Futures of agriculture and food systems: impacts on rural job dynamics in SSA

Mathilde Douillet (Cirad, FARM, corresponding author mathilde.douillet@fondation-farm.org)

Carmen Estrades (Independent consultant)

Preliminary version April 2014

Comments are welcome

Do not cite

Abstract

In the coming years, several dynamics of transformation of African agriculture and food systems are possible as a consequence of the rising food demand in Africa and worldwide, the growth of African cities, the impacts of climate change on the yields and that of the booming labor force. Although it is impossible to foresee the future path of agriculture in Africa before it unfolds, the aim of this paper is to shed lights on some of the dynamics at stake by using the global dynamic CGE model, MIRAGE, developed by CEPII and IFPRI, incorporating unemployment into the initial model and testing several options of its factor market specification. Our baseline scenario is based on the increase in global and African production as anticipated by the "World Agriculture Towards 2050" of the FAO and population and GDP growth by the CEPII towards 2050. We also explore different assumptions of technical changes in the African agricultural sector and global trade reforms, and compare their impact in terms of the level of agricultural production, volume of trade, availability of food, agricultural income, employment, management of natural resources and regional development.

Keywords: Africa, rural employment, agricultural growth, food security, global CGE

1. Introduction 3
2. Agriculture and food systems in Africa: current situation and challenges ahead for food security 4
a) Will production meet the rising food demand from a growing population? 4
b) Supply urban markets not only expanding, but also characterized by a change in dietary habits 4
c) Adapt to climate change, which may reduce crop yields and increase their fluctuations 4
d) Improve production techniques to save energy and preserve natural resources sustainably 4
e) Will productivity increase significantly enough to increase income of the workers and reduce food prices ? 5
f) Will agriculture and food related activities provide enough employment to the growing rural population to slow migration flows and reduce inequality and poverty ? 5
3. Methodology 5
a) MIRAGE model 5
i. Core model 5
ii. Unemployment in the labor market 6
iii. Land market 7
b) Data 7
c) Baseline and simulations 8
i. The future of global agriculture: a global picture from the FAO perspective 2030/2050 8
ii. Baseline calibration 9
iii. Simulation scenarios 9
4. Results 9
5. Final remarks 9
APPENDIX A: Supplementary Tables 10

1. Introduction

It is timely that 2014 has been declared Year of Agriculture and Food Security in Africa by African Head of States, marking the tenth Anniversary of the adoption of the Comprehensive Africa Agriculture Development Programme (CAADP), the most ambitious and comprehensive agriculture-led growth strategy ever undertaken in Africa.

For the first time in history, economic growth in Sub-Saharan Africa[1] is shared broadly across many countries. But on average in the region agriculture is still a major source of employment, and food supply, an essential part of foreign exchange earnings and of government fiscal revenues (FAO 2010). And with the growing incomes and population in Africa and globally, in the coming years, African agriculture and food systems will be presented with a unique opportunity to thrive thanks to the soaring food demand, and the booming rural labor force in Africa.

But they will also face multiple challenges: Production will have to increase much more than it has in the past in order to keep up with the rising food demand; African cities that are growing at unseen rates will have to be supplied in food; the production and transformation processes will have to improve to save energy and preserve natural resources sustainably, while the impacts of climate change in Africa is expected to reduce average yields and increase their fluctuations; and finally, African agriculture and food processing industries will need to provide employment to the booming rural population to slow migration flows and reduce inequality and poverty Brooks et l., 2013).

To rise to these challenges, experts from research institutions, the governments, the donor community and international financing institutions are now unanimous: agricultural productivity will have to increase. But that being said, several dynamics of transformation of African rural areas are possible, depending on whether the path of agricultural productivity growth is, on instance, through higher yields, expansion of cultivated area and mechanization of farms, or a combination of these elements. Although it is impossible to foresee the future path of agriculture in Africa before it unfolds, the aim of this paper is to shed some lights on the impacts of those distinct paths by testing several scenarios.

