



Impact of Economic and Trade Expansion of China on Employment and Household Welfare in Burkina Faso: A Computable General Equilibrium Analysis

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ABSTRACT

The impact of economic and trade expansion of China on Burkina Faso's economy is analyzed in this work through three channels: trade in goods and services, foreign direct investment and development assistance. To capture the direct and indirect effects of Chinese growth, we use a computable general equilibrium model. The results show that expanded trade with China leads to an increase in domestic prices, an increase in exports to China among product categories for which exports increases, and an increase in imports. The effect on growth, value added and household well-being is small. We find a decline in domestic prices, an increase in exports and a decline in imports. Higher FDI inflows induce additional economic growth equal, increased total labour demand and increased average household well-being, especially among cotton farmers.

Keywords: FDI, Aid, trade, CGE, Chine, Burkina Faso

JEL Classifications: F14, F35, D58, O19

1. INTRODUCTION

China has experienced robust economic growth rates over the last three decades. The ability of China to eliminate extreme poverty and become an emerging country and one of the main exporters of manufactured products has attracted the attention of numerous developing countries (Renard, 2011). Since 1980, the Chinese economy has grown by 9% annually and its external trade has risen by 15% annually during that period. Its share of international trade rose from <1% in 1980 to about 5% in 2002 and 11% in 2012¹. The emergence of China as a major economic and trading power brings large-scale changes to the world economy and international economic relations (Gaulier et al., 2005). For developing countries, the performance of

the Chinese economy is a model of development. Since the emergence of the Chinese economy, China has had a very important presence among donor countries for development and financing development projects (infrastructure, industry and agriculture) in developing countries. The cooperation relations between Africa and China date to before the independence of African countries. The contemporary Sino-African relationship began with the 2000 Forum on China-Africa Cooperation. In 2012, at the fifth China-Africa ministerial conference, China announced that it would double its credit granted to the continent over the following three years and committed to invest more than 20 billion dollars into Africa in projects targeted to development in agriculture, industry and infrastructure (AFD, 2013)². The

¹ IMF, using WEO (April 2013) and DOT (August 2013) databases.

² For more detail on Chinese commitments in Africa, readers may consult FOCAC (2012), "The Beijing Declaration of the Fifth Ministerial Conference of the Forum on China-Africa Cooperation (2013-2015)".

stock of Chinese foreign direct investment (FDI) in Africa reached 16 billion dollars in 2011³.

Overall, the growing presence of China in Africa can bring both growth opportunities and risks for economies of the continent. Opinions on the relationship between China and African countries are subject to debate. Studies such as those of McCormick (2008) and Penhelt (2007) are critical in terms of the effectiveness of aid from China, while other authors, such as Davis et al. (2008), Wang (2007) and Foster et al. (2008) highlight positive aspects of Chinese aid. Other analyses claim that in sectors where China and Africa are in competition, the increase in Chinese exports induces a decline in African production (Renard, 2011). Ademola et al. (2009) conclude that exporting countries in oil, gold and metals, cotton, and importers of vehicles, motors for vehicles, textiles, clothing and rice benefit from trade relations with China. For Benin, Burkina Faso and Mali, which are cotton exporting countries, Zafar (2007) concludes that the effects of trade with China are mixed; these countries benefit from higher prices of primary products, but lose from higher oil prices.

Burkina Faso maintained a diplomatic relation with the People's Republic of China between 1973 and 1994. Since 1994, Burkina Faso has not had direct diplomatic relations with China. The authorities of Burkina Faso chose economic cooperation with Taiwan. Despite the cessation of formal cooperation between Burkina Faso and China, economic and trade relations between the two countries are not insignificant. In 1995, trade relations between Burkina Faso and Taiwan amounted to 2.4 million US dollars and trade with China totalled 5 million. In 2011, trade with China totalled an estimated 381 million US dollars while trade with Taiwan was evaluated at 19 million US dollars (UNCTAD, 2013). Exports from Burkina Faso to China are mostly of agricultural products (cotton, fruits and vegetables, oleaginous products, live animals) and extraction products (gold, zinc). Imports into Burkina Faso from China are mainly transportation products (cars, tractors and other vehicles), chemical products, telecommunications products, electric products, pharmaceutical products, grains, iron and steel.

As is the case with trade relations, economic relations between Burkina Faso and China continue to be large despite the interruption of formal economic cooperation. Despite the absence of diplomatic relations between China and Burkina Faso, Chinese presence in the country has increased through migration since the end of the 1990s (Mohammed 2014). The expansion of the relationship between China and Burkina Faso was caused by economic and trade liberalization undertaken by Burkina Faso since 1991 and also partnership agreements with the West African Economic and Monetary Union (WAEMU)⁴ and the Economic Community of West African States (ECOWAS) as well as agreements under the

framework of the World Trade Organization (WTO)⁵. In terms of bilateral and multilateral agreements to promote and protect investments, the government of Burkina Faso in 1998 signed an investment protection agreement with China. This agreement was signed for a fixed period of ten years renewable on tacit agreement for an unlimited period. The agreement was ratified in 2003. These different agreements and reforms enabled the entry of Chinese multinationals and the expansion of trade between the two countries. Economic and trade relations between China and Burkina Faso expanded in part through trade facilities instituted under WAEMU and ECOWAS. Among the trade measures, there is the common external tariff (CET). The existing literature holds that the trade and economic relationship between China and African countries brings both risks and opportunities.

The objective of this study is to evaluate the direct and indirect effects of Chinese growth on the economy of Burkina Faso. More specifically, to evaluate the effects of Chinese economic and trade expansion on GDP, employment and wellbeing of households in Burkina Faso. The studies which analyzed the impact of Chinese growth on developing and developed countries are descriptive in nature (Zafar 2007; Mohammad, 2014) or are in partial equilibrium (Renard, 2011; Villoria, 2009; Villoria et al., 2009). Partial equilibrium methods can only capture the direct impacts of Chinese growth. However, the literature shows that economic growth in China affects international import and export prices and the volume of exports. In short, changes in world price levels, foreign direct investment and development aid have important general equilibrium effects. In this context, a calculable general equilibrium model is the appropriate tool to capture the direct and indirect effects of Chinese growth. Another advantage of a CGE model is its ability to evaluate the effect of an exogenous shock on the wellbeing of households. To do this, a computable general equilibrium model will be used.

This study aims to evaluate the impact of economic and trade growth in China on employment and household welfare in Burkina Faso. More specifically, the study evaluates the impact of increased FDI, development aid from China and changes to levels of international prices for imports and exports on the distribution of income, wellbeing and poverty in Burkina Faso. Considering the complexity of how aid, FDI and trade impact economies, in order to account for the direct and indirect effects of these different economic variables, the appropriate analytical tool is a computable general equilibrium model. The approach that we develop is a static CGE model in order to analyze the short- and medium-term effects.

The present study is divided into five parts. After the introduction which outlines the study context, the problem and the research questions and objectives, the second section takes stock of the existing literature on FDI, aid and trade in general equilibrium

3 Ibid.

4 The China Development Bank (CDB) signed an agreement to lend 60 million euros to the West African Development Bank to develop small and medium enterprise among countries of the West African Economic and Monetary Union (WAEMU).

5 In recent years, cooperation between China and regional African organizations has strengthened and been institutionalized. Since 2011, the Chinese government has signed framework agreements for economic and trade cooperation with the East African Community (EAC) and the Economic Community of West African States (ECOWAS), to expand cooperation in promotion of trade facilitation, direct investments, cross-border infrastructure and development aid. All of these agreements enable China to penetrate the Burkina Faso market.

modelling. The third part deals with the methodology and data and the fourth part covers the application and results. Finally, the fifth part presents conclusions and policy recommendations.

