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Potential effects of foreign direct investment in African agriculture

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1. Introduction

Given longer term income and population projections and consequent growth in food demand, global food production will need to increase by more than 40 per cent by 2030 and 70 per cent by 2050 relative to 2005–07 average levels (OECD and FAO 2009). Achieving such increases in food production will depend on the availability of arable land and water, increased agricultural investment and prospects for enhanced productivity. Although there is broad agreement that global agriculture has the capability to meet the growing food demand by 2050, there is little consensus on how this can be achieved by sustainable means (Tilman et al. 2002). However in this context, there is growing focus on 'sustainable intensification' as a means to increase crop yields in underperforming regions while simultaneously lowering the adverse environmental effects of farming systems. In particular, there is an increasing attention on reducing yield gaps (i.e. differences between observed yields and those attainable in a given region) (Mueller et al. 2012) Fundamental shifts in institutions, policies, investment (both domestic and foreign) and incentives will be needed in the search for, and large scale adoption of sustainable agricultural practices to ensure regional and global food security. This search must be an on-going and adaptive process (Tilman et al. 2002).

At present, cultivated global arable land area is estimated at 1.3b ha, relative to the total available land area of 4.3b ha. The expansion of arable land has been slow in the past, growing at an average annual rate of 0.2 per cent since the 1960s. After allowing for competition by forestry, urbanisation and protected areas, it is estimated that around 1.5b ha of land is available for crop expansion. Most of this land is in Africa and South America (OECD and FAO 2009). Limited investment in African agriculture is one of the key constraints to expansion in agricultural production in the region. For most African countries, domestic investment in agriculture is constrained by the limited availability of domestic

savings and heavy reliance on bilateral and multilateral aid funding. The share of agriculture in total bilateral and multilateral aid declined from a peak of 22.5 percent in 1979–1981 to a low of 5.4 percent in 2003–2005, before increasing to 6 percent in 2009 (Cleaver 2012). The combination of declining aid to agriculture and low public investment in agriculture by developing countries (including those in Africa) in recent decades has resulted in a large public investment gap between what is needed and what is supplied (see Figure 1). In Africa, most governments still spend less than 10 percent of public budgets on agriculture (Cleaver 2012). Hence additional agricultural investment financing through domestic sources alone is not only be difficult but also not strategic (Brzeska et al 2012). In this context, it could be argued that foreign direct investment (FDI) can play an important role in supplementing the investment requirements in African agriculture.

Given this background, the main focus of this paper is on the potential effects of FDI in global agriculture, with a particular emphasis on African agriculture. In general, FDI in agriculture is relatively small in comparison with other economic sectors (UNCTAD 2012). At present the FDI in agriculture takes several different forms. These include foreign investment in land, agribusinesses and water entitlements (Moir 2011, Deininger et al 2011). Furthermore, FDI in agriculture can affect different components along the production and marketing chain, from direct production of food and cash crops to entry of providers of farm inputs (e.g. seeds and agro-chemicals) and of food distributors (e.g. supermarkets) (Rakotoarisoa 2011). Agricultural FDI has been growing steadily in recent years with farm land being the main focus of investors. The continually rising global interest in agricultural FDI has manifested predominantly in the form of land acquisitions with a strong focus on Africa. In many cases, the land acquisitions in Africa have involved long term leases of use rights through the public sector rather than outright purchases or ownership (Deininger et al 2011).

The issue of FDI in agriculture has received considerable amount of attention domestically and internationally over the past several years (Deininger et al 2011, Moir 2011, Department of Treasury 2011). This has been triggered by factors such as the growing inflow of foreign investment in food and agricultural sectors in Africa (Rakotoarisoa 2011). From a domestic perspective, there has been continuing interest in FDI in Australian agriculture, given the fact that Australia has continued to attract foreign investment over the past half a century as a major supplier of surplus food products (Young and Sheales 1991, Department of Treasury 2011).

Given the growing interest in FDI in domestic and global agriculture, this paper explores the potential role, sources, destinations and the nature, and the impacts of foreign investment in agriculture, with a particular attention on FDI in African agriculture. There are several reasons for focussing on FDI in agriculture in Africa. Firstly, despite the fact that agricultural FDI accounts for less than 5 per cent of overall FDI in Africa, it has grown on average by 17 per cent during 2003-10 period showing an upward trend (Rakotoarisoa 2011, World Bank 2011). Secondly, as discussed earlier, there is scope for expanding agriculture into new farm land in Africa. Thirdly, as will be discussed later, there is considerable opportunity to raise agricultural productivity in currently cultivated land in Africa. Fourthly, there is a need to raise farm incomes in Africa. The per person agricultural incomes in Africa increased at less than 1 percent per year during 2000–09. This rate was only a third of the non-agricultural sector's income growth rate. Hence, there has been a continuation of the rural–urban income inequality in Africa (Brzeska et al 2012). Finally, African agriculture could play a potentially important role in the medium to long term in helping to meet the growing global food demand.

Six sections follow this introduction. First, the key factors influencing FDI in agriculture (including the triggers and concerns) are briefly presented. This will be followed by a brief discussion of the role of FDI in agriculture, and then a review of the sources and destinations of FDI in African agriculture. Sources of agricultural growth within the context of FDI are discussed thereafter. The potential impacts of FDI in African agriculture are analysed and briefly discussed afterwards. The final section provides some concluding remarks.

2. Factors influencing FDI in agriculture

There are several factors which are triggering the growth in interest in agricultural FDI. Some of them are 'push factors' while others are 'pull factors'. The 'push factors' include: increasing demand for food and feed in major importing countries and the need to seek opportunities to secure adequate food supplies overseas; growing demand for biofuel feed stock; and continuing concerns about potential vulnerability to substantial volatility in global food markets. The 'pull factors' include: agro-ecological suitability of the FDI recipient countries; relocating food production in regions where land is relatively cheaper and the scope for agricultural productivity growth is comparatively higher; projections of secure returns from land-based investments; and increasing expansion in large scale agro-processing and agro-industrial operations with forward and backward linkages (Arezki et al 2011, Deininger et al 2011, UNCTAD 2009).

It is important to recognise that there are large amounts of land suitable for agricultural production available in both Africa and Latina America. Compared to Africa, Latin America has land areas closer to relevant infrastructure. According to Deininger et al (2011), one of the key reasons for continuing greater investor interest in agricultural production in Africa relative to Latin America is the relatively higher land prices and rents in the latter. This is due to the fact that better infrastructure access and a large pool of skilled labour in Latin America

has already been capitalised into their land values, compared to those in Africa. Comparatively low cost land in Africa appears to provide the agricultural investors with potentially greater investment opportunities (Deininger et al 2011).

Arguments for and against FDI in agriculture, particularly in developing regions such as those in Africa have been presented by many commentators. Those who favour agricultural FDI, (particularly in developing regions) highlight the benefits of reversing long term under investment in agriculture in such regions. This could facilitate land abundant countries to gain access to better technology and expertise resulting in productivity improvements and the flow on favourable growth and development, employment and income effects. Those who are less favourable towards agricultural FDI, particularly in regions with weak institutions, governance arrangements and regulatory regimes, and ill-defined land and water property rights, argue that such investment could result in projects that are socially, technically, environmentally and financially unviable without any appreciable local benefits (Deininger et al 2011). Recent cross-country empirical analysis has shown that governance of the land sector and long term tenure security in the recipient countries has been less of a concern for investors (Arezki et al 2011). Nevertheless, there is a growing need for improvement in land governance and transparency and monitoring in many of the FDI recipient developing countries.

