result, the gap between urban and rural poverty widened by 13.5 percentage points (from 19.2 percentage points to 32.7 percentage points).

61. A large urban-rural gap emerges when comparing the endowment levels of rural and urban households across a wide range of assets and access to services. While being demographically similar, rural and urban households tend to differ significantly in terms of human capital, nutrition, access to services, housing quality, ownership of durable goods, sector and type of employment, connectivity, and migration patterns (table 4.3). In addition, access to basic services such as water, sanitation and electricity is substantially lower for rural households (table

16). About 95 percent of rural households consume water obtained from unprotected wells, as opposed to only 46 percent of urban households. Among rural households, less than 2 percent have access to piped water and over 60 percent lack toilets. Access to electricity is also very unequal between urban and rural areas, reaching 41.7 of urban households but less than 2 percent of rural households.

62. Large urban-rural disparities in terms of housing quality and ownership of durable assets are also observed. Overall, rural dwellings tend to be made of less durable materials, such as grass, adobe, and wattle (table 4.4). Housing materials used in urban areas tend to be more durable, as the majority of roofs is made of zinc foils, and walls tend to be in cement. Rural households also exhibit lower endowments of durable assets with respect to their urban counterparts. Whereas levels of radio ownership are relatively uniform in both rural and urban areas, cellphone ownership is significantly more common among urban households (52.4 percent) than rural households (11.2 percent). Only 0.7 percent of all rural households own a stove, as opposed to 14.7 percent of urban households.

Table 4.3. Human capital and nutrition indicators are much lower for rural Households

Location	Educational attainment of head (years)	Head cannot read or write (%)	School attendance (6-17 age group) (%)	Three daily meals (%)
Urban	5.24	27.83	83.89	45.14
Rural	2.72	56.12	72.70	29.40
Total	3.51	47.90	76.09	33.98

Source: World Based on IOF 2008/9

Table 4.4. Access to basic services and asset ownership is also lower for rural households (%)

	Water and Sanitation							
	Piped water	Protected well	Unprotected well	Flush toilet	Improved latrine	Improved traditional latrine	Unimproved latrine	No toilet
Urban	39.2	15.2	45.6	13.2	16.1	12.3	36.1	22.3
Rural	1.2	3.1	95.8	0.3	0.7	4.4	34.3	60.2

	Durable Assets						
	Radio	Mobile phone	Bed	New car	Stove	Watch	Bicycle
Urban	47.9	52.4	64.0	5.0	14.7	28.6	24.2
Rural	45.1	11.2	28.9	0.6	0.7	16.9	44.0

Source: World Based on IOF 2008/9

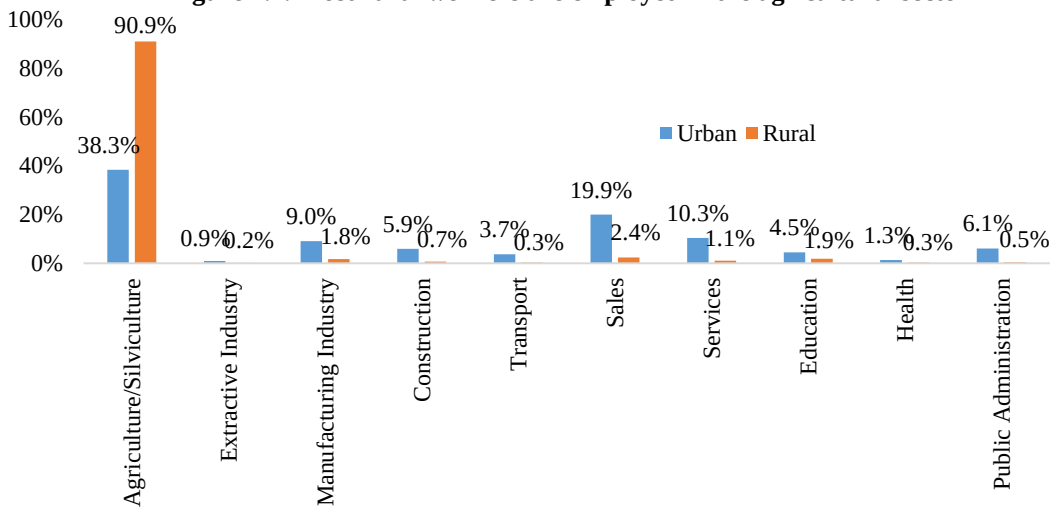
63. The overwhelming majority of rural dwellers is employed in the agricultural sector. The proportion of household heads engaged in agricultural activities reaches 90.9 percent in rural areas. Nearly all the jobs in the agricultural sector are clustered in low-productivity, self-employment activities (World Bank, 2015). Employment in other sectors (such as sales, services, manufacturing, and public administration) is much less common in rural areas, suggesting little income diversification away from agriculture (figure 4.2).

64. The agricultural sector is dominated by smallholders, with very few medium- and large-scale operations. Out of a total of 3.9 million households in the sector, about 3.86 million

are engaged in small-scale agriculture (based on IAI 2012). Only 52,851 households are registered as medium-scale and only 618 as large-scale farms (CAP/INE, 2010). Overall, small-scale farms still represent more than 99% of all Mozambican farms (World Bank, 2016) (table 4.5).

65. Most farmers in Mozambique are classified as small, and are characterized by limited ownership of productive assets and little engagement in off-farm activities. Less than 1 percent of household heads working on small-scale farms have completed at least 3 months of agricultural studies and less than half can read or write. A reflection of the broad material deprivations and limited economic opportunities across rural Mozambique, small-scale farms tend to own fewer assets and are less likely to complement their agricultural income with additional non-farm revenues.

Figure 4.2. Most rural workers are employed in the agricultural sector



Source: World Based on IOF 2008/9

Table 4.5. The agricultural sector is dominated by smallholders

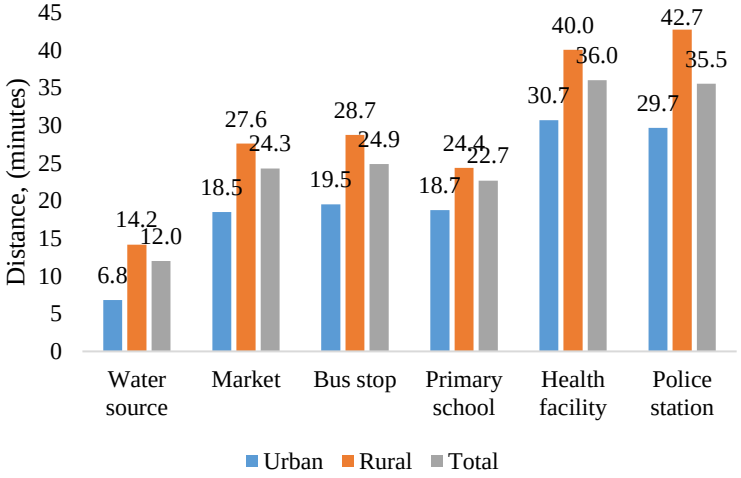
Farm Type	%	N
Small Scale	98.7	4,074,111
Medium Scale	1.3	53,564
Total	**100.0**	**4,127,675**

Source: World Based on IOF 2008/09

66. Rural households appear to be significantly more isolated than urban households and are physically less mobile. Rural households are more than twice as distant to the nearest water source as urban households, on average (figure 4.3). Rural households also tend to be located further away from food markets, bus stops, primary schools, health facilities and police stations than their urban counterparts. Only 17 percent of the rural population is estimated to live within 2 kilometers of the nearest road in good condition, as measured through the Rural Access Index (RAI). As a result, approximately 16 million people lack a connection to an all-season road (World Bank, 2015).

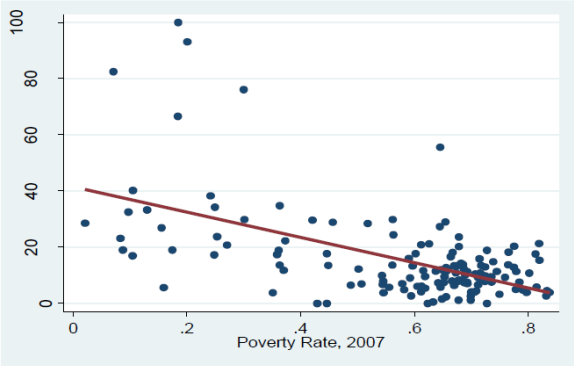
67. Rural accessibility is strongly correlated with poverty. In districts with a RAI lower than 20 percent, poverty rates tend to be above 60 percent whereas districts with RAI above 60 percent have poverty rates in the order of 20 percent (figure 4.4). Rural and urban households also follow markedly different migration patterns: while most of the former tend to remain in their area of origin (80.3 percent of rural households have never migrated), the latter are more likely to migrate (53.9 percent of urban household heads have arrived from other districts, typically in search of productive employment opportunities).

Figure 4.3. Rural households are more isolated from basic services and markets



Source: World Based on IOF 2008/09

Figure 4.4. Rural accessibility is strongly correlated with poverty



Source: World Bank, 2015

4.3 What Is Behind the Low Level of Agricultural Productivity?

68. Agricultural productivity is lower in Mozambique than in comparator countries. As discussed above, large productivity gaps with respect to neighboring countries are observed between Mozambique and its neighboring countries in terms of cereal yields (here: maize, rice, millet, sorghum, and wheat). Over the past decade, cereal yields have also been growing at a slower pace in Mozambique than in neighboring countries. For example, average yields of millet and sorghum have been falling, on average, in Mozambique (by -1 percent and -4 percent, respectively, between 2000 and 2013), while they have grown or stayed the same in Malawi, South Africa, Zambia, and Zimbabwe (FAOSTAT, 2015). Also, both the number of farming households and the

area cultivated in Mozambique have been increasing gradually over time, which is indicative of increases of agricultural output through area expansion rather than through more intensive use of existing land. In fact, the area planted to food crops increased between 3 percent and 9 percent per annum during the period 2002-2012, well above population growth.

69. A strong negative correlation seems to exist between poverty and average yields in Mozambique. Farmers in the poorest provinces remain less productive, on average, than those in the rest of the country. In Nampula and Zambezia, where headcount poverty rates are particularly high, the average cereal yield is about 761 kilograms per hectare. In the rest of the country, the average yield equals 910 kilograms per hectare, 19.5 percent higher.

Land allocation and crop choices

70. The overwhelming majority of households cultivate small plots for which they do not have formalized land use rights. The Mozambican Land Law states that land is the property of the State, but it also establishes various modalities under which land use rights are confirmed. The Direito de Uso e Aproveitamento das Terras (known as DUAT) is a secure, renewable, and long-term user right that can be inherited, transferred or sold. DUATS are used mostly by larger landholders, while customary and accrued land use rights for individual smallholders as well as community land delimitation certificates are equally recognized[16]. Only 2.1 percent of households surveyed in the AIS report having a land title (i.e. DUAT), and only 3 percent report having an alternative document that grants them the right to use the land. In addition to scant land ownership, in general land plots are small. About 98.7 percent of Mozambican farms are smaller than 10 hectares, with the average field area corresponding to about 1.7 hectares (Table 4.6). Most of the land is cultivated continuously, with fallow areas often representing only a very small portion of total field area (averaging 0.1 hectares in 2012). Since the mid-2000s, demand for land has been increasing significantly due to spikes of food prices, increased demand for bio-fuels, and accelerating urbanization.