1.1. Context of Study

Over the last two decades, China has become a major actor in the world economy. Strong growth of China's economy has been accompanied by an acceleration in its external trade, its aid and foreign direct investment. China's transition from developing country to emerging country is an example of development for developing countries in addition to having been a source of technical and financial aid, which it has offered for more than a decade. The strong presence of China in world trade is linked to the need to procure energy resources to fuel economic growth, and the expanding market for export of manufacturing products, enabling it to build investment relationships (Renard, 2011). Thus, China finds itself on two sides of the international market, both supply and demand. According to statistics from the 2013 WTO report on world trade, China is the number one exporter of merchandise in the world (11.2% of world exports in merchandise) and the second largest importer of merchandise in the world after the United States (9.8% of world imports) (WTO 2013). Moreover, China is the second largest importer of oil products after the United States⁶. To satisfy its energy demands, China diversified its suppliers. Africa has become sought after land⁷ because the African continent holds 8.9% of world oil reserves and accounts for 11% of world oil production (Lafargue, 2005). Africa is also a large market for Chinese manufacturing products, with 15% of the world population in 2011⁸. The presence in Africa is characterized by trade, FDI, development aid, technical assistance, global governance, migration and the environment. Thus, studies hold that Chinese economic growth will have different effects across African economies, depending on the complementarity of their trade, the competitiveness of their industries, the degree of diversification of their economy and the supply capacity of their economy (Doumbouya and Gassama, 2008, p.4). The expanded presence of China on the continent should affect overall growth of the continent and growth of each country.

The economic growth of Burkina Faso was 5.8% in 2010, and then somewhat slower at 5.5% in 2011 and 5.6% in 2012 (IMF 2013). This decline was caused by the decline in gold and cotton prices and the increase in oil prices on world markets. The size of Chinese demand for primary products on the world market affects growth of developing economies such as Burkina Faso. According to the 2012 report on external trade of the National Institute of Statistics and Demography (INSD), gold and cotton account for 86.95% of the total value of exports of Burkina Faso. The change in prices of these products on the world market leads to changes in economic growth through changes to the

trade balance. According to Mohammad (2014), an estimated 600 Chinese entrepreneurs are in Burkina Faso. The Chinese entrepreneurs invest in hotel and restaurant services, commerce, infrastructure and telecommunications. It is important to note that Chinese multinationals have succeeded in penetrating the lucrative sectors of activity in Burkina Faso, in particular automobile imports (especially Lifan Motors), the telecommunications sector (with Huawei and ZTE) and public works (with Geo-Engineering Corporation International Ltd (CCG int'l))⁹.

Relations between African countries and China are fuelled by trade, investment and development aid (Renard, 2011; Drummond and Lui, 2013). The impacts of Chinese growth on African economies are diverse and depend on the composition of the structure of production of each country (Renard, 2011). According to the basic development indicators in the world according to the World Bank in 2010, the rate of openness to external trade in Burkina Faso was 38.7% in 2007. Trade is thus the main transmission channel for various changes in the world economy to impact the economy of Burkina Faso. Also, according to the October 2013 estimates of the International Monetary Fund (IMF), development aid and FDI which respectively amounted to 3.6% and 0.4% of Burkina Faso's GDP in 2012, also have a non-negligible impact on the economy of Burkina Faso.

Major changes in external trade variables, namely prices and volumes of imports and exports, affect the trade balance and thus the real exchange rate of the national economy. The impact of Chinese growth on the trade balance and the current account balance depends on shocks to prices and volumes of the main export and import products of Burkina Faso, as well as the coverage rate of imports by exports. According to the report on external trade by the National Institute of Statistics and Demography (INSD) in 2009, the coverage rate of imports by exports was 42.13% in 2009, resulting in a deficit in the trade balance (-565.26 billion FCFA in 2009).

Trade between Burkina Faso and China is mostly in extractive products, cash crops (cotton, sesame, grains and other vegetable oil products), manufactured products (textiles, telephones and accessories, electronic products), transportation products (vehicles, motorcycles and parts) and pharmaceutical products. As a result, cash crops, the extractive sector and manufacturing industries all experienced the effects of expanding Chinese demand for primary products and supply of manufactured products. According to the 2011 statistical yearbook of the AfDB, exports from Burkina Faso (in percentage of total value of exports of the country) are dominated by gold (33.66%), cotton (28.23%), oleaginous fruits and seeds (5.64%) (AfDB, 2011). This statistical yearbook also shows that the main products imported by Burkina Faso (as a percentage of total imports of the country) are petroleum products (21.54%), rice (4.68%), medications (4.59%), hydraulic cement (3.54%) and cars (3.27%).

According to Roache (2012), intensification of economic activity in China has impacted prices of oil and base metals. For Villoria

6 Since 2006, China has been the second largest consumer of oil with more than 6 million barrels/day, behind the United States (20 million barrels/day) and ahead of Japan (5 million barrels/day). By 2030, experts expect Chinese demand to exceed 13 million barrels/day, 80% of which will be imported (Atlas of Regional Integration in West Africa, 2006/2007).

7 The Middle East crisis reduces possibilities for China to acquire energy resources.

8 The United Nations Population Fund, UNFPA (2011), State of the World Population 2011.

9 For more detail on the activities of Chinese firms in Burkina Faso, see Mohammad (2014).

(2009), Chinese growth led to an increase in prices of agricultural products and a decline in prices of manufactured products. Drummond and Liu (2013) find that growth in production activities in China is associated with a higher growth rate in exports from Sub-Saharan African countries. However, the size of the effect of Chinese growth on developing economies depends on the size of the relation between China and each country. According to the 2011 statistical yearbook of the AfDB, China has been the third largest supplier to Burkina Faso since 2006 (9.82% of imports into Burkina Faso in 2009 – AfDB, 2011) and the second largest importer of products from Burkina Faso (14.11% of the total value of exports from Burkina Faso in 2012 (INSD, 2014). The trade balance between Burkina Faso and China is in deficit from the perspective of Burkina Faso. The trade balance went from -62.06 billion FCFA in 2007 to -66.49 billion FCFA in 2009, and in 2012 was -153.92 billion FCFA (INSD, 2014). There is a clear upward trend in imports of Chinese products in Burkina Faso. According to the statistics on external trade of Burkina Faso from the National Institute of Statistics and Demography (INSD), exports from Burkina Faso to China rose by 31.98% between 2011 and 2012 and in the same period imports of Chinese products rose by 33.81% (INSD 2014). Chinese interest in Burkinabe products has gained momentum since 2009 and the country is among the five main clients of Burkina Faso. Cotton, gold and oleaginous products are among the main products demanded from Burkina Faso.

The setting up of small and medium enterprises and multinationals shows the presence of China in Burkina Faso (Mohammad, 2014). To assure the development of the private sector, the government of Burkina Faso has since 1990 with the Structural Adjustment Programmes (SAPs) adopted a liberal economy strategy. With nearly half of the population living in poverty, the government with the support of technical and financial partners between 2000 and 2010 implemented different strategic approaches to reducing poverty. In order to reduce extreme poverty as much as possible, the government revised the strategic framework of poverty reduction by implementing the Strategy for Accelerated Growth and Sustainable Development Strategy (SCADD). For the 2011-2015 period, the government aims, through the SCADD, to improve production and create growth hubs. Also, for SCADD to succeed, the government engaged in international cooperation and attraction of foreign direct investment (FDI) in priority areas. The priority to attract FDI led to reforms to the business environment and the establishment of a presidential council for investment (CPI). The government carried out different reforms in order to reduce poverty as much as possible; it is 43.9% now, 2.5% less than in 2003 (MEF, 2010). Despite the policies and political will displayed by the government of Burkina Faso, numerous challenges remain, such as the high cost of energy, limited infrastructure and development of human capital.

According to the report on cooperation for development, between 1985 and 1990 China invested 1.8375 billion CFA francs in hydro-agricultural development (e.g. irrigation) in Burkina Faso¹⁰. Also, between 1991 and 2000 it participated with the Burkinabe

state in the hydro-irrigation project in a large area in Bagré in the form of a 7 billion CFA franc contribution. In 2003, as a part of a bilateral cooperation framework, China granted 4.929 billion CFA francs or 10% of total aid from bilateral partners (DGCOOP 2004). The subsidies from China are mostly into infrastructure construction projects and development of farmland and livestock¹¹. These investment projects are 4.31% of aid from China (DGCOOP 2004). In 2007¹², Chinese aid accounted for 1.6% of aid received by Burkina Faso. Moreover, for the triennial investment programme for the 2011-2013 period, China participated in financing development projects and programmes. The value of Chinese involvement is estimated at about 903,872 billion CFA francs (MEF, 2010)¹³. In December 2011, China signed a technical agreement with four main African cotton-producing countries: Burkina Faso, Mali, Chad and Benin. Through the cotton agreement, China committed to provide the four countries with expertise, cotton seeds, machines, fertilizers and other materials with the objective of increasing and improving the quality of domestic production. The agricultural sector of Burkina Faso also benefitted from technical and financial support of the Comprehensive Africa Agriculture Development Program (CAADP) of the African Union (AU) supported by the People's Republic of China. Finally, the government of Burkina Faso integrated the CAADP of the AU into its National Rural Sector Programme (PNSR). The PNSR targets agricultural sector development by investing 10% of budget resources into the agricultural sector¹⁴.

