

Are investments in agricultural infrastructure really boosting farmers' market access in Sub Saharan Africa: A CGE Analysis

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Abstract:

Most countries in the world adopt trade and domestic market policies that affect production incentives. Recent results produced by FAO's Monitoring and Analyzing Food and Agricultural Policies (MAFAP) programme show that other factors than explicit policies contributed to the pattern of production disincentives across commodities in Sub-Saharan Africa (SSA). Severe market failures in the form of high marketing margins lowered farmer prices. Governments in SSA are increasingly recognizing that smallholder farmers' participation in markets and agribusiness development also depend on investments and not only on short term policies. Yet, the specific issue of excessive market access costs for farmers and other agents in key value chains has been insufficiently analyzed. In this paper, we perform several real-world policy simulations to further explore the issue of production resulting from high marketing costs. We propose to answer the questions like of how much would the marketing margins in a given value chain be reduced as result of a 10% increase in the budget for roads. As budgetary allocations are usually a zero sum game in SSA, we account for the trade-offs in public expenditure allocation decisions. Exploiting the MAFAP dataset, we extend the standard GTAP 9 Data Base to include not only domestic support and border protection but also detailed data on market access costs in a few commodity-specific value chains and the agricultural sector as a whole for a dozen of SSA countries. Taking into account transaction costs as well as missing markets, we examine the welfare effects for both net food buyers and net sellers of an improved connection of farmers to domestic and international markets compared to a scenario where major policy distortions have been discontinued. Furthermore, we investigate the impact and fiscal implication of an increase in agricultural spending to 10 percent of the national budget with an exclusive focus on physical infrastructure.

Key words: policy distortions, market failures, infrastructure investments, welfare, Sub Saharan Africa, GTAP

1. Introduction

Most countries in the world adopt policies that affect their agricultural sectors, and Governments tend to influence farmers' behavior through various channels. Trade and domestic market policies widely affect the prices farmers receive for their produce or the prices of inputs they purchase. Governments typically also use budgetary transfers either to directly support specific agents or indirectly through investments in public goods (research, infrastructure, etc.). While these policies and their incidence have long been monitored for OECD countries, there is scarce literature on those provided with focus on developing countries and especially Sub Saharan Africa. This is largely because of the challenges in data quality and availability in this region. As result, a substantial amount of research can solely be found for OECD countries and few emerging

economies where data on public expenditure in agriculture are available and reliable. Research in this area is focusing, for example, on the efficacy and efficiency of input subsidies, or the return of public spending in agricultural research and infrastructure as opposed to transfers on private goods, typically using CGE models in order to account for cross-sector linkages and distributional effects. This paper addresses the gap in the policy literature by applying this type of analysis to developing countries.

Following a first experiment by Krueger, Schiff and Valdes (1988), Anderson and Valenzuela (2008) followed by Anderson and Nelgen (2010) bridged this gap in the literature by estimating these distortions to agricultural incentives in developing countries. More recently, the FAO implemented the Monitoring and Analyzing Food and Agricultural Policies (MAFAP) programme with the objective, among others, to update this kind of dataset. More generally, the MAFAP programme seeks to establish country-owned and sustainable systems to monitor, analyze, and reform food and agricultural policies to enable more effective, efficient and inclusive policy frameworks in a growing number of developing and emerging economies. Recent MAFAP results show that countries have adopted agricultural, trade policies or budgetary transfers to stimulate agricultural production and productivity growth in an attempt to achieve food security. These policy decisions include a wide range of policy measures from highly distortive administered producer or consumer prices, to border protection or export restrictions, to slightly less distortive inputs subsidies, and more WTO compatible types of direct or indirect transfers to agents or groups of economic agents to support marketing, research, extension, infrastructures (feeder roads, storage facilities, etc.).