Table 4.6. The characteristics of small farmers in Mozambique

	Crop area (HA)	**Fallow area** (HA)	**Total field area** (HA)	**Leases field** (% of all farmers)	**Number of crops**	**Sellers** (% of all farmers)	**Maize eq.* sold** (% of production, for those who sold)
2012	1.5	0.1	1.7	3.9	5.3	22.2	19.3

Source: World Bank based on AIS 2012

Note: the cereal equivalent measure includes maize, rice, sorghum, pearl millet, groundnuts, cassava, and sweet potato. Together these crops accounted for 85 percent of total crop area

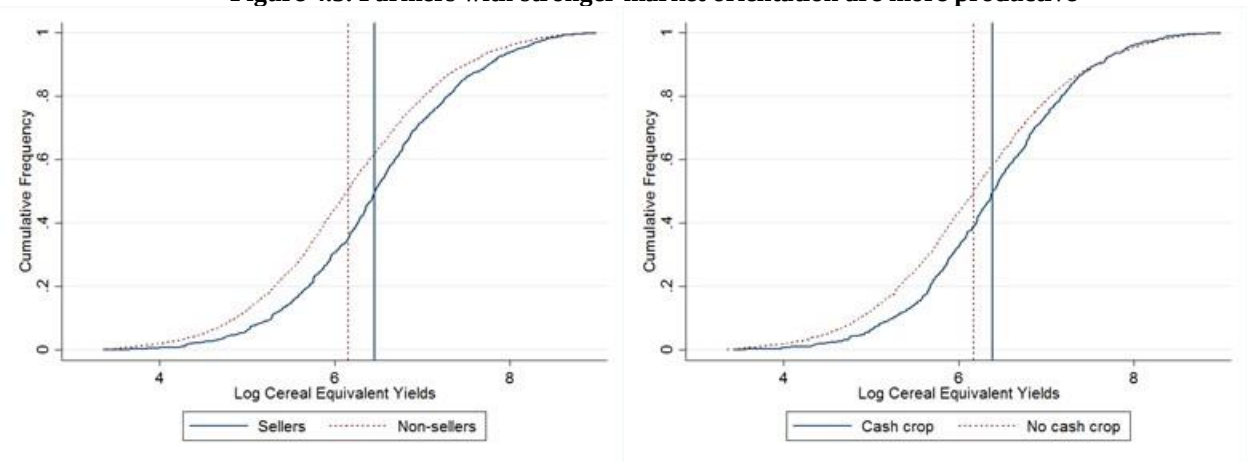
71. Most of the land is used to cultivate staples for subsistence rather than cash crops, and as a result the share of production sold in markets is small. On average, farmers cultivate

[16] The Constitution (1990) establishes that land belongs to the State, but goes on to say that the 'use and benefit of land is the right of all Mozambicans'. This right is awarded to anyone who wants to use land for social and economic purposes, in the form of a Land Use and Benefit Right (or DUAT). The Land Law (1997) puts these principles into effect through its Article 10 (men and women can be holders of the DUAT); and Article 12, which is the cornerstone of the legal framework and details how the Right of Use and Benefit of Land is acquired: a) occupation by individuals and by local communities, according to customary norms and practices insofar as these do not contradict the Constitution; b) occupation by national individuals who, in good faith, have used land for at least ten years; and c) authorization of a request presented by individuals or collective entities in the way established in the present law.

5.3 crops and six main staple crops account for 85 percent of total crop area (namely, maize, pulses, cassava, groundnuts, rice, and sorghum). In 2012, only 22.2 percent of farmers sold some of their production. Consequently, the vast majority of agricultural output is retained by producers for consumption within the household. The average share of production sold is only 19.3 percent of total production.

72. Farmers with a stronger market orientation are more productive[17]. As expected, farmers who sell a portion of their production are on average more productive than those who do not. Closely related to this observation, there is also a relationship between the type of crop (staple or crash) and productivity. Farmers who cultivate cash crops are generally more productive than those who only cultivate staple crops (figure 4.5). Farmers who sold part of their production produced, on average, 1,007 kilograms per hectare of cereal equivalent crops. In contrast, those who did not sell their production only obtained an average of 795 kilograms per hectare. Similarly, farmers who cultivated cash crops produced on average 903 kilograms per hectare of cereal equivalents, while those who did not produced on average 828 kilograms per hectare.

Figure 4.5. Farmers with stronger market orientation are more productive



Source: World Bank based on AIS 2012
Note: Cumulative distribution functions trimmed at 1st and 99th percentiles Vertical lines show median values.

Low rates of technology adoption

73. Rates of adoption of productivity-enhancing technologies appear to be remarkably low, particularly among farmers who only cultivate staples. Data for 2012 indicates that only 8.8 percent of farmers employed improved seeds whereas only 2.7 percent of farmers used any irrigation method. Similarly, inorganic fertilizer is used by only 2.6 percent of farmers and only 5 percent applied Pesticides (table 4.7). Rates of technology adoption are particularly low in the

[17] Cereal equivalent yields are used to measure farm productivity throughout this report. The cereal equivalent measure allows for direct comparison of yields between Mozambique and other countries, as this type of aggregation is commonly used in agricultural studies. The most important food crops in Mozambique (i.e.: maize, rice, sorghum, pearl millet, groundnuts, pulses, cassava, and sweet potato) are aggregated in cereal equivalents following the methodology presented by FAO (2009) and Rask and Rask (2014). Firstly, the average energetic value (Kcal/100g) is calculated; then the energetic value of each crop is divided by the average value to obtain a conversion factor. The conversion factors are then used as weights to aggregate the production of different food crops. Finally, cereal equivalent yields (in kilograms per hectare) are computed to provide a measure of farm productivity. Since the energetic value of maize is similar to that of the average cereal, the resulting indicator is close to a "maize equivalent" measure.

cultivation of food crops. Restricting the sample to this group of farmers shows basically no adoption of any of these inputs.

Table 4.7. Adoption of productivity enhancing technologies is low in the agricultural sector

Technology Adoption		Agricultural Practices		Access to Services	
Improved seeds	8.8	Crop Rotation	29.3	Agricultural Extension	6.6
Irrigation	2.7	Intercropping	73.7	Agrarian Association Membership	4.5
Inorganic fertilizer	2.6	Line Sowing	38.6	Rural Credit	2.0
Pesticides	5.0				

Source: World Bank based on AIS 2012

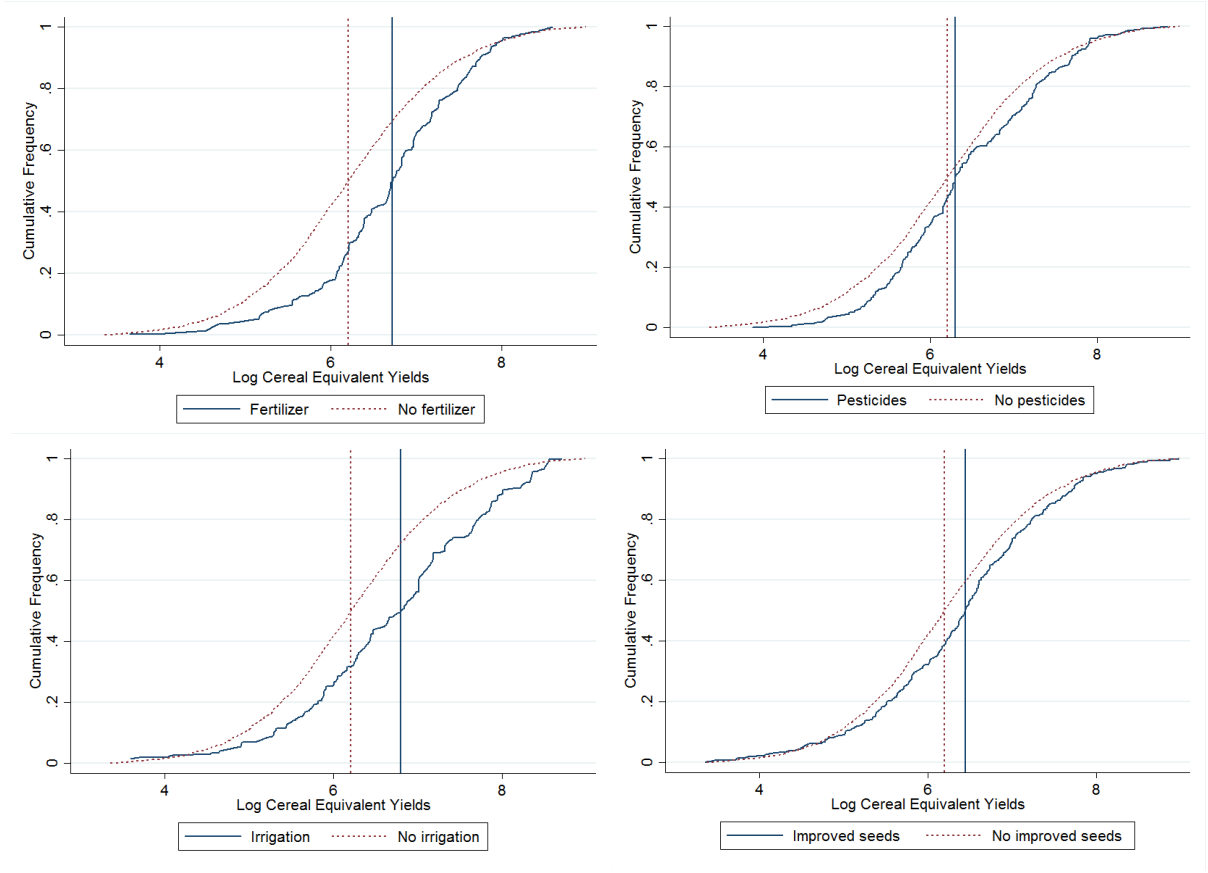
74. The evidence available suggests that farmers who adopt technologies such as improved seeds, irrigation, fertilizer, and pesticides, are more productive than those who do not.[18] Correlation analysis shows that, on average, cereal equivalent yields in the first crop season were higher for technology adopters (figure 4.6). For instance, the average cereal equivalent production totaled 1,340 kilograms per hectare for farmers who cultivated under irrigation, but only 830 kilograms per hectare for those who did not, 61 percent less[19]. Similarly, farmers who used improved seeds obtained on average 967 kilograms per hectare of cereal equivalent production, while those who did not only obtained an average of 831 kilograms per hectare. The difference in average yields was also large between users and non-users of fertilizer: while the former produced 1,118 kilograms of cereal equivalents per hectare, the latter produced only 835 kilograms per hectare, equivalent to 33 percent less. Lastly, farmers who employed pesticides obtained on average 955 kilograms of cereal-equivalent production per hectare, while those who did not produced only 835 kilograms per hectare. The magnitude of these differences is not only meaningful in economic terms but also statistically significant.

75. The use of improved seeds, fertilizer and other agricultural inputs and technologies results in significantly higher crop yields, even after controlling for other relevant factors. The adoption of agricultural technologies (i.e.: improved seeds, irrigation, fertilizer, pesticides, or any of these) is positively and significantly correlated with yields, even when controlling for access to agricultural services (i.e.: extension services, agricultural associations, and credit), for demographic characteristics (i.e.: age, gender, and education level of household head), for climatic shocks (droughts, cyclones, floods, and fires), and for regional fixed effects (table 4.8). The adoption of at least one agricultural technology (among improved seeds, irrigation, fertilizer, and pesticides) is correlated with a 14.8 percent increase in average cereal equivalent yields, *ceteris* paribus (coefficient 0.138 in column 5 of table 5.8). Similar findings hold for each agricultural technology individually. In particular, use of pesticides and use of fertilizer are associated with 16.1 percent and 40.1 percent higher yields, respectively (as depicted in columns 3 and 4). Irrigated agriculture is also correlated with a 33.2 percent average increase in yield (as shown in column 2). Lastly, the adoption of improved seeds is associated with an 8.5 percent average increase in yields, although this result is not statistically significant at the 10 percent level (as indicated in column 1).

[18] In order to provide a more complete analysis of the relationship between input usage and agricultural productivity in Mozambique, a discussion of synergies among different inputs would be needed. However, due to data limitations, it has not been possible to investigate this relationship further for this note.

[19] The agricultural production measure used in this note is based on a basket of six main crops (i.e.: maize, rice, sorghum, pearl millet, groundnuts, pulses, cassava and sweet potato). Together, these six crops account for over 85 percent of total crop area.

Figure 4.6. Agricultural yields are higher among farmers that use technological inputs



Source: World Bank based on AIS 2012
Note: Cumulative distribution functions trimmed at 1st and 99th percentiles Vertical lines show median values.