Also there have been concerns in recent years about the actual and proposed FDI in relation to large farmland acquisitions in developing countries. These concerns relate to, for example, the issue of neglecting land property and tenure rights of farmers, the likely long term effects on poverty reduction and sustainable development in recipient countries, and the likelihood of high socio-economic costs being borne disproportionately by vulnerable groups in recipient countries. Some of these concerns are a consequence of existing institutional gaps,

lack of basic relevant information including those relating to documented land tenure and property rights of farmers, weak consultation processes between the investors and the recipients, and limited local capacity and expertise in assessing technical, economic, social and environmental viability of the FDI arrangements in some of the recipient countries. Another set of concerns about the FDI in agricultures relate to failures in implementation of land acquisitions deals and scale back of investment plans due to inadequate infrastructure, technology and institutions. This has led to only just over 20 per cent of announced land acquisition deals been manifested in actual farming in recent years (Deininger et al 2011).

3. Role of FDI in agriculture

Recent analysis of the long term nature of agricultural development globally highlights the role of new technologies and effective institutions in stimulating agricultural productivity and inclusive economic growth, and in that context, the role of investment in agricultural research is a key ingredient (Barrett et al 2010). One possible way to explore the issue of FDI in agriculture is to view it from the perspective of long term agricultural development.

In the past, international investment in several key agricultural R&D breakthroughs such as those associated with Green Revolution has emerged from public sector global and regional initiatives. However, there has been a slowdown in recent years in domestic and international investment in agricultural R & D in many parts of the world. According to Zhai and Zhuang (2009) low levels of investment in agricultural R&D may have influenced the slowdown in agricultural productivity in recent years. There is evidence from many empirical studies that investment in agricultural R&D generates high returns (Alston et al. 2009). For example, investment in agricultural R&D in Africa has been associated with returns in excess of 20 percent (see Thirtle, Lin, and Piesse (2003), Pauw and Thurlow (2012)). Despite this evidence, the average annual growth rates in public agricultural research expenditure have

continued to fall in recent years. From 1981–91 to 1991–2000, they declined from 2.43 per cent to 0.52 per cent in high income countries and 3.02 per cent to 1.91 per cent in low and middle income countries, in general (OECD and FAO 2009). On the other hand, private sector involvement in agricultural R&D has risen considerably, particularly in the area of genetic modification technology development. Such private sector investment is generally induced by profit-seeking innovation by private firms. Between 1994 and 2010 private sector R & D spending (led by seed-biotechnology and farm machinery) increased by 43 per cent globally. By 2000, private sector food and agricultural R & D in OECD countries and globally accounted for 54 per cent and 39 per cent respectively (Fuglie *et al* 2012).

It is important to note that recent research by the International Food Policy Research Institute (IFPRI) (Cleaver 2012) has shown that investment in agriculture is 2.5 to 3.0 times more effective in increasing the income of the poor than in non-agricultural investment. The investments need to be both private and public. In this context, the creation of an enabling environment for private investment in marketing, farm input supply, agro-processing, and, farming in general is quite important (Cleaver 2012).

In exploring the role of FDI in African agriculture, there are several noteworthy questions that can be raised based on the recent work of Barrett et al (2010). First, what can be the role of FDI in African agriculture in stimulating technical change, enhanced market participation and productivity growth? Second, can FDI help many small farms in Africa to be integrated efficiently into modern supply chains? Third, is there a role for FDI to enhance the competitiveness of the small farm sector in Africa where many poor reside in rural areas?

A potentially important area of FDI in agriculture is transfer of farming technologies and best practice expertise. In this regard, there is scope for transfer of best practice agricultural expertise between, for example, Asian FDI providers (such as China) and African recipients

(see Deininger et al 2011). In recent years, China has become a major investor in Africa. According to Mlachila and Takebe (2011), in Africa at present, China is the largest investor among the major group of emerging economies of Brazil, Russia, India and China (BRICs). According to their analysis, while earlier investment, largely by state-owned companies in China has often been directed towards mining and resource industries, over time, investment has been destined for agriculture, manufacturing and service industries (Mlachila and Takebe 2011). For example, recent Chinese FDI in African agriculture has ranged from poultry industry in Ghana to coffee in Kenya, sugar in Madagascar to cotton in Mali, Uganda and Zambia. The China-Africa Development Fund (which encourages Chinese private enterprises to make direct investment in Africa) has been increasingly facilitating equity financing in priority areas including agriculture in Africa in recent years (Mlachila and Takebe 2011).

Another important role of FDI is the formation of infrastructure including roads, port facilities and irrigation dams. In this regard it is noteworthy that, for example, the current FDI in the Ethiopian sugar industry has involved the construction of dams for irrigation and energy supply (Rakotoarisoa 2011).

Recent analysis of the effects of FDI and trade on economic growth (see Makki and Somwaru 2004, Mlachila and Takebe 2011) has shown several major beneficial impacts of FDI, particularly in developing countries. First, FDI is a key channel through which improved technology is transferred to developing economies. Second, the benefits of FDI are likely to be greatly enhanced if the recipient country has a better stock of human capital. Third, FDI tends to stimulate or crowd-in domestic investment in recipient developing economies. Fourth, FDI has the potential of supplementing low domestic savings and adding to the capital stock, and hence raising productive capacity (especially if accompanied by improvements in infrastructure, as is often the case of FDI from China, for example). Fifth,

FDI can lead to productivity gains via technology transfer, skill acquisition, increased competition and expansion of exports. In regard to the latter issue, it is noteworthy to mention that, for example, FDI in fruit and vegetable production in East Africa has been aimed at diversifying export revenues (see Rakotoarisoa 2011). Sixth, sound macroeconomic policy regimes and domestic institutional stability in the recipient developing countries are necessary preconditions for FDI triggered growth to eventuate (Makki and Somwaru 2004, Mlachila and Takebe 2011).

In general, FDI in agriculture could lead to better use of currently cultivated areas and/or bring in new land areas for cultivation. According to Deininger et al (2011), around 6m ha per year of additional land is likely to be brought into production by 2030 in developing countries with two-thirds of the expansion expected in land abundant regions in Sub-Saharan Africa and Latin America. In contrast to Latin American region, it is important to recognise that none of the African countries of most interest to investors (for example, Mozambique, Zambia, Sudan and Madagascar) is achieving more than 25 to 30 per cent of the potential crop yields on currently cultivated areas (see Figures 2 and 3). These yield gaps are due to several factors including deficiencies in technology, capital markets, infrastructure, public institutions and property rights. This situation in some of the African countries is quite contrast to those countries in Asia, Western Europe and Middle East where there is little available land for expansion and the yield gaps are relatively low. Hence FDI driven increase in crop productivity on existing farmlands in some African countries will have considerable potential benefits (see Deininger et al 2011).

Comprehensive Africa Agriculture Development Programme (CAADP) is an Africa-wide initiative of the New Partnership for Africa's Development (NEPAD) (http://www.nepad.org). A key component of CAADP is a commitment to increase agricultural growth to 6 percent per year by allocating at least 10 percent of the domestic

budget to the agricultural sector. According to Benin et al. (2012) these targets present an ambitious task, particularly given agriculture's current poor performance in many African countries. However, recent IFPRI analysis indicates that a 6 percent agricultural growth is possible in the medium to long term if the sector-level targets for crop yields and productivity are achieved (Benin et al, 2012).

As a part of the NEPAD, many African governments have signed the Maputo Declaration in 2003 to increase the share of agricultural spending to 10 percent of their total budgets (http://www.nepad.org). According to Cleaver (2012), the African countries who are meeting the 10 percent target since 2000 include: Ethiopia, Madagascar, Malawi, Mali, Niger, and Senegal. It is important to recognise that allocating 10 percent of their budget to agriculture means that fewer resources are available for other interventions or sectors. Benin et al (2012) argue that, expenditure prioritisation both across sectors and within sectors in the context of change or reform in fiscal policy and public spending to raise agricultural productivity in many African countries will be critical.