Previous research considering the spillover effects of agriculture growth on overall economic growth has been decisive in the recent shift in attitude towards agriculture from governments, the donor community and international institutions (see World Bank 2008 and seminal contribution, among others, from Delgado *et al.* 1994, Haggblade, Hazell and Reardon 2007 and Self and Grabowski 2007). However, in the context of globalized agricultural markets, some researchers doubt the possibility to actually develop what is seen as slow-growth, low return agriculture and rather document that urban-based manufacturing and services as more likely to stimulate broad-based economic growth in some African settings (eg. Ellis 2005, Dercon 2009, Collier 2009). But to our mind, a contribution of agriculture that is often forgotten is agriculture's linkages with industry and manufacture in the agricultural and food systems, through agro-processing (direct value-addition downstream of farms), direct upstream in the provision of farm inputs, and more generally in improved postharvest operations, storage, distribution and logistics that are essential elements of agribusiness value chains (Yumkella *et al.* 2011). Wilkinson and Rocha (2009) have estimated empirically that the ratio of GDP generated by agribusiness to that generated by farming increases with level of economic growth, a trend that had been identified in Europe by Malassis (1997). They further show that in agriculture-based countries agro-processing contributes 66 percent to total manufacturing, and that productivity levels for food processing are above the manufacturing average. According to Page (2012) this makes food processing an ideal candidate as the key entry sector to push the rest of the manufacturing sector towards higher levels of "*technical capabilities*" and "*value-adding achievements*", as in the framework of Mac Millan and Rodrik (2011).

Furthermore to our knowledge there is no available result on the impacts of futures paths of African agricultures and food systems and their intersectoral linkages with the rest of African economies, in terms of dependence to imports, food prices and employment creation. From an analytical point of view, computable general equilibrium (CGE) models, traditional tools of economic policy analysis, are convenient to capture those linkages. Furthermore, as we want to be able to analyze the futures in Africa in the context of global agricultural markets, a global CGE model seems adequate.

[1] "SSA" refers here to all the countries in the African continent below the Sahara, as opposed to northern Africa. SSA is composed of Benin, Burkina Faso, Cape Verde, Cote d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Saint Helena, Sierra Leone, Togo Nigeria, Senegal, Ethiopia, Madagascar, Malawi, Mauritius, Mozambique, Tanzania, Uganda, Zambia, Zimbabwe, Botswana, South Africa, Cameroon, Central African Republic, Chad, Congo, Equatorial Guinea, Gabon, São Tomé and Principe, Angola, Democratic Republic of Congo, Burundi, Comoros, Djibouti, Eritrea, Kenya, Rwanda, Seychelles, Somalia, Sudan, Lesotho, Namibia, Swaziland. Note that Mayotte and the Reunion are not assumed to be part of SSA but are included in some of the database used.

The primary goal of this paper is to contribute to shedding light on the futures of agriculture and food systems. To do so, we use the global dynamic CGE model, MIRAGE (Modeling International Relationships in Applied General Equilibrium), incorporated unemployment into the model, updating the input data, and testing several options for its factor market specification. We define different scenarios, each corresponding to a path of agricultural development, and compares their impact in terms of the level of agricultural production, volume of trade, availability of food, agricultural income, employment, management of natural resources and regional development. In our baseline scenario, we project agricultural productivity changes as estimated in the FAO perspective of the world agriculture towards 2030/2050 (Alexandratos and Bruinsma, 2012).

The simulations presented here explore various possible futures for employment opportunities in agriculture and food processing industries in sub-Saharan Africa given the scenarios of increase in global demand, under different assumptions of technical changes in the African agricultural sector. Their main objective is to promote awareness about the multiple and complex dimensions of the futures of agriculture and food systems in Africa. This study does not pretend to predict the future. It rather aims at facilitating a collective understanding of the current situation and possible future trajectories with the objective to spur a debate on the desirable futures, with a view on the efforts to achieve these.

2. Agriculture and food systems in Africa: current situation and challenges ahead for food security

In the coming years, small and medium-sized farms in Africa, and the agricultural and food systems in which they are inserted will face many challenges. The aim of this section is to list the issues at stake, introducing the available data and results from previous research and stating clearly to what extent global CGE modeling can help understanding them.

a) Will production meet the rising food demand from a growing population?

The population in Africa is expected to double by 2050, reaching approximately 2.2 billion people. This continent will become the second most populous region in the world, behind Asia (Losch 2013). Population growth will be distinct in the different African regions, with population growth being the highest in the Western and Central African regions.