76. Crop-rotation and line sowing are uncommon practices. Only 29.3 percent of farmers used crop rotation, changing the type of crops grown in the field each season or each year, and only 38.6 percent used line sowing, planting seeds with the help of a tool such as a seed drill (as shown in table 4.7 above). The average productivity of farmers who adopted crop rotation was slightly higher than the productivity of those who did not: 871 kilograms per hectare, as opposed to 829 kilograms per hectare respectively, although it was not statistically significant. This result is consistent with the rotation effect that results in increased productivity because of improvements in soil physical quality and organic matter (see, for example, Bullock 2008). Farmers who used line sowing, instead, were on average significantly more productive than those who did not: they produced 924 kilograms per hectare, as opposed to 785 kilograms per hectare on average, respectively[20]. Despite its yield-increasing benefit, line sowing has low uptake rates among smallholder farmers, primarily because of the lack of skilled labor to perform the sowing task (Vandercasteelen et al. 2014).

[20] Line sowing results in higher yields compared to broadcasting, primarily because it reduces weed pressure and maximizes photosynthesis through increased exposure to sunlight (Crop Review, 2015).

Table 4.8. The use of technological inputs is correlated with higher agricultural yields after controlling for factors such as household characteristics, access to services and climatic Shocks

Dependent Variable:	Cereal Equivalent Yield (Log)				
	(1)	(2)	(3)	(4)	(5)
Drought	-0.108	-0.105	-0.101	-0.109	-0.106
	(0.037)**	(0.037)**	(0.037)**	(0.037)**	(0.037)**
Flood	0.004	0.007	0.003	0.003	0.004
	(0.064)	(0.064)	(0.064)	(0.064)	(0.064)
Cyclone	-0.126	-0.124	-0.118	-0.124	-0.127
	(0.058)*	(0.058)*	(0.059)*	(0.058)*	(0.058)*
Fire	0.216	0.213	0.217	0.218	0.213
	(0.042)**	(0.042)**	(0.042)**	(0.042)**	(0.041)**
Used Improved Seeds	0.082				
	(0.063)				
Used Irrigation		0.287			
		(0.071)**			
Used Fertilizer			0.341		
			(0.088)**		
Used Pesticide				0.149	
				(0.064)*	
Used Any Technology					0.138
					(0.039)**
Constant	6.533	6.532	6.502	6.523	6.512
	(0.124)**	(0.123)**	(0.129)**	(0.126)**	(0.126)**
R^2	0.07	0.07	0.07	0.07	0.07
N	6,049	6,049	6,049	6,049	6,049

Source: World Bank using AIS (2012).

Notes: Results from an OLS Regression of Cereal Equivalent Yields (Log) on Access to Services, Adoption of Agricultural Technologies, Climatic Shocks, and Household Characteristics Standard errors clustered at the district level shown in parentheses. *** denotes significance at the 1% level, ** denotes significance at the 5% level and * denotes significance at the 10% level. Controls included in all regressions include dummies for characteristics of the household's head (age, gender, education level), dummies for access to services (extension services, membership in agricultural associations, agricultural credit), and province dummies.

Access to information, skills development and production support services

77. Smallholder farmers have limited access to key production support services. Services from agricultural extension or through membership in agricultural associations, and agricultural credit are either not widely available or used by the rural population. In 2012, only 6.6 percent of farmers received information from an agricultural extension service program; only 4.5 percent reported being members of an agricultural association, and only 2.0 percent had received agricultural credit.

78. Low accessibility and demand for agricultural production support services, including little participation in agricultural associations, may be undermining technology adoption and economic opportunities. When market failures exist, the ability of farmers to adopt productivity-enhancing technologies and inputs is often limited. This issue is particularly pervasive in rural areas, where markets for credit, insurance, labor, inputs, and output are often plagued by such failures, and by issues of spillovers in technology adoption and asymmetric information. Credit markets are of particular importance in accelerating productivity, given the increase in the financial requirements of modern agriculture, which call for increased mechanization and extensive use of fertilizers and improved seeds, among other practices.

Participation in agrarian associations, in turn, can help in pooling resources, exploiting economies of scale, mobilizing community resources in pursuit of economic opportunity, and addressing some market failures such as the lack of credit or individual liability. Membership in cooperatives can facilitate access to agricultural inputs such as seeds, fuel or fertilizers, support the transportation, distribution and marketing of farm products or provide sources of financing. Farmers who receive information from agricultural extension services are observed to be more productive, on average, than farmers who did not: cereal equivalent yields averaged 957 kilograms/hectare per hectare for the former relative to 834 kilograms/hectare for the latter.

79. Multivariate analysis shows that access to credit, extension services, and participation in farmers' cooperatives are, in fact, positively correlated with uptake of enhanced agricultural inputs and technologies. Farmers seemed to be significantly more likely to have adopted any agricultural technology (among improved seeds, irrigation, fertilizer, and pesticides) if they had either accessed credit, joined an agricultural association, or received extension services in 2012 (table 4.9). Membership in agrarian associations seems to be more closely related to usage of irrigation and fertilizer, while credit is associated more strongly with use of fertilizer and pesticides. In addition, extension services appear to increase the likelihood of adoption of all agricultural technologies of interest. Gender and education level of the household head also seem to affect the probability of adoption of rural technologies. More educated household heads are more likely to adopt any kind of technology, and female household heads are less likely to adopt any technology. This result holds for each type of technology and is consistent with the fact that female-headed households also tend to be poorer.

Table 4.9. Production support services raise the uptake of agricultural inputs and technologies

	(1)	(2)	(3)	(4)	(5)
Dependent Variable:	**P(Improved seeds)**	**P(Irrigation)**	**P(Fertilizer)**	**P(Pesticide)**	**P(Any technology)**
Received Credit	0.170	0.209	0.675	1.162	1.009
	(0.156)	(0.183)	(0.163)**	(0.169)**	(0.146)**
Agricultural Association	0.229	0.234	0.244	0.057	0.206
	(0.102)*	(0.117)*	(0.136)	(0.119)	(0.087)*
Extension Service	0.247	0.258	0.365	0.244	0.293
	(0.106)*	(0.101)*	(0.106)**	(0.098)*	(0.078)**
Age of Household Head	0.001	0.003	-0.005	-0.002	-0.002
	(0.002)	(0.002)	(0.002)*	(0.002)	(0.001)
Education Household Head	0.040	0.016	0.019	0.003	0.025
	(0.008)**	(0.011)	(0.011)	(0.010)	(0.007)**
Female Household Head	-0.170	-0.104	-0.279	-0.278	-0.264
	(0.063)**	(0.068)	(0.084)**	(0.085)**	(0.047)**
Constant	-1.815	-2.213	-1.241	-1.353	-0.961
	(0.140)**	(0.199)**	(0.210)**	(0.178)**	(0.123)**
N	6,049	6,049	6,049	6,049	6,049

Source: World Bank using AIS (2012).

Notes: Results from a Probit regression of agricultural technologies on access to agricultural services and household head characteristics. Clustered standard errors in parentheses. *** denotes significance at the 1% level, ** denotes significance at the 5% level and * denotes significance at the 10% level. Controls included in all regressions include province dummies.

Exposure and vulnerability to natural shocks is high

80. High levels of incidence of climate-related shocks are observed in rural Mozambique. As it will be evident in the next chapter, the country is often confronted with droughts, floods, cyclones, pests, and diseases which generate significant agricultural risks. This, in turn, can lead to food availability and affordability problems for vulnerable rural populations and urban consumers, and sometimes results in sudden spikes in the food insecure population. Drought has been identified as the most important agricultural risk, occurring in 1979, 1983, 1988, 1992, 1994, 2005, 2008, 2009 and the recent one in 2015/16/. Floods appear to be the second most important climate-related risk in the country, and are likely to pose additional concerns in the near future as excess rainfall events are expected to become more frequent due to climate change. Lastly, cyclones are common along the coastline during the wet season, and tend to inflict the highest level of damage on farm infrastructure and tree crops (Mozambique Risk Assessment, 2015).

81. Natural shocks affect a large share of farmers, exerting both direct and indirect effects on agricultural output and rural livelihoods. In 2012, about 73.6 percent of farmers lost part of their crops, animals, or implements due to climatic shocks. A similar share of farmers reported losses due to natural hazards in 2005 and 2008. In 2012, 62.1 percent of farmers experienced drought (table 4.10). Floods, cyclones and fires were also prevalent shocks, affecting 11.0 percent, 7.4 percent, and 16.5 percent of rural households in 2012, respectively. In the absence of functioning markets for credit, savings and insurance, major shocks are expected to reduce agricultural output and, consequently, negatively affect rural livelihoods. In particular, droughts and cyclones seem to have exerted a strong negative impact on agricultural productivity (figure 4.7). Farmers who experienced droughts obtained yields that are lower (economically and in statistical sense) than those who did not: 804 kilograms per hectare, as opposed to 915 kilograms per hectare, on average. Similarly, farms that were hit by cyclones had average yields of 705 kilograms per hectare, while those who were not yielded 853 kilograms per hectare on average in 2012. The occurrence of droughts and cyclones is associated with an average 10.1 percent and 11.9 percent decrease in cereal equivalent yields, respectively.

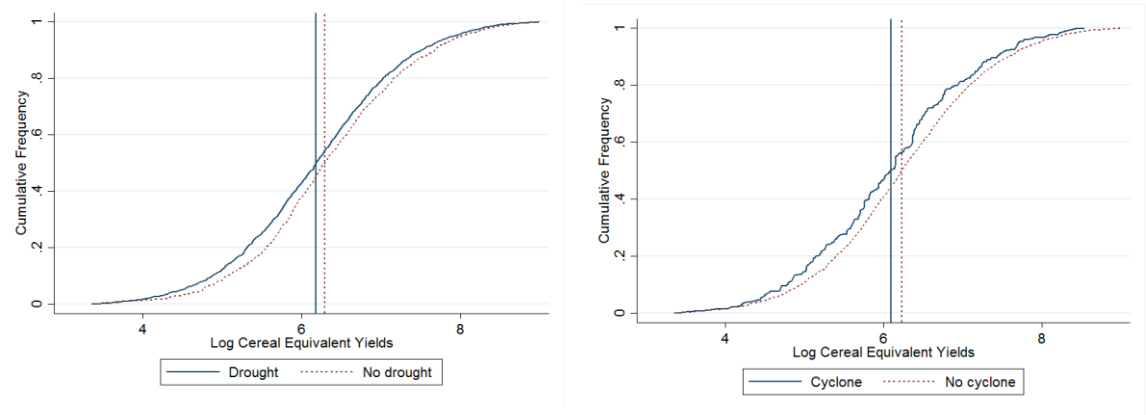
Table 4.10. The big burden of weather risk for farmers

	2012
Droughts	62.1%
Floods	11.0%
Cyclones	7.4%
Fires	16.5%

Source: World Bank based AIS 2012

Note: Percentage of farmers reporting being affected by weather shocks

Figure 4.7. Uninsured weather shocks lead to lower agricultural productivity



Source: World Bank based on AIS 2012
Note: Cumulative distribution functions trimmed at 1st and 99th percentiles. Vertical lines show median values.

82. Suboptimal cropland decisions partly reflect the desire of Mozambican farmers to self-insure against weather shocks. In the absence of complete credit and insurance markets, crop choice is often the only viable solution that remains available for farmers to manage risks. In addition, the occurrence of shocks influences crop choices by shaping farmers' perceptions of the overall riskiness of their environment.[21] After extreme weather events take place in Mozambique, land tends to be reallocated from high-risk to low-risk cropping activities. Farmers tend to shift resources away from cash crops and permanent crops after the occurrence of floods and droughts (Salazar et al. 2015). This reallocation follows a short-term pattern, which is consistent with the idea that households first tap into their buffer stock of food staples to smooth consumption when a shock occurs. As climate change intensifies, weather events are expected to become more frequent and more severe, and in the absence of insurance markets, crop choices are likely to remain suboptimal. This may have significant consequences in countries in which large shares of the population are still heavily reliant on agriculture for their livelihoods, such as Mozambique. More specifically, this may further slowdown the pace of adoption of commercial crops or productivity-enhancing technologies by smallholder farmers, particularly in areas where food security risks are high.