2. LITERATURE REVIEW

Computable general equilibrium models are often used to analyze the effects of reforms to economic and social policies and exogenous shocks in developing economies. Many studies have evaluated the impact of incoming FDI, development aid and trade on the wellbeing of households. This section presents an overview of studies which have pursued this objective and the different approaches developed, which will enable us to situate the methodology of this study.

Bandara (1995) shows, in a static model for Sri Lanka, that the effects of aid depend on the flexibility of production in the host economy. It considers different degrees of factor mobility between

10 Report on the state of water resources in Burkina Faso and their management framework, May 2001 version, Ministry of Environment and Water, Burkina Faso.

11 Most reports on development cooperation show the presence of China in Burkina Faso and FDI and development aid remain unknown: the information is not very transparent, both for the country as a whole and at the sectoral level. According to IMF report no 08/212 of June 2008, China invested in building and equipping four professional-oriented high schools under the Burkina Faso-China cooperation framework. For the research plan of the Université de Ouagadougou for the 2012-2016 period, the China Development Bank was among the funders. The engineering company from China was responsible for the geophysical setting up of boreholes for the hydraulic part of the health, population and rural hydro project (PSPHR).

12 This amount from China to Burkina Faso is calculated using the 2007 SAM.

13 The Chinese subsidy involves building a health promotion centre, building a traditional medicine centre and integrated care in Ouagadougou.

14 For more detail on Burkina Faso's National Rural Sector Programme see the post-compact review of the PDDAA: http://www.gafspfund.org/sites/gafspfund.org/files/Documents/7.%20Burkina%20Faso_review%20of%20investment%20plan.pdf

sectors, which explains in part the different levels of production and price responses in different sectors of the economy. Vos (1998) used a dynamic general equilibrium model for the economy of Pakistan with four sectors explicitly accounting for features of the capital market. He finds that the extent of Dutch disease depends on the type of international transfers. It is worse if aid is in the form of direct subsidies or direct transfers to the government than the Dutch disease effects brought about by FDI or international loans. Adam and Bevan (2002 and 2006) use a dynamic CGE model for Uganda which groups the economy into four sectors. They find that the main Dutch disease effects can be countered over time if all aid is invested into productive sectors and leads to productivity gains, but only if these favour the non-market sector. They also find negative distributive effects. Agénor et al. (2008) use a dynamic CGE model with one sector, one household and a very detailed government sector. Most Dutch disease aspects are not considered in their model, for example the highly aggregated structure does not account for sectoral reallocations. However, they conclude that the negative effects of aid can be avoided if the supply response is sufficiently large and the absorption capacity of the beneficiary country sufficiently high. However, the underlying model with just one sector and just one representative household is clearly restrictive. Clausen and Schürenberg-Frosch (2009) develop a static CGE model for the Zambian economy with 11 production sectors and 5 households. They find many effects of international aid: on aggregate production, on international trade, the wellbeing and distribution effect, the effect on spending from the demand perspective and the effect on productivity from the supply perspective. They consider aid as a transfer from the rest of the world to the government. They assume that aid is a financial flow that the government can use for its own spending or to make transfers to the private sector. They propose different mechanisms for the government's use of aid. They introduce a factor productivity function which accounts for public investment. They find that growth and trade policies do not improve the wellbeing of poor populations in the short run, whereas transfer policies contribute immediately to the wellbeing of poor populations.

Estache et al. (2009), using a CGE model where foreign aid is modelled as transfers from the rest of the world to the government and as being used to finance public infrastructure, show that the use of foreign aid to finance public infrastructure produces Dutch disease effects. They show that the size of the effect depends on the type of financing, but the effects on growth mitigate the negative effects. Dissou and Didic (2011), using an inter-temporal CGE model, show the impact of different mechanisms of financing public infrastructure: domestic financing through taxes and financing by foreign aid. They conclude that public investment in infrastructure leads to Dutch disease problems but increasing the production capacity of firms can reduce the severity of this problem.

Very few works have incorporated FDI into a CGE model. Research by Preti (1997), Lee and Van der Mensbrugge (2001), Brown and Stern (2001), Hanslow et al. (2000) and Bchir et al. (2002) has contributed to integrating FDI into a CGE model. Some CGE models, notably those from the GTAP Consortium (Dimaranan and McDougall 2002), group all international financial

flows together and assume perfect capital mobility, under the constraint of equal capital remuneration rates. While it is a correct point of view theoretically, this type of modeling leads to higher capital movements than tend to occur in reality (Bchir et al., 2002). Preti (1997) includes simple modelling of the multinational firm in a computable general equilibrium model, where the foreign subsidiary is assumed to produce a good of similar quality to that of its parent. The modelling of FDI done by Preti (1997) is also followed by Hanslow et al. (2000) and Lee and Van der Mensbrugge (2001). They find that liberalization of FDI can be at the origin of major gains, mostly due to an increase in quality in the recipient region. This type of effect is interesting, but it is difficult to confirm if they are systemic. Bchir et al. (2002) used a multi-sectoral and multiregional CGE model (called MIRAGE) to incorporate FDI data to analyze the impact of trade liberalization between Europe and its periphery. They integrate an investment function into their model by country and sector in the recipient country. They also consider two types of FDI: FDI by buying existing firms and by creation of firms. The first category does not increase the stock of capital, while the second does increase the stock of existing capital. The modelling adopts the assumption that FDI is responsive to industrial and non-financial logic. FDI is represented in the model as an ordinary investment, from abroad but with no effect on the technology and type of products. As a result, the effects induced by FDI are only linked to their impact on the stock of capital and the number of firms.

Abdelkhalek et al. (2006) for Morocco, Boccanfuso et al. (2007) for Mali and Boccanfuso and Savard (2007) for Senegal, analyze the impact of policy reforms on poverty. They analyze the potential effects of FDI, development aid, migration and changes in international import and export prices, on different countries. They model aid as a transfer from the rest of the world to the government and to households, while FDI is considered as an increase in the stock of productive capital. For Morocco, Abdelkhalek et al. (2006) find that FDI flows in the tourism sector enable increased production and growth. For the case of Mali and Senegal, the authors find that the simulated policies are more conducive to poverty reduction but the distributive effects are weak.

Applications of CGE models were done to analyze the effects of Chinese growth on developed and developing economies. Ianchovichina et al. (1999) analyze the effects of China's accession to the World Trade Organization (WTO) by looking at capital flows using a multi-country general equilibrium model, GTAP. They consider FDI as new firms which increase the stock of existing capital. They find that net creditor countries lose and debtor countries gain from their relation with China due to the reduced cost of capital. So, as did authors such as Martin et al. (1999), Walmsley et al. (2000), Ianchovichina and Martin (2001), Hertel and Walmsley (2000) and Walmsley et al. (2002), started from a GTAP model to analyze the effect of China's accession to the WTO on its neighbours. They arrive at the conclusion that China's joining the WTO enables the development of more trade with its neighbours and an increase in world trade. However, the model used does not enable to make specific policy recommendations for each country due to the level of aggregation of sectors and products.

Bussolo et al. (2007) explore potential effects of sustained economic expansion in China and India on world trade, production and income distribution. They use a highly disaggregated world CGE model with a dynamic module for the global income distribution (GIDD). The GIDD module is an ex-ante analysis of the distribution of poverty and the effects of macroeconomic policy changes and changes to the structure of the world market. It enables analysis of poverty, inequality and income distribution effects of Chinese economic and trade expansion using survey data from 63 developing countries. Finally, the study on the effects of Chinese economic and trade expansion on African economies which uses a CGE approach is that by Sandrey and Edinger (2009), applied to South Africa and only interested in trade in agricultural products between South Africa and China through use of a GTAP model. Their model is static and does not include any specifications for trade. However, they deal with trade liberalization between South Africa and China through a tariff reduction. The results of the simulations show an improvement in the wellbeing of the population of South Africa. In this study, we develop a computable general equilibrium approach which permits analysis of the effects of foreign direct investment (FDI), development aid and trade.