But there is a potential: A result that is often forgotten is that the growth of agricultural production in value in Africa in the last 30 years, an increased by more than 160% (according to FAO data) has been higher than agricultural growth in South America and almost equivalent to Asia on the same period. But this agricultural growth has occurred in an unprecedented demographic context, since overall Africa’s population has already doubled in the last 30 years and urban population has tripled. As a consequence, food production, especially of processed products and meat, has been unable to keep pace with growth in demand. Hence, from self-sufficient in the 1960’s, Africa has become a net importer of meat, dairy products, cereals and oils. With, African agricultural exports falling by half since the mid-1990s, imports now account for 1.7 times the value of exports.

Will current dependence on imports accentuate?

b) Supply urban markets not only expanding, but also characterized by a change in dietary habits

Today Africa has the highest rate of urbanization, with an urban population expected to triple by 2050 (Losch 2013). Furthermore demand pattern is shifting: diets change towards a greater variety and improved quality of processed food products with income growth, while the importance of food preservation and convenience increases with urbanization, and the greater internationalization of retail outlets influence shifts in consumer behaviour and patterns (Yumkella *et al.* 2011). Even though it is technically possible to take those shifts into account with CGE models, a global consistent data on consumer preference and their evolution is still missing, thus we use current data provided with the model, and should consider our model cannot fully take those impacts into account.

c) Adapt to climate change, which may reduce crop yields and increase their fluctuations

The economic costs of climate change could reach 10% of gross domestic product of Africa (IPCC 2007). Agriculture is particularly vulnerable (IFPRI 2013), and so are its value chains. We hope to take some impact of climate change into account, but preliminary results should be considered as not taking climate change into account in a satisfactory way for lack of a readily available consistent and exhaustive database.

d) Improve production techniques to save energy and preserve natural resources sustainably

About half of African farmlands is already in use (Alexandratos and Bruinsma, 2012) and there is much uncertainty about those who are not (use as pastures, low soil fertility, covered by forests and other ecosystems to be protected, etc.). In addition, over the past two decades, the state of the environment, of freshwater and forests has deteriorated in almost all countries of the continent (Temm 2013). But compared to other regions, SSA has plentiful supplies of land and often of water. Considering that past production increase has been mainly based on land extension often in an unsustainable way, it will be crucial to constrain additional land extension in the model. Some very detailed database on land use and quality now exist, such as but in this version of the research we have not tried to link our CGE model with other models more specifically dedicated to land such as Globiom model from IIASA[2] or the Nexus Land Use. This is an area where the current research could be improved.

e) *Will productivity increase significantly enough to increase income of the workers and reduce food prices ?*

The agricultural productivity per hectare and per agricultural worker is significantly lower in Africa than in most other regions, and past growth has also been much lower (Fuglie ?). Today cereal yields are half of that of Asia. However in order to both increase income of the workers and reduce food prices productivity needs to increase both at the farm level as other segments of the value chain.

Furthermore as countries grow, the gap between rural and urban income tends to increase. This has been a major concern in China, Brazil, India…

Thanks to the dynamic CGE model, productivity increase in all sectors of the economy will be simulated and their impacts analyzed in detail. The productivity difference between sectors will also be translated into income differences.

f) *Will agriculture and food related activities provide enough employment to the growing rural population to slow migration flows and reduce inequality and poverty ?*

Indeed Africa has the world's fastest and youngest growing population. It is the only region where the rural population will continue to increase, by more than 300 million people by 2050 (United Nations). In the next 15 years, more than 200 million rural youth should enter the labor market; most of them seeking jobs in rural areas (see for instance IFPRI 2013). Hence, the question "does labor need to move out of agriculture as productivity grows?" is crucial. In most developed countries growth in agricultural productivity has been accompanied by an increase in farm size, a reduction in labor intensity, and the exit of labor from agriculture. But a recent report by the World Bank and AFD looking at youth employment opportunities in SSA (Deon and Fox 2014) states that "*If land is available and crop area is still expanding, increased farm size need not displace labor, especially where the cost of capital to invest in mechanization is high*."