4.4 Isolation and Limited Access to Information Hinder Market-Based Agriculture

Physical accessibility to markets

83. Transport networks are critical for agricultural development, yet the road system of Mozambique appears to lag behind that of neighboring countries in terms of both coverage and quality. The Mozambican road network is comprised of about 30,000 kilometers of functional classified roads, and roads are used 98 percent of the time for passenger traffic. However, only 23 percent of the classified road network is paved. Road density is low compared to neighboring countries, averaging 2.9 kilometers per 100 square meters of land in Mozambique, as opposed to 10.8 in Kenya and 5.5 in Tanzania (figure 4.8) (Iimi and Rao, 2015).

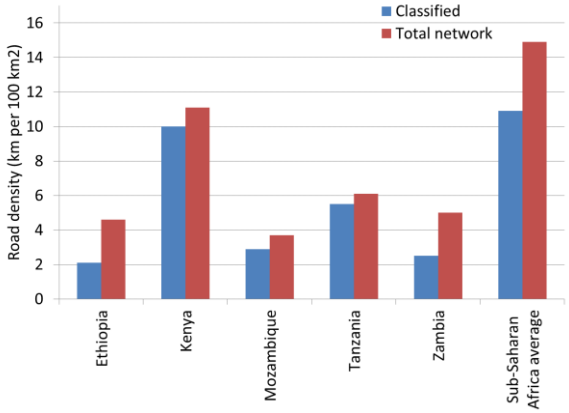
[21] The choice of farmers to diversify their cropping systems in order to insure themselves against weather shocks has been widely documented in the literature (Benin et al., 2004; Di Falco et al., 2010; Bezabih and Sarr, 2012; Bezabih and Di Falco, 2012).

84. The shortage is more pronounced in rural areas, especially in the poorest parts of the country. Around 81 percent of rural residents are still disconnected from reliable all-weather road networks. This means that about 14.5 million Mozambicans are isolated from the main urban centers, markets and public infrastructure (Iimi and Rao, 2015). This compares unfavorably with other countries in the region. While preliminary estimates for the overall RAI for Mozambique are about 19 percent, it is estimated at 58 percent in Kenya.[22] Road quality is also a concern, particularly in rural areas, where most roads connecting villages to district centers remain unpaved and in poor condition (Iimi and Rao, 2015). Transport connectivity is particularly weak in the northern and inland provinces (such as Niassa, Sofala, Nampula, Zambezia, and Tete) where poverty is also the highest (figure 4.9). Rural accessibility seems to be highly correlated with poverty rates at the district level. In particular, poverty tends to be higher than 60 percent where rural access is limited to less than 20 percent (Iimi and Rao, 2015). Transport costs are also highest in the poorest and most rural provinces.

Rural Accessibility Index

The Rural Accessibility Index (RAI) is a key transport headline indicator that has been established to focus on the critical role of access and mobility in the reduction of poverty in developing countries. The RAI estimates the proportion of the rural population who have adequate access to the transport system. In this section, a newly developed RAI that uses technologies such as geo-referenced road network data and highly disaggregated population distribution data is used. It estimates the share of the population that lives within a 2-km distance from the nearest road in good condition.

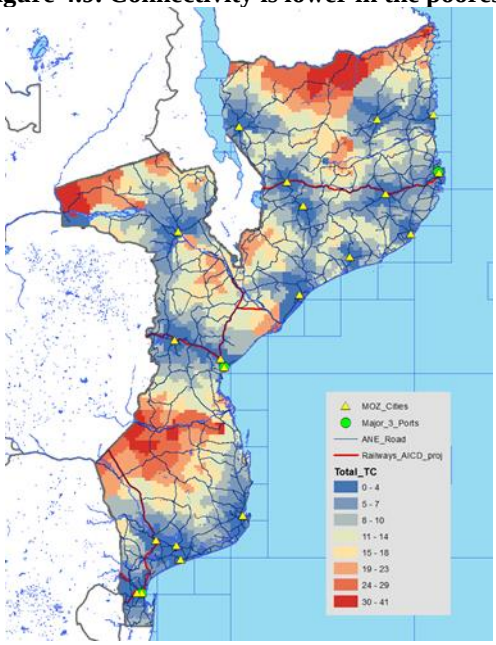
Figure 4.8. Mozambique's road density is low



Source: Gwilliam (2011)

[22] A preliminary version of the RAI is published in the forthcoming report: "Mozambique: Spatial Analysis of Transport Connectivity and Growth Potential", World Bank, 2106. A new RAI is currently being calculated with updated road network data.

Figure 4.9. Connectivity is lower in the poorest areas



Source: Iimi and Rao, 2015. Calculations based on data provided by National Roads Administration
Note:Higher values of the variable Total_TC denote lower levels of connectivity

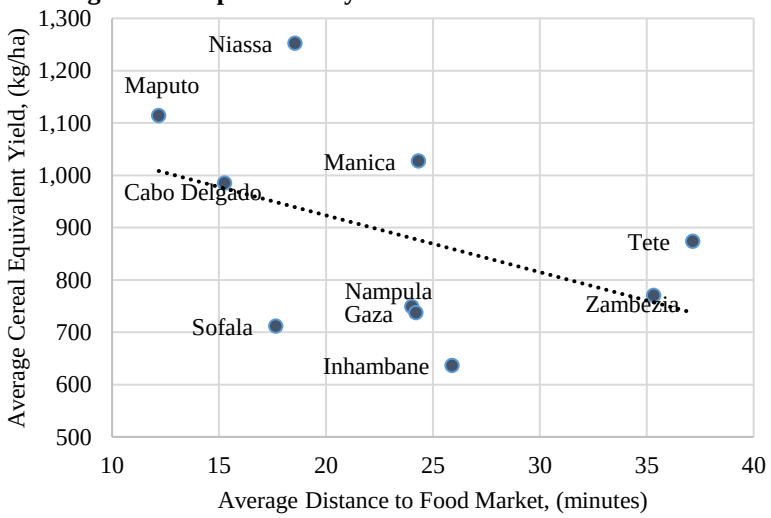
85. Low agricultural productivity and high transportation costs appear to be associated with the low connectivity of farmers. Farmers in more isolated provinces tend to have, on average, lower levels of cereal equivalent yields (figure 4.10). In this case, distance to the nearest food market is used as a proxy for isolation. The negative association also holds when using different proxy measures of isolation such as distance to closest bus stop, health facility and primary school. Likely due to poor connectivity, a strong negative correlation between productivity and transport costs also exists. Average maize productivity, for instance, is estimated at about 1.2 tons per hectare in the districts that have close access to markets, namely where transport costs are lower than US$2 per ton. Conversely, where transport costs exceed US$20 per ton, maize productivity appears to be nearly 20 percent lower (Iimi and Rao, 2015). While it is not possible to establish a definitive causal link due to data limitations, these results are consistent with the idea that long distances to markets do not provide incentives to farmers to increase their productivity levels since the transportation costs that they face are high compared to the revenue that they would earn from the commercialization activity.

86. Low farmer connectivity has arguably contributed to preventing the agricultural potential of Mozambique from being realized. Simulation analyses suggest that a 10 percent reduction in transport costs to major cities would increase household agricultural production values by 2.7 percent (Iimi and Rao, 2015). This result is consistent with the idea that road investments could contribute to raise agricultural productivity by linking high-potential rural areas to markets. As the rural population of Mozambique is expected to grow from 15 million to about 25 million by 2050, efforts for improving rural transport infrastructure will be particularly relevant to help provide better economic and social opportunities to rural dwellers (Iimi and Rao, 2015).

87. Underlying the relatively lower productivity of more isolated areas is arguably a weaker access and lower use of some important agricultural inputs. While the negative

relationship does not hold for all types of inputs and production support services, there are some cases in which less connected farmers report lower utilization of improved agricultural technology. For instance, provinces with a lower RAI are characterized by a lower proportion of farmers who are members of agricultural associations. The percentage of farmers who use irrigation also seems to be correlated with vicinity to roads. In addition, better-connected farmers are also more likely to use fertilizer, although rates remain low across the country. This is true for all provinces except Niassa and Tete, which share the longest borders with Malawi, where an extensive program of subsidy for fertilizers is in place.

Figure 4.10. Agricultural productivity falls as the distance to food market increases



Source: World Bank based on IOF 2008/2009 and AIS 2012

Access to market information

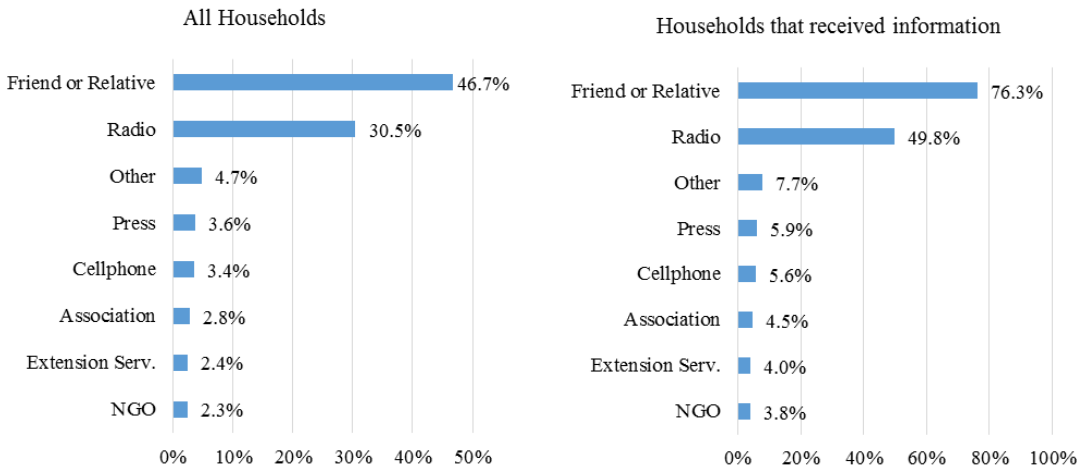
88. Mozambican farmers still face significant obstacles in gathering input and output market information that can help them form decisions to make the most out of their crop choices and harvests. In order for farmers to benefit from vicinity to markets, access to timely and reliable information is crucial. Information can help farmers make better decisions on where to purchase inputs or sell production, how to prepare for weather events, how to choose and plant the best seed varieties, and how to combat diseases and pests most effectively. Access to information on agricultural prices is of particular relevance for small-holders deciding to sell part of their production. However, access to this type of information is still limited among Mozambican farmers. In 2012, only 61 percent of farmers declared having received information on prices over the previous 12 months (AIS 2012). In addition, only 7 percent of farmers reported having received extension information over the same period.

89. Farmers are still overwhelmingly reliant on friends, relatives, and the radio for gathering information on agricultural prices. Over 76 percent of farmers that received price information listed their friends or relatives as a source. While over 34 percent of households declare owning a cellphone, only 3.4 percent cite it as a source of price information. Overall, less than 16 percent of farmers reported having received information from sources other than relatives, friends, and the radio (figure 4.11). In some particularly poor and rural regions, this proportion

shrinks considerably (in Zambezia, for example, only 9 percent of farmers received price information from sources other than relatives, friends, and the radio).

90. Farmers who received price information were more likely to sell some of their production. Only 18.7 percent of farmers who did not receive price information sold some of their agricultural products, as opposed to 24.7 percent of those who did (AIS 2012). Arguably, expanding the role and outreach of information and communication technologies to enable timely and affordable dissemination of relevant information to farmers would help reduce transaction costs in the Mozambican agriculture sector, promote market participation and raise economic efficiency.