Analysis of the MAFAP dataset suggests that there are additional factors, other than trade and price policies, which contribute to the pattern of production disincentives across commodities in Sub-Saharan Africa. Most of the explanation for these frequent disincentives to production lies in the type and the mix of policy measures that have been adopted by Governments. Indeed, border policies favorable to consumers are often combined with excessive market access costs (transport, handling, storage, margins, etc.) that reveal important inefficiencies or even underdevelopment of the value chains (World Bank, 2009), therefore lowering prices received by producers even when offsetting mechanisms for producers resulting from other forms of support and primarily budgetary transfers, such as input subsidies, are in place. Ultimately, one of the recurrent MAFAP finding is that when farmers receives price disincentives, this is not primarily the result of explicit policies in the form of direct taxation but rather because they face very high market access costs.

In this paper, we perform several real-world policy simulations to further explore the issue of disincentives to agricultural production and market participation resulting from high marketing costs. Governments in

developing countries are increasingly recognizing that long term development issues such as agricultural transformation, smallholder farmers' participation in markets, and agribusiness development are linked to decisions on investments and not only to short term policies. Yet, the specific issue of excessive market access costs for farmers and other agents in key value chains has been insufficiently analyzed. In MAFAP countries, these high marketing margins for exportable commodities compared to the situation of the main emerging economies that benefit from better physical infrastructures represent a serious handicap in international competition and call for strategic decisions by Governments on the types of targeted domestic investments that could bring these costs down. For example, answering the question of how much would the marketing margins in a given value chain be reduced as result of a 10% increase in the budget for roads would prove incredibly valuable to most Governments in the developing world. At the same time, as budgetary allocations are usually a zero sum game at least in most Sub Saharan countries, there is a need to account for the tradeoffs in public expenditure allocation decisions. More evidence is needed to convince decision makers that a different mix in public resources allocation favoring transport infrastructure would be beneficial to the agricultural sector and the economy as a whole.

Exploiting the dataset compiled by MAFAP, we extend the standard GTAP Data Base (version 9, year 2011) to include not only domestic support, border protection, export subsidies, export restrictions but also detailed data on market access costs in a few commodity-specific value chains and the agricultural sector as a whole for a dozen of the Sub Saharan countries. The countries currently covered by the MAFAP dataset include Burkina Faso, Benin, Burundi, Ethiopia, Ghana, Kenya, Malawi, Mali, Mozambique, Nigeria, Rwanda, Senegal, Tanzania, and Uganda. The Altermat tool (Malcolm, 1998) is employed to perform the analysis in the GTAP framework for this purpose.

The aim of this paper is to shed some light on the likely impacts of selected policy reform scenarios through GTAP simulations. Two policies are examined including (i) targeted investments in agricultural infrastructures especially on rural roads in order to reduce market access and transaction costs with an overall increase in budget, (ii) a similar investment policy under a constant budget constraint implying budgetary tradeoffs. Taking into account market access and transaction costs as well as missing markets, we examine whether such scenarios are welfare-enhancing compared to a policy scenario where major policy distortions have been discontinued. Furthermore, considering that farmers in MAFAP countries have tended to receive lower prices than those prevailing in international markets, we test the potential welfare enhancing effect for both net food buyers and net sellers of an improved connection of farmers to domestic and international markets as a result of targeted investments. Finally, we investigate the impact and fiscal implication of an

increase in agricultural spending to 10 percent of the national budget with an exclusive focus on physical infrastructure.

In this paper, we first introduce the main policy questions and the derived GTAP simulations. In a second part, we present the MAFAP dataset. In part three, we introduce the methodology used and explain how the MAFAP dataset has been incorporated into GTAP to design the selected policy simulations. In the fourth part, we explain the policy simulations undertaken and present the results. In the fifth and last part, we propose a discussion of these results, deriving policy implications and recommendations, and we conclude.

2. Data Sources and Methodology

MAFAP methodology includes computation of indicators for price incentive analysis and public expenditure analysis. The data requirement and sources are described hereafter for the two methodology components.

