

Agricultural technology adoption and impact

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AFRICA POVERTY REPORT

POVERTY IN A RISING AFRICA



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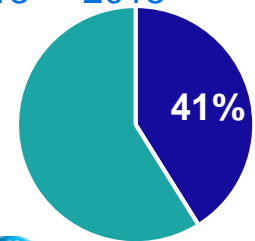
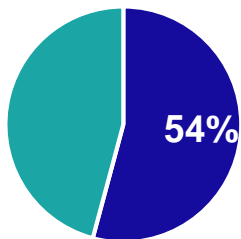
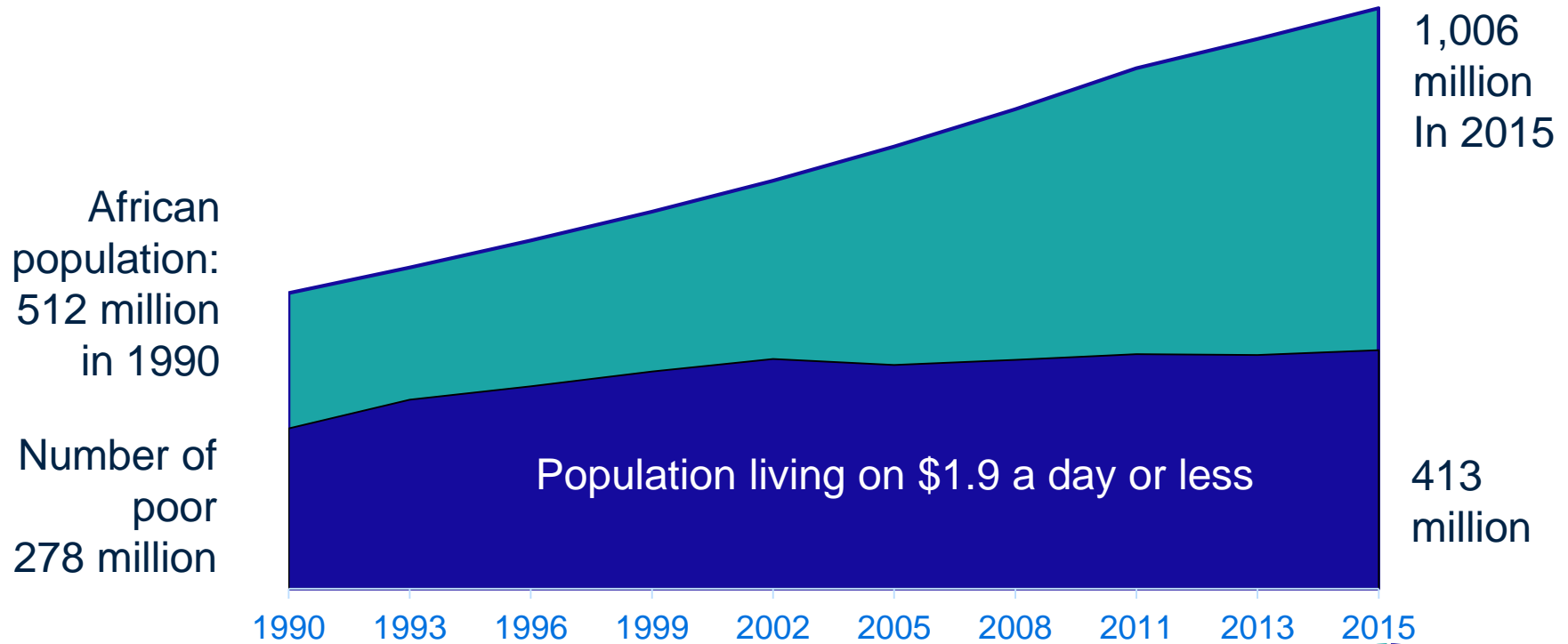
Report 1: “Poverty in a Rising Africa” looked at the big trends in Africa’s living standards, with special attention to the robustness of the data.

Report 2: “Accelerating poverty reduction in SSA” examines what to do about it

<http://www.worldbank.org/africa/povertyreport>



Poverty rate in Africa has gone *down*, but number of poor has *increased*



Accelerating Poverty Reduction in Africa

Ch1 – Poverty in Africa today

Spread 1: Avoid the human development trap

Ch2 – Earn more on the farm

Spread 2: Address gender structural inequality

Ch3 – Move to jobs beyond the farm

Spread 3: When (public) productive assets become attainable

Ch4 – Manage risks and conflict

Spread 4: Recognize the politics of poverty reduction

Ch5 – Mobilize resources for the poor

Chapter 2: Earn more on the farm

Advantage of agriculture to reduce poverty highest at lowest levels of development