Figure 4.11: Farmers rely on friends, relatives and the radio for gathering market information



Source: World Bank based on AIS (2012)

5. The Vulnerability of Household Welfare to Weather Shocks

5.1 Mozambique's High Propensity to Natural Disasters

91. Globally, Mozambique is among the countries with the largest exposure to various types of natural hazards. It is extensively and increasingly subject to cyclones, floods and droughts and secondary hazards arising from these events**.** While 17 natural hazards (i.e. droughts, earthquakes, floods, storms) were recorded in the country between 1993 and 2002, as many as 28 occurred between 2003 and 2012 (World Bank, 2013). Mozambique is ranked higher than other neighboring countries in terms of exposure to floods, cyclones, droughts, and all natural hazards combined (which also include earthquakes and tsunamis), as shown in table 5.1 (EMDAT, INFORM, 2016). The country also ranks high in two other dimensions (vulnerability and lack of coping capacity) of the same index.

Table 5.1: Mozambique is highly exposed to natural disasters

COUNTRY	Earth-quakes	Flood	Tsunami	Tropical Cyclone	Drought	**Natural Hazards**	**INFORM RISK**
Mozambique	2.5	5.8	6.7	8.3	5.2	**6.0**	**5.8**
Madagascar	0.1	6.6	7.4	7.6	3.7	**5.7**	**4.9**
Tanzania	4.5	5.4	4.2	0.3	4.6	**4.0**	**4.6**
South Africa	0.4	5.0	5.5	0.4	4.8	**3.5**	**3.7**
Malawi	3.8	5.2	0.0	0.8	5.1	**3.3**	**4.2**
Zimbabwe	0.2	3.8	0.0	0.4	6.2	**2.5**	**4.2**
Zambia	1.4	4.3	0.0	0.0	3.7	**2.1**	**4.2**

Source: INFORM, 2016

Note: Scores are calculated on a 0-10 scale, with 0 representing the lowest risk and 10 the highest risk

92. Long and severe droughts constitute a recurring threat. Severe droughts are experienced in 7 out of 10 years in the Southern regions, and in 4 out of 10 years in the Central regions (GFDRR, 2012). Lower-intensity droughts occur even more frequently. Unlike other weather shocks, droughts tend to affect large areas and have negative consequences for extended periods of time. Overall, it is estimated that droughts have affected over 17 million Mozambicans since 1956, and drought risk is projected to increase over the coming years, both in terms of higher frequency and longer duration of droughts (EM-DAT, GFDRR, 2012).

93. Mozambique is also particularly exposed to cyclones and floods. The Mozambican coastline borders one of the most active basins of tropical cyclones, the Southwest Indian Ocean. Each year, on average, Mozambique is hit by one tropical storm or cyclone, and by three or four additional tropical disturbances (UN-Habitat, 2015). Tropical cyclones have produced devastating effects in the country, with five tropical cyclones (of category 1 to 4) making landfall between 2000 and 2008. The coastal region, home to over 60 percent of Mozambicans, is the most heavily affected and often experiences widespread destruction of infrastructure and population displacement as a result of cyclones (GFDRR, 2012). Frequent floods, another common threat, tend to result from the high winds and heavy rain associated with cyclones, but also from a combination of excess rainfall, upstream discharges from major river basins, and poor drainage

infrastructure. Floods generally occur every two or three years, mostly during the rainy season and along the nine major international river systems that cross Mozambique or across the low-lying, densely-populated coastal areas. Extreme floods tend to occur once every 15 to 20 years. It is estimated that floods have affected over nine million Mozambicans since 1958 (GFDRR, 2012).

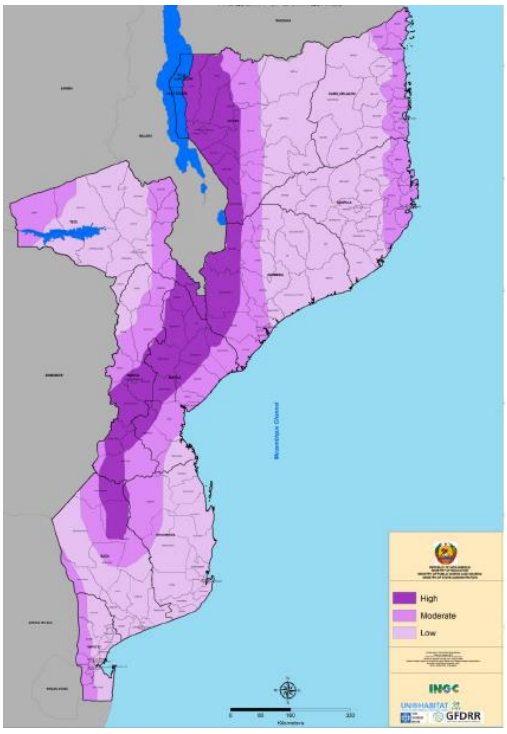
94. Some degree of exposure to geological hazards, while relatively low in Mozambique, is also present. Generally, Mozambique tends to be considered as free from seismic activity. However, since 2006, the country has experienced more than 80 earthquakes, with magnitudes ranging from 3.9 to 7. In addition, starting in early 2015, continuous seismic activity has been recorded, peaking at magnitude 7.0 (UN-Habitat, 2015). Therefore, while in the past geological risks have not been particularly severe in the country, presently they do represent a valid concern.

95. The costs of weather-related disasters are particularly high given the country's heavy reliance on the agricultural sector for providing livelihoods to the vast majority of its population. The potential for disaster losses in the agricultural sector is extremely high in Mozambique. In fact, the almost totality of production (97 percent) comes from rain-fed agriculture, which is particularly vulnerable to extreme weather events. A 2009 estimate of drought and flood costs places average annual losses of maize and sorghum at 9 percent and 7 percent of each crop, respectively. Further losses of around 20 percent of crops are also estimated to occur once every ten years (GFDRR, 2012). Climate shocks do not impose costs solely on the agricultural sector, but also on buildings and physical infrastructure. It has been estimated that an average of 100km of roads and 33,000 households are impacted by flooding every year in Mozambique, resulting in direct losses of about US$700,000 and US$17.5 million respectively. The high concentration of population and economic activities in coastal areas predisposes the country to large losses in case of extreme weather events. For example, in 2000, cyclone Eline imposed an estimated cost equal to 20 percent of GDP (GFDRR, 2012).

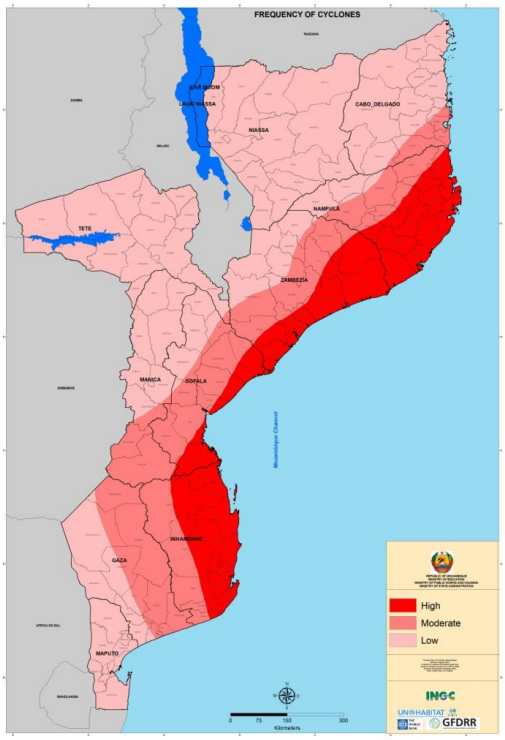
96. There is high regional variation inside Mozambique in the occurrence of weather shocks. Exposure to natural hazards, both in terms of frequency and intensity, varies substantially across the country. For instance, the southern and inland regions are more prone to suffer droughts than the northern and coastal regions. Conversely, areas most affected by cyclones are generally located along the coastline. In terms of floods, areas along the major international river systems are the ones most likely to be affected, as illustrated figure 5.1 (UN-Habitat, 2015).

Figure 5.1. The incidence of natural shocks vary across regions in Mozambique

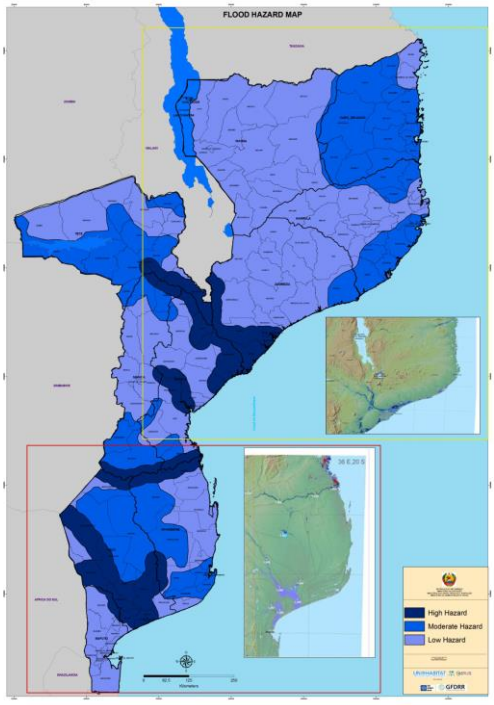
(Earthquakes Frequency Map)



(Cyclones Frequency Map)



(Flood Hazard Map)



(Drought Hazard Map)

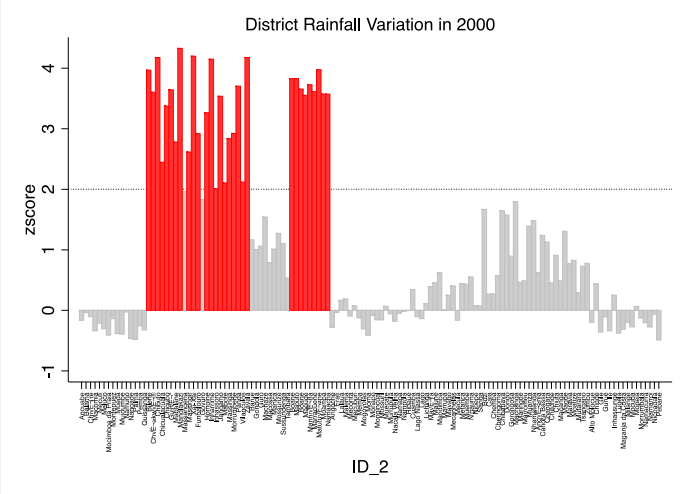
Source: UN-Habitat, 2015

5.2 Rainfall Patterns and Anomalies

97. Mozambique has a tropical climate that is characterized by two seasons. The wet (rainy) season goes from October to March, and is characterized by heavier rainfall between December and March. Most cyclones are also experienced over the same period, especially in the coastal areas. The dry season extends from April to September, and is particularly pronounced in the south of the country, making it more prone to drought. Due to Mozambique's location in the tropical zone, temperatures do not fluctuate much within and across seasons.[23]

98. Rainfall shocks are prevalent across regions in Mozambique. They are defined here in this chapter as district-level annual cumulative rainfall events between 1950 and 2014 that were two standard deviations above (for floods) or below (for droughts) the historical annual mean for the corresponding district. The annual historical mean is calculated over the 1901-2014 period for each of the 128 districts into which the 11 provinces of Mozambique are divided. It is observed that extreme precipitation (whether in deficit or in excess) occurs with relative frequency. There is wide geographical variation across the country; provinces such as Niassa, Tete, Inhambane and Manica record the largest number of rainfall anomalies. Major disasters such as the floods in 2000, which were caused by Cyclone Eline and Cyclone Judah and affected mostly districts in the Inhambane and Gaza provinces, are well captured by the rainfall shock variable (figure 5.2).