There are at least two areas where FDI could play a critical role in African agriculture. The first involves improving productivity in currently cultivated land, and this could involve investment strategies to reduce the 'yield gap' between current yields and potentially viable yields of specific crops. Such investment strategies would particularly benefit countries with relatively little or no availability of additional land suitable for cultivation (e.g. Burundi, Egypt, Malawi and Rwanda). The second area relates to helping to develop suitable land which is currently available and not efficiently cultivated (e.g. in Mozambique, Sudan and Zambia). This will involve area expansion and could create opportunities for outside investors. Robust institutions, improved infrastructure and better information on business models and contractual arrangement are required to maximise the spillover benefits and local socio-economic multipliers of potential FDI in such situations.

4. Sources and destinations of FDI in agriculture

Recent analysis by Deininger et al (2011) identifies three key sources of agricultural FDI: food importing countries (e.g. China, South Korea, Saudi Arabia); global and regional financial entities (e.g. pension funds) and; large agricultural and agro-industrial firms.

Around 45 m ha of large scale farmland transactions globally have been announced by 2009, of which 70 per cent accounts for transactions in Africa, and in particular in Ethiopia, Mozambique and Sudan. This compares with an average annual increase of global farmland of less than 4 m ha prior to 2008. The land area available for potential expansion of cultivated area globally is around 445 m ha. This is equivalent to around one third of globally cropped land (1.5 b ha). Furthermore, more than 50 per cent of land that could potentially be used for expansion of cultivated area (445 m ha) is in ten countries, of which six are in Africa (Sudan, Democratic Republic of Congo, Mozambique, Madagascar, Chad and Zambia). It is important to recognise that many of this land in Africa are located far from basic infrastructure (Deininger et al 2011).

Maize, oil palm, rice, canola, soybean, sunflower and sugarcane have been the key agricultural commodities which accounted for most of the increase in land use globally during 1990-2007. It could be argued that maize, soybean, sugarcane and oil palm are of particular interest from the perspective of current and future increase in agricultural FDI, especially with respect to the African region. There are several reasons for this likely trend (Deininger et al 2011). First, from the perspective of a range of natural resource and environmental factors (i.e. from an agro-ecological perspective), cultivation of these crops in certain parts of Africa has the potential to make a valuable contribution in the medium to long term. Second, there are a number of African countries where some of these crops are already being cultivated, yet with large yield gaps. Third, there are several key African

countries attracting investor interest and where substantial areas of currently non-cultivated areas with important attributes that could be suitable for cultivation of some of these crops (see Deininger et al 2011).

A recent case study (see Deininger et al 2011) of agricultural FDI related land acquisition projects globally show that during 2008-09, 48 per cent of the projects covered around two-thirds of the total area (32 m ha) which involved Sub-Saharan Africa, followed by East and South Asia (8 m ha), Europe and Central Asia (4.3 m ha) and Latin America (3.2 m ha) (see Figure 4). The commodity coverage of land acquisition projects with relevant data indicate that 37 per cent focused on food crops, 21 per cent on industrial or cash crops, and 21 per cent on biofuels, with the remainder distributed across conservation/game reserves, livestock and plantation forestry (Deininger et al 2011).

One of the major constraints to investment projects in Africa has been the lack of appropriate infrastructure. Many countries in Africa lag behind other developing regions on most key indicators of infrastructure including paved roads, railways, electricity supply and communications. Annual infrastructure expenditure requirements in Sub-Saharan Africa amount to US$ 90 billion, of which only two-thirds are met (Mlachila and Takebe 2011). Given the infrastructure deficiencies in many parts of Africa, it is interesting to note that recent Chinese FDI in Africa in general has involved 'packaged investment projects' involving, for example, both mining/resources (equity financed by Chinese entities) and in related infrastructure (debt financed by Chinese EXIM Bank) (Mlachila and Takebe 2011). Mlachila and Takebe (2011) highlight several advantages of such 'packaged investment projects' arrangements, from a political economy point of view. First, such arrangements are more appealing to recipient African countries given that inadequate infrastructure has been a key impediment for attracting FDI and also for fostering domestic economic growth. Second,

such arrangements give China a competitive edge against other potential investors, and this is also helped by the very competitive Chinese infrastructure/construction sector. Third, the 'packaged investment projects' arrangements enable China to demonstrate to the recipient countries that it is in it 'for the long haul'. Fourth, for strategic commodities such as minerals and energy resources and food, it is in China's interest to make sure that it can rely upon secure supply routes in the long term. Given this background, the application of the concept of 'packaged investment projects' arrangements by the Chinese investors in African agriculture could potentially contribute towards addressing the major infrastructure constraint in recipient countries with beneficial flow-on effects.

The business models for FDI can range between establishing an agriculture sector founded on broad based ownership of medium sized farms (much larger than those currently operated and expanding over time) or a dual structure where a number of large farms coexist with many small producers (Deininger et al 2011). The latter business model has important potential implications for small farmers, given that the average small holder farm size of regions in Africa of most interest to investors is less than few hectares.

In the context of the business models for FDI, it is noteworthy to consider the potential role of small holder farms vs. medium to large farms in African agriculture. Collier and Dercon (2009) argue for a more open-minded approach to different modes of farm production in Africa. According to them the changing global economic context and climate change suggest that more flexible organisational models are required where both small and large farms can operate. There is potential for large farms to interact with small farms using institutional frameworks that encourage vertical integration and scale economies in processing and marketing (Collier and Dercon 2009). In relation to different modes of farm production, Collier and Dercon (2009) have highlighted the lessons that African agriculture can learn

from experiences in Latin America and Asia. In particular, they note two key examples. One involves large scale mechanised production of soybean and rice in the Brazilian Cerrado region. The second example involves cassava and rice production in Northeast Thailand where farms remain of relatively smaller size but with plot consolidation, vast area expansion and some mechanisation, they have become commercial enterprises different from the typical small peasant and family farms (Collier and Dercon 2009).

There are several other factors which have the potential to further increase the importance of agricultural FDI in Africa. They include the emergence of export oriented commercial farms growing horticultural and floricultural products in some African countries and the spread of supermarkets through Africa with vertical integration to commercial farms (Collier and Dercon 2009).

5. Sources of agricultural growth and FDI in African agriculture

In assessing the potential benefits of FDI, it is important to recognise key sources of growth in agricultural production: arable land expansion; increases in cropping intensity; and yield increases (see Bruinsma, 2009).

It is estimated that during 2005/07-2050, yield increases and arable land expansion will remain as potentially important contributors to overall crop production in many regions in Africa, particularly in Sub-Saharan Africa. On average, yield increases, arable land expansion and increases in cropping intensity in the African region have the potential to contribute 69, 25 and 6 per cent respectively to future growth in crop production in Africa during 2005/07-2050 (Bruinsma, 2009). It is important to note that ratios of current yields to estimated potential yields (i.e. the yield gaps) for maize, oil palm, soybean and sugarcane in Sub-Saharan Africa are 0.20, 0.32, 0.32 and 0.54 respectively (see Deininger et al 2011). Mueller et al (2012) point out that there is considerable 'low hanging' crop intensification

opportunities for major cereals such as maize in Sub-Saharan Africa. Their recent analysis indicates that Sub-Saharan Africa could have large production gains if crop yields were increased to only 50 per cent of attainable yields.

Recent empirical analyses provide considerable support for agricultural investment spending in a range of African countries. The elasticity of agricultural growth with respect to agricultural spending for Africa on average is estimated to be around 0.366, which is based on cross-country estimations using long term time series data (Fan, Yu, and Saurkar 2008). Recent analysis by Thurlow et al (2012) has shown that raising investment expenditure by 1 per cent on irrigation infrastructure, rural roads and agricultural R&E (research and extension) could lead to an estimated 0.06, 0.08 and 0.13 percent increase in agricultural GDP respectively in Kenya. Analysis by Fan and Zhang (2008) shows that policies and programs promoting fertilizer use, for example, will have considerable agricultural productivity and poverty-reduction effects. The estimated agricultural productivity and poverty elasticity with respect to fertilizer use are 0.16 and 0.04, respectively (see Benin et al 2012).

