Decline in gold prices, tax receipts and employment:
Which adaptation strategy for Burkina Faso?

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Résumé

Le Burkina Faso connait depuis 2007 une expansion de son secteur de l'extraction et l'or est devenu le premier produit d'exportation supplantant ainsi le coton. Cependant à partir de 2012, la baisse du cours de l'or a frappé de plein fouet l'économie burkinabé. A l'aide d'un Modèle d'Equilibre Général Calculable (MEGC) statique, l'étude évalue les effets macroéconomiques et sectoriels de ce choc sur l'économie mais aussi l'impact de la révision du code minier sur le revenu de l'Etat. Les résultats montrent que la baisse du prix international à l'exportation de l'or a comme conséquence une baisse de la main-d'œuvre, et une réduction du revenu des agents économiques. Une politique fiscale basée uniquement sur l'augmentation de la taxe sur la production du secteur aurifère augmente le niveau des recettes publiques et conduit à une baisse du chômage et du revenu des firmes aurifères. Des résultats plus prononcés mais similaires ont été trouvés à travers l'application exclusive de l'impôt sur le bénéfice des sociétés minières. Enfin la réforme fiscale qui est la combinaison des deux taxes appliquées dans un contexte de baisse de prix montre que cette seule politique ne permet pas une amélioration de l'emploi et des revenus du gouvernement.

Mots clés : boom minier, réforme fiscale, marché du travail, MEGC

Abstract

Since 2007, Burkina Faso's mining sector has been growing quickly, with gold replacing cotton as its biggest export. However, the decline in gold prices since 2012 has hit the Burkinabe economy hard. Using a static calculable general equilibrium (CGE) model, the study evaluates the macroeconomic and sectoral effects of this shock and the recent revision of its mining code. The results show that the decline in global gold prices has significantly reduced employment and income. In this context, a tax policy based solely on increasing taxes on production in the gold sector increases government revenues and a decline in total unemployment and in the income of gold mining firms. More pronounced but similar results are found when only considering application of a tax on profits of mining firms. Finally, a combination of production and profit taxes does not lead to higher employment and government revenues.

Keywords: mining boom, tax reform, labour market, CGE

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List of abbreviations

ANPE	National Employment Agency (*Agence Nationale de l'Emploi*)
BAD	African Development Bank
BEPC	Primary Graduation Certificate (*Brevet d'Etude du Premier Cycle*)
CGE	Calculable general equilibrium model
CES	Constant elasticity of substitution
CET	Constant elasticity of transformation
IDRC	International Development Research Centre
DFID	Department for International Development
EBITDA	Earnings before interest, taxes, depreciation, and amortization
EITI	Initiative for Transparency in Extractive Industries (*Initiative pour la Transparence dans les Industries Extractives*)
HDI	Human Development Index
GDP	Gross domestic product
IBIC	Tax on industrial and commercial profits (*Impôt sur les bénéfices industriels et commerciaux*)
ICMM	International Council on Mining and Metals
ILO	International Labour Organisation
IMF	International Monetary Fund
INSD	National Institute of Statistics and Demography (*Institut National de la Statistique et de la Démographie*)
INSEE	National Institute of Statistics and Economic Studies (*Institut national de la statistique et des études économiques*)
IRVM	Tax on income from securities (*l'impôt sur le revenu des valeurs mobilières*)
IUTS	Income tax on wages (*Impôt Unique sur le Traitement des Salaires*)
KPMG	KPMG
MEF	Ministry of Economy and Finance (*Ministère de l'Economie et des Finances*)
MMCE	Ministry of Mines, Quarries and Energy (*Ministère des Mines, des Carrières et de l'Energie*)
OECD	Organisation for Economic Cooperation and Development
PEP	Partnership for Economic Policy
PNDES	Economic and Social Development Plan (*Plan de Développement Economique et Social*)
PNJ	National Youth Policy (*Politique Nationale de la Jeunesse*)
PSCE/JF	Special Job Creation Program for Youth and Women (*Programme Spécial de Création d'Emplois pour les Jeunes et les Femmes*)
SAM	Social accountability matrix
SCADD	Accelerated Growth and Sustainable Development Strategy (*Stratégie de Croissance Accélérée et de Développement Durable*)
SME	Small and medium enterprises
VAT	Value added tax
UNDP	United Nations Development Program
US	United States