Figure 5.2. Large rainfall anomalies were caused by cyclones Eline and Judah in 2000

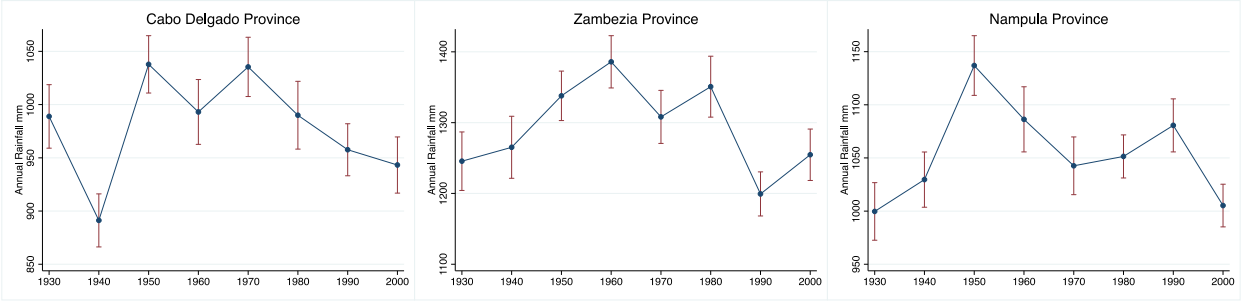


Source: World Bank staff calculations using CRU-TS data
Note: red bars show districts where cumulative rainfall was two or more standard deviation away from the district-level historical mean

[23] Identifying rainfall anomalies, the most important dimension of weather variation in Mozambique, requires rich historical climate data. The data used for the empirical analysis of this chapter comes from the CRU TS dataset, which is managed by the Climate Research Unit at University of East Anglia. It provides extensive spatial and temporal gridded monthly precipitation data for global land areas for the period 1901-2014, with a resolution of 0.5 x 0.5 degrees (50 x 50 km). The data is constructed using records from more than 2,400 meteorological stations across the world. Station anomalies are interpolated into grid cells combined with local climatology data to obtain absolute monthly values. The variables included in the dataset in addition to precipitation are mean temperature, diurnal temperature range, wet-day frequency, vapor pressure and cloud cover (Harris, et al. 2014). For the empirical analysis, the rainfall and temperature variables are weighted by population at the district level and are obtained by overlaying the gridded CRU TS climate data with population and district-level grid maps.

99. Further analysis of weather data over a long interval of time reveals that some regions of Mozambique are experiencing a reduction in total rainfall. One of the expected consequences of a warmer world is a regional change in total precipitation. In Mozambique, some provinces recorded rainfall levels in the 2000s that are quantitatively and statistically lower that the levels seen in previous decades. For instance, Cabo Delgado recorded an annual rainfall average of 957 and 943 millimeters in the 1990s and 2000s, respectively. These levels of precipitation are statistically lower than the average annual precipitation in the 1970s (1035 millimeters). In the case of Zambezia, its rainfall levels in the last 25 years are lower than those recorded between the 1950's and 1980s. A similar pattern is observed for Nampula, which jointly with Zambezia are the poorest provinces in the country (figure 5.3).

Figure 5.3. Some provinces in Mozambique are experiencing lower rainfall in recent decades



Source: World Bank staff calculations using CRU-TS data

100. There is, however, no evidence of changes in rainfall seasonality across the country and variability across years. Climate change is expected to also alter other aspects of rainfall regimes such as the seasonal distribution across space, namely a change in the timing of the onset of the rainy and dry seasons across different regions. Similarly, the literature predicts changes in inter-annual variability. Both variations are expected to have effects on agricultural output and farmers' livelihoods. The rainfall data from CRU TS for Mozambique does not provide evidence of such changes: 10-year average monthly rainfall shares are statistically similar for every month for the period 1930-2014, suggesting that the seasonal changes in rainfall recorded for Mozambique are within the standard intervals of variation. Likewise, there is no evidence of a systematic change in rainfall variation across years.

5.3. The Effects of Rainfall Shocks in Early Life on Long-Term Human Welfare

Weather shocks reduce household welfare

101. The objective of this analysis is to empirically estimate the causal effect of exposure to rainfall shocks in early childhood on long-term socioeconomic outcomes in Mozambique. The analysis is based on rainfall variation across space and time. More specifically, it compares the outcomes of adults who were in districts exposed to extreme rainfall anomalies around the time of birth (i.e. in utero or during the first year of life) against outcomes of individuals in the same age cohort who resided in districts not affected by weather shocks as well as against outcomes of individuals from slightly or older younger cohorts in affected and unaffected districts. The causal effects of the shocks were obtained using statistical regression analysis that run measures of long-

term outcomes of a certain individual *i* in a district *d* and at time *t*, and the weather shock indicators (see Annex 1 for more details about the empirical design and data).

102. Exposure to extreme early-life rainfall anomalies, and particularly to floods, appears to have a negative relationship with the employability of individuals in adulthood. First, the analysis investigates whether individuals that experienced severe droughts or floods while in utero or during their first year of life are less likely to participate in the labor market or not. Two indicators are defined: the first one (Labor Participation 1) measures engagement or desire to work in remunerated activities, whereas the second one (Labor Participation 2) adds participation in non-remunerated activities to the first definition. The results indicate that excess of rainfall while in utero had a negative effect on their probability to participate in the labor market later in life (Table 5.2). Affected individuals exhibit on average a participation rate that is 6 percent lower compared to the control mean. This subset of the findings is quite consistent across subsamples (all versus rural) or the inclusion of variable for factors that are specific to districts (also known as "fixed effects").[24] As for the droughts, they are not found to influence labor force participation, regardless of whether they were experienced while in utero or in the first year of life.

Table 5.2. Early-life rainfall anomalies associated with lower employability by adulthood

	Labor Participation 1				Labor Participation 2			
	All		Rural		All		Rural	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lack of rain utero	0.025	0.015	0.019	0.014	0.017	0.010	0.013	0.010
	(0.034)	(0.031)	(0.034)	(0.031)	(0.034)	(0.031)	(0.034)	(0.031)
Lack of rain 1st year	0.044	0.040	0.036	0.036	0.037	0.035	0.031	0.032
	(0.029)	(0.027)	(0.030)	(0.027)	(0.029)	(0.027)	(0.029)	(0.028)
Excess of rain utero	-0.030**	-0.041**	-0.034**	-0.040**	-0.033**	-0.040***	-0.036**	-0.040***
	(0.015)	(0.016)	(0.015)	(0.016)	(0.015)	(0.015)	(0.015)	(0.015)
Excess of rain 1st year	0.006	-0.012	0.005	-0.011	0.004	-0.008	0.004	-0.008
	(0.015)	(0.014)	(0.014)	(0.014)	(0.014)	(0.013)	(0.013)	(0.013)
R-squared	0.093	0.139	0.090	0.127	0.100	0.132	0.098	0.126
Control Mean	.657	.657	.659	.659	.667	.667	.669	.669
Observations	19,018	19,018	18,593	18,593	19,018	19,018	18,593	18,593
District FE	no	yes	no	yes	no	yes	no	yes

Source: World Bank staff calculations using IOF-2008/09

Note: Robust standard errors in parenthesis clustered at the birthyear-district level. Labor Participation 1 = 1 if individual either worked in the past 7 days or did not work but had a job. Labor Participation 2 is equal to Labor Participation 1 but also include individuals that either worked in the past 7 days or had been looking for jobs in the past month. Rainfall shocks are defined as two standard deviations below (drought) or above (floods) the historical mean for the district. *** p<0.01, ** p<0.05, * p<0.1.

103. Similarly, floods are associated with a lower level of expenditures per capita and higher likelihood of households to be poor. The analysis also investigates the relationship between droughts and floods and expenditures per capita. Seeking to pinpoint the direct effects on household wellbeing, the subsample for this part of the analysis consists of individuals that are household heads. Consistent with the results on labor participation, households headed by individuals that were hit by floods while in utero and during early childhood record lower consumption per capita, approximately 14 percent less than the median consumption of the

[24] Since the 2008-09 IOF did not collect the exact month of birth (but only the year) of the individuals interviewed, the window used to define the in utero and first year of life periods are imprecisely measured. Arguably, this could explain why the effects of floods are seen only for the in utero period.

comparison group (table 5.3). The results are statistically weaker for the rural subsample. Regarding poverty vulnerability, lower consumption per capita due to floods that affected individuals early in life increases the likelihood that the households they head in adulthood fall below the poverty line (9 percentage points or around 18 percent). This evidence suggests that effects of uninsured weather shocks that occurred decades ago show strong persistence over time and are still felt by affected individuals and their families to this day.

Table 5.3. Early rainfall anomalies also increase the risk of poverty

	Expenditure per capita				Probability of being poor			
	All		Rural		All		Rural	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lack of rain utero	0.177	-1.370	-0.173	-1.181	0.070	0.020	0.092	0.039
	(4.693)	(5.389)	(4.799)	(5.652)	(0.101)	(0.098)	(0.101)	(0.099)
Lack of rain 1st year	-0.245	-1.484	0.221	-2.107	0.069	-0.010	0.066	-0.009
	(4.168)	(4.895)	(4.171)	(4.889)	(0.083)	(0.077)	(0.083)	(0.077)
Excess of rain utero	-7.309*	-5.017	-6.359*	-4.742	-0.005	-0.027	-0.008	-0.028
	(3.819)	(4.968)	(3.794)	(4.975)	(0.040)	(0.038)	(0.040)	(0.038)
Excess of rain 1st year	-8.097***	-4.429*	-7.045**	-3.990	0.099**	0.093**	0.095**	0.092**
	(2.860)	(2.693)	(2.809)	(2.674)	(0.042)	(0.039)	(0.042)	(0.039)
R-squared	0.011	0.038	0.011	0.033	0.015	0.084	0.015	0.083
Control Mean	27.744	27.744	27.110	27.110	0.498	0.498	0.500	0.500
Observations	6,321	6,321	6,228	6,228	6,321	6,321	6,228	6,228
District FE	no	yes	no	yes	no	yes	no	yes

Note: Robust standard errors in parenthesis clustered at the birthyear-district level. Rainfall shocks are defined as two standard deviations below (drought) or above (floods) the historical mean for the district. *** p<0.01, ** p<0.05, * p<0.1.
Source: World Bank staff calculations using IOF-2008/09

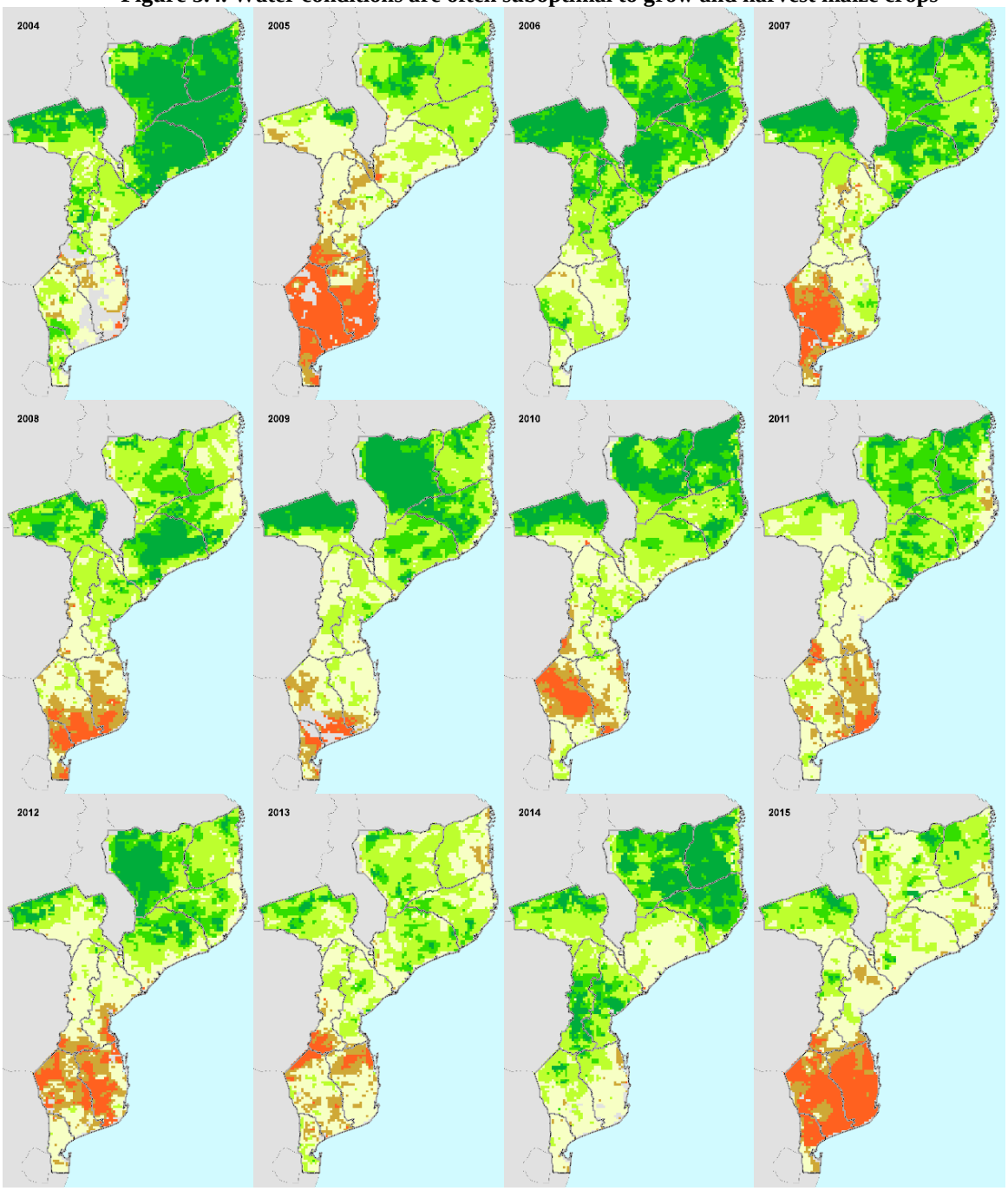
Why Negative Effects? The agricultural output channel