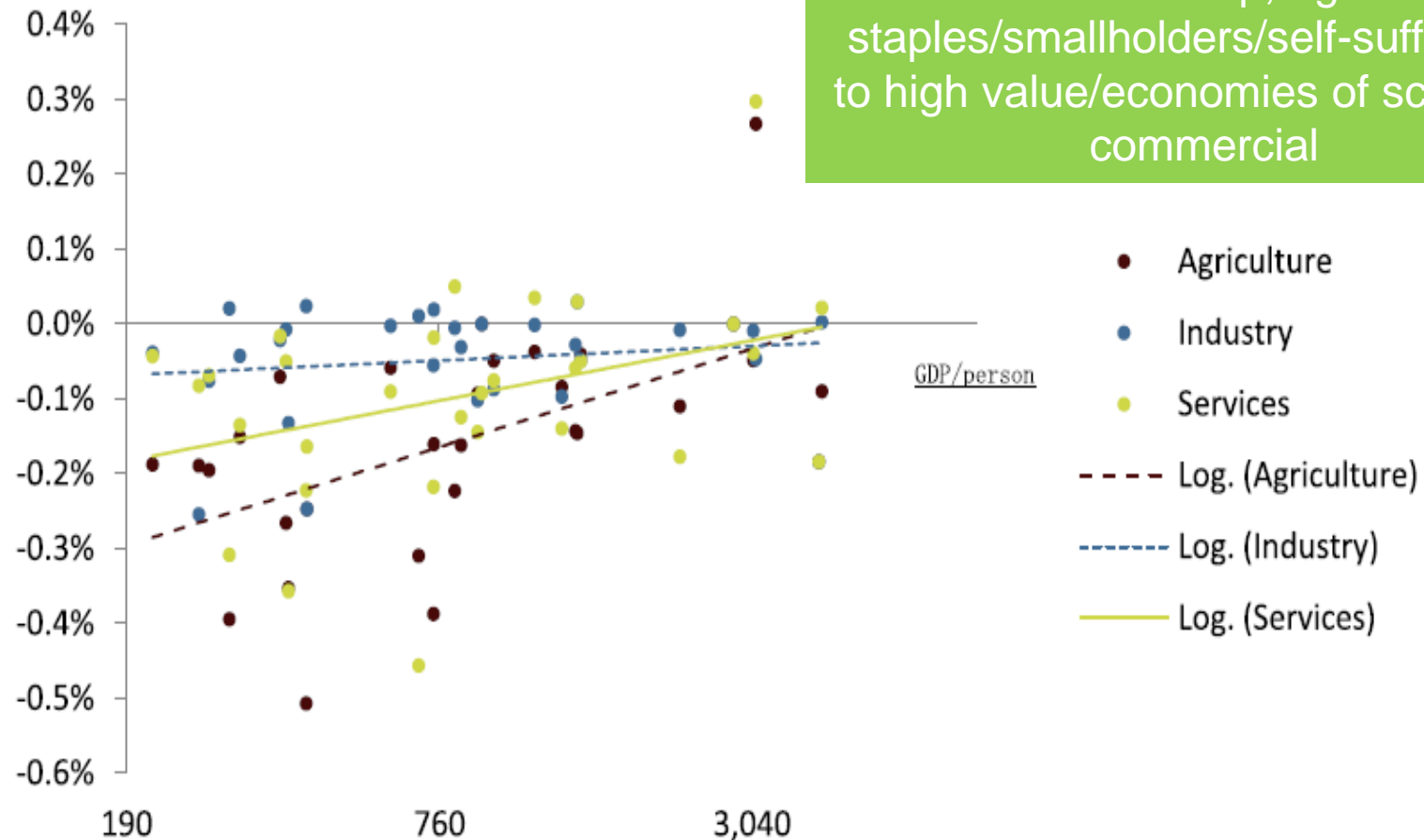


Figure 4. Relationship between per capita GDP and poverty change from a 1% productivity increase (global simulation).

Message 1: Conditions largely favorable for agriculture to help accelerate poverty reduction

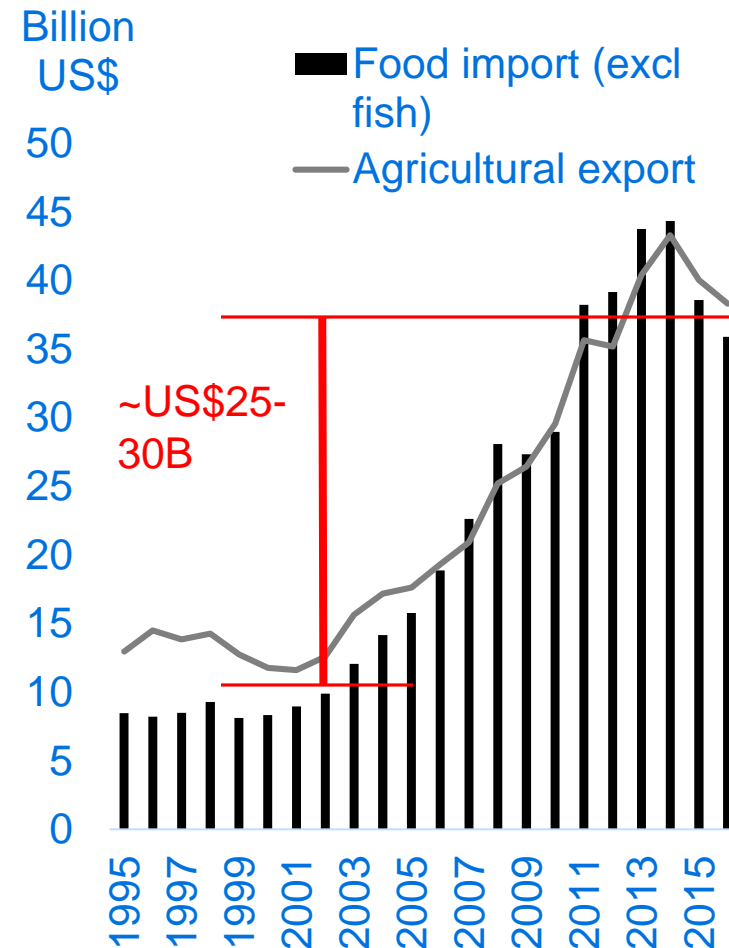
❑ Food demand growing rapidly, and exceeding supply

- Agriculture & agri-business can command US\$1 trillion by 2030 (US\$300 billion now)
- Food imports increased by US\$ 25-30 billion since early 2000s (~1/3=cereals)