I.   Introduction

Since 2007, Burkina Faso has placed its hopes in the mining sector as having strong potential for productive investment and economic growth by implementing a 2014-20125 sectoral policy for mines that is attractive for foreign investment. Although the country registered satisfactory 6.7% annual growth over 2011-2013, it decelerated to 4% in 2014. The recent mining sector balance sheet and review of public investment expenditures place doubt on its capacity to meet expectations in terms of poverty reduction. Economic growth in recent years has not been inclusive because it has not been accompanied by improved living conditions of the population.

Between 2007 and 2012, Burkina Faso recorded a high rate of poverty, with 40% of the population living under the $1.25 a day poverty line and 72.6% living on 2 dollars a day or less (World Bank 2013; UNDP 2013). Over 1994-2014, the poverty rate set by the authorities has more than tripled and so the reduction in the percentage under the official threshold is slower as a result (IMF 2014). According to the 2012 Human Development Index (HDI), Burkina Faso was ranked 181st among 187 countries (UNDP 2014). Over the same period, economic growth was primarily accounted for by the tertiary sector (3.7 percentage points) and primary sector (1.9 points), with the secondary sector only accounting for 0.8 percentage points of GDP growth (IMF 2014).

This economic performance can mainly be explained by the 15% fall in international gold prices, and had negative impacts on public finances in terms of receipts and investments [1] (World Bank 2015). In 2016, the budget of the Burkinabe state included a 239 billion FCFA deficit which remained high due to needs and the incompressibility of major public expenditures. It mostly affects the budget for public salaries and public social spending (transportation, electricity, justice, health, education). There is also financing for the National Program for Economic and Social Development[2] (PNDES).

According to the IMF (2014), the failure of the mining sector to meet expectations in terms of poverty reduction can also be due to the lack of capacity of the Burkinabe government to convert revenues from mining activities into spending on development in order to support the other sectors of the economy and to create employment. The impact of a mining boom on economic development varies significantly from one country to another (ICMM 2012). The results of economic studies indicate that there is no consensus on the direction of effects (positive or negative) of extractive sector development on economic growth and poverty reduction (Frankel 2010; van der Ploeg and Frederick 2010 ; Mainguy 2013, Betz 2014; Lippert 2014). According to some authors, the beneficial effects of a mining boom may have negative effects due to quality of institutions, governance (Caselli 2006) and good management of receipts from exploitation.

Given the uncertainty associated with international gold prices and the forecast level of public receipts, there is a risk of public spending growing faster than receipts. In a pessimistic scenario, the share of mining revenues in public receipts may decline and jeopardize forecast public spending needed for development of the country. To address

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[1] www.banquemondiale.org/fr/country/burkinafaso/overview

[2] The PNDES plans to implement sectoral reforms and investment over 2016-2020 in three main areas: governance, human capital, and also the economy and employment.

this budget gap, the 2003 mining code was revised in 2014 in order to improve collection of fiscal revenues from mining. However, in a context of lower gold prices, is an increase in the tax burden on the mining sector justified?

According to KPMG (2013), the revision of the mining code can have the effect of reducing the net present value of mining projects by 56% for a price of gold at $1500 US per ounce. This also leads to an increase in the profitability threshold of mining projects from $1425 US per ounce to $1465 per ounce. In terms of revenues drawn by investors, Burkina Faso risks becoming a less attractive destination for investment than other countries in the region such as Ghana and Mali (KPMG 2013, page 53). Also, working together with policy deciders, we can ask the following questions: what was the impact of the gold price decline on the economy? How might the increase in taxation affect the economy in terms of mobilizing public receipts and employment?