3. Methodology

In this section we present both the model we use, the changes we made to it and the updates data we added. We base our baseline scenario on the most recent and commonly accepted global projections of growth of population, GDP, land and yield worldwide from various United Nations organizations, presented below.

a) *MIRAGE model*

i. *Core model*

We apply the MIRAGE model of the world economy, a multi-sector, multi-region Computable General Equilibrium (CGE) model devoted to trade policy analysis. In this paper, we introduce different modifications to the model in order to adapt it to the objectives of the study.

A detailed technical description of the standard version of MIRAGE is available in Bchir et al. (2002) and Decreux and Valin (2007). The model assumes perfect competition across all sectors[3]. On the production side, value added and intermediate goods are complement under a Leontief hypothesis. The intermediate inputs function is an aggregate CES function of all goods: it means that substitutability exists between two intermediate goods, depending on the relative prices of these goods. This substitutability is constant and at the same level for any pair of intermediate goods. Similarly, value-added is a constant elasticity of substitution (CES) function of unskilled labor, land, natural resources, and of a CES bundle of skilled labor and capital. This nesting implies less substitutability between capital and skilled labor than between these two and other factors. In other words, when the relative price of unskilled labor is increased, this factor is replaced by a combination of capital and skilled labor, which are complementary.

---

[2] See Globiom and Nexus Land Use respective websites.

[3] There is a version of MIRAGE with imperfect competition, usually in the manufacture sector. However, this version requires detailed information on economies of scale, mark-ups and number of firms in each sector under imperfect competition, so we chose to work with perfect competition.

Factor endowments are fully employed, except for labor. The only factor whose supply is constant is natural resources. Capital supply is modified each period because of depreciation and investment. Growth rates of labor supply are fixed exogenously. Land supply is endogenous; it depends on the real remuneration of land. However, in this paper, we introduce an exogenous component of land supply, which is detailed below.

Skilled labor is the only factor that is perfectly mobile. Installed capital and natural resources are sector specific. New capital is allocated among sectors according to an investment function. Unskilled labor is imperfectly mobile between agricultural and nonagricultural sectors according to a constant elasticity of transformation (CET) function: unskilled labor's remuneration in agricultural activities is different to that in nonagricultural activities.[4] This factor is distributed between these two series of sectors according to the ratio of remunerations. Land is also imperfectly mobile between agricultural sectors.

In this version of the model, we assume unemployment of labor in specific regions. The changes introduced to the model in order to include unemployment are detailed in the next subsection. Capital in a given region, whatever its origin, domestic or foreign, is assumed to be obtained by assembling intermediate inputs according to a specific combination. The capital good is the same whatever the sector. In this version of the MIRAGE, we assume that all sectors operate under perfect competition, there is no fixed cost, and price equals marginal cost.

In the external sector, real exchange rate is endogenous and adjusts in order to keep the ratio of current account balance to GDP fixed.

In each country, a representative consumer maximizes a CES-LES (Constant Elasticity of Substitution – Linear Expenditure System) utility function under a budget constraint that allocates income across goods. The calibration procedure aims to reproduce reasonable price and income elasticities; the latter is a particularly important feature in a dynamic model to control for the changes in demand for agricultural commodities led by economic evolution. Since the income channel is even more important in this study, we rely on an updated calibration method for elasticities (Gouel, 2009). The origin of goods is determined by a CES (Constant Elasticity of Substitution) nested structure following the Armington assumption. In addition, Northern countries are supposed to produce higher-quality industrial goods than those supplied by Southern countries. On the production side, value added and intermediate goods are complement under a Leontief hypothesis. The value added is a CES function of unskilled labor and a composite of skilled labor and capital, applying less substitutability between the last two production factors. In agriculture and mining, production also depends on land and natural resources. Investment is savings-driven and the current account is assumed to be constant in terms of world GDP.

We apply the dynamic version of MIRAGE, in which the model operates in a sequential dynamic recursive set-up: it is solved for one period, and then all variable values, determined at the end of a period, are used as the initial values of the next one. We run our model up to year 2050.

ii. Unemployment in the labor market

In order to incorporate unemployment in MIRAGE, we introduced a wage curve that negatively relates unemployment and wages. The specification follows the work by Blanchflower and Oswald (1995), and has been applied in several CGE models.