❑ More favorable policy environment

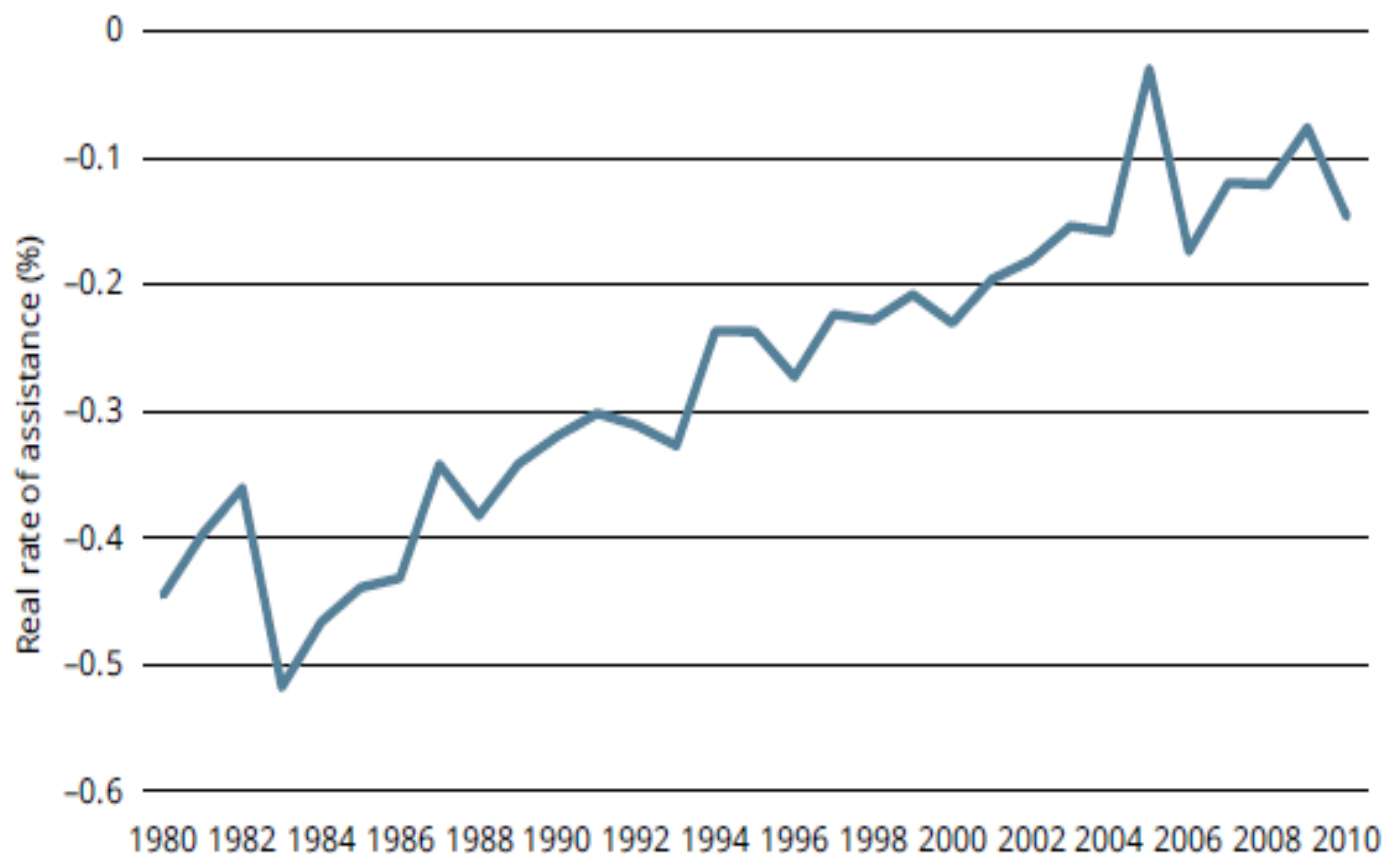
- Better prices (world food price, RRA&NPR)
- Positive political vibe (Maputo/Malabo), but ag public investment (levels) slacking, with focus on private goods (composition)

❑ But, new challenge of climate change and conflict



Improving price and trade environment

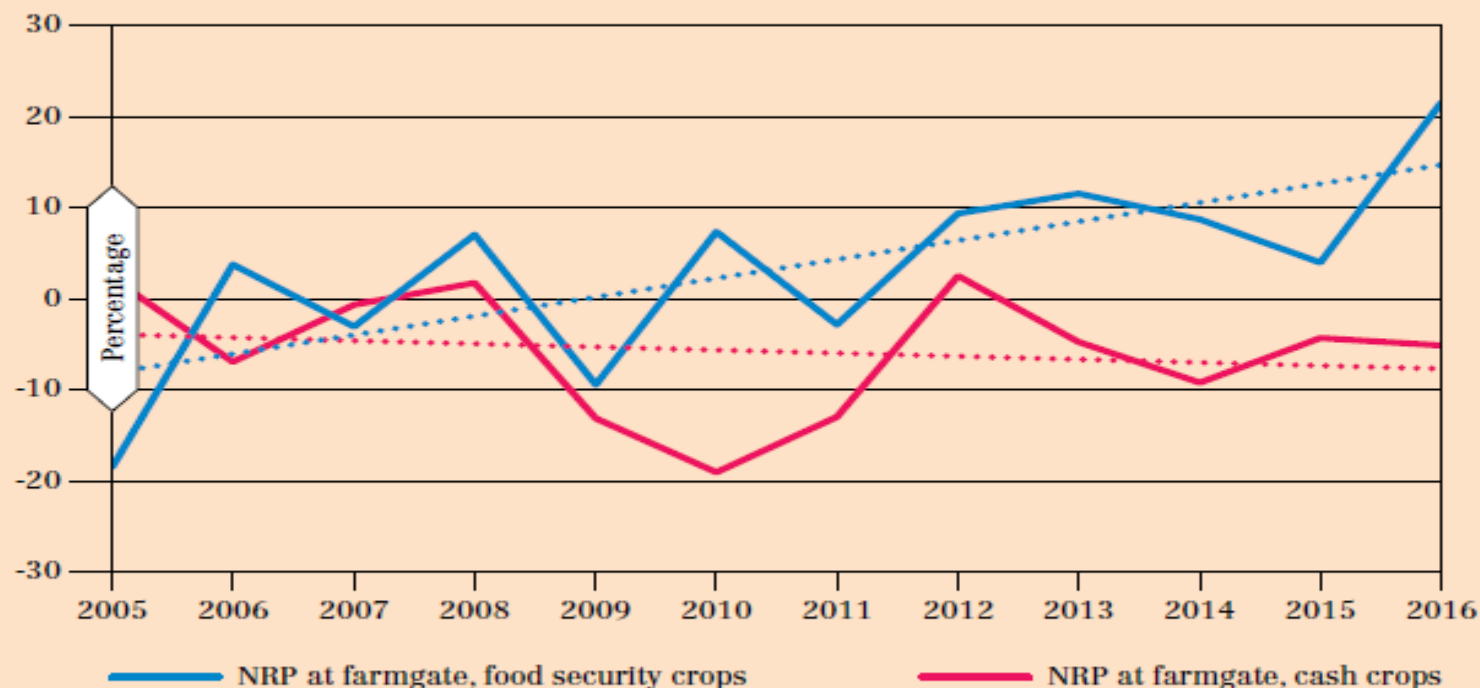
FIGURE 2: Real Rate of Assistance to Agriculture (RRA) in SSA (Actual Numbers and Smoothed)



⁸ Source: Janssen and Swinnen, 2016 in Brenton and Hoffmann eds.