Recent analysis by Breisinger et al (2012) illustrates that agricultural public investment in Ghana would have to grow by about 32–59 percent annually in the next 5–8 years in order to support 6 percent agricultural growth relative to what would otherwise be. This represents a rise in the share of agriculture in total government expenditures to 15–34 percent, which is, doubling or trebling its average share during 2000–07. Such a large increase in public investment in Ghanaian agriculture is likely to be highly unrealistic given that the government alone would not be able bear such costs. However, improving the efficiency of public sector spending programs and reforming the institutional and governance arrangements can help to facilitate crowding-in greater private investments including FDI and

reduce crowding-out effects (see Breisinger et al 2012). It could be argued that a similar situation will apply to many other African countries.

Information on key commodities of interest, yield and productivity gaps can provide useful insights into the options available to different African countries to take advantage of investor interest to promote agricultural FDI.

Key commodities of interest

According to Deininger et al (2011), production of maize, soybean, sugarcane and oil palm offer potential for raising the productivity and output of already cultivated areas and for expanding into new farm land in several key African countries that have recently attracted investor interest.

For example, Angola, Democratic Republic of Congo, Ethiopia, Kenya, Mozambique and Tanzania each cultivate more than 1 m ha of maize at present, but with low yields (see Table 1). According to a recent agro-ecological assessment by the World Bank (see Deininger et al (2011)) Mozambique could add 7.1 m ha of maize (3.1 m ha in areas closer to markets) to the 1.4 m ha it already cultivates. However, the major constraints are the large yield gaps and lack of infrastructure. Current maize yields in Mozambique are around 0.92 /ha which is less than a tenth of potential yields. Only around 4 m ha of maize grown areas are within six hours from the nearest market. Zambia has around 13 m ha available for maize cultivation, and more than 80 per cent of which is located within six hours of the nearest market. Similarly, around 3.6 m ha of land suitable for maize in Ethiopia is located far from the required infrastructure (Deininger et al 2011). Furthermore, there are a number of African countries with large potential for cultivable land area expansion to grow maize and will be of

interest to investors. These include Sudan (32 m ha), Chad (9 m ha), Madagascar (7 m ha), Mali (2.4 m ha) and Burkina (2.3 m ha). Area expansion and enhancement of agricultural productivity in these regions will require significant investments in R&D and technology transfer, markets, other infrastructure related to processing etc which could not be funded by domestic investment alone.

Soybean is another crop with considerable potential for expansion in Africa but with little or no experience with the cultivation of the crop in many parts of the region, according to World Bank agro-ecological assessments (Deininger et al 2011). African countries with potential for soybean cultivation in the future include Sudan (14 m ha), Democratic Republic of Congo (9 m ha), Mozambique (7 m ha), Chad, Madagascar, Zambia (6 m ha), Angola (5 m ha) and Tanzania (4 m ha) (see Table 2).

There is also potential for area expansion in sugarcane cultivation in parts of Africa, particularly in the Democratic Republic of Congo and Madagascar (see Table 3). Key constraints are the considerable yield gaps and poor infrastructure, which will require additional investment (Deininger et al 2011). Oil palm is another crop that has the potential to expand in part of Africa given the growing demand for palm oil globally (see Table 4).

Sugarcane has received considerable attention in Mozambique as a biofuel feedstock crop for producing ethanol from foreign companies (Arndt et al. 2010). By 2009, the government of Mozambique had received requests from overseas companies (thorough FDI) for land-use rights covering more than 12 m ha to be used for feedstock cultivation (mainly to grow sugarcane (for ethanol) and *jatropha* (for biodiesel)) (Arndt et al. 2010). This is more than double the amount of land currently cultivated for non-biofuel crops in Mozambique. Proposals of more than 0.5 m ha had been approved by the end of 2009 for biofuels production in Mozambique (Thurlow 2012). Most requests for land for sugarcane envisage

using a plantation approach to producing the feedstock. Given Mozambique's abundance of favourable land, it is reasonable to expect that all the biofuel feedstock could be produced on currently uncultivated lands (Thurlow 2012).

Yield gaps

According to Mueller et al (2012) yield gaps are caused by deficiencies in the biophysical crop growth environment that are not addressed by farm management practices. Their recent analysis has shown that spatial patterns of climate, fertiliser application and irrigated area explain 60 to 80 per cent of global yield variability for most major crops. The factors that primarily limit increasing crop yields to within 75 per cent of their attainable yields vary by crop and region. For example, West African region stands out as a hotspot of nutrient limitation for maize. On the other hand combined limitation of fertilisers and water is observed across the East African region for maize (Mueller et al 2012).

The analysis of Mueller et al (2012) has shown that closing maize yield gaps in Sub-Saharan Africa to 50 per cent (approximately 2.5 tonnes/ha) primarily requires addressing fertiliser deficiencies. Furthermore, closing maize yield gaps to 75 per cent of attainable yields (approximately 3.6 tonnes/ha) requires increases in both irrigated areas and fertiliser applications over most of Sub-Saharan Africa.

It is noteworthy that recent cross-country empirical analysis has shown that agro-ecological suitability and the yield gaps are critical determinates of demand for agricultural FDI (Arezki et al 2011). However, it is important to recognise that introduction of new technologies and farm management practices to close the yield gaps require complementary investment in infrastructure and support services.

Figure 5 illustrates the yield gap and the ratio of cultivated to suitable area in a number of African countries. Several observations can be made based on Figure 5 and in combination with other relevant information. First, there are large tracks of land suitable for rainfed cultivation in areas of sufficient rainfall in sparsely populated regions such as Democratic Republic of Congo, Mozambique, Sudan, Tunisia and Zambia. Second, there are some regions where political tensions and disputes could limit investor confidence. Third, labour and capital supply constraints are limiting agricultural development in some parts of Africa. Fourth, crop intensification and labour saving-mechanisation in some countries will require both domestic investment and FDI. Fifth, FDI in agriculture could help introduce new crop varieties, better farming systems and investment in agricultural processing and marketing. Finally, a combination of better institutional arrangements, agricultural R&D and technology, and infrastructure could provide a framework for mutually beneficial land and resource transfer and use between the recipient countries and the providers of FDI (Deininger et al 2011).

Productivity gaps

Between 1975 and 2007, annual TFP growth in Sub-Saharan agriculture was estimated to be around 0.9 per cent. This compares with annual TFP growth rates of 2.1 per cent from China, 1.4 per cent for Economies in Transition, 1.4 per cent for rest of Asia and 1 per cent for Latina America. An increase in public sector expenditure on agriculture by 10 per cent is estimated to raise a country's agricultural TFP b 0.34 per cent, all other things being equal. FDI is also expected to have a positive impact on agricultural TFP in the presence of adequate institutions, infrastructure and governance (von Cramon-Taubadel et al 2009).

6. Potential impacts of FDI in African agriculture

The focus of most of the recent literature, analysis and debate on agricultural FDI has been on investors' demand for land. There is very limited discussion on the potential implications of agricultural FDI for expanding new cultivable land or raising the productivity of currently cultivated land from the perspective of recipient countries, particularly in regions such as Africa.

The analyses of Deininger et al (2011) and Bruinsma (2009) again highlight the importance of focussing on reducing the yield gap as one of the key strategies for agricultural development in Africa and for fostering the agricultural potential from a regional and global food security perspective.

It is important to recognise that reducing yield gaps may not always be practical in the short term given marginal returns to additional inputs, regional land management policies, limits on sustainable water resources and socio-economic constraints including access to capital, infrastructure, institutions and political stability. But, use of precision farm management techniques, conservation tillage, and high yielding crop varieties can help sustainable crop intensification in the medium to long term (Mueller et al 2012).