3. METHODOLOGY AND DATA

3.1. Methodology

In this section we present the method that we used for this study. This method is a static computable general equilibrium (CGE) model and builds from the standard PEP-1.1 CGE model developed by Decaluwé et al. (2010); we will incorporate specific details as clarified in this section. The details of the PEP-1.1 base model can be found in Decaluwé et al. (2010) (all the equations, exogenous and endogenous variables, and the parameters of the model).

Production is done by firms in a perfectly competitive environment. The firms maximize their profit under constraint of the existing production technology and take prices for goods, services and production factors as a given. Production is modelled using a Leontief-type production function. The production of each sector is modelled as having perfect complementarity between value added and total intermediate consumption. The value added is a combination of composite labour and capital through a constant elasticity of substitution function (CES). The substitution elasticities between labour and capital are taken from Decaluwé et al. (2000). As is the case for these authors, the values of substitution elasticities are between 0.45 and 2¹⁵. To capture the effects of Chinese multinational firms entering in Burkina Faso, we include modelling of externalities to production into the model. We consider the entry of FDI as an increase in the productive capital stock. Productivity gains are expressed at the level of the value added function by incorporating a productivity factor; we introduce total factor productivity (TFP) as the ratio between the new stock of capital invested and the old stock of capital, and the relationship

15 For Decaluwé et al. (2000), the substitution elasticities between labour and capital are 0.45 in agricultural sectors, 0.6 in extractive sectors, 1.5 in industrial sectors, 0.95 in the construction sector and 2 in private and public services sectors. More detail on the elasticities used in this study can be found in that article.

is high as indicated by the elasticity linked to the externality of the invested capital. The value of the elasticity that we use is 0.3, from the study on Burkina Faso by Cockburn et al. (2012).

To characterize the effects of the trade relation, we have divided Burkina Faso's trade partners into three groups: WAEMU countries, China and the rest of the world. Discerning between WAEMU countries and the rest of the world is done to detect the effect that an increase in exports from Burkina Faso to China can have on inter-regional trade. Exports from Burkina Faso within WAEMU accounted for 27.48% of the value of total exports in 2012.

Referring to Armington (1969), domestic and foreign products are distinguished by their origin. This specification has the advantage of accounting for imports and exports of the same products. From the demand side, the consumer has the possibility to consume either domestic or imported goods. To characterize the imperfect substitutability between imported and domestic goods in final demand, constant elasticity of substitution (CES) functions with three levels of nesting are used. At the first level, domestic absorption of a good is a CES function of demand for the local goods and total import demand. At the second level, total demand for imports is a CES function of demand for imports from WAEMU and demand for imports from countries outside of WAEMU. Finally, at the third level, demand for imports from countries outside of WAEMU is a CES function between demand for imports from China and demand for imports from other countries in the rest of the world. At each step, consumer expenditure minimization determines the optimal distribution of final demand among diverse origins. At each level, the ratio of volumes demanded from two competing sources depends on their relative price. Their aggregated price corresponds to the dual price from the minimization program. A change in the price to a lower level is transmitted to the other of the dual prices.

Similarly on the supply side, goods produced by firms are comprised of goods for the domestic market and goods for export. Exported goods are differentiated by their destination. Constant elasticity of transformation functions (CET) with three-level nesting enable to account for imperfect substitutability between goods produced for different markets. At the first level, firm output is an aggregate of supply for the local market and total export supply. At the second level, total export supply is a CET function between the supply of exports to WAEMU countries and the supply of exports to countries outside of WAEMU. Finally, at the third level, the supply of exports to countries outside of WAEMU is also a CET between the supply of exports to China and the supply of exports to countries in the rest of the world. Producers maximize their profits and determine optimal allocations of labour and intermediate consumption needed to produce the composite output. Profit maximization enables to optimally allocate output across each of the markets. We determine the nested CET function at each level of aggregation using a dual price which represents the price of the aggregated good. Given the functional form used, the ratio of supply from two given competing sources depends on their relative price. This modeling has the advantage of being able to correctly capture the effects of trade between Burkina Faso and

China. To calibrate the CET functions we use elasticities which are found in Decaluwé et al. (2000) in the annex. Export demand for each area is a CET function with finite demand elasticity. Export prices at the border are defined for each partnership. These prices are defined as the product export price (domestic prices for export plus trade margins) and the rates of export taxes. Similarly, import prices are modeled as a function of area of origin. The import prices of each area account for the tax rates on different products, import tax rates, international import prices, the exchange rate and trade margins.

For the case of Burkina Faso, there is no export tax. In terms of government revenues from import tariffs, this is the sum of revenues from taxes levied on imports of products, by area of origin. The import taxes of each partner are modelled as the product of the import tax rate by product and area, international import prices by product and area, the exchange rate and the value of imports per product and area. Finally, the import tax rate is calibrated using data from the social accounting matrix.

To analyze the impact of Chinese economic and trade expansion on the economy of Burkina Faso, we develop a static CGE model. Equilibrium on each market is reached through changes in relative prices and quantities supplied and demanded. The exchange rate is fixed and is the numeraire of the model. We assume that Burkina Faso is a small country and has no impact on international prices, which are assumed fixed. We consider that the labour market is comprised of qualified and unqualified labour and fully employs production factors, but we assume in the model that the nominal wages in these two categories of labour are fixed. Moreover, we consider the sectoral capital stock, the current account, transfers from China to the government, government expenditures and stocks as fixed in the model. Finally, transfers from the rest of the world are modelled by their area of origin. The analysis of household wellbeing is done using equivalent variation¹⁶.

3.2. Data

The data is used to calibrate the static CGE model using the 2009 SAM built by Cockburn et al. (2012)¹⁷. The 2009 SAM includes two types of workers (qualified and unqualified), one household, 24 products and 17 sectors. The products are grouped into two main categories, which are food products (corn; rice; millet, sorghum and other grains; fruits, vegetables and tubers; oils, fats and sugar; condiments and salt; meat, chicken, fish, eggs and dairy products; and beverages and coffee) and non-food products (silviculture; extractive industries; cotton; electricity, gas and water; petroleum; other manufactured products; construction works; commerce;

transportation services; postal and telecommunications services; financial services; other market services; primary education services, secondary education services, health and social action services, and other public administration services). Changes were made to the 2009 SAM to account for the objectives of our study: it includes 6 categories of households and 3 rest-of-world groups (WAEMU, China and Rest of World). For the structure of the household account, we retained the household groups specified in the study by Balma et al. (2010), but the data on consumption expenditures are calculated using the 2012 supply-use table (SUT)¹⁸.

To account for changes which have occurred in recent years, the 2009 SAM with six households and three external rest-of-world categories is updated for 2012, in order to reflect the situation in 2012. To do this, the 2012 SUT¹⁹ is used. Other data used to calibrate the model are the elasticities. The elasticities for import demand and export supply are taken from Decaluwé et al. (2000)²⁰. The income elasticities and Frisch parameters are from Balma et al. (2010). The scale parameters are calibrated from the SAM.

4. APPLICATION AND RESULTS

4.1. Description of Simulation Scenarios

The scenarios simulated in this study are based on assumptions regarding the evolution of variables which transmit the effects of economic and trade expansion of China to Burkina Faso, and on the results of previous empirical studies. According to Villoria (2009), Chinese exports of manufactured products have significantly reduced world prices of manufactured products on the main markets. Moreover, Villoria et al. (2009) find that at the aggregate level, demand for primary agricultural products by China led to a moderate increase in prices of agricultural products on the international market. Following previous works, we present a set of scenarios of Chinese growth and its effects on international import and export prices of Chinese products. And so, we assume that the effect of expanded exports of manufactured Chinese products is accompanied by a 2% decline in international import prices of Chinese manufactured products. The empirical literature on Chinese growth shows that it affects prices of goods and services. According to Villoria (2009), Chinese growth leads to an increase in international prices of food products and an increase in exports of agricultural products from developing countries. Roache (2012) finds that aggregate economic activity in China significantly impacts short-term prices of oil and base metals. He concludes that the impact of Chinese growth on the increase in prices of primary materials is less than the effect of economic activity of the USA. For Villoria (2009), the increase in prices

¹⁶ Equivalent variation:

$$EV_h = \prod_i \left(\frac{PCO_i}{PC_i} \right)^{\sigma_{i,h}} \left[\begin{array}{l} \left(CTH_h - \sum_i CMIN_{i,h} PC_i \right) \\ - \left(CTHO_h - \sum_i CMINO_{i,h} PCO_i \right) \end{array} \right], \text{ where } PC_i \text{ is}$$

the consumer price, CTH_h is household consumption expenditures and $CMIN_{i,h}$ is minimum consumption spending.