Improving price and trade environment

◆ **FIGURE 11** Nominal Rate of Protection at farmgate for food security and cash crops, average for 14 sub-Saharan Africa countries



Source: Authors' calculations based on MAFAP price incentives database, as of October 2017.

Message 2: Not all agriculture is equally poverty reducing

☐ Differences within agriculture

- ✓ **Staples** vs nonstaples (cash crops; NT-Ex)
- ✓ **Smallholder** versus larger farms
 - China vs Brazil
 - Emergence of medium size farms (spillovers)?

☐ Differences in incentives

- ✓ **Productivity increase** is more sustainable than price increase (Malawi/Zambia vs Rwanda; Cambodia)
- ✓ Labor vs capital intensive (exchange rate; capital subsidy)

☐ Differences in territory

- ✓ **Lagging areas** with high agricultural potential

→ Over time, we expect a move from “staple, smallholder, self-sufficiency” to “non-staple, economies of scale and trading but getting staple crop productivity remains first order issue”

TZ: - staples & vegetables by smaller farms, oil seeds & cash crops by larger SH; labor productivity higher on large farms; higher for rice and highest for vegetables

Table 5. Patterns of production and labor productivity across crops and land holding classes, Tanzania

	Total land holding size class					Overall
	< 1 ha	1-2 ha	2-5 ha	5-10 ha	> 10 ha	
Current shares of production						
Wheat & Rice	0.26	0.25	0.29	0.11	0.09	1.00
Other Grains	0.21	0.27	0.30	0.18	0.04	1.00
Pulses	0.21	0.28	0.31	0.11	0.09	1.00
Oilseeds	0.08	0.24	0.29	0.38		1.00
Roots & Tubers	0.34	0.34	0.25	0.05	0.03	1.00
Vegetables	0.28	0.33	0.34	0.04		1.00
Other cash crops (mostly cotton & tobacco)	0.10	0.20	0.43	0.18	0.09	1.00
Current LQ (days labor per USD output)						
Wheat & Rice	0.18	0.15	0.14	0.06	0.08	0.14
Other Grains	0.35	0.31	0.28	0.12	0.31	0.28
Pulses	0.44	0.35	0.28	0.17	0.21	0.32
Oilseeds	0.29	0.22	0.16	0.07		0.15
Roots & Tubers	0.39	0.20	0.29	0.25	0.40	0.30
Vegetables	0.11	0.08	0.08	0.13		0.09

TZ: Simulated impact of inc growth with diet change: distribution of change in demand & associated change in demand for labor and gross returns per grower

	Total	Total land holding size class				
		< 1 ha	1-2 ha	2-5 ha	5-10 ha	> 10 ha
Associated change in ...						
... labor ('000 days)						
Wheat & Rice	5,471	1,904	1,456	1,573	240	299
Other Grains	3,413	920	1,049	1,031	259	155
Pulses	4,246	1,266	1,323	1,169	240	248
Oilseeds	708	109	247	231	122	-
Roots & Tubers	3,547	1,606	808	871	137	125
Vegetables	1,654	564	484	497	109	-
Total	19,040	6,368	5,367	5,371	1,106	828
... gross income per grower (USD/year)						
Wheat & Rice	31	18	31	39	80	98
Other Grains	2	1	2	3	7	4
Pulses	3	2	3	5	7	11
Oilseeds	10	4	6	10	48	-
Roots & Tubers	11	7	15	13	11	10
Vegetables	50	32	48	93	83	-

Source: Authors' calculations from Tanzania 2010/11 NPS data

Source: Tschirley et al. 2018

Take aways

- ❑ Staples offer most employment growth opportunities for smallholders (absorb slack labor)
- ❑ Rice offers in addition also income growth opportunities
- ❑ Vegetables offer great income growth opportunities, but only for a small slice of farmers
- ❑ Larger farms have greater labor productivity, but shifting production to larger farms would eliminate most of the additional labor demand
- ❑ Value chain development can help raise labor absorption benefits of certain crop, such as oils seeds, if better local processing capacity (would facilitate vegetable oil import substitution).

Poverty reduction from staple productivity growth often exceeds productivity growth of nonstaples

TABLE 1: Growth and poverty impact of different agricultural sub-sectors

	Staple crops	Growth multiplier	Growth elasticity of poverty	Export crops	Growth multiplier	Growth elasticity of poverty
Ethiopia	all cereals	1.13	-1.40	all export crops	1.04	-1.16
Malawi	maize	1.11	-0.74	Tobacco	1.05	-0.62
	Horticulture	-	-0.85	Other export crops	1.06	-0.57
Mozambique	Maize	1.42	-0.73	Traditional exports	1.48	-0.29
	All cereals	-	-0.65	Biofuel crops	0.83	-0.43
Rwanda	Maize	-	-2.39	Coffee	-	-1.81
	Pulses	-	-2.59	Tea	-	-1.63
Uganda	Roots	-	-1.07	Other export crops		-2.27
	Horticulture	1.39	-1.38	All export crops	0.62	-0.64
Zambia	All cereals	1.63	-0.27		-	-
	Roots	1.88	-0.33	All export crops	0.30	-0.25
					-	-

Agriculture growth is generally pro-poor, with multiplier effects and growth elasticities of poverty larger for staple foods than for export crops

Source: Diao, et al., 2012

Source: Diao et al. 2012

Message 2: Not all agriculture is equally poverty reducing

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- ❑ Differences in incentives
 - ✓ **Productivity increase** is more sustainable than price increase (Malawi/Zambia vs Rwanda; Cambodia)
 - ✓ Labor vs capital intensive (exchange rate; capital subsidy)
- ❑ Differences in territory
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→ Over time, we expect a move from “staple, smallholder, self-sufficiency” to “non-staple, economies of scale and trading but getting staple crop productivity remains first order issue”