Empirical estimates of the elasticity of agricultural productivity with respect to public agricultural spending in Africa show a range of 0.08–0.38, with the elasticities being higher for development spending (for example, research and extension) compared to total spending (Thirtle, Lin, and Piesse 2003; Benin et al. 2008; Fan, Yu, and Saurkar 2008; Fan and Zhang 2008). These elasticities are comparable to those estimated for the Asian region or some specific countries, which range from 0.09 to 0.46 (Thirtle, Lin, and Piesse 2003; Fan and Zhang 2004; Fan, Yu, and Saurkar 2008).

A key investment area in African agriculture is the support of technology generation and dissemination by means of agricultural R&D, technology transfer and extension. Research on investment in agricultural R&D offers the greatest potential for enhancing productivity and reducing poverty (Fan and Zhang 2008). According to analysis by Thirtle, Lin, and Piesse (2003) shows that for every 1 per cent increase in yield brought about by investments in agricultural R&D, two million Africans can be lifted out of poverty.

Modelling the changes in land productivity and FDI

In this paper, we use the dynamic GTAP (Global Trade Analysis Project) model (GDyn) (Ianchovichina and McDougall 2012) to analyse the potential impacts of FDI and land productivity in African agriculture. GDyn is a recursively dynamic applied general equilibrium model of the world economy. It extends the standard GTAP model (Hertel 1997) to incorporate international capital mobility, capital accumulation and an adaptive expectations theory of investment. The GDyn version of the model used in this paper is applied to a seven region by 16 sector aggregation of the version 8 GTAP data base (Narayanan *et al*, 2012). A list of these regions and sectors is provided in Tables 5 and 6.

We undertake the analysis of economic implications of an improvement in land productivity and FDI in Africa by undertaking the following illustrative scenarios using the Gdyn model:

1. Reference case (baseline) scenario: land productivity and FDI in the five African regions (see Table 5) are assumed to increase at an average annual rate of 0.8 per cent and 3.0 percent respectively based on recent trends (based on Ludena et al (2007), Diao et al, (2012), Breisinger et al (2012), Valenzuela and Anderson (2011)) and Rakotoarisoa (2011)) over the simulation period of 2007-30.

2. Land productivity growth scenario: land productivity in the five African regions is assumed to increase at an annual average rate of 1.2 percent over the simulation period off 2007-30
3. FDI growth scenario: FDI in the five African regions is assumed to increase at an annual average rate of 10 percent over the simulation period off 2007-30
4. Combined scenario: (scenarios 2 plus 3)

Analysis of the potential impacts of raising land productivity in currently cultivated African farm land with the help of FDI will involve comparing a baseline scenario (i.e. reference case) with the land productivity, FDI and combined policy scenarios described above.

In reality, land productivity growth rates can be erratic because of the impacts of climate variability and hence growth rates could vary between years. Hence the land productivity growth rates assumed in our analysis can be regarded to represent average annual growth rates.

In the Gdyn model, regional capital is owned by domestic and foreign households via a global trust. This relationship is described as $V=V_H + V_F$. V is the equity value of firms in a given country or region. V_H and V_F are domestic and foreign components of V, respectively. In our modelling of FDI, we increase the annual average rate of growth of V_F from the baseline case of 3 per cent to FDI growth scenario case of 10 per cent during the simulation period. It is expected that the increased levels of FDI have the potential to transfer technology and managerial skills to a host country or region, thereby enhancing productivity. Such a process could be particularly useful given the large gaps between current and potential yields for most crops in many African countries.

In the combined land productivity and FDI growth scenario, it is assumed that additional growth in productivity improvements will result from increasing yields to achieve a reasonable reduction in the gap between current and potential yields over the simulation period. Achieving productivity-led agricultural growth requires a significant increase in investments in agriculture, rural infrastructure, and marketing. This will enable African countries to close the existing yield gaps and achieve favourable productivity growth over time.

It is important to recognise that modelling analysis described above does not explicitly consider how increased land productivity and FDI growth might be achieved, or what the cost might be in terms of actual levels of investments. The approach described above, however, provides broad insights into how investment in agricultural R&D and infrastructure is likely to generate beneficial outcomes in the medium term.

Discussion of simulation results

The key simulation results from the GDyn scenario modelling analysis are presented in Tables 7 and 8 for years 2015 and 2030. Several observations can be made from these simulation results. First, over the simulation period, improvements in land productivity and FDI growth lead to an estimated increase in crop output and exports in the different African regions, although the rates of increase are different across regions and crops. Second, growth in FDI tends to have a large output and export growth impact, highlighting the enhanced favourable effects of investment in agriculture. Third, it is important to recognise that the estimated increases in output and trade under the policy scenarios are from lower base levels at the reference case for many African countries. Fourth, the simulated combined effects of land productivity enhancement and FDI growth tends be larger than the individual effects.

7. Concluding remarks

The aspiration of African countries to improve their agricultural sector will be influenced by several factors. These include substantial domestic public expenditure programs for agriculture, adequate aid allocations for the sector, growth in FDI in agriculture, and good policy and adequate governance and improved infrastructure. Available data over the past several decades suggest that good policies and high investment in agricultural programs by African countries such as Mozambique, Tanzania, Ethiopia, Mali, and Niger have helped them achieve high agricultural growth (over 4 percent per year) (Cleaver 2012).

Given this background, FDI has an important potential role to play over the coming decades. Growing interest in agricultural FDI presents potential opportunities and benefits to many African countries with large agricultural sectors, gaps in crop yields and farm productivity and abundant supply of arable land. Many countries in Africa who have received the particular attention of agricultural investors in recent years display two important characteristics: first, the availability of considerable amounts of currently uncultivated land suitable for cultivation; and second, substantial gaps between potential and actual crop yields. Furthermore, there is considerable scope for enhancing the overall productivity of currently cultivated land areas in many of these countries (Deininger et al 2011).

The effectiveness of agricultural FDI in developing countries, particularly in Africa will be influenced by several factors: investing in agricultural technology; fostering of local comparative advantage; assessing technical and socio-economic feasibility of proposed FDI arrangements in a transparent and robust manner; making improvements to the existing weak institutional frameworks for land governance; enhancing small holder competiveness and;

fostering market access in a non-distortionary manner (Deininger et al 2011). An important risk to expansion in agricultural production in Africa is the impact of climate change. According to Hertel et al (2010), a one degree Celsius warming globally by 2030, could have potential adverse effects particularly on maize and other coarse grains in the sub-Saharan Africa region.

Any future growth in African agricultural production triggered by FDI could also have several important implications for global trade and hence for Australian agriculture. The global trade effects will be influenced by the extent to which FDI recipient markets are linked to their trading partners: the stronger the links, the larger the impacts. If agricultural FDI consists of producing food to be exported to other regions, the direct effect will be an increase in the supply of food in the destination regions. This could potentially put downward pressure on food prices and raise consumption (Rakotoarisoa 2011). Depending on the size and nature of the expansion in African agricultural production, for example, their grain imports could potentially fall and exports could rise in the medium to long term, particularly due to the high substitutability of all major grains such as wheat, rice and maize in the global markets for calories. Such changes in African trade patterns for grains could impact on global grain trade resulting in implications for grain exporters such as Australia. Furthermore, global bio-energy markets could also be potentially affected, if there is a considerable expansion in biofuel feedstocks such as sugarcane in some African countries.

Foreign investment remains the largest external financial flow to Africa and has great potential for stimulating long-term growth and employment. Yet, the increase in investment in recent decades did not produce more inclusive growth or sufficient jobs as most of the finance went on the hunt for resources. Africa needs to attract more productive FDI to

diversify its economy and benefit from technology transfers and spill over effects (AEO 2012).