This specification for labor market has been widely applied in CGE models (Carneiro and Arbache, 2003; Estrades and Llambi 2013, among many others) and is consistent with the efficiency wage theory, which argues that in certain economies firms have an incentive to pay salaries above the average in order to promote higher efficiency or lower quit rate among workers. In a context of high unemployment, firms do not need to pay a high incentive, since workers are more prone to lose their jobs. Thus, the higher the unemployment rate in the economy, the lower the wage premiums and the average wage rate of the economy.

In our model, we define a wage curve for skilled workers, and another wage curve for unskilled workers, whichis in turn segmented into agricultural and non-agricultural sectors. For calibration purposes, the value of the elasticity of wages to unemployment is usually taken from literature. In general, the estimated value is -0.10 for most countries, both developed and developing (see Blanchflower and Oswald 2005 for a general review and

---

[4] This is known as the Lewis assumption, and seeks to represent the rigidity in labor markets in developing economies, where the urban labor market is distinct from the "traditional" market in rural areas. The modern sector (industry and services) pays an efficiency wage to unskilled workers. This wage is independent from labor supply and is indexed on price inflation. The primary sector (i.e. agriculture), by contrast, relies on a fixed quantity of labor that is paid at its marginal productivity. This assumption derives from the high level of underemployment observed in rural areas of many developing countries. That situation allows rural workers to answer to any labor demand in the formal urban sector, while being replaced at their position in the agricultural sector. As this situation applies to African economies, we adopt this assumption in our version of the model.

Hoddinott (1993) and Kingdon, G. and J. Knight (1999) for African countries), and thus we take this value for simulations, and we run some sensitivity analysis thereafter.

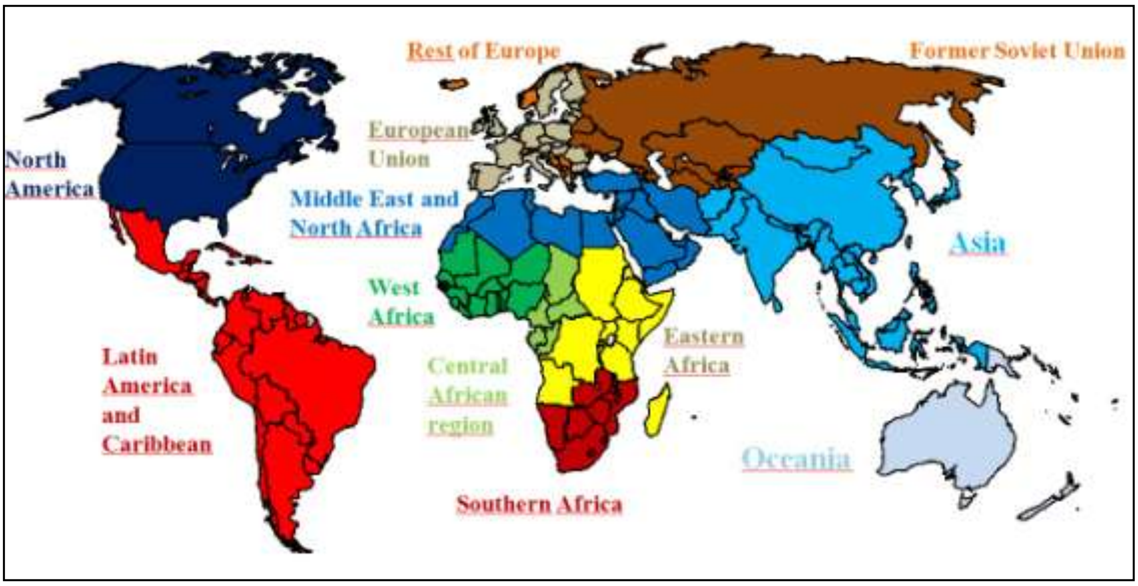
iii. Land market

In the standard version of MIRAGE model, land supply is endogenous and follows real returns to the factor. In our version, we modify the land market, so that we can increase exogenously the amount of land devoted for each crop by each country/region.