104. The burden placed by rainfall shocks on agricultural output in the short term is identified as the most plausible channel driving the effects on socioeconomic outcomes in the long run. Back in the 1970s, virtually all Mozambicans (nearly 98 percent) lived in rural areas. At the time, agriculture –even more so than today— represented the main source of their livelihoods. Arguably, agriculture is therefore the main mechanism at play behind the observed negative impacts, as the shocks examined in this study are expected to strongly affect soil water balance. As a result, severe droughts or floods can exert a negative impact on yields and, in turn, on household income, consumption and food security.

105. In the case of droughts, a measure that examines the relationship between water conditions and agricultural yields in Mozambique can be used to gauge the possible effects of water shortage on agricultural output. The Water Requirement Satisfaction Index (WRSI) is a measure employed by the Famine Early Warning System project (FEWS NET) to predict harvest outcomes and to identify potential food security issues on a seasonal basis. The WRSI is defined as the ratio of seasonal actual crop evapotranspiration to the seasonal crop water requirement, and captures the expected impact of water deficits on harvest at different points in time over the growing season. The WRSI is crop-specific, spatially explicit and dynamically identifies start-of season based on rainfall patterns. It ranges between 0 and 100, with values below 50 showing levels of soil water well below the minimum. Its limitations include not accounting for excess water (e.g. floods), and the fairly coarse resolution of some of its static inputs (e.g. soil water holding capacity). The computation of the WRSI for Mozambique confirms the high prevalence

of years in which soil humidity is well below the critical levels required for the normal growth and harvest of maize crops (figure 5.4).

Figure 5.4. Water conditions are often suboptimal to grow and harvest maize crops

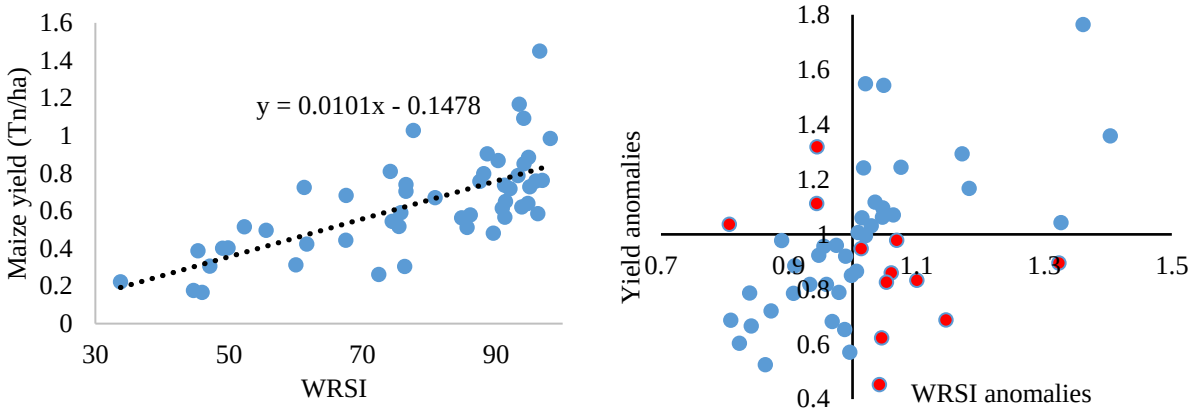


Source: World Bank staff calculations using FEWS NET and FAO Agromaps
Notes: orange color denotes geographic areas were maize crops were projected to fail due to excessively low soil humidity

106. Weather data and crop growth models reveal the high sensitivity of agricultural output to extreme weather in Mozambique. While data on agricultural yields at the province level is patchy, looking at the unconditional correlation between the WRSI for maize and their

corresponding yields reveals evidence of a positive relation between water supply during the growing season and crop performance (figure 5.5). A ten-unit reduction in the cumulative crop water requirement index is shown to reduce maize yields by 0.1 tons per hectare. Figure 6.5 also illustrates the existence of a positive relationship between yield anomalies (i.e.: deviations from the mean at the provincial level) and WRSI anomalies. Since the WRSI is capped at 100 and is not designed to measure excess water, the points located in the lower right of the graph might be revealing the negative effects of too much rain or flooding. Low values of the WRSI are observed with high frequency in Mozambique, and this may be indicative of recurrent crop failures in the areas in which precipitation levels fall well below the historical mean (as shown in Figure 5.5).

Figure 5.5. Maize yields in Mozambique are highly sensitive to lack of rainfall



Source: World Bank staff calculations using FEWS NET and FAO Agromaps
Note: WRSI provincial average from posto levels measured on X-axis. Maize yields at the provincial level measure in tons per hectare on the Y-axis Provinces: Cabo Delgado, Gaza, Inhambane, Maputo, Manica, Nampula, Nassa, Sofala, Tete and Zambezia. Years: 2002, 2005, 2006, 2007 and 2008.

107. Lower crop yields caused by rainfall shocks can reduce household incomes and consumption, and significantly affect parents' ability to afford nutritional inputs for their young children. When confronted with floods or droughts, households may be forced to cut basic investments in the nutrition and human capital of their children. As a result, the underlying mechanism which causes the effects of rainfall shocks to persist over time is arguably their influence on critical endowments of affected individuals, such as their health during a crucial period of physical development (i.e. the nutritional environment in the womb and in the first year of life). Therefore**,** the same identification strategy employed in the models above is used to explore the contemporaneous (i.e. short-term) impacts of the same floods and droughts on the anthropometrics of children (0-4 years old), more specifically on the height-for-age z-score, a strong predictor of height in adulthood.

108. The results show a strong relationship between rainfall anomalies (both droughts and floods) in the first year of life and the height-for-age z-score. Shortly after the extreme shocks occur, affected children are about 0.6 standard deviations smaller than the control children, whose mean is -1.89 standard deviations below the World Health Organization international reference group. The results, illustrated in table 5.4, are robust across specifications and subsamples, and are statistically significant in a quantitative sense.

Table 5.4. Rainfall shocks deteriorate the nutritional status of affected children

	Height for Age z-score			
	All		Rural	
	(1)	(2)	(3)	(4)
Lack of rain utero	-0.160	0.154	-0.054	0.174
	(0.194)	(0.176)	(0.184)	(0.176)
Lack of rain 1st year	-0.779***	-0.582***	-0.670***	-0.559***
	(0.172)	(0.165)	(0.158)	(0.165)
Excess of rain utero	-0.500	-0.449	-0.409	-0.447
	(0.363)	(0.286)	(0.361)	(0.286)
Excess of rain 1st year	-1.177**	-0.818**	-1.072**	-0.805**
	(0.515)	(0.363)	(0.510)	(0.362)
R-squared	0.026	0.110	0.028	0.104
Control Mean	-1.893	-1.893	-1.987	-1.987
Observations	5,620	5,620	5,056	5,056
District FE	no	yes	no	yes

Source: World Bank staff calculations using IOF-2008/09

Note: Robust standard errors in parenthesis clustered at the birthyear-district level. Rainfall shocks are defined as two standard deviations below (drought) or above (floods) the historical mean for the district. *** p<0.01, ** p<0.05, * p<0.1.

Why Negative Effects? The short- and long-term human capital and productivity channel

109. Children affected by shocks are found to perform more poorly in terms of schooling indicators, and this is possibly mediated by the negative effects of extreme rainfall anomalies on their health as infants. Results of econometric analysis on school participation and attainment show that droughts reduce the likelihood of school-aged children to attend school regularly. Overall, affected children accumulate 0.2 fewer years of schooling, equivalent to a drop in their school attainment of 6 percent relative to the mean among unaffected children (3.3 years) (table 5.5). Similarly, affected individuals are 1.4 percentage points (2.8 percent) less likely to accumulate some level of education. It is unlikely that rainfall anomalies occurring around the time of birth exerted a direct impact on school enrollment, attendance, progress and attainment of the children. In fact, affected infants had to wait at least 4 or 5 years after the shocks happened before they formally started school. The most plausible explanation is therefore that the negative effects of droughts and floods on the schooling of affected individuals are mediated by the influence that these shocks exerted on their nutritional and health status as infants.

110. The nutritional deprivations suffered in infancy also appear to have long-lasting consequences on the physical development of affected individuals. In an effort to connect early life health shocks –caused by extreme weather– and well-being in adulthood, the analysis looks at the height of adults several decades after they experienced droughts and floods around the time of birth. While comprehensive data on adult anthropometrics is rarely available in household surveys, the Demographic and Health Survey (DHS) constitutes an exception but collects data only for women 15 to 40 years old, and not for men. The DHS also lacks information concerning the place and date of birth of adults in the sample**.** For this analysis, women's anthropometric data (i.e.: height, measured as a percentage of an international reference group) in the DHS is used. An attempt to circumvent lack of information on date and location of birth is made by restricting the sample to include only districts with permanent migration rates below 20 percent. To do so, the 1997 census is used to calculate the share of adults born in the same district of permanent residence.

Reduced-form results on this sample are shown in columns 5 and 6 of table 5.6[25]. The results indicate that extreme rainfall events experienced during infancy, particularly droughts for the district fixed effect models, hamper the physical development of women. Affected women are around 0.5-0.7 centimeters shorter than the comparison unaffected women, on average.

Table 5.5. Children affected by droughts exhibit poorer school participation and attainment outcomes

	School Attendance		Education Attainment		Any Education	
	All	Rural	All	Rural	All	Rural
	(1)	(2)	(3)	(4)	(5)	(6)
Lack of rain utero	-0.261***	-0.262***	-0.213	-0.201	-0.015*	-0.014*
	(0.069)	(0.069)	(0.274)	(0.277)	(0.008)	(0.008)
Lack of rain 1st year	0.064	0.064	-0.466*	-0.446*	0.011	0.013
	(0.041)	(0.041)	(0.247)	(0.252)	(0.008)	(0.008)
Excess of rain utero	-0.005	-0.003	0.220	0.220	0.007	0.009
	(0.011)	(0.011)	(0.190)	(0.190)	(0.006)	(0.006)
Excess of rain 1st year	-0.008	-0.009	0.057	0.047	0.008	0.010
	(0.012)	(0.012)	(0.165)	(0.167)	(0.008)	(0.008)
R-squared	0.077	0.078	0.260	0.243	0.197	0.170
Control Mean	0.932	0.931	3.438	3.348	0.532	0.509
Observations	8,304	8,134	14,232	13,871	488,192	457,854
District FE	yes	yes	yes	yes	yes	yes

Source: World Bank staff calculations using data from the Mozambique DHS 2011

Note: Robust standard errors in parenthesis clustered at the birthyear-district level. Rainfall shocks are defined as two standard deviations below (drought) or above (floods) the historical mean for the district. Height-for-age variable defined as the percentage of the height-for-age in a reference population.*** p<0.01, ** p<0.05, * p<0.1.