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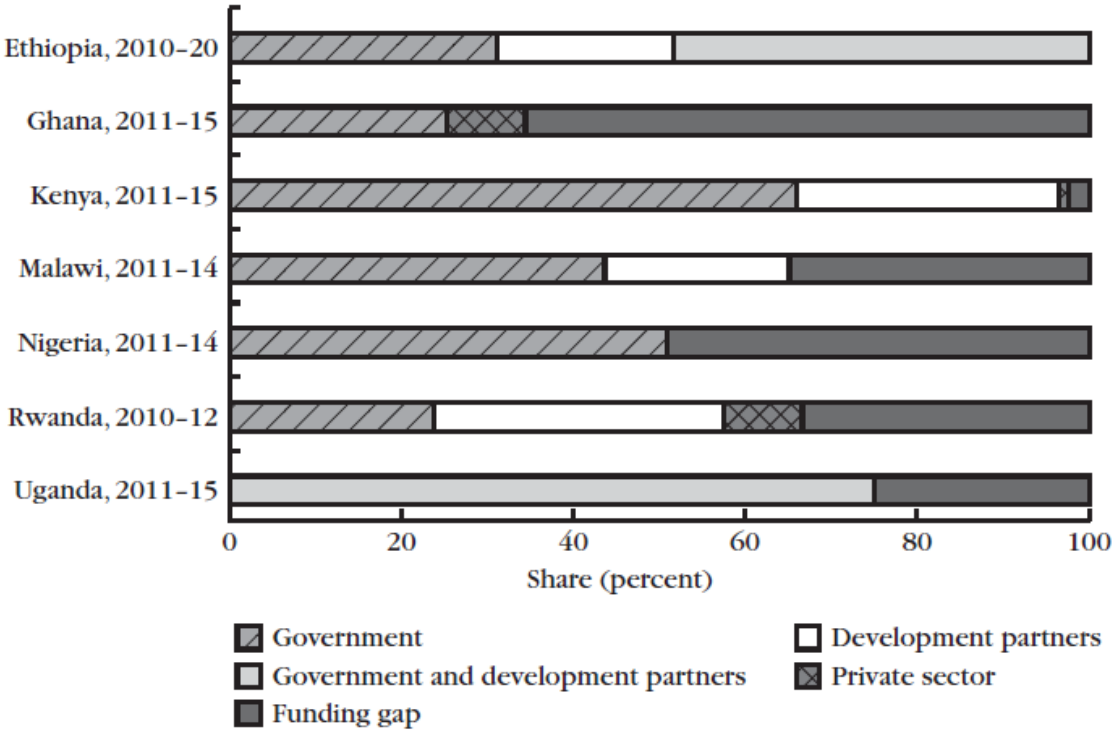
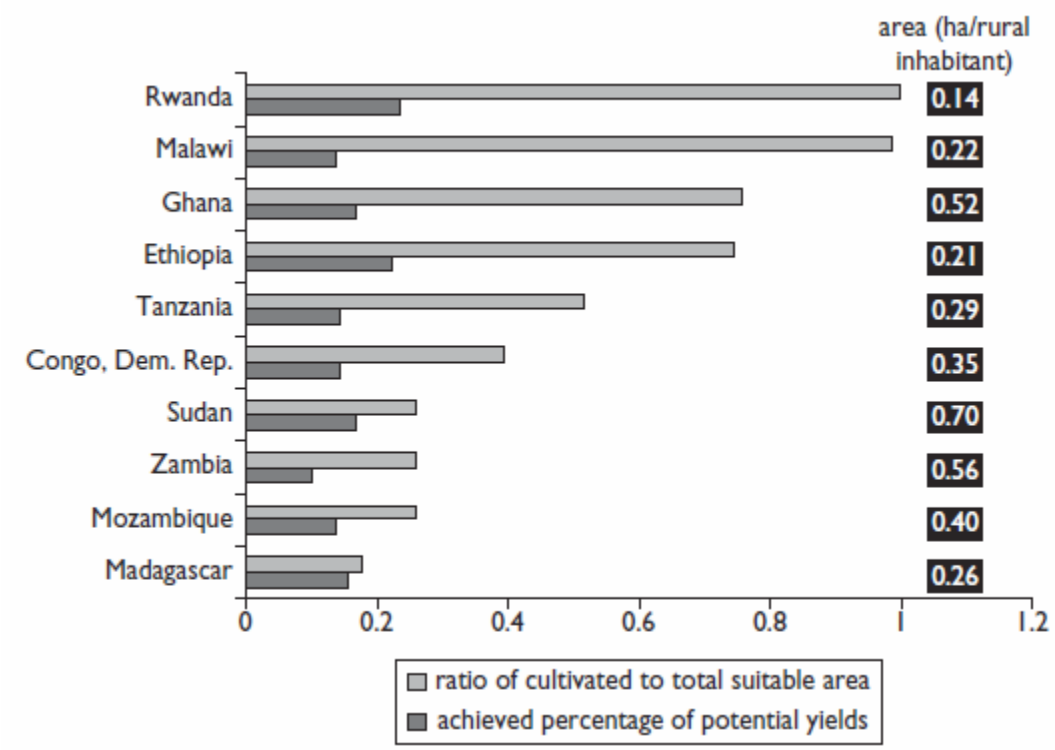
Figure 1: National agricultural investment plans: funding sources and gaps in selected African countries



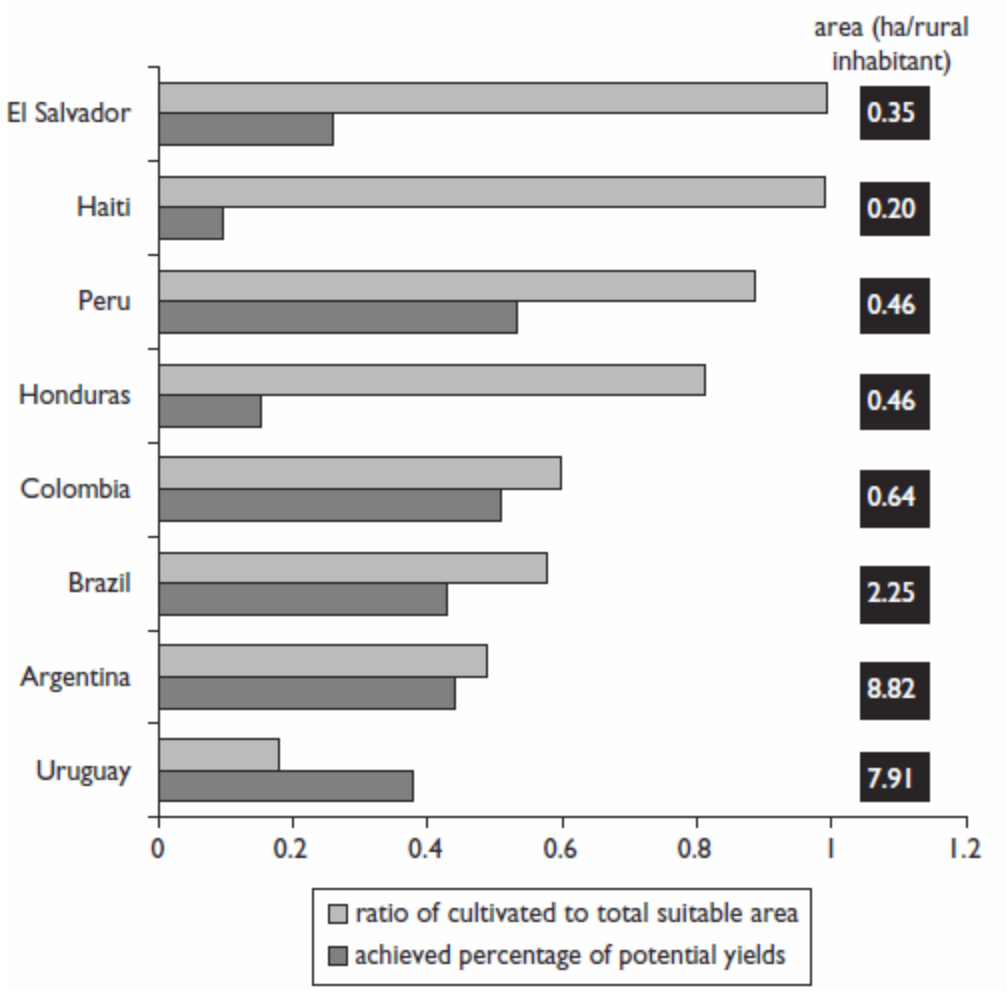
Source: (Benin et al 2012).