b) Data

The main source of data for the MIRAGE model is the GTAP7 database (Global Trade Analysis Project of Purdue University, which is the most used database for trade policy analysis) that provides an exhaustive picture of the world economy for the year 2004.But it is noteworthy that the GTAP 7 database limit the analysis of distributional impacts across African countries and agricultural and food processing sectors. Indeed only 13[5] of the 52 countries of SSA appear individually in the GTAP 7 database, and the rest are included in five regions, grouping highly heterogeneous countries. Furthermore, the agricultural sectors of specific importance for SSA, other than grains, are not detailed in the GTAP 7: Roots and tubers are not separated and traditional export crops such as coffee, cocoa, cotton, tea, and tobacco are aggregated into the "exportable other crops" sector. The regional and sectoral mapping, focusing on SSA agricultural sectors, is presented below and fully described in Appendix A. Results for each scenario are available for the 12 regions, of which 4 are SSA, and the 24 sectors, of which 20 are agriculture and food processing. In the remainder of the analysis, for simplicity, the results are presented aggregated in five "zones of interest" as detailed in Table II.B.2 and "sectors of interest" in Table II.B.1, but detailed results are available upon request.

Graph 1: Regional aggregation in GTAP 7



Source: authors

Trade information and tariffs are based on ADEPTA (Laborde, 2010).

Then, we updated other data, mainly related to dynamic projections in order to calibrate the baseline scenario.

First, we updated GDP projections in order to run the baseline scenario, using recent estimations by CEPII (Fouré, Bénassy-Quéré and Fontagné (2012 and 2013). These estimations include data for all countries and for years up to 2100.

---

5 Individual countries are Nigeria, Senegal, Ethiopia, Madagascar, Malawi, Mauritius, Mozambique, Tanzania, Uganda, Zambia, Zimbabwe, Botswana, and South Africa. Regions are Rest of Western Africa (Benin, Burkina Faso, Cape Verde, Cote d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Saint Helena, Sierra Leone, Togo), Rest of Central Africa (Cameroon, Central African Republ ic, Chad, Congo, Equatorial Guinea, Gabon, São Tomé and Principe), Rest of South Central Africa (Angola, Democratic Republic of Congo), Rest of Eastern Africa (Burundi, Comoros, Djibouti, Eritrea, Kenya, Mayotte, Reunion, Rwanda, Seychelles, Somalia, Sudan), and Rest of South African Customs Union (Lesotho, Namibia, Swaziland).

Second, we updated population growth projections. To do so, we checked UN population projections (UN, 2012), but we kept CEPII estimations (which are based on UN projections), in order to keep a coherence between GDP estimations and population growth projections. In spite of this, we also kept UN estimations assuming a high fertility growth rate, and we used these projections to estimate a second baseline (*baseline_highfert*).

Third, we updated the ratio between rural and urban population, using information from UN population division (UN 2012).

Fourth, we updated the economically active population working in agriculture sectors. We took data from FAOstat (2013). This is particularly important in order to better represent the rural-urban segmentation in unskilled labor markets in regions in which we assume the Lewis hypothesis.

Finally, data on labor market in order to calibrate unemployment rates -unemployed workers and active population by country in the benchmark- was taken from ILO estimations. In order to differentiate skilled and unskilled workers, we assumed skilled workers to have intermediate and advanced levels of education. Then, in order to make the distinction among agriculture and non-agriculture workers, we took data for rural and urban sectors respectively. Several caveats arise when working with labor market data, especially for African countries. First, we do not count with information on unemployed workers by education and geographical coverage at the same time. Second, we are assuming that non-agriculture workers are employed in the urban sector, which might not be always the case. Third, many African countries do not have information on labor market differentiated by education level or geographical coverage, or some of the data might be outdated.[6]

Table 1 shows the unemployment rate by region at the benchmark. The highest unemployment rates are in Africa, especially among urban and skilled workers. Traditionally, as informality in the rural areas is higher, rural workers show lower unemployment rates. This is particularly true for Africa.