111. Suggestive evidence of positive returns to health in Mozambique is found, implying that uninsured weather shocks that worsen nutrition status also leads to lower productivity. The existence of a positive association between improved nutrition and increased productivity is often assumed and has been widely demonstrated in the empirical literature. Good health is particularly important in agricultural settings in developing countries, where the structure of employment requires strong physical development, particularly among men. To contextualize the negative effects of weather shocks on adults' height, this study provides non-parametrical estimates of the relationship between height and school attainment and wealth for adult women in Mozambique (figure 6.6). The results show a positive relationship between women's height and human capital and wealth accumulation. This implies that the physical development lost due to extreme weather is likely to translate into lower productivity and, ultimately, lower welfare.[26]

Table 5.6. Weather shocks early in life appear to undermine physical development later in life

	Height for Age Adults					
	All		Rural		Low Migration	
	(1)	(2)	(3)	(4)	(5)	(6)
Lack of rain utero	-0.338	-0.467	-0.299	-0.558	-0.333	-0.406
	(0.544)	(0.580)	(0.588)	(0.626)	(0.437)	(0.457)
Lack of rain 1st year	-0.287	-0.582*	-0.205	-0.627*	-0.332	-0.610**

[25] The internal validity of these results may be compromised by the fact migration decisions are likely endogenous to weather shocks. However, a district-level regression of migration rates on weather shocks and district fixed effects do not reveal systematic differences in migration patterns between affected and non-affected villages.

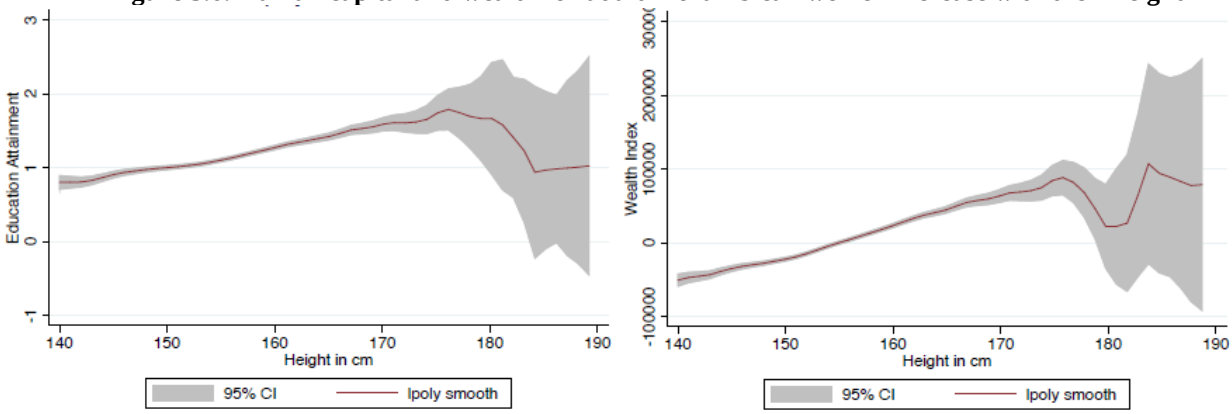
[26] The relationship is estimated with much less precision for women above 175cms because of the low number of observations in this height range.

	(0.330)	(0.323)	(0.341)	(0.337)	(0.306)	(0.304)
Excess of rain utero	-0.522**	-0.328	-0.524**	-0.329	-0.483*	-0.330
	(0.250)	(0.207)	(0.264)	(0.229)	(0.259)	(0.250)
Excess of rain 1st year	-0.196	-0.111	-0.175	-0.095	-0.137	-0.109
	(0.293)	(0.269)	(0.306)	(0.270)	(0.298)	(0.294)
R-squared	0.012	0.105	0.012	0.105	0.012	0.097
Control Mean	94.772	94.772	94.703	94.703	94.708	94.708
Observations	7,445	7,445	6,954	6,954	7,305	7,097
District FE	no	yes	no	yes	no	yes

Source: World Bank staff calculations using data from the IOF-2008/09 and the Population Census 2007

Note: Robust standard errors in parenthesis clustered at the birthyear-district level. Rainfall shocks are defined as two standard deviations below (drought) or above (floods) the historical mean for the district. Any education is binary variable that takes a value 1 if the individual has one or more years of education, and zero otherwise. *** p<0.01, ** p<0.05, * p<0.1.

Figure 5.6. Human capital and wealth for adult Mozambican women increase with their height



Source: World Bank staff calculations using data from the Mozambique DHS 2011

Note: Locally weighted scatterplot (lowess). Bandwidth = 1.94 for height-educational attainment function and 1.8 for height-wealth index function. Bootstrapped 95% confidence interval shown in gray.

6. Conclusion

112. Over the past two decades Mozambique enjoyed robust and accelerating economic growth, yet strong economic progress only translated into modest poverty reduction. The economy grew by an average of 7.9 percent per year from 1993 to 2014, an impressive rate by regional and global standards. However, Mozambique has struggled to translate this stellar growth into poverty reduction. Between 1997 and 2009, for each percent increase in SSA's per capita GDP, poverty fell by 0.5 percent in the region. Over the same period, for each percent of growth in Mozambique, poverty fell by only 0.26 percent in the country, nearly half as fast as the pace of poverty reduction in the region. At 52 percent in 2009, the level of poverty level is high both regionally and globally. After the end of the civil war in 1993, Mozambique was the third poorest country in the world. By 2013 it was the 13th poorest, signaling progress in poverty reduction. Yet, with a poverty rate of 69 percent ($1.9 2011PPP), Mozambique still ranks among the countries with the highest levels of poverty, alongside countries such as Liberia, Guinea-Bissau, Malawi, Democratic Republic of Congo, Burundi and Madagascar.

113. Not only poverty fell at slower pace than expected but the gains in income and consumption growth are unevenly distributed across the country and across groups of people. Some parts of the country –especially the center and the north– account for a disproportionate share of the poor. Overall, urban provinces tend to have lower poverty rates than rural provinces, particularly those in the central and northern parts of the country. Maputo City has the country's lowest poverty rate. At the other end of the distribution, Zambezia has a poverty rate in the order of 73 percent. Rather than falling as in the rest of the country, poverty increased between 2003 and 2009 in the provinces of Zambezia, Sofala, Manica, and Gaza. These five provinces together accounted for approximately 70 percent of the poor, a considerable increase from 59 percent in 2003. Looking across income groups, the better off benefitted disproportionally from economic growth. Between 2002/3 and 2008/9, the annual growth rate of per capita expenditure of the bottom 40% of the population was lower than the rate of the upper part of the distribution.

114. Three factors contribute to the low equity outcomes in Mozambique: unequal access to economic opportunities across regions and income groups, low productivity and market-based growth in agriculture and high vulnerability to weather shocks. Growth could have had a much larger impact on poverty reduction in Mozambique if its effects had not been offset by the observed increase in inequality. Largely contributing to that inequality is the lagging behind of the most isolated regions in the norther parts of the country, especially Nampula and Zambezia. While there is no clear indication that households living in these provinces accumulated assets at a slower pace than the rest of the country, they are substantially less able to earn fair returns on their productive assets, and lack of connectivity is an important factor underlying that inability. A second explanation is the underperformance of agriculture, a sector that employs the vast majority of the poor. The sector is dominated by smallholders, subsistence farming, low rates of adoption of productivity-enhancing inputs and technologies and limited access to production support services (extension, credit, etc.), which result in low levels of productivity. Market orientation in agriculture is small, constrained by lack of connectivity and limited access to input and output market information. The third hypothesis investigated in this study documents sizable negative

effects of uninsured weather shocks (such as floods and droughts) on the labor market, income and consumption outcomes of affected individuals.

115. Accelerating poverty reduction requires addressing structural factors that undermine the inclusiveness of growth. The returns to growth have to be distributed more widely to invest in the most isolated parts of the country in for these regions to be able to seize the economic opportunities brought about by economic expansion and close the gap with the rest of the country. Efforts to promote economic diversification and accelerate private sector growth – necessary for an economy that is highly dependent on its natural resource wealth– should contribute to support more equitable progress. Considering the importance of agriculture for poverty reduction, higher productivity in this sector needs to happen alongside with higher connectivity to markets. Policies efforts to achieve those goals also need to recognize the factors that constrain farmers with potential to develop commercially-oriented production that feeds into value chains from those that constrain farmers focused on subsistence-oriented production with limited potential to commercialize. Underlying these objectives is the need to deepen the investments in the human, physical and institutional capital of the country. Finally, given the high exposure of Mozambique to natural disasters, it is necessary to strengthen formal and informal risk management systems to avoid that the living standards of the population are highly influenced by major shocks out of their control.

ANNEX 1 – Empirical design and data used for the analysis of long-term effects of weather shocks (Chapter 6)

Assessing the effects of weather shocks in early life on long-term welfare requires extensive data. As discussed above, weather information is obtained from the CRU-TS dataset, disaggregated at the district-year level. In addition, three main sources of data provide information on adult outcomes. The first one is the 2008-09 income and expenditure household survey (known as IOF, for its acronym in Portuguese) collected by the National Institute of Statistics of Mozambique. The IOF survey is representative at the province level and, in addition to providing detailed data on expenditures (including self-consumption) and incomes, it also contains a wealth of information on sociodemographic characteristics, education, health, children's anthropometrics, labor market indicators and housing conditions. The second source of data is the 2011 Demographic and Health Survey (DHS), which provides a range of variables in the areas of population, health and nutrition. Lastly, A 10 percent random sample of the 2007 population census serves as the third main source of data, especially in regard to providing information on indicators of human capital.

The objective of this analysis is to empirically estimate the causal effect of exposure to rainfall shocks in early childhood on long-term socioeconomic outcomes. The analysis exploits rainfall variation across space and time. More specifically, it compares the outcomes of adults who were in districts exposed to extreme rainfall anomalies around the time of birth (i.e. in utero or during the first year of life) against outcomes of individuals in the same age cohort who resided in districts not affected by weather shocks as well as against outcomes of individuals from slightly or older younger cohorts in affected and unaffected districts. Reduced-form impacts of the shocks were estimated through the following empirical relationship between the long-term outcome *Y* of individual *i* in district *d* and at time *t*, and the shock indicators:

$$Y_{idt} = \sum_{s=1}^{2} (\beta_{s,u} * \text{Shock}_s, \text{ in utero}_{idt} + \beta_{s,l} * \text{Shock}_s * 1\text{st year of life}_{idt}) + \text{District FE} + \text{Cohort FE} + X_{idt}'\gamma + \varepsilon_{idt}$$

Where the parameters of interest are $\beta_{s,u}$ and $\beta_{s,y}$, which measures the effects of either extreme droughts (*s*=1) or extreme floods (*s*=2) on the outcomes of interest, whether they affected the child while in utero (indicated by subindex *u*) or during the first year of life (indicated by subindex *l).* The model also includes controls for district and cohort fixed effects, as well as gender and other individual-level covariates (e.g. school attainment), which are captured in the term X_{idt}.[27] Finally, the term ε_{idt} stands for a zero-mean error term. Standard errors are clustered at the same level of the treatment, namely by district of birth-year. The results of all the empirical models are presented both for the whole sample of adults in the surveys of the census, irrespective of the area of birth (urban or rural), and also solely for individuals born in rural districts.

[27] The empirical models were also run without controlling for the school attainment of the individual since this indicators is endogenous to the weather shocks.

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