Message 3: But Africa's agricultural labor productivity growth has remained low

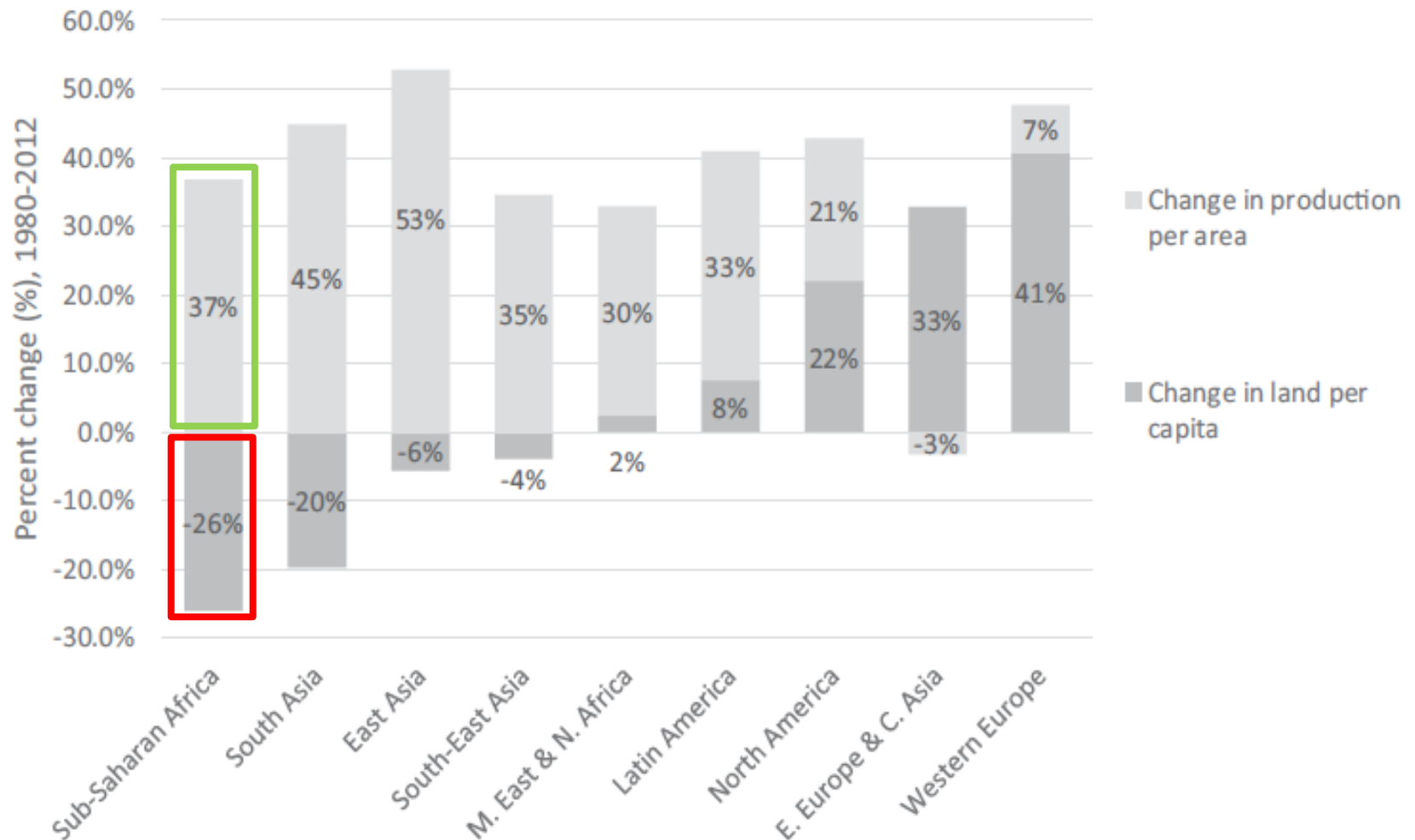
- ❑ Farm size has been declining (& soil fertility depleting)
 - pockets of landlessness emerging (Eth, MWI)
 - Emergence of medium size farms
 - ➔ Need to increase smallholder **land** productivity

- ❑ Declining farm size only partly offset by rising land productivity
 - Myriad of constraints (input, output and factor markets)
 - Single constraint interventions limited effect (fert. subsidy)
 - ➔ Need integrated interventions → VCD

- ❑ Continued underutilization of farm labor
 - Underemployment b/c low productivity and seasonality
 - ➔ Irrigation, livestock, off-farm employment

Message 3: But Africa's agricultural labor productivity growth has remained low

D. D. Headey/Agricultural Economics 47 (2016) supplement 185–196



Is fertilizer use profitable?

Key ratios driving profitability of fertilizer use	Low ratios (with low fertilizer adoption/use)	High ratios (with low fertilizer adoption/use)
$\frac{\text{Change in crop yield}}{\text{Change in fertilizer use}}$	<ul style="list-style-type: none"> • Lack of complimentary inputs (e.g water) • Poor soil quality • Poor quality/wrong type of fertilizer • Timeliness of fertilizer use, management 	<ul style="list-style-type: none"> • Lack of awareness of fertilizer • Insufficient knowledge on use • Risk of technology adoption • Learning by doing (gaining experience)
$\frac{\text{Crop price}}{\text{Fertilizer price}}$	<ul style="list-style-type: none"> • Import restrictions/taxes • Transportation/logistics costs • Fertilizer demand constraints prevents economies of scale to lower input prices 	<ul style="list-style-type: none"> • Credit/liquidity constraints