Table 1. Unemployment rates by region and labor markets at the benchmark year

	Total workers	Urban workers	Rural workers	Skilled workers
Africa	9,01	12,68	4,05	17,89
Asia	5,50	8,48	4,83	7,92
Europe	5,29	6,72	5,46	6,87
Latin America and the Caribbean	4,06	4,90	7,85	6,98
Northern America	6,07	8,15	8,77	4,52
Oceania	7,08	5,09	0,29	4,31

Source: own elaboration with data from ILOSTAT, ILO

c) Baseline and simulations

In order to analyze the future of African agriculture markets, we use as starting point the FAO perspectives for 2030/2050. Thus, we run our baseline scenario trying to replicate the main economic projections in this document, and we compare other simulation scenario results with this baseline. In this subsection we depict the main assumptions of FAO perspective, we describe the specific changes incorporated into our baseline, and we present the simulation scenarios to be run thereafter.

i. The future of global agriculture: a global picture from the FAO perspective 2030/2050

The United Nations Food and Agriculture Organization (FAO) regularly publish medium and long term projections on the future of world agriculture. "World agriculture towards 2030/2050, the 2012 revision" (Alexandratos and Bruinsma, 2012) is the latest. It is a follow up product of the expert meeting on "How to Feed the World in 2050" held by the Department of Economic and Social Development of the FAO in 2009. According to the authors, "*the projections presented reflect the magnitudes and trajectories we estimate the major food and agriculture variables may assume in the future; they are not meant to reflect how these variables may be required to evolve in the future in order to achieve some normative objective*". The figure of a necessary 70% increase of food production by 2050 was picked up from this report. It is now a global reference on the future needs of agricultural production. The FAO has accepted to transmit the detailed data of the "WAT 20150 2012 Revision" (Bruinsma, 2012) to Bruno Dorin who made them available to us, on which we have based our baseline scenario until 2050. Specifically, we calibrated the baseline in order to obtain the projected change in yields by crops and regions/countries by FAO perspective. We followed the calibration method proposed by

[6] Out of 55 African countries, ILO statistics include information on 29 countries, of which we did not considered data prior to 2005.

Laborde et al (2011), in which a specific productivity factor is introduced into the agriculture production function, which is calibrated in the baseline in order to reach the yield targets. We named this baseline scenario *baseline_FAO.*

ii. Baseline calibration

We also calibrated a more standard baseline scenario, named *baseline*, in order to better understand the implication of the *baseline_FAO* scenario. In this scenario, we target as usual real GDP growth projections and we introduce population growth.

Then, as we work with GTAP7 database, which has as benchmark year 2004, we recalibrate the dynamic model for the period 2005-2012 to reproduce existing changes. Specifically, we simulated the end of multifiber agreement and other trade agreements in place, mainly among African regions and the European Union.

iii. Simulation scenarios

To be included

4. Results

To be included

5. Final remarks

To be included

APPENDIX A: Supplementary Tables

TABLE A.1 — MAPPING OF THE SECTORAL DECOMPOSITION

Type of sector of interest	Sectoral decomposition	GTAP 7 sectoral abbreviation
Raw agricultural products	Cattle	ctl, cmt
	Cereals	gro
	Export crops	ocr
	Milk	rmk
	Oilseeds	osd
	Paddy rice	pdr
	Plants for fibers	pfb
	Sugar plant	c_b
	Vegetables and fruits	v_f
	Wheat	wht
Processed agricultural products	Beverages and tobacco	b_t
	Dairy	mil
	Meat	oap
	Other food products	ofd
	Oils and fats	vol
	OMeat	omt
	Processed rice	pcr
	Sugar	sgr
Fish	Fishing	fsh
Other	Animal fibers	wol
	Other Manufactured products	crp, nmm, omf
	Primary products	coa, oil, gas, omn, p_c, i_s, nfm, fmp
	Services	ely, gdt, wtr, trd, otp, wtp, atp, cmn
	Textile	tex, wap, lea

Source: GTAP 7 database sectoral listing.

TABLE A.2 — MAPPING OF THE REGIONAL DECOMPOSITION

References

Alexandratos N. and J. Bruinsma, 2012, WORLD AGRICULTURE TOWARDS 2030/2050 The 2012 Revision. ESA Working Paper 12-03. FAO: Rome.

Blanchflower, David G., and Andrew J. Oswald. 1995. "An Introduction to the Wage Curve." *Journal of Economic Perspectives*, 9(3): 153-167

Blanchflower, David G., and Andrew J. Oswald. 2005. The Wage Curve Reloaded, IZA DP No. 1665

Bouët, A., Bureau, J.-C., Decreux, Y. and Jean, S. (2005), Multilateral Agricultural Trade Liberalisation: The Contrasting Fortunes of Developing Countries in the Doha Round. *World Economy*, 28: 1329–1354.