Many studies examined the impact of the natural resources boom in developing countries. However, to our knowledge, none of these empirical studies used a calculable general equilibrium (CGE) model which links natural resources and effects in terms of fiscal receipts in Burkina Faso. The present work follows this approach and proposes to analyse different tax policy options that the government plans to implement in order to maintain its level of financing of public spending in the face of persistent declines in tax receipts from mining.

Thus, the present study aims to evaluate the impact of the decline in gold prices and the changes to the mining code on the economy of Burkina Faso. The change to the mining code analysed in the framework of this research only deals with the 10% increase in the tax on production and a 10% increase in taxes on profits. More specifically it:

➢ Evaluates the impact of the 15% decline in international gold prices on production, labour demand and income of households, government and firms;

➢ Evaluates the impact of a 10% increase in the production tax in the gold mining sector and a 10% increase in the tax on profits of mining firms, in each case on production, labour demand and income of households, government and firms.

This research is of political and economic importance because it is framed in a consistent manner with the vision of the authorities of Burkina Faso in terms of collecting and managing public resources, composing the budget programme, and in the fight against poverty. The results will make it possible to attract the attention of policy deciders with respect to issues not only related to a negative shock on the mining sector, but also a change in taxation in this sector. This research can also be used in support of decisions on strategies to collect tax revenues and to promote employment, with the final objective of poverty reduction. Section 2 of this work proposes a brief description of the labour market and the gold sector in Burkina Faso. Section 3 provides a literature review on mining taxation and employment. Section 4 describes the detailed methodology of the study and the data used. Section 5 presents the results of the study and proposes policy recommendations.

II. Labor market and mining sector in Burkina Faso

2.1. Labour market in Burkina Faso

The employment rate[3] is a basic indicator of the capacity of an economy to provide employment for its growing population. A decline in the employment rate is often considered as a sign of economic slowdown and a decline in total employment is a sign of a more serious economic recession. According to the definition of the International Labour Organisation (ILO), the unemployment rate in the narrow sense[4] in Burkina Faso was 6.6% in 2014. This rate indicates a deterioration in the employment situation in Burkina Faso, considering that it was 3.3% in 2007. In Burkina Faso, unemployment is considered to be an urban phenomenon because it affects 7.1% of those living in urban areas as compared to 6.4% in rural areas. The modern private sector represents 65.6% of employment in the modern sector as compared to 34.4% for the public and para-public sector (INSD 2015). The unemployment rate in the broader sense[5] was 14.1% in the first quarter of 2014 at the national level and affected qualified workers[6] (17%) more than unqualified workers (13.2%) (Annex C2.1).

This situation reveals the nature of economic growth which is still not generating much employment and is conducive to social inequality. The disequilibrium in the labour market in Burkina Faso is mostly due to the economic structure of the country, where capacity to create decent employment is weak, and also due to demographic pressures. The active Burkinabe population is largely rural and unqualified. Since 2009, the Burkinabe economy has experienced very little structural transformation. The subsectors which have grown most are mining and construction (Dayo, Sylla and Sabo 2015). The distribution of the active employed population across the three economic sectors of Burkina Faso show that the share of employment in the primary sector is highest, followed by the tertiary sector, and finally the secondary sector. Working opportunities are thus limited to the agricultural sector, which is characterized by low remuneration and productivity (ADB 2012). This situation requires policies to promote employment in order to reduce youth unemployment and avoid their radicalization (Gharbi 2015).

With adoption of the National Youth Policy (PNJ) in September 2008, the Ministry of Employment adopted a framework which provides a comprehensive view of how employment issues are treatment and undertook three priority actions: strengthening support for creation of micro and small enterprise (MSE); improvement of youth employability; and intermediation and information on the labour market. Twenty projects and programs were implemented to promote self-employment and employability (Zerbo and Ouédraogo 2014). In 2012, the government launched a Special Job Creation Program for Youth and Women (PSCE/JF) covering 2012-2014 with a view to significantly reducing unemployment and poverty in both urban and rural areas. Implementation of this

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[3] The employment rate is the ratio between the number of persons with a job and the working age population.