Myriad of constraints impede technology adoption

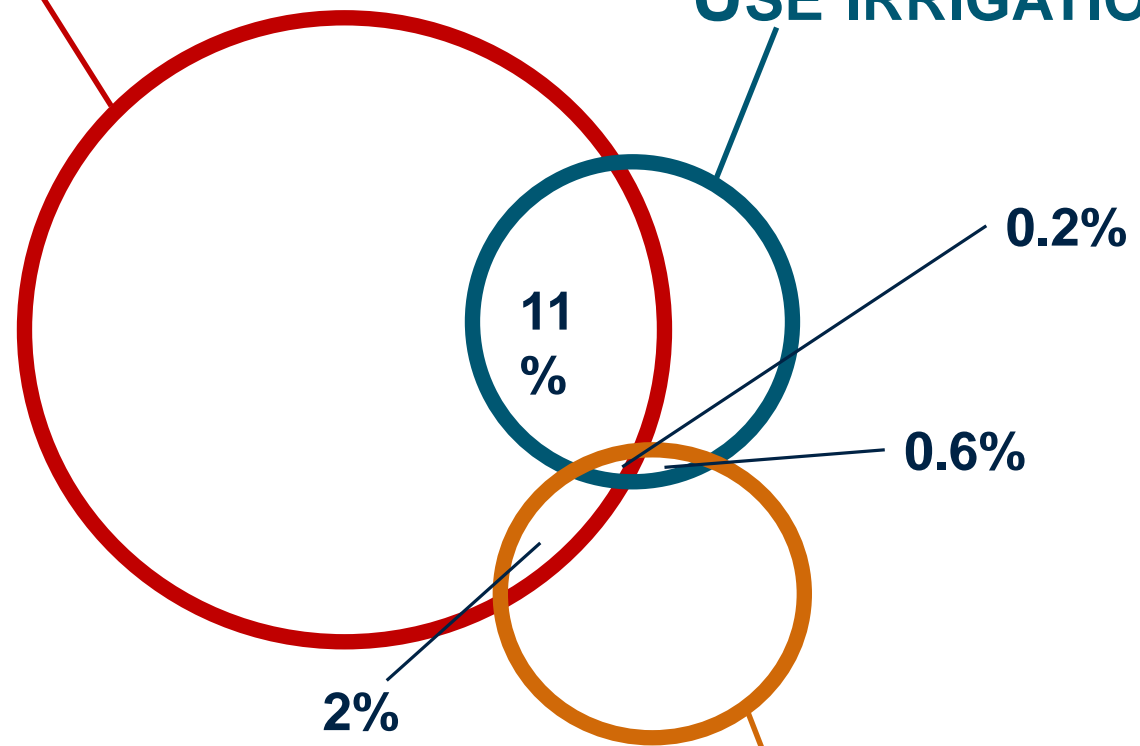
Synergies from joint input use, largely foregone

Input use on plots in Ethiopia

USE INORGANIC FERTILIZER

USE IRRIGATION

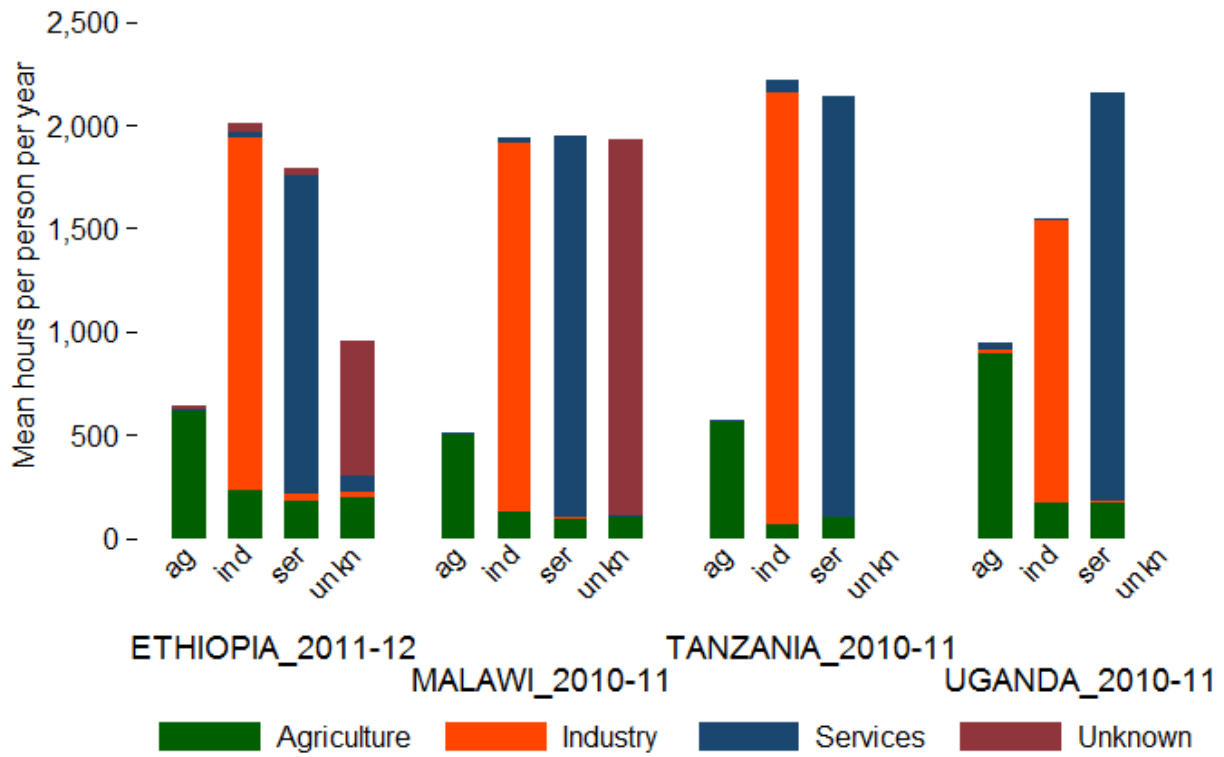
<15% of plots with at least 1 of these inputs uses 2 or more of them together!



USE IMPROVED SEED VARIETIES



Underutilization of farm labor: Agricultural workers work fewer hours per year



- Agriculture not intrinsically less productive.
- But underemployment
- Seasonality?