Brooks, K., Zorya, S. and Gautam, A. (2013) Jobs for Africa's Youth, in IFPRI (2013) *2012 Global Food Policy Report*, Chapter 5: Washington DC.

Carneiro, Francisco G., and Jorge S. Arbache.S. 2003. "The Impacts of Trade on the Brazilian Labor Market: A CGE Model Approach." World Development 31(9): 1581–1595.

Christiaensen, L., L. Demery, and J. Kuhl, 2011. "**The (evolving) role of agriculture in poverty reduction--An empirical perspective**," Journal of Development Economics, Elsevier, vol. 96(2), pages 239-254, November.

COLLIER P. 2009. Africa's organic peasantry: Beyond romanticism. Harvard International Review, Summer 62-65.

Decreux Y. and H. Valin, 2007. "MIRAGE, Updated Version of the Model for Trade Policy Analysis: Focus on Agriculture and Dynamics," Working Papers 2007-15, CEPII research center.

Delgado *et al.* 1994, Haggblade, Hazell and Reardon 2007 and Self and Grabowski 2007
Estrades, C. and C. Llambí, 2013. "Lessons from the 2008 Financial Crisis: Policy Responses to External Shocks in Uruguay," The Developing Economies, Institute of Developing Economies, vol. 51(3), pages 233-259.

DERCON S. 2009. "Rural poverty: old challenges in new contexts". *World Bank Research Observer*, 24 (1), 1–28

ELLIS F., 2005 Small farms, livelihood diversification, and rural–urban transitions: Strategic issues in Sub- Saharan Africa. Paper presented at the future of small farms, Wye College, London, June 26–29.

Fouré, J., A. Bénassy-Quéré and L. Fontagné (2012), The Great Shift: Macroeconomic projections for the world economy at the 2050 horizon, CEPII Working paper 2012-03.

Fouré, J., A. Bénassy-Quéré and L. Fontagné (2013), Modelling the world economy at the 2050 horizon, Economics of Transition (forthcoming).

Filmer, D. and L. Fox. 2014. *Youth Employment in Sub-Saharan Africa*. Africa Development Series. Washington, DC: World Bank. doi:10.1596/978-1-4648-0107-5

HAGGBLADE S., P. HAZELL, and T. REARDON. (Eds) 2007. *Sectoral Growth Linkages between Agriculture and the Rural Nonfarm Economy*. Baltimore: Johns Hopkins University Press

Hoddinott, John (1993). 'Wages and Unemployment in Urban Cote d'Ivoire', mimeo, Centre for the Study of African Economies, Oxford University

IFPRI (2013) 2012 Global Food Policy Report, IFPRI: Washington DC.

Kingdon, G. and J. Knight (1999), "Wages and unemployment in South Africa; a spatial analysis", Centre for the Study of African Economies, University of Oxford, WPS/99-12.

Laborde D. 2010. "ADEPTA:anAnalyticalDatabaseforEconomistsonProtectionandTrade."Mimeo.

Laborde, D., C. Lakatos, G. Nelson, R. Robertson, M. Thomas, W. Yu, H.G.P. Jansen (2011) Climate change and agriculture in South Asia: alternative trade policy options, Working Paper 2011/09/01, The World Bank.

Malassis (1997)

Page (2012)

Self and Grabowski 2007

United Nations, Department of Economic and Social Affairs, Population Division (2012). World Urbanization Prospects: The 2011 Revision, CD-ROM Edition.

United Nations, Department of Economic and Social Affairs, Population Division (2013). World Population Prospects: The 2012 Revision, DVD Edition.

YUMKELLA K. K., KORMAWA P. M., ROEPSTORFF T. M., and A. M. HAWKINS (Eds). 2011. Agribusiness for Africa's Prosperity. Vienna: United Nations Industrial Development Organization.

WILKINSON, J. and R. ROCHA. 2009. Agro-industry trends, patterns and development impacts. In C. da Silva, D. Baker, A.W. Shepherd, C. Jenane, S. Miranda-da-Cruz (eds.), Agroindustries for Development, Wallingford, UK: CABI for FAO and UNIDO, pp. 46-91.