MAFAP's price incentives analysis is commodity and country specific. The MAFAP methodology on price incentives produces five commodity-specific indicators: (i) price gap; (ii) nominal rate of protection (NRP); (iii) effective rate of protection (ERP); (iv) nominal rate of assistance (NRA) and (v) the market development gap (MDG). The first two are calculated at three points along the value chain: (i) retail; (ii) wholesale and (iii) farm gate, while the other three are only calculated at farm gate level. All indicators are calculated using two different types of data: (i) observed and (ii) adjusted. Observed indicators include all direct taxation over the specific commodity, while the adjusted indicators account for all indirect taxation and market inefficiencies as well. The market development gap summarizes the gap between observed and adjusted measures.

The MAFAP database currently includes fourteen Sub-Saharan countries although only data for the first ten countries covered by MAFAP are available in early 2016. Similarly, the effective rate of protection and the nominal rate of protection at retail level are not released because the required information is not available for all commodity and countries yet.

Indicators are computed on an annual basis from 2005 onwards and updated regularly. Commodities to be analyzed are selected on the basis of their contribution to the country's food security, import bill and export revenue. Products with high potential in promising or emerging value chains are also taken into account.

All indicators are publicly available and data elements are available upon request (see table 1). Table 2 gives an overview of countries and commodities covered so far by the MAFAP program in its phase II (2014-2019). Most of the data regarding these value chains are available up to 2014 with others only ending in 2013. In 2016, it is expected that the MAFAP Phase II will also allow for coverage of commodities in Benin, Nigeria, and Rwanda in addition to Burundi and Senegal that were added in 2015.

Table 1: Table 1: List of MAFAP indicators

Publicly available	Available upon request
Price gaps	Benchmark prices
Nominal rates of protection	Access costs
Nominal rates of assistance	Output prices
Effective rates of protection	Input Prices
Market development gaps	Quantities

Table 2: MAFAP country coverage

Burkina Faso	Burundi	Ethiopia	Ghana	Kenya	Malawi	Mali	Mozambique	Senegal	Tanzania	Uganda
Cattle	Coffee	Barley	Cassava (raw)	Beans (dry)	Cotton	Cattle	Cashew nuts (processed)	Onion	Cashew Nuts	Cassava (raw)
Cotton	Maize	Beans	Groundnuts	Beans (green)	Groundnuts	Cotton	Cashew nuts (raw)	Potatoes	Coffee	Cattle
Groundnut	Rice	Cattle	Maize	Cassava (raw)	Maize	Groundnuts	Cassava	Rice	Maize	Coffee
Maize	Tea	Coffee	Palm Oil	Cotton	Sugar	Milk (cow)	Cotton		Rice	Cotton
Onion		Lentils	Rice	Maize	Tea	Maize	Maize			Milk (cow)
Rice		Maize	Yam	Potatoes	Tobacco	Millet	Rice			Maize
Sesame		Sesame		Rice		Rice				Rice
Sorghum		Sorghum		Sorghum		Sorghum				Sugar cane
		Teff		Sugar cane						Tea
		Wheat		Tea						Wheat
				Wheat						

Source: authors based on MAFAP, 2015

In its current second phase, MAFAP is planning to conduct pilot study in two countries (Ethiopia, and Tanzania) to test new, cost-efficient data collection tools and methodology, which minimize the time lag between collection and publishing. The purpose is to compute frequent, timely and reliable market prices indicators for staple foods and to make this data available to the general public and the decision-makers to support evidence based policies.

The price data is usually collected in rural, wholesale markets in each country by national authorities. MAFAP does not collect primary data itself and rely on national institutions to do so. However, the MAFAP team promotes consultations and exchanges of experiences among participating countries to adopt common approaches for commodity and market selection. All data entered in the MAFAP database is subject to automatic and manual robustness and consistency checks before it is published. After validation, data are published on the MAFAP website with profile webpages for each MAFAP country that display the data in various graphs and tables for users. The data displayed are comparable and consistent across countries. The data inputs required for the analysis of each commodity and potential sources are provided below and are generally listed by order of preference.

The benchmark prices are annual nominal prices of the commodity at the country's border, where the commodity is imported or exported. When higher frequency data are available (e.g. quarterly, monthly, daily) the annual average is computed. For a net import, the benchmark price is the CIF (cost of insurance and freight) price. For a net export, the benchmark price is the FOB (free on board) price. The sources usually include the UN Comtrade database, the BACI database, or the FAOSTAT trade database or national sources (e.g. ministry of trade or statistics).