[4] The unemployment rate corresponds to the percentage of persons in the active population without employment, and indicates disequilibrium on the labour market, i.e., the share of available workers in the country who are not working. The unemployed (in the narrow sense of the ILO), according to the international norms adopted by the 13th ICLS, represents all persons without work, who are available to work and are looking for work. The unemployment rate in the narrow sense represents the unemployed who are looking for work (and are available to work).

[5] The broad unemployment rate represents all persons without work who are available to work.

[6] The National Institute of Statistics (INSD 2015) defines qualified labour as workers with a level of education beyond the Primary Graduation Certificate (BEPC).

special program should, by its completion, generate 54,209 jobs, create 10,000 indirect jobs and train more than 45,100 rural youth graduates per year on average.

However, Lachaud (2000), using a model of the inverse relationship between wages and unemployment developed by Blanchflower and Oswald (1995) shows that these objectives in terms of job creation may seem ambitious. They find that the elasticity of wages with respect to unemployment in Burkina Faso is -0.258 and appears to be twice as high as in the case of Côte d'Ivoire (-0.119). Thus, a doubling of the unemployment rate involves a 25.8% reduction in real wages, which can be explained by the fact that wage labour is relatively undeveloped in Burkina Faso. In urban areas, this only affects 16.8% of all individuals between 14 and 60 years of age. This result is consistent with the idea that the precariousness of work is higher when wage flexibility is high. The vulnerability is associated with irregularity of incomes associated with employment status, absence of social protection, and also weak real gains due to behaviour of employers when there is excess labour supply. It appears as though wage rigidity is higher for protected workers than for those with an unprotected labour status. But what is the impact of the recent mining boom on the labour market in Burkina Faso? What role does this sector play in the economy of Burkina Faso?

2.2   Mining sector in Burkina Faso and its impact on the economy

2.2.1   Mining sector in Burkina Faso: Evolution and tax reform

Development of the mining sector is relatively recent. Since 2007, Burkina Faso has been engaged in an externally-oriented development strategy based on exports of primary products such as gold. Gold mining has, in this context, received particular attention from the public authorities, notably with liberalization of the mining sector and tax incentive provisions (2003 mining code). This results in Burkina Faso being the fourth largest product of gold in Africa after South Africa, Ghana and Mali (EITI 2014). The gold sector in Burkina Faso is characterized by two subsectors: a large scale modern mining sector with high capital intensity and a small scale artisanal sector which is more intensive in its use of labour (MMCE 2013).

Between 2000 and 2007, gold production was insignificant and averaged about 0.95 tonnes per year (MEF 2013); it rose to 42.47 tonnes in 2014. This production gained momentum after 2008 with new discoveries of deposits, an attractive mining code (dating to 2003) for investors, and especially high international gold prices which rose by 139% from $698 in 2007 to $1669 in 2012 (INSD 2015; IMF 2014; INSEE 2015). Due to lack of reliable statistical data in the artisanal sector, the present study focuses on modern industrial mining. The costs of industrial gold mining in Burkina Faso ($756 US / ounce) are generally higher than the world average ($656 US / ounce) due to the small scale and low content of deposits, the high price of fuel oil (35% of production costs) and wage costs.

Despite these handicaps, gold has become the largest exporting sector of the country, ahead of cotton. Cotton was previously nearly 80% of exports and gold production was nearly inexistent ten years ago, but now gold accounts for about 72% of exports (IAP 2015). The mining subsector remains the pillar of the secondary sector and is

considered as one of the most dynamic subsectors of the economy. It accounts for 13% of gross domestic product (GDP).

Revenues[7] drawn from the gold sector by the Burkinabe state are mainly comprised of dividends from its profit sharing stake with firms and public revenues from mining. Table 1 shows that Burkina Faso has lower mining taxation than Mali or Ghana.