Figure 2: Yield gap, availability of uncultivated land, and area cultivated per rural inhabitant for selected countries in Africa



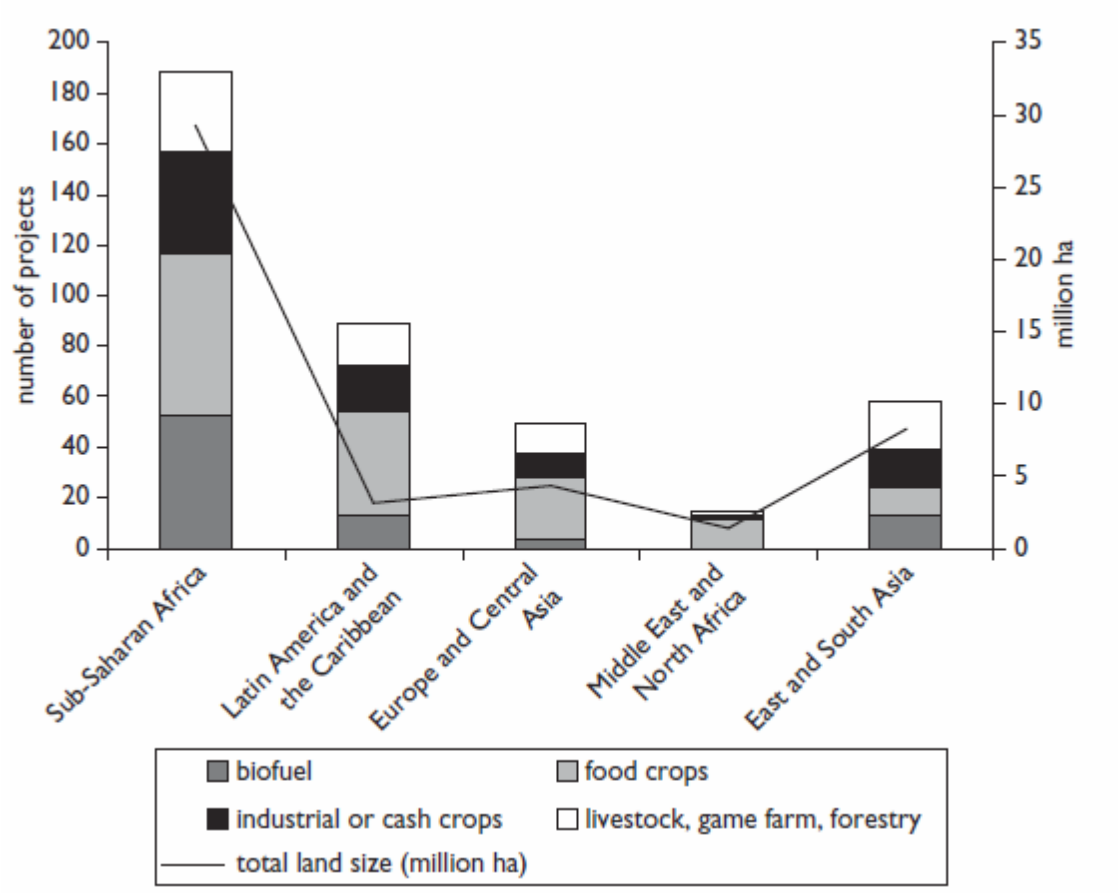
Source: Deininger et al 2011

Figure 3: Yield gap, availability of uncultivated land, and area cultivated per rural inhabitant for selected countries in Latin America and Caribbean



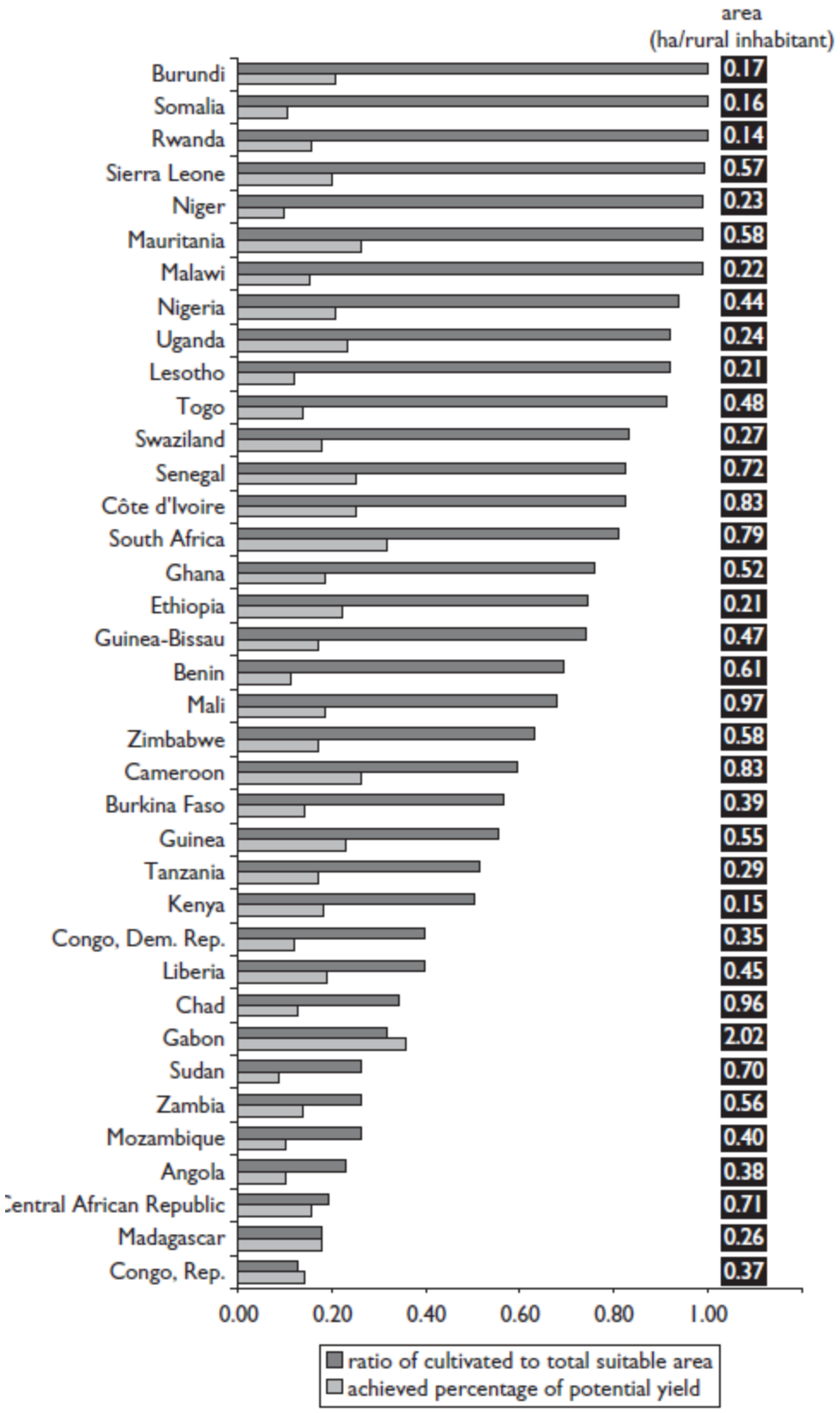
Source: Deininger et al 2011

Figure 4: Frequency distribution of projects and total land area by destination region and commodity group