¹⁷ SAMs were already published for Burkina Faso, but the 2009 SAM effectively reflects the changes experienced in recent years, with the expansion of the mining sector.

¹⁸ Households in the 2012 SUT: cotton farmers, food crop farmers, livestock farmers, public employees, private formal employees, private informal employees, self-employed and inactive households. The household categories defined in Balma et al. (2010) were used to group together formal sector private and public employees, and self-employed and inactive households, to have six household categories in the 2012 SAM. We grouped together households in the 2012 SUT with information from the links to other accounts in the SAM used for the grouping of households.

¹⁹ Automated forecasting tool.

²⁰ Decaluwé et al (2000) model export and import functions with three level nesting. <http://www.ecn.ulaval.ca/w3/recherche/cahiers/2000/0009.pdf>.

of agricultural goods in economies such as those of Asian and European countries is between 1.5 and 2.5% points. Also, the study by Borensztein and Reinhart (1994) shows that a 1% point increase in world industrial production leads to price declines in the range of 1.5-2%. On the basis of empirical evidence, we make the assumption of a 2% increase in international export prices caused by the increase in Chinese demand for agricultural products. According to the study of Paulo and Lui (2013), a 1-percentage point increase (decrease) in the growth rate of Chinese domestic investment is associated with a 0.6% average increase (decline) in the growth rate of exports from Sub-Saharan Africa. According to Villoria et al. (2009) the impact of reduced Chinese spending on imports of agricultural products reduces agricultural exports from Malawi and Mozambique by 3.58%. Similar numbers are observed for Tanzania (-5.15%), Zambia (-4.01%) and SACU (-4.01%). According to Roache (2012), China is increasingly present on the market for base metals and primary agricultural products. In these conditions, Chinese spending on imports of agricultural products and base metals will rise, and so we simulate a 5% increase in exports from Burkina Faso to China.

Another important channel of Chinese economic expansion in Africa is official development assistance and foreign direct investment. The government of Burkina Faso adopted a policy to attract foreign direct investment through trade facilities. In this context, Burkina Faso and the government of China signed an agreement in 1998 to promote and protect investments, which was ratified in 2003. A study on the presence of China in Burkina Faso by Mohammed (2014) shows the presence of Chinese multinationals in Burkina Faso in areas such as the public works, commerce and telecommunications sectors. We postulate the assumption of an increase in Chinese foreign direct investment into Burkina Faso. In the model we have considered that the entry of FDI increases the stock of existing capital. Moreover, the arrival of highly performing and competitive foreign firms forces domestic firms to improve the productive performance and the quality of production by adopting new technologies and ideas. Development aid is also an important aspect of the Chinese presence in countries in Sub-Saharan Africa. Thus, with a view to aiding African countries, China signed agreements with four cotton producing African countries (Benin, Burkina Faso, Mali and Chad) to support production and processing. As a point of reference, we can look to the 3.6% of GDP received by Burkina Faso as aid in 2012 according to the 2013 IMF report; the estimates show aid from China to Burkina Faso amounting to 0.23% of GDP in 2012. We assume a 10% increase in transfers from China to the government of Burkina Faso, as per commitments made by China to Burkina Faso. However, the setting up of Chinese multinationals and public investments in the agricultural sector (cotton) contribute to increasing the stock of productive capital in the agricultural, construction, telecommunications, commerce, transportation and manufacturing sectors. These sectors are the main ones to benefit from the Chinese intervention in Burkina Faso. We assume that the transfers from China will be used for public investments (irrigation, transportation, sylviculture). The empirical study of Benin et al. (2009) shows that a 1% increase in public spending in agriculture in Ghana is associated with a 0.15% increase in the productivity of agricultural labour. Also, Diao et al. (2010) find

that a 1% increase in agricultural spending is associated with a 0.24% annual increase in total factor productivity (TFP) in the agricultural sector in Nigeria. Based on empirical evidence, we assume that the increase in transfers and the capital stock enable a 2% average increase in total TFP productivity in Burkina Faso.

According to the IMF (2013), FDI entering into Burkina Faso in 2011 and 2012 totalled 0.4% of GDP. According to UNCTAD statistics for the period between 2009 and 2012, incoming FDI flows were estimated at 714.25 million dollars²¹. Moreover, the stock of FDI in 2012 was estimated at 430.7 million dollars. Chinese FDI was mostly bound for the telecommunications sector (ZTE and Huawei), transportation, manufacturing industry, hotels and retail trade. To capture the effect of Chinese FDI, we assume a 5% increase in the stock of productive capital in the agricultural, construction, telecommunications, commerce, transportation and manufacturing sectors.

4.2. Presentation and Analysis of Results

In this part we present the results of two groups of simulation scenarios. The analyses are done step by step in order to be able to understand the expected impacts of the different scenarios. The expected effects of fiscal and price changes enable to analyze the effects on the wellbeing of households.

4.2.1. Increase in stock of productive capital, total factor productivity and transfers from China to Burkina Faso

4.2.1.1. Impact on production and factor allocation

An increase in transfers from China to the government of Burkina Faso (Simulation 1a) affects production. This increase leads to a change in government revenues and thus contributes to a change in government savings. This change in government savings leads to a change in total investment and a change in the level of fixed capital formation. The effect of increased transfers to the government on production comes through changes in the final level of demand for investment goods which is a fixed share of fixed capital formation. Moreover, the increase in transfers leads to changes in the volume of government consumption. The change in final demand for investment goods as well as the change in the volume of government consumption lead to variation in consumer prices for goods through changes in domestic absorption.

We find that the effects of the increase in transfers to the government (Simulation 1a, Table 1) from China lead to a 0.13% increase in final demand for investment goods and a 0.03% decline in the volume of demand for goods consumed by the government. Also, the volume of consumption demand by households increases by 0.02%. These different effects contribute to a 0.01% increase in domestic absorption. In sectors which produce investment goods (manufacturing sector, construction sector and livestock sector), the increase in demand for investment goods leads to an increase in demand for both qualified and unqualified labour. Thus, labour demand rose by 0.05% in manufacturing sector and by 0.27% in construction sectors. The effect on labour demand led to an increase in returns to capital in livestock (+0.08%),

21 For more information on the evolution of foreign investment in Burkina Faso, consult <http://unctadstat.unctad.org/wds/TableViewer/tableView.aspx>