Table 1: Mining taxes in place in Burkina Faso, Mali and Ghana and revision of mining code

Taxes	Burkina Faso		Mali	Ghana
	Current	After code change		
Mining royalty rate (ad valorem)	3 - 5%	3% to 5%	3%	5%
IBIC	17.50%	27.50%	35%	35%
IRVM	6.50%	12.50%		10%
Tax for local development (ad valorem)	0	1%	0	
Government profit sharing stake	10%	10%	10% to 20%	8%

Source: KPMG 2013, authors, 2016.

The Burkinabe state holds 10% of shares (a direct stake in the capital of mining firms) in each mining firm as per article 18 in the 2003 and 2014 mining code.

The revision of the mining code mostly involves:

- removal of the tax exemption on income of mining firms to bring the income tax to 27.5%;
- creation of a fund which collects 20% of royalties collected by the state on mining extraction production and 1% of the monthly turnover of mining companies toward local development plans;
- an increase in the tax on income from securities (IRVM) from 6.5% to 12.5%.

2.2.2   Contribution to government budget and employment creation

Until recently, the extractive sector in Burkina Faso has been economically isolated from the rest of the economy, with a limited impact on the real economic activity of the country. Thus, its contribution to the real economy of the country has been through tax receipts, spending associated with these public revenues, and creation of jobs. The gold sector has undergone modernization over the last decade involving industrial installations. The modern sector has created permanent direct jobs, temporary direct jobs and also indirect jobs (INSD 2015; ANPE 2014; EITI 2014). Most of the indirect employment involves the transportation and construction sectors and economic activities near sites, and accounts for about 7% of all employment in the economy.

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[7] The sources of state revenues are primarily from tax receipts (taxes on income and profits, domestic taxes and other taxes), non tax revenues (land surface taxes and proportional royalties), revenues from capital, and exceptional revenues including donations and loans. **Royalties and rents** for use of public or private domain of the state are imputed as **products of state domain. Revenues from capital** are dividends paid out by firms in which the state is a shareholder. They are imputed as dividends and similar receipts. Royalties and rents for use of public and private domain of the state are imputed as **products of state domain.** http://www.vie-publique.fr/decouverte-institutions/finances-publiques/ressources-depenses-etat/ressources/quelles-sont-ressources-non-fiscales-etat.html

From 2007 to 2015, gold mining provided nearly 800 billion FCFA in budget receipts to the Burkinabe state. Between 2007 and 2012, public revenues from mining were 3.3 billion FCFA as compared to more than 186 billion FCFA, for a contribution to total exports which went from 1% in 2007 to 21% in 2012. Public revenues from mining rose faster than current spending during that time. According to the IMF (2014), this low level of public revenues from mining is mostly attributable to the slow execution of investments, adjustments to the public wage bill and different subsidies to support the cost of energy and public enterprises. In the 2012 fiscal year (Diagram 1), public revenues from mining included both non-fiscal and fiscal revenues. Net tax revenues in 2012 included taxes on profits (37%) and customs tariffs and other taxes (43%). Non tax revenues were mostly proportional royalties (20%).

In recent years, the sector has been hit hard by the decline in gold prices on the international market, leading to a 21% decline in its value added in 2013 as opposed to an 11.1% increase in 2012. The price effect entirely explains this decline in production, considering that volume increased from 31 tonnes in 2012 to 36 tonnes in 2016. The share of gold in total export revenues went from 63% in 2013 to 51% in 2015. As for public revenues from mining, they declined by 40%, which led to a major decline in income taxes as a share of total receipts and an increase in the share of royalties. Aside from this decline in public receipts and employment directly caused by the gold sector, the decline in gold prices led to a contraction in fiscal receipts and employment in other sectors of the economy. Hence, the importance of performing a general equilibrium analysis of such a shock on the entire economy