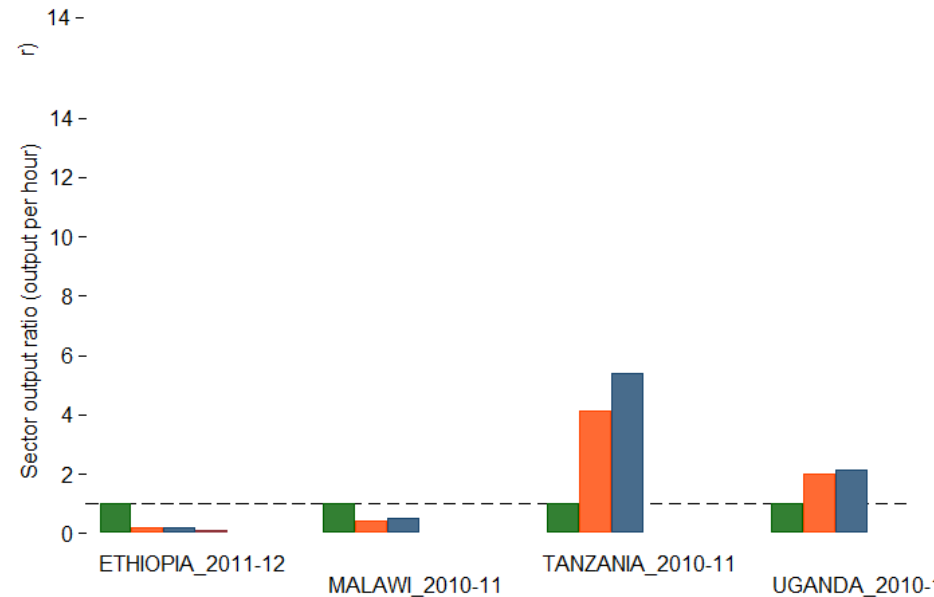
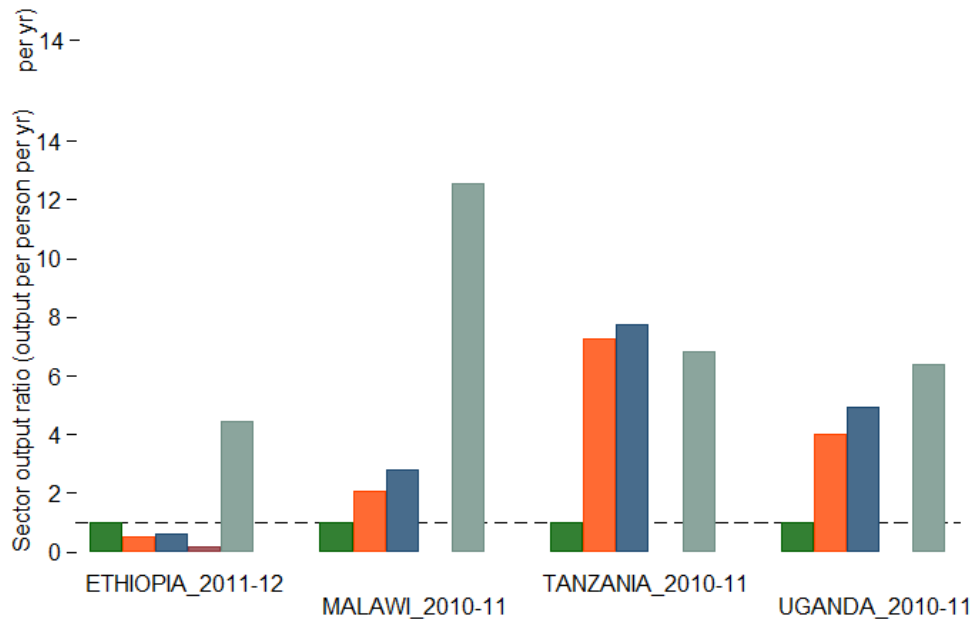
Source: McCullough, 2017



Adjusting for hours worked, productivity gaps not so large

Per Working Person Gaps

Per Worked Hour Gaps



■ Agriculture
 ■ Industry
 ■ Services
 ■ Unknown
■ Nonag (macro, raw)

Source: McCullough, 2017

Message 4: Foster an *integrated approach* thru inclusive ag value chain development (VCD)

- ❑ Strengthen producer organizations (challenging)
 - Market concentration and bargaining power of farmers
 - But challenging (few success stories)
 - ❑ Manage medium/large scale production (when necessary to ensure market access) for poverty reduction
 - Opportunities – spillovers in output (higher prices)/input (mechanization) markets, technology transfer
 - Challenge – employment generation, ag wage labor conditions (child labor), technology transfer effective ?
 - Own policy dynamics (land tenure security) + space to watch
 - ❑ Facilitate outgrower schemes (inclusive VCD)
 - Mixed evidence on smallholder participation
 - Participation increases productivity and income (between 25-75%)
- ➔ Product specificity + Transaction costs

Message 5: Complement VCD with public support to smallholder staple crop productivity

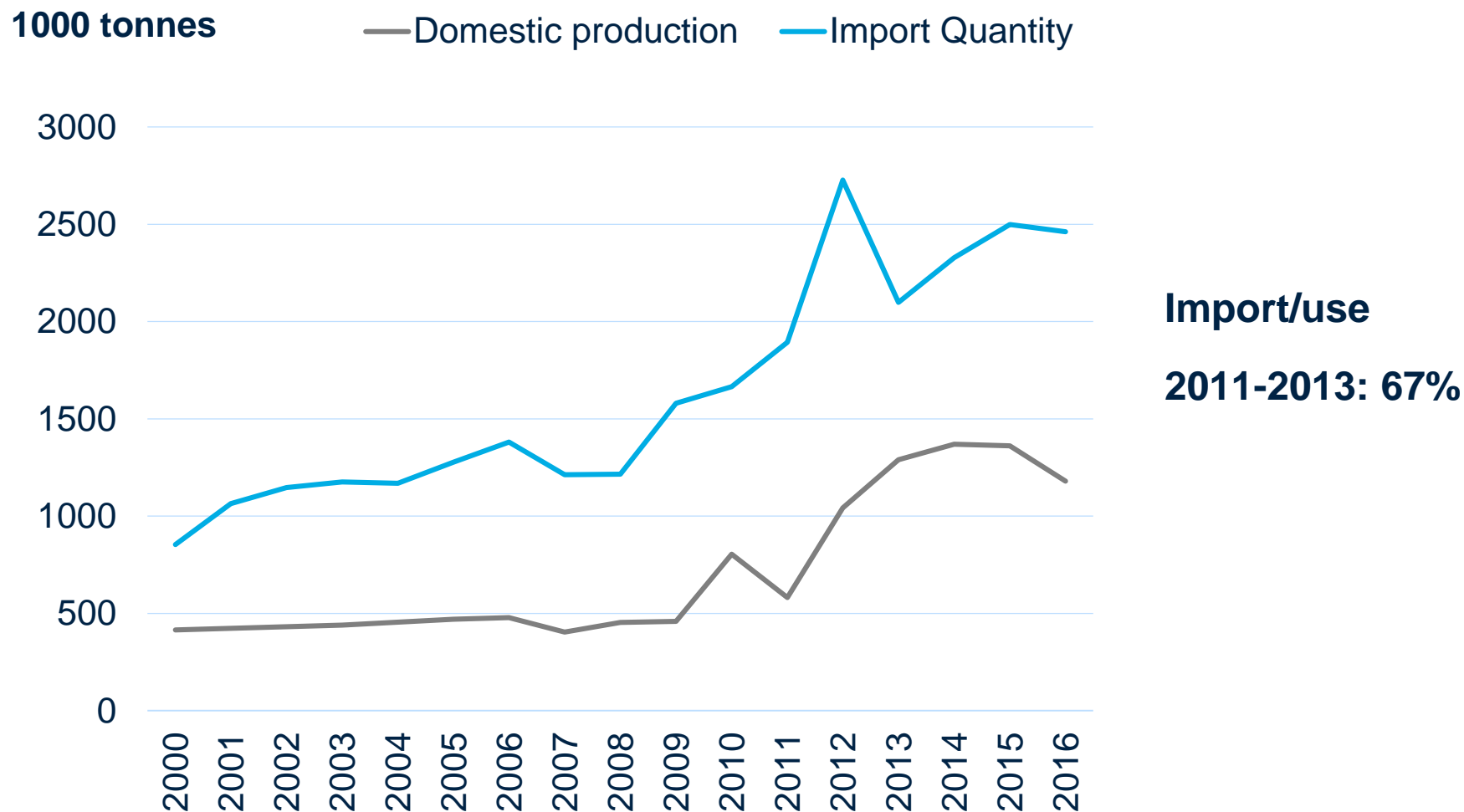
- ❑ VCD more difficult for staples than nonstaples (side selling; contract breach; insufficient value added)
 - VCD in staple production is recent, but holding promise
 - Better potential if cash crop (rice, teff) or use for animal feed or industrial use (beer) (rice in CIV)
- ❑ In addition, boost public investment in smallholder staple crop productivity. This requires special attention to
 - Ag RD&E (new extension models)
 - Irrigation and land management
 - Access to finance
 - Livestock development support
 - Rural transport and infrastructure (high AEP areas)