Table 1: Impact on production and factor allocations

	Simulation 2 a				Simulation 2 b				Simulation 2 c						
	Value added	Price of value added	Returns to capital	Qualified labour	Unqualified labour	Value added	Price of value added	Returns to capital	Qualified labour	Unqualified labour	Value added	Price of value added	Returns to capital	Qualified labour	Unqualified labour
Crops	0.01	0.16	0.19	0.08	0.08	0.00	0.05	0.05	0.02	0.02	0.00	0.00	0.00	0.00	0.00
Livestock	0.00	0.20	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sylviculture	0.00	0.32	0.33	0.15	0.15	0.00	0.13	0.13	0.06	0.06	0.00	-0.03	-0.01	0.00	-0.01
Extraction	0.01	0.11	0.13	0.08	0.08	0.01	0.11	0.11	0.06	0.06	0.00	0.00	0.00	0.00	0.00
Beverages, tobacco	0.01	0.01	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Electricity, gas, water	0.04	0.07	0.10	0.12	0.12	0.01	0.02	0.03	0.04	0.04	0.00	0.01	0.01	0.01	0.01
Other manufacturing industries	0.03	0.07	0.09	0.13	0.13	0.02	0.06	0.06	0.09	0.09	-0.01	-0.03	-0.04	-0.06	-0.06
Construction	0.09	0.18	0.27	0.26	0.26	0.02	0.06	0.06	0.06	0.06	0.01	0.01	0.02	0.02	0.02
Commerce	0.04	0.12	0.14	0.22	0.22	0.02	0.04	0.05	0.08	0.08	0.01	0.03	0.04	0.06	0.06
Transportation	0.05	0.02	0.04	0.09	0.09	0.02	0.01	0.01	0.03	0.03	-0.04	-0.02	-0.04	-0.08	-0.08
Telecommunications	0.04	0.09	0.11	0.21	0.21	0.01	0.03	0.03	0.07	0.07	0.00	0.01	0.01	0.02	0.02
Finance	0.04	0.04	0.07	0.13	0.13	0.01	0.02	0.02	0.04	0.04	0.00	0.00	0.00	0.00	0.00
Other private services	0.00	0.01	0.01	0.02	0.02	0.00	0.00	0.00	0.01	0.01	-0.01	-0.01	-0.01	-0.02	-0.02
Basic education	-0.01	0.00	-0.01	-0.02	-0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Higher education	-0.01	-0.01	-0.02	-0.04	-0.04	0.00	0.00	0.00	-0.01	-0.01	0.00	0.00	0.00	0.00	0.00
Health	-0.02	-0.01	-0.01	-0.03	-0.03	0.00	0.00	0.00	-0.01	-0.01	0.00	0.00	0.00	0.00	0.00
Public services	-0.01	0.00	-0.01	-0.01	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.02	0.08	0.10	0.09	0.09	0.01	0.03	0.03	0.03	0.03	0.00	0.00	0.00	0.00	0.00

Source: Simulation

construction (+0.28%) and manufacturing industries (+0.03%). As a result, the increase in domestic absorption is small because the government’s demand for consumption goods declines due to the 0.05% increase in consumption prices. The increase in the consumption price leads to a 0.06% average increase in the price of domestic demand and the price of domestic supply. This increase in the price of domestic supply leads to a 0.05% increase in the base production price. The increase in production prices leads to a reallocation of production factors. On average, labour demand increases by 0.06% for the two categories of labour. It is in the public administration (education, health and public service) that demand for labour declines. However, it should be noted that the effect of the decline in labour demand in the public administration sector (basic education, higher education and public services) is mixed. This decline is partly linked to the decline in current government spending which affects absorption of goods in the sector. The effects on demand for production factors contributed to differentiated variations in terms of the formation of value added. In general for Simulation 1a, value added rose by 0.01%, whereas the decline in labour demand in the public administration sectors contributed to value added declining in these sectors.

In the second scenario, there is an increase in the stock of productive capital in production sectors (Simulation 1b, Table 2). This shock consists of increasing production capacity in sectors which receive productive capital. Thus, production increases by 4.59% in the crops sector, 2.03% in transportation, 2.83% in telecommunications, 4.78% in the extraction sector, 2.00% in commerce and 3.03% in manufacturing industries. In this simulation, labour demanded increased by 0.14% on average. At the sectoral level, labour demand decreased by 4.89% in manufacturing sectors, 1.07% in construction sectors, 9.75% in commerce, 0.17% in the transportation sector and 7.73% in telecommunications. These sectors all saw an increase in capital. The increase in productive capital caused a contraction in the additional labour demand in these sectors. In the sectors which are not directly affected, the indirect effect is an increase in value added. This increase is caused by an increase in labour demand. The increase in production in sectors which do not directly receive additional capital is also caused by the increase in demand for intermediate consumption.

The third simulation (Simulation 1c, Table 2) deals with an increase in TFP. We find a 0.03% overall increase in labour demand. An increase in TFP in construction, extraction, manufacturing industries, commerce, food crops and telecommunications, leads to an increase in the value added in these sectors. Value added rose in construction (+0.50%), extraction (+0.62%), telecommunications (+0.46%), commerce (+0.30%) and food crops(+0.59%). For these sectors, the increase in value added has the effect of reducing the price of value added. The increase in TFP in these sectors leads to a decline in the rate of return to capital in agriculture (-0.13%), commerce (-0.99%), telecommunications (-0.41%), construction (-0.29%) and manufacturing industries (-0.33%). The higher productivity leads to a reduction in returns to capital in the affected sectors, thereby reducing labour demanded in these sectors. We see a decline in demand for labour in agriculture (-0.06%), commerce (-1.49%), telecommunications (-0.82%), construction

Table 2: Impact on production and factor allocations

Sector	Simulation 1a			Simulation 1b			Simulation 1c				
	Value added	Price of value added	Returns to capital	Value added	Price of value added	Returns to capital	Value added	Price of value added	Returns to capital		
Crops	0.00	0.06	0.07	0.03	0.03	0.03	0.59	-0.71	-0.13	-0.06	-0.06
Livestock	0.00	0.08	0.08	0.00	2.43	0.00	0.00	0.37	0.37	0.00	0.00
Sylviculture	0.00	0.21	0.21	0.09	17.00	7.37	0.01	2.53	2.55	1.14	1.14
Extraction	0.00	0.00	0.00	0.00	-2.52	3.19	0.62	-0.32	0.31	0.18	0.18
Beverages, tobacco	0.01	0.01	0.01	0.01	2.19	4.53	0.26	0.31	0.53	0.63	0.63
Electricity, gas, water	0.02	0.05	0.07	0.08	3.04	3.65	0.18	0.33	0.48	0.57	0.57
Other manufacturing ind.	0.01	0.03	0.03	0.05	-5.19	-4.89	0.50	-0.86	-0.33	-0.50	-0.50
Construction	0.09	0.19	0.28	0.27	-4.09	-6.07	0.50	-0.79	-0.29	-0.28	-0.28
Commerce	0.04	0.10	0.12	0.18	-7.83	-9.60	0.30	-1.39	-0.99	-1.49	-1.49
Transport	0.03	0.01	0.03	0.06	-1.08	-2.49	0.23	0.09	0.20	0.41	0.41
Telecommunications	0.02	0.06	0.07	0.14	-5.28	-6.26	0.46	-0.93	-0.41	-0.82	-0.82
Finances	0.02	0.03	0.04	0.08	0.58	0.86	0.08	0.09	0.13	0.25	0.25
Other private services	0.00	0.01	0.01	0.01	0.47	0.67	0.06	0.08	0.11	0.21	0.21
Basic education	-0.01	0.00	0.00	-0.01	0.02	0.08	0.02	0.00	0.01	0.03	0.03
Higher education	-0.01	-0.01	-0.01	-0.02	0.17	0.24	0.03	0.03	0.04	0.09	0.09
Health	-0.01	0.00	-0.01	-0.02	0.06	0.18	0.04	0.01	0.03	0.06	0.06
Public services	0.00	0.00	0.00	-0.01	0.03	0.06	0.01	0.01	0.01	0.02	0.02
Total	0.01	0.05	0.06	0.06	-0.37	-0.67	0.23	-0.07	0.15	0.03	0.03

Source: Simulation

(-0.28%) and manufacturing industries (-0.50%). The effect on the extraction sector is a 0.33% increase in returns to capital and a 0.18% increase in labour demanded. The effect of the increase in total productivity on other sectors is an increase in production and thus value added. These effects are caused by higher returns to capital and labour demand. The increase in expenditures to employ this additional labour and capital in sectors other than those where TFP rises contributes to higher prices of value added in these other sectors.

4.2.1.2. Impact on incomes, consumption of economic agents and wellbeing of households

The increase in transfers from China to the government of Burkina Faso (Simulation 1a) affects government revenues (+0.17%). The increase in government revenues contributes to a 9.35% increase in savings of the government. If we increase the stock of productive capital in the sectors (Simulation 1b, Table 3), government revenues increase by 0.11%. This increase is due to the increase in revenues from direct taxes on the income of firms (+0.12%), revenues from indirect taxes on products (+0.32%), and revenues from capital (+0.12%). The small size of the increase in government revenues is in part due to the decline in revenue from direct taxes on households (-0.15%) and revenue from taxes on production (-2.32%). The decline in taxes on production is explained by the decline in the unit cost of production. Finally, government savings rise by 8.07%. The last simulation (1c, an increase in TFP) led to a decline in the unit cost of production, accompanied by a decline in revenues from taxes on production (-0.37%) and revenue from taxes on household income (-0.05%). The increase in imports and domestic supply enabled a 0.02% increase in revenues from indirect taxes on products. We find a 0.02% decline in revenues from direct taxes on the income of firms. Also, the increase in returns to capital leads to a 0.15% increase in government income from capital. Overall, government revenues decline by 0.003% and savings rise by 0.15%. The effect on government savings is in part explained by the choice made for model closure.