The exchange rate is the annual average of the nominal exchange rates between the local currency and USD. The main sources are the International Monetary Fund database and the World Bank World Development Indicators (WDI) database.

Domestic prices at the wholesale, the farm gate or retail levels are annual nominal prices. When higher frequency data are available (e.g. quarterly, monthly, daily) the annual average is computed. The point in the value chain where the domestic product competes with the internationally traded product is called the point of competition. For a net export, this may be the price at the international auction or the price at the border. For a net import, the price at the point of competition is the price at the main wholesale market where the product is traded. The nominal producer price is sought at the commodity's main production area. Usually

the main source of data comes from the national level (e.g. commodity boards; producer organizations; ministry of agriculture, statistics bureaus, planning or trade directorates). Occasionally, MAFAP also uses the FAO's Food Price Monitoring and Analysis (FPMA) database as well as the CountrySTAT database

Input Costs and Quantities at farm level are necessary to measure the effective rate of protection which is based on value added. The MAFAP teams at country level use data from annual crop budgets of representative farmers in the main producing areas of the relevant value chains. Prices and applied quantities of the main tradable inputs such as seeds, fertilizers and energy are taken into consideration as well as production and harvested area.

Access Costs from the Border to the Point of Competition, from the Farm Gate to the Point of Competition and from the Point of Competition to Retail are also very important data requirements to compute MAFAP indicators. Marketing costs include border clearance costs, storage and handling, inland transport, government taxes and fees, bribes, marketing margins of traders and/or processors, etc. The main sources of data include national sources (e.g. commodity boards; producer organizations; ministry of agriculture, statistics, planning or trade); private companies (i.e. processors, estates, etc.); value chain and marketing studies/publications but also for estimates of the port costs for example, MAFAP relies on the Doing Business and/or Enabling the Business of Agriculture databases produced by the World Bank Group. Data are usually collected with annual frequency even if in some cases this is not possible and therefore they are inferred using the available information on previous years.

Average quantity and quality conversion ratios are used to render products comparable at levels stages of the value chain. The quantity conversion ratio relates to the volume of a given commodity generated from one unit of raw inputs of the same commodity. This information is only relevant for those commodities that undergo processing between the farm gate and the point of competition or between the border and point of competition. For example, the conversion ratio for rice is equal to the volume (tons) of milled rice produced per one unit (ton) of paddy rice inputs. Similarly, the quality conversion ratio accounts for quality differences between the domestic product and the internationally traded product. Indeed, in order to compare like with like between the internationally and domestically produced commodities, a conversion accounting for the quality difference needs to be made. For example if most domestic milled rice is 30% broken and milled rice imports are 100% whole, the quality conversion ratio would be 0.7. Thus, the import price for milled rice would be multiplied by .70 to make it comparable to the price for domestic milled rice. To obtain both the quantity and quality conversion ratios, the national sources (e.g. commodity boards; producer organizations;

ministry of agriculture, statistics, planning or trade) including private companies (i.e. processors, estates, etc.) are usually favored.

Finally, the MAFAP methodology allows to incorporate data resulting from public expenditure analysis into the price incentives analysis to construct an indicator that captures commodity specific public spending, in addition to policy and market performance already captured by the NRP. Combining price and budget information, the nominal rate of assistance provides a more complete picture of incentives, particularly in cases where budgetary payments may be compensating for disincentives to producers. Data on input subsidies (in nominal, unit prices) for producers of the commodities selected for analysis are extracted from the MAFAP public expenditure analysis which is conducted at aggregated and disaggregated levels. Regarding the aggregated level, MAFAP seeks information on overall national public expenditure, budgeted and actual allocations. MAFAP public expenditure analysis is disaggregated at program and project level. It includes budgeted and actual, accounts for spending done at central and decentralized level, regardless of the implementing agency/ministry, and incorporates both donor and government outlays on-budget and off-budget. The public expenditure data are obtained for the period starting with the fiscal year 2005/06 onwards.