Source: Deininger et al 2011

Figure 5: Yield gap vs. Relative land availability in Africa



Source: Deininger et al 2011

Table 1: Maize - potential for land/yield expansion

Country	**Production area (M ha) 2008**	**Yield (t/ha) 2008**	**Additional land availability (M ha)**
Nigeria	3.8	1.96	1.3
Tanzania	3.1	1.18	3.7
South Africa	2.7	4.14	1.1
Ethiopia	1.7	2.14	2.4
Zimbabwe	1.7	0.29	1.0
Kenya	1.7	1.39	2.5
D. R. Congo	1.5	0.78	2.6
Mozambique	1.4	0.92	7.6
Angola	1.1	0.51	4.1
Zambia	0.6	2.18	5.7
Burkina Faso	0.6	1.67	2.3
Guinea	0.5	1.97	1.4
Madagascar	0.2	1.48	6.7
Chad	0.2	0.96	9.1
Cent. Afr. Rep	0.1	1.09	2.4
Sudan	0.03	2.02	31.8
Mali			2.3
Malawi	1.5	1.65	0.012

Source: Deininger et al 2011

Table 2: Soybean - potential for land/yield expansion

Country	Production area (1 000 ha) 2008	Yield (t/ha) 2008	Additional land availability (M ha)
South Africa	174	1.85	1.6
Zimbabwe	65	1.62	1.4
D. R. Congo	35	0.48	8.7
Cameroon	12	0.58	2.3
Zambia	10	1.20	6.3
Ethiopia	8	1.08	2.1
Burkina Faso	5	1.13	1.4
Tanzania	5	0.38	3.8
Kenya	3	0.84	1.3
Madagascar			6.2
Mali			1.5
Cent. Afr. Rep			4.3
Angola			5.2
Chad			5.6
Sudan			13.6
Mozambique			7.3
Guinea			1.3

Source: Deininger et al 2011

Table 3: Sugarcane - potential for land/yield expansion

Country	Production area (1 000 ha) 2008	Yield (t/ha) 2008	Additional land availability (M ha)
Cameroon	145	10.00	1.3
Madagascar	82	31.71	2.1
D. R. Congo	40	38.75	6.5
Congo	18	36.11	1.4
Cent. Afr. Rep	13	7.20	1.2

Source: Deininger et al 2011

Table 4: Oil palm - potential for land/yield expansion

Country	**Production area (1 000 ha) 2008**	**Yield (t/ha) 2008**	**Additional land availability (M ha)**
D. R. Congo	175	6.48	4.5
Liberia	17	10.76	0.4
Congo	7	12.50	1.2
Gabon	4	7.98	0.3
Guinea	310	2.68	
Ghana	300	6.33	
Cote d'Ivoire	215	5.58	0.1

Source: Deininger et al 2011

Table 5: Regional Aggregation of GDyn Model

Region Code	**Region Description**
developed	Developed Countries
developing	Developing Countries
NAfrica	North Africa
WAfrica	Western Africa
CAfrica	Central Africa
EAfrica	Eastern Africa
SAfrica	Southern Africa

Table 6: Sectoral Aggregation of GDyn Model

Sector Code	Sector Description
rice	paddy rice
wheat	wheat
c_grain	coarse grain
fru_veg	vegetable and fruit
oilseed	oil seeds
sugar	sugar, sugar cane, beet
cotton	cotton and fiber
othercrop	other crops
beefsheep	beef and sheep
porkchick	pork and poultry
dairy	milk and milk products
forestry	fishing and forestry
p_food	processed food
mine	mining
mnfc	manufacturing
serv	service

Table 7: Change in output relative to the baseline (%)

Output Year
2015

% Deviation from Baseline

		Central Africa	Eastern Africa	North Africa	Southern Africa	Western Africa
Coarse Grain	LP	0.0	0.1	0.2	0.1	0.0
	FDI	8.5	2.7	1.5	1.8	1.5
	+	8.6	2.9	1.9	1.9	1.5
Veg/Fruit	LP	-0.1	0.0	0.0	0.0	0.0
	FDI	6.4	1.4	0.8	1.5	1.1
	+	6.4	1.5	0.9	1.6	1.1
Oil Seeds	LP	-0.1	0.9	0.5	0.1	0.2
	FDI	5.7	0.0	-1.6	2.2	2.2
	+	5.8	1.0	-0.9	2.4	2.4
Sugar	LP	0.0	0.2	0.1	0.1	0.7
	FDI	12.9	4.6	2.0	2.5	5.9
	+	13.2	4.8	2.2	2.6	6.1
Cotton	LP	-0.2	1.4	0.2	0.0	0.6
	FDI	-11.0	0.2	5.1	1.2	4.7
	+	-10.3	1.9	5.5	1.8	5.3

Output Year
2030

% Deviation from Baseline

		Central Africa	Eastern Africa	North Africa	Southern Africa	Western Africa
Coarse Grain	LP	0.2	0.1	0.3	0.1	0.2
	FDI	43.1	10.7	66.5	11.4	14.2
	+	43.3	11.1	67.3	11.5	14.3
Veg/Fruit	LP	0.2	0.0	0.1	0.1	0.1
	FDI	41.1	9.4	48.7	17.0	12.5
	+	41.2	9.6	49.0	17.0	12.5
Oil Seeds	LP	0.1	1.7	0.3	0.0	0.7
	FDI	32.4	15.3	88.3	14.4	28.5
	+	32.5	18.5	90.2	14.4	28.5
Sugar	LP	2.5	0.9	0.6	0.5	1.7
	FDI	158.3	33.2	66.1	17.7	26.6
	+	159.5	34.1	66.6	17.9	27.3
Cotton	LP	0.7	2.7	0.2	-0.6	1.2
	FDI	81.6	19.4	87.0	26.6	34.2
	+	82.8	24.5	88.0	26.3	34.5

Table 8: Change in exports relative to the baseline (%)

Export Year 2015

% Deviation from Baseline

		Central Africa	Eastern Africa	North Africa	Southern Africa	Western Africa
Coarse Grain	LP	0.4	1.1	1.3	0.3	1.1
	FDI	-21.0	-1.4	-16.1	2.9	2.9
	+	-19.8	-0.2	-14.6	3.4	3.6
Veg/Fruit	LP	-0.8	0.0	-0.4	-0.1	0.3
	FDI	-26.4	-6.3	-18.0	1.7	3.7
	+	-26.1	-6.1	-17.9	1.9	3.6
Oil Seeds	LP	0.0	2.6	2.6	1.0	1.0
	FDI	-33.9	-6.8	-26.9	3.1	4.2
	+	-32.6	-3.8	-24.4	4.6	5.1
Sugar	LP	0.0	0.6	0.3	0.4	1.7
	FDI	-4.8	2.6	-14.1	5.1	9.7
	+	-4.0	3.1	-13.7	5.4	10.3
Cotton	LP	-0.1	2.2	0.9	0.2	0.7
	FDI	-27.0	-4.4	-25.5	-0.4	4.9
	+	-25.9	-1.7	-23.7	0.7	5.8

Export Year 2030

% Deviation from Baseline

		Central Africa	Eastern Africa	North Africa	Southern Africa	Western Africa
Coarse Grain	LP	2.8	1.6	0.7	0.1	1.8
	FDI	62.0	12.8	128.3	24.6	52.4
	+	66.0	15.5	133.6	24.4	52.5
Veg/Fruit	LP	2.8	0.7	0.0	0.2	2.3
	FDI	107.1	14.8	153.0	36.5	65.2
	+	108.0	15.8	153.7	36.5	65.1
Oil Seeds	LP	3.9	4.9	1.0	0.4	2.1
	FDI	95.6	25.5	337.9	52.5	67.6
	+	101.3	34.4	359.7	52.9	67.5
Sugar	LP	5.7	2.6	1.7	1.9	4.0
	FDI	335.7	63.4	262.7	61.3	34.1
	+	343.0	66.1	266.0	62.0	35.9
Cotton	LP	2.6	4.2	-0.3	-0.2	1.3
	FDI	111.4	9.8	204.9	33.4	35.1
	+	116.4	17.7	215.0	34.1	35.4