In terms of firms, the increase in transfers from China to Burkina Faso (Simulation 1a, Table 3) leads to a 0.08% increase in income from capital due to the increase in the rate of return to capital, which increases both income and savings of the firm by 0.08%. The increase in the stock of productive capital leads to a 0.12% increase in capital income, and thus the income and savings of the firm rise by 0.12% in this second scenario. As for the increase in TFP, income and savings of the firm decline by 0.02%.

Households receive income from work, transfers and income from capital. The impact on households arises from the effect on the allocation of the labour force, the effect on the rate of return to capital and on income from transfers. The increase in transfers from China to the government of Burkina Faso leads to an increase in demand for labour in different production sectors, which enables a 0.06% increase in labour income. The increase in returns to capital leads to a 0.08% increase in the capital income of households. Meanwhile, higher income for households across a variety of sources leads to a 0.07% increase in household income (Table 3, below).

Table 3: Impact on households

		Employee formal public or private sector	Employee informal private sector	Cotton farmers	Food crop farmer	Livestock farmers	Self-employed and inactive	Total
Simulation 1a	Total income	0.05	0.07	0.07	0.07	0.07	0.07	0.07
	Capital income	0.08	0.08	0.08	0.08	0.08	0.08	0.08
	Labour income	0.03	0.05	0.08	0.07	0.08	0.06	0.06
	Transfers (income)	0.07	0.07	0.05	0.05	0.05	0.07	0.06
	Savings	-0.05	-0.04	-0.05	-0.04	-0.02	-0.04	-0.04
	Consumer price index	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	Welfare index	0.01	0.02	0.02	0.02	0.02	0.02	0.02
Simulation 1b	Total income	-0.01	-0.26	-0.15	-0.32	-0.45	-0.55	-0.29
	Capital income	0.12	0.12	0.12	0.12	0.12	0.12	0.12
	Labour income	-0.06	-0.91	-1.98	-1.93	-2.08	-1.29	-1.38
	Transfers (income)	-0.20	-0.11	-1.74	-1.74	-1.74	-0.33	-0.98
	Savings	2.00	2.13	2.06	2.86	4.00	2.53	2.59
	Consumer price index	-1.30	-1.59	-1.95	-1.88	-1.92	-1.63	-1.72
	Welfare index	1.23	1.35	1.81	1.55	1.48	1.07	1.41
Simulation 1c	Total income	-0.03	-0.07	-0.05	-0.08	-0.09	-0.11	-0.07
	Capital income	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
	Labour income	-0.03	-0.15	-0.30	-0.29	-0.31	-0.20	-0.22
	Transfers (income)	-0.06	-0.05	-0.27	-0.27	-0.27	-0.08	-0.17
	Savings	0.31	0.33	0.32	0.43	0.59	0.39	0.40
	Consumer price index	-0.21	-0.26	-0.30	-0.29	-0.30	-0.26	-0.27
	Welfare index	0.17	0.19	0.25	0.21	0.20	0.15	0.19

Source: Simulation

The second simulation (1b), which is an increase in the stock of productive capital, led to a decline in demand for labour where the stock of productive capital rose. The sectors in which there was a contraction of labour demand employ a total of 33.58% of the labour force. The decline in labour demand in these different sectors negatively affects the labour income of households; income from transfers also falls. Ultimately, the 0.12% increase in capital income is not sufficient to compensate for the decline in household income brought about by the decline in labour income and transfers.

The third simulation (1c, Table 3) has the same effects on households as the second scenario. However, note that the negative effect on households is less pronounced in this last simulation. The increase in TFP contributes to reduced demand for the labour force and thus reduces labour income. Moreover, income from transfers and capital decline for all households. Household income declines by 0.07%.

The increase in transfers from China to the government of Burkina Faso enables an increase in savings of the government of Burkina Faso (+9.35%) and savings of firms (+0.08%); savings of the rest of the world declines (-4.42%) decline, as do household savings (-0.04%). Total investment comprised of savings of different agents increases by 0.22%. As for the second simulation, the decline in prices of consumption goods contributed to the decline in consumption expenditures, thus causing an increase in savings. Thus, savings rises among households as a group (+2.59%), government (+8.07%) and firms (+0.12%), while savings of the rest of the world declines by 0.85%. Total investment rises by 0.65%. Finally, in the third simulation, total investment rose by 0.05%. This increase occurred through the savings of economic agents.

Table 3 indicates that the transfers from the government of China to Burkina Faso lead to an increase in prices of consumption

goods. This ultimate effect is a 0.05% increase in the consumption price index. The increase in household incomes counters the effects of higher consumption prices on household wellbeing. Thus, the wellbeing of households increases by 0.02%. In terms of the increase in the sectoral stocks of productive capital, this leads to reduced prices of consumption goods (-1.72%). The decline in the consumption price index leads to a 1.41% increase in household wellbeing. Finally, the increase in the TFP enabled a 0.19% increase in the wellbeing of households. For the last two simulations, agricultural households in cotton and food crops have the highest gain (Table 3).

The impact in the simulations with respect to prices, production and changes in the level of fiscal receipts enable more wealth creation. The increase in transfers from China to the government of Burkina Faso led to 0.02% higher real GDP. Introducing an increase to the stock of productive capital led to a 1.90% increase in real GDP. Finally, the increase in the TFP led to a 0.27% increase in real GDP.

4.2.2. Increase in exports from Burkina Faso to China, decline in import prices of Chinese products

4.2.2.1. Impact on production and distribution of production factors

Table 1 below presents the impact of different scenarios on production and on distribution of production factors. The effects on the price of value added and distribution of the labour force are due to changes to production levels. For the first simulation (2a), exports increase from Burkina Faso to China in cotton, extraction, fruits and vegetables, meats and oils. For sectors which produce these goods (crops, extraction, industry), the effect leads to a small increase in production. As a result, value added rose in these sectors. These effects contributed to an increase in labour demand. The indirect effect is a reduction in production in the public

administration sectors, and thus a decline in labour demand and returns to capital. The second simulation (2b) involves a decline in the international price of exports of manufactured goods from China and an increase in international export prices of primary products demanded by China. The effect of the simulation is very small for sectors which are directly affected by the policy, as is the case in other sectors too. The variation in international prices of exports leads to an increase in domestic prices. The increase in domestic prices of exports leads to an increase in production costs, and thus lower production in agricultural sectors and non-agricultural private sectors, in addition to declines in the public administration. The outcome is a decline in domestic supply and intermediate consumption of public administration goods. The reduced production in the public administration sectors leads to reduced demand for qualified and unqualified labour (Table 1). The effect of the increase in production in the agricultural sectors and other private sectors leads to an increase in labour demand.

Finally, the third simulation (2c) (see Table 1, above) shows that the magnitude of changes is very small. The increase in imports from China contributed to a contraction in production in manufacturing (-0.01%), transportation (-0.04%) and other private sectors (-0.01%). The contraction in production leads to reduced demand for both qualified and unqualified labour in sylviculture (-0.01%), manufacturing industries (-0.06%), transportation (-0.08%) and other private services (-0.02%). The effect on sectors which are not directly affected in the simulation is very weak. This effect is explained as resulting from the reduced volume of intermediate consumption. Production in these sectors uses products from sectors with reduced production as intermediate inputs. In the context of Burkina Faso, and given the reserve pool of workers, this negative effect should not occur. We can then expect that more in trade going to China should have positive effects on production, employment in the private sector of production and on household wellbeing.

4.2.2.2. Impact on income, consumption of economic agents and wellbeing of households

As illustrated in Table 1 above, the rate of return to capital increases in the private sectors and agriculture, and declines in the public administration sectors. This variation in the rate of return to capital has important impacts on the income of firms. Returns to capital comprise the entirety of firms' income. Thus, we observe a 0.14% increase in the income of the firm. The savings of the firm being a share of after-tax income of the firm, this also increased by 0.14%. For the second simulation, the capital income of the firm increased by 0.04%, as did the total income of the firm and also its savings. In the third simulation which deals with the decline in international prices of imports from China, this decline had an upwards impact on returns to capital in private production sectors, which leads to income and savings of firms rising by 0.001%.