Public expenditures for agriculture that need to be considered are:

- Expenditures to individual agricultural agents (e.g. input subsidies), or to the sector as a whole (e.g. agricultural research). This type of expenditure is referred to as agriculture-specific expenditure. Agricultural agents, or the sector as a whole, must be the only, or the principal recipient of the transfers generated by expenditure measures in this category.
- Expenditures in support of rural development, such as rural infrastructure, rural education and rural health, as these also have an important role in indirectly supporting agricultural sector development. These expenditures are referred to as agriculture-supportive expenditures.

All the measures that comply with these criteria are considered, regardless of their nature, objectives or perceived economic impacts. Furthermore, general public expenditure measures available throughout the entire economy are not considered, even if they generate benefits that can accrue to the agricultural sector or part of it. Private expenditures are also not considered.

MAFAP public expenditure analysis also requires qualitative information on budgetary process in the country: institutional architecture, if possible with a diagram, together with a detailed explanation of the functioning of the budget. Moreover, a thorough description of all policy project/programmes that will be considered in the analysis is sought: objectives, activities, status of implementation of activities, commodities targeted and level of government implementing the project. Each measure needs to be well documented to facilitate MAFAP classification and this for the last 7 years before the period of analysis.

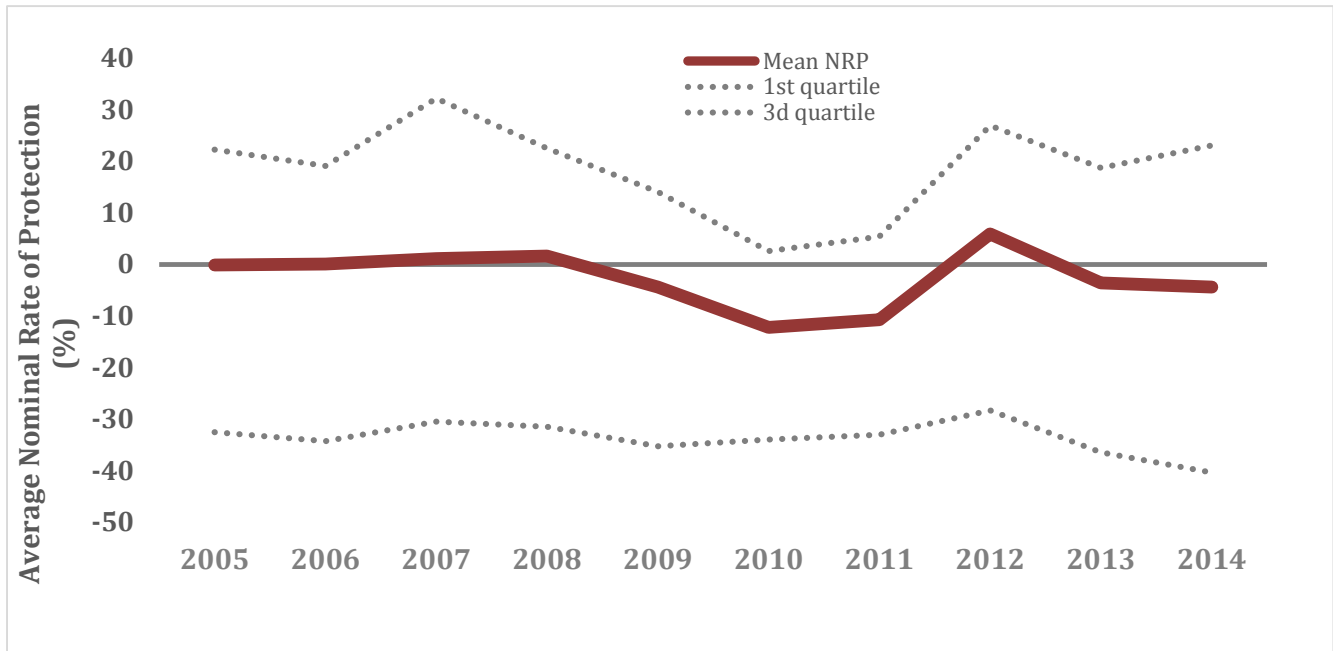
The sources of information include the Ministry of Finance, Ministry of Agriculture, and Ministry of Planning. Moreover when possible, MAFAP also seeks to obtain data from donors for off-budget expenditures as well as data from other Ministries/agencies for expenditures not recorded on the Ministry of Finance or Ministry of Agriculture's budget (Presidential Initiatives, for instance).