Example - Rice in Côte d'Ivoire

Challenges of Rice Chain in Cote d'Ivoire

- **Macro picture:** growing demand, mainly met by imports (>50%), politically salient following 2008 world rice price spike, scope for import substitution if assured volume of good quality for urban markets and scope for poverty reduction given labor intensive and grown across the country
 - **Farmers:** Lack of access to finance (liquidity constrained) and inputs, as well as machinery and lack of access to urban/higher value markets (in addition to lack of access to water control) – low quality subsistence/local market production, also b/c poor incentives and processing
 - **Processors:** Lack of volume and good quality supply; lack access to finance (today especially working capital today, less so for investment) (much equipment pre-financed by government), some input provision on credit
 - **Distributors:** Conflict of interest for large distributors (import licenses vs domestic purchases)
- ➔ Chain underfinanced, with lack of coordination between and low performance of each of the stakeholders

Rising rice demand in CIV met by imports; since 2008 also partly by domestic production.



Source: FAOSTAT, 2018

Government response/strategy

- Private sector driven, internationally competitive, VCD with strengthening of rice mills as entry point

mills	number	Share processed of total collected (%)	Share processed (%) of total produced (collected, export, stored, autocons)
<1t/h	2635	72%	26%
1-2t/h	283	26%	9%
>2t/h	6	2%	1%

Processing Units

1T/H PROCESSING UNIT



2T/H PROCESSING UNIT



Government response/strategy

- Support to mills :

✓ 2t/h:

- publicly provided/leased equipment, but privately run (coop/individuals/LLC); provided training
- work under capacity b/c not enough volume → lack working capital → 5t/h
- Now rolling fund provision micro-finance institution

✓ 30 5/th:

- equipped by government, given in concession to large private firms who have easier access to finance

Government response/strategy

- Division of country in 10 zones (200k ton potential).
Managed by “Pole leaders” (Big industrials) responsible for chain development (importers)
- Seed/input provision and expansion of irrigation (2012-2016: rice area expansion from 729,000 to 875,000, with % irrigated up from 14 to 18 %)
- Platform establishment with regular sector wide consultations, professional rice organizations

More on 2t/h processing units

- They work well below capacity (800-900 ton/year) compared to break-even point of 2000 ton/year and potential of 5000 ton/year
- Working capital identified as main constraint, then investment, not lack of buyers
- Individual producers are the most important source of rice for 72% of the mills, followed by traders and producer organizations (2nd most important source in 25-30% of the case). Mills are not engaged in rice production.
- About 50% have a contractual relationship with some farmers, primarily focused on input provision on credit (69%), followed by the provision of mechanization services on credit (41%) and rice collection in the field (59% 3rd service)
- Sell mostly in the local market (local traders and households)

Research agenda

- Target group: CT recipients in CT beneficiary villages around 2t/h mills
- Two intervention packages
 - Demand side intervention - support to mill
 - Rolling fund provision (through micro-finance institution) with management capacity building of mills and **liaison officer** with farmers (WBG) (in return for catering input provision on credit to CT beneficiaries)
 - Supply side intervention – support to farmers
 - strengthening farmer organizations + extension services (WBG)
- + 1 (later): Development of machinery service provision (tri-partite agreement: incubator training/coaching + investment and working capital credit + agreement with producer organizations to buy machinery services on credit from mill/bank)

Research agenda

- Experiments
 - Start implementing the 2 packages in 3 mills
 - Extend to 100 PUs – 25 Demand side only, 25 Supply side only, 25 both, 25 nothing
 - Machinery services to be added later on
- Some research questions:
 - Effect of VCD on agricultural and welfare indicators of CT and non-CT beneficiaries over and above CT (directly and indirectly) (e.g. Maertens/Vandeveldde, 2017)
 - Effect of conditioning factors (distance to mills, PO performance, mill competition)
 - Effect on performance of mills (employment, profit)
 - Effect on small traders
 - Synergy from integrated approach

Five messages in sum

M1: Conditions favorable for agriculture to help accelerate poverty reduction (demand, price, political), but climate smart

M2: Not all agriculture is equally poverty reducing (don't forget staples)

M3: But Africa's agricultural labor productivity growth has remained low

M4: Need for more integrated approaches, i.e. inclusive value chain development

M5: Complement VCD with public support to smallholder staple crop productivity

Thank you for your attention