For the government, the increase in exports to China had an impact on fiscal revenues mainly through government revenues and returns to capital. The increase in returns to capital led to a 0.14% increase in capital income of the government. The increase in the firm's income leads to an increase in income from direct taxes paid by the firm (+0.14%) and direct taxes paid by households (+0.11%). The

increase in household consumption expenditures leads to a 0.13% increase in revenues from indirect taxes on the sale of products. The increase in the various components of government revenues leads to an overall 0.12% increase in government revenues. The increase in government revenues then leads to a 6.21% increase in government savings (from an initially low level). As for the increase in international prices of exports to China for primary products and a decline in international export prices of products manufactured in China, we see a decline in revenues from indirect taxes (-0.002%) and taxes on production (-0.017%). In this simulation, direct taxes paid by households increase slightly as do direct taxes paid by firms (+0.001%). Government savings rise by 0.003%. Finally, if we simulate a decline in international import prices of products from China, government revenues rise by 0.025%. The decline in international prices leads to lower tax receipts on imports of products for which the price declined and also reduced indirect tax receipts on products. Finally, government savings increases by 1.34%.

Households receive income from labour, capital and transfers. They pay taxes on income to the government. Table 4 below shows differences in various sources of income and in total household income. The income of households is mainly from capital income and labour income to a lesser degree. Table 1, above, shows higher household income in the simulations. The increase in income of households is affected by the decline in labour demand and returns to capital in the public administration sectors (public service, education and health). The impact on prices leads to an increase in household consumption expenditures. We also note an increase in direct taxes paid by households to the government. These different effects on the income of households lead to lower savings by households. In the first simulation, the increase in the household incomes compensated for the increase in consumption prices of goods and services. This effect made possible a 0.023% increase in household wellbeing. Households in cotton farming and food crop farming are the main beneficiaries.

The increase in exports to China leads to a decline in savings of households and savings of the rest of the world because the increase in exports leads to a contraction in income of the rest of the world (China). The increase in income of government and firms leads to an increase in the savings of government and firms. The increase in savings of government and firms enables a 0.22% increase in total investment. In the second simulation, total investment is 0.06% higher and in the last simulation it is 0.004% higher. The decline in savings of the rest of the world and especially China and households mean that the overall increase in investment is negligible.

The increase in production, fiscal receipts and prices has had an important effect on economic growth. The increase in exports from Burkina Faso to China affected both production and prices, leading to 0.03% higher real GDP. Moreover, the increase in international export prices of raw products to China and the decline in international prices of agricultural products to China combine for a very small positive effect in real GDP (+0.0002%). Finally, the decline in international prices of imports from China leads to 0.007% higher real GDP. The weakness of the increase in real

Table 4: Impact on households

		Employee in formal public or private sector	Employee private informal	Cotton farmer	Food crop farmer	Livestock farmer	Self-employed and inactive	Total
Simulation 2a	Total income	0.090	0.120	0.140	0.130	0.130	0.110	0.120
	Capital income	0.140	0.140	0.140	0.140	0.140	0.140	0.140
	Labour income	0.040	0.070	0.100	0.100	0.100	0.080	0.080
	Transfers (income)	0.130	0.140	0.090	0.090	0.090	0.130	0.110
	Savings	-0.090	-0.080	-0.090	-0.070	-0.040	-0.080	-0.080
	Consumer price index	0.071	0.072	0.084	0.085	0.087	0.076	0.079
	Welfare index	0.007	0.027	0.033	0.027	0.024	0.018	0.023
Simulation 2b	Total income	0.029	0.035	0.039	0.039	0.039	0.035	0.036
	Capital income	0.040	0.040	0.040	0.040	0.040	0.040	0.040
	Labour income	0.019	0.027	0.038	0.038	0.039	0.031	0.032
	Transfers (income)	0.037	0.038	0.024	0.024	0.024	0.036	0.030
	Savings	0.017	0.017	0.024	0.015	0.005	0.012	0.015
	Consumer price index	0.021	0.022	0.024	0.024	0.025	0.023	0.023
	Welfare index	0.007	0.012	0.014	0.014	0.013	0.012	0.012
Simulation 2c	Total income	0.000	0.000	0.001	0.001	0.001	0.001	0.000
	Capital income	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Labour income	0.000	0.001	0.002	0.002	0.002	0.001	0.001
	Transfers (income)	-0.002	-0.001	-0.013	-0.013	-0.013	-0.003	-0.008
	Savings	-0.017	-0.019	-0.016	-0.023	-0.035	-0.024	-0.022
	Consumer price index	-0.011	-0.013	-0.015	-0.014	-0.014	-0.013	-0.013
	Welfare index	0.010	0.013	0.015	0.014	0.014	0.013	0.013

Source: Simulation

GDP is explained in part by the increase in imports.

Finally, household wellbeing increases in the last two simulations. In the second simulation, household wellbeing increases due to the increase in consumption of households driven by increased income. The increase in household wellbeing in Simulation 2c is caused by the decline in consumption prices.

5. CONCLUSIONS AND POLICY IMPLICATIONS

This study developed a static multi sectoral CGE model to analyze the effects of economic and trade expansion of China on the economy of Burkina Faso. The model is used to evaluate the effect of a change in the volume of exports, changes in international prices of imports and exports with China and the change in Chinese foreign direct investment in Burkina Faso as captured by the positive change in the stock of productive capital and factor productivity.

An increase in transfers from China to the Burkinabe government positively impacts demand for investment goods as well as real household consumption. The results show that sectors producing investment goods increase their demand for labour. This alternative enables an increase in economic growth and wellbeing of households, but it results in higher domestic consumption prices. The effect of the increase in the stock of productive capital is larger. GDP ends up 1.90% higher and household wellbeing 1.41% higher on average. The impact on wellbeing is influenced by the decline in consumption prices. The increase in TFP positively impacts growth, employment and wellbeing, but the effect is relatively small. However, re-establishing diplomatic links between Burkina

Faso and China could lead to interesting opportunities in terms of investment in agricultural sectors and non-agricultural private sectors. Expanded Burkina Faso-China cooperation could have greater results in terms of wellbeing and growth.

The increase in exports of products to China and also the decline in international export and import prices of China both improve government revenues and economic growth. Household wellbeing improves in all simulation scenarios. This increase is caused by higher household income. The effect is larger if Chinese growth does not lead to a decrease in international export prices. These results support the idea that in sectors where China and African countries are in competition, the increase in the volume of Chinese products at low cost induces a decline in production of African economies. Note that this simulated policy leads to an increase in price levels of goods and services. The increase in household income is not able to counter the increase in price levels, and so the price increase causes an increase in the cost of living.

The impact of Chinese growth on wellbeing of Burkinabe households is positive in all simulation scenarios. The increase in wellbeing is highest for cotton farming households and food crop farmers. We see that the effect on Burkina Faso of expanded trade is small. These effects are explained by the low volume of exports from Burkina Faso to China. The effects could be larger if trade relations were larger.

A priori, we note that an intervention which can improve production and real household consumption enables an improvement in wellbeing and reduces the incidence of poverty among households. Trade relations between Burkina Faso and China would have a large positive effect if Chinese growth leads to higher exports at higher prices. There needs to be processing of domestic products

which can be the object of adding value in order to export final products. The current extent of benefits of trade relations between Burkina Faso and China is small. However, it should be noted that trade expansion of China on the world market has reverberated through the national market in Burkina Faso through increases in the price of domestic supply and thus an increase in the index of consumption prices. It is thus necessary to manage resources from exports of primary products to support investments in sectors to promote production (infrastructure in roads, communications and agricultural production). This recommendation is supported by the fact that the effect of economic expansion of China on Burkina Faso, as analyzed by an increase in the stock of productive capital and total factor productivity, drives higher production and thus job creation as a part of positive growth effects. To obtain results from Chinese growth, it is thus important to attract Chinese FDI in sectors of economic production and to support production (agriculture, industry and infrastructure). To do this, it will be necessary to strengthen the agreements for investment protection that have existed between Burkina Faso and China since 2003, by also granting investment facilities. This would require a major improvement in the business climate. All of this necessarily involves re-establishing formal cooperation links between China and Burkina Faso.

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