3. Incorporating MAFAP data into GTAP Data Base and designing the policy simulations

In order to incorporate the MAFAP-based taxes/subsidies data into GTAP, we employ the widely used Altax tool. This entails changing the taxes and subsidies in the dataset, without affecting the balance and other parts of the data base. The closure and elasticity parameters are designed to suit this requirement of changing nothing else other than these taxes and subsidies. The GTAP Data Base (Narayanan et al, 2015) is an assembly of trade, protection, input-output, consumption and macro-economic datasets from various established sources across the world. The reason why we incorporate MAFAP data into GTAP is to enable us to work on simulations that reflect the real-world policies.

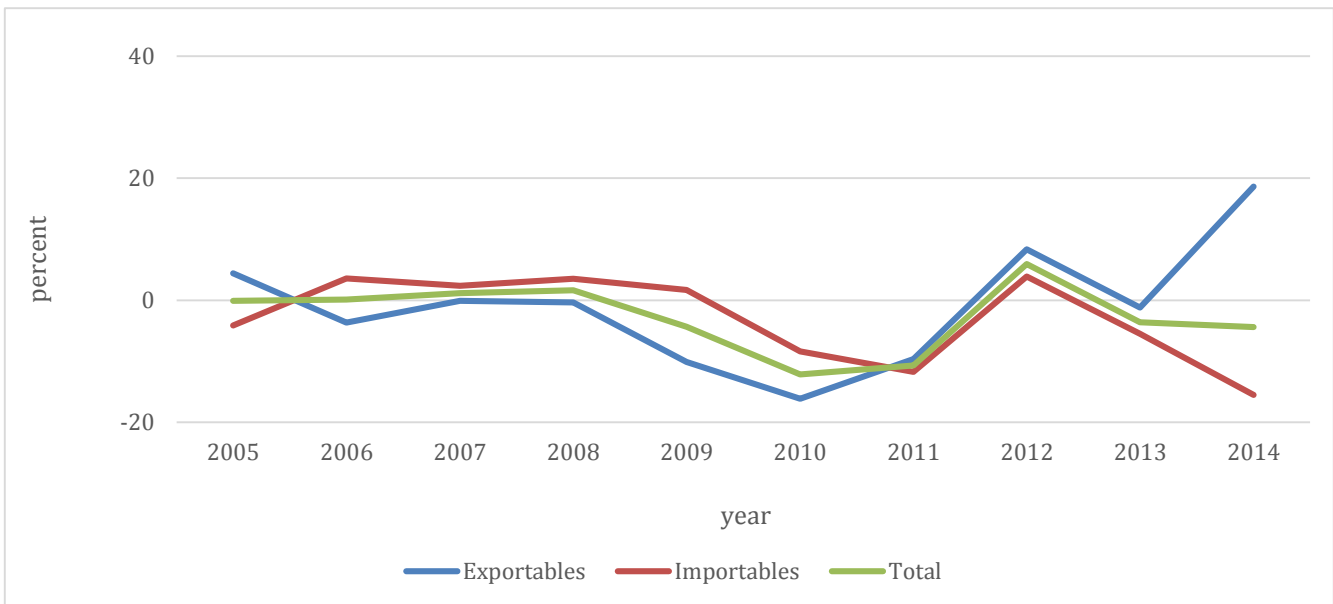
As can be seen in *Figure 1* and *Figure 2*, the MAFAP dataset suggests a general pattern of production disincentives across commodities in Sub-Saharan Africa although the situation seems to change as of 2014 at least for exportable products while it deteriorates for importable ones.

Figure 1: Nominal rates of protection, 11 African focus countries, unweighted average 2005-14.



Source: MAFAP (2015).

Figure 2: Nominal rates of protection to exportable, importable and all agricultural products, unweighted average, African focus countries, 2005 to 2014 (percent)



Source: MAFAP (2015).

However, a careful analysis based on actual policy decision by country and commodity suggests that factors other than only trade and price policies explain this anti production bias.

Most policy analysts recognize that to really understand the source of disincentives to agricultural production, marketing and trade, it is often necessary to look beyond explicit market and trade policies and include market inefficiencies, lack of a good infrastructure, land right issues, access to credit markets and technologies and

illicit taxes as well as bribes as additional distortions. Indeed, border policies favorable to consumers are often combined with excessive market access costs that reveal important inefficiencies or even underdevelopment of the value chains (World Bank, 2009) which have tended to lower prices received by producers. Hence, in a developing country context, the level of the indicators (NRPs, NRAs, or others) are likely to also be influenced by implicit factors, such as market failures and underdevelopment, not just through explicit policy measures. Moreover, even only considering different explicit policies, these can have different effects on the agricultural sector and farmers, but result in the same indicator. The extreme case is that an indicator shows zero distortion, when in reality there are incentives and disincentives to producers leveling each other out. Ultimately, we consider that most of the explanation for the frequent disincentives to production observed in Sub Saharan Africa lies in the type, the mix, or lack of policy measures that have been adopted by governments.

However, there were offsetting mechanisms for producers resulting from other forms of support including primarily budgetary transfers such as input subsidies. While the use of inputs by farmers in Sub Saharan Africa is constrained by substantial market failures including the lack of access to credit, high cost of inputs -generally imported-, important price variability, high market and financial risks (Dorward and Chirwa, 2011, Demeke et al., 2015), it is generally recognized that input subsidies are not effective at improving productivity in the long run and are costly for typically scarce national budgets and therefore often not sustainable (Jayne et al., 2010; Ghins, Mas Aparis, and Balić, 2016). This questions the suitability of investment on input subsidies to offset price disincentives arising in output markets for most products. A more promising option seems to be to promote investments to address the market failures that cause marketing margins to be too high for farmers to be able to participate effectively in markets and trade. Marketing margins are the focus of this research while it is recognize they are only one of set of the non-policy induced price disincentives. Consistent with previous findings (Schultz, 1964; Bates, 1981; Demeke et al., 2008; Maetz et al., 2011), we therefore propose to address the main and probably also the most difficult issue that is policy coherence across government's decisions. In other words, assuming that the objective of governments is to support farmers to achieve higher levels of outputs, it seems useful to explore whether investment aimed at reducing transaction costs and more particularly marketing margins could indeed result in better market price signal transmission to farmers and in a substantial increase of the production incentives. Yet, market access costs have several components such as transport cost, handling cost, storage cost, commercial margins, and others. Because they are distinct in nature and composition, each of these costs are not likely to be reduced as a result of one single policy intervention. Rather in most cases a set of policy measures will be necessary to achieve results in terms of overall marketing costs reduction. However, in this preliminary analysis and for practicality reasons, the data used only correspond to transport costs and we focus on the potential benefits

of targeted public investments in road infrastructure that could lead to substantial reduction in transport costs.

Using specifically designed policy simulations, the aim of this paper is to shed some light on the likely impacts of alternative investment scenarios. We examine the possible effects of two policy reform options: (i) targeted investments in agricultural infrastructures especially on rural roads in order to reduce market access and transaction costs with an overall increase in budget, and (ii) a similar investment policy under a constant budget constraint implying budgetary tradeoffs.

Furthermore, considering that farmers, in MAFAP countries, have tended to receive lower prices than those prevailing in international markets, we test the potential welfare enhancing effect for both net food buyers and net sellers of a better international price transmission as a result of public investments aimed at reducing marketing margins. These features are captured as reduction in transaction costs and/or rise in productivity in agricultural sectors owing to such developments.

4. Results

In progress

5. Conclusions

In progress