<u>Diagram 1:</u> **Composition of mining receipts**
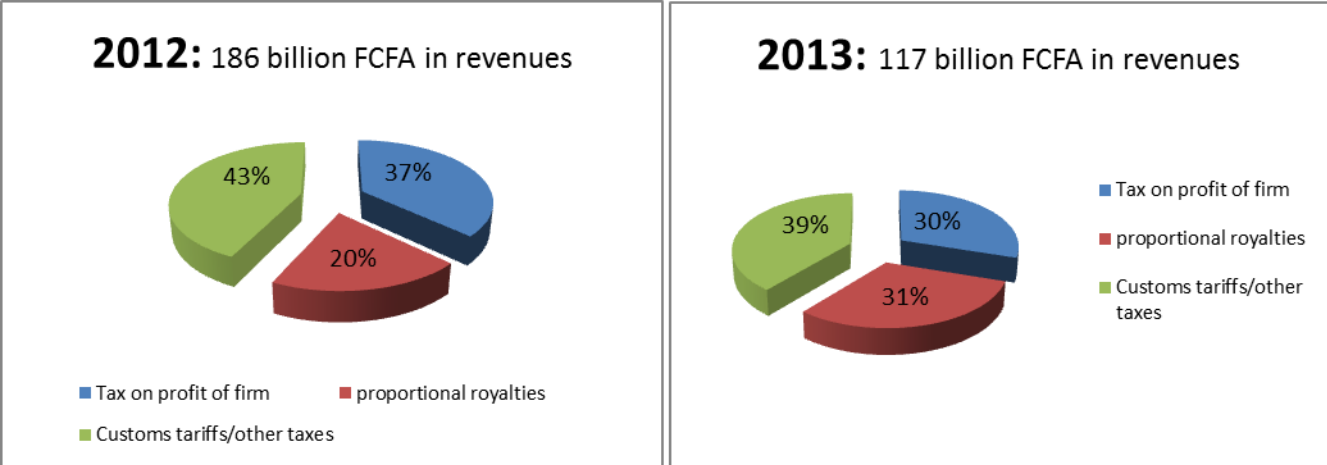
III. Literature review

3.1. Natural resources and employment

Many models have been developed to explain the inability of countries to transform natural resource booms into economic growth. These notably include theories on international trade, impoverishing growth (Bhagwati 1972),

dependence and domination (Koutassila, 2000) and Dutch disease (Corden and Neary 1982; Gorden 1984). The Gordon model (1984) assumes that a small open economy has three sectors: the booming sector, the lagging sector where the market sector produces other tradable goods and the non-market sector (here not being traded internationally) which includes services, construction and transport. Prices of tradable goods are exogenous and those in the non-market sector are flexible and are established by domestic supply meeting domestic demand. The potential causes of Dutch disease can be related to technical progress in a sector involving a substantial decline in production costs, entry of foreign capital, and an increase in international prices of exported products. The model also assumes that each sector has sector-specific capital and labour which is mobile between the three sectors of the economy.

According to these authors, the expansion of the booming sector can be summarized by two distinct effects: a *resource allocation effect* and a *spending effect*. The spending effect assumes that a share of public revenues from mining is spent on the purchase of goods from the non-market sector. This leads to an increase in demand and prices of non-market goods relative to tradable goods. This situation leads to an appreciation of the real exchange rate, causing growth in production of non-market goods and a contraction of production of tradable goods outside of mining.

Assuming full employment and a boom in the mining sector, the marginal product of labour increases in the booming sector. The effect of reallocating resources leads to a transfer of workers from the lagging sector and the non-market sector into the booming sector, which reduces production in these two sectors. This is called the *direct industrialization* effect. The resource effects also create more demand for non-market goods which is in addition to the spending effect. The combination of these two effects leads to a transfer of workers from the lagging sector to the non-market goods sector, thus creating an *indirect industrialization* effect which complements the *direct deindustrialization* effect. Corden (1984) notes that the spending effect tends to increase non-market production and the resource effect tends to reduce it. He observed that the two effects reduce production and real remuneration to capital specific to the lagging sector. The lagging sector experiences a decline in its production in all cases, while the non-market sector may be either higher or lower.

Other empirical studies make it possible to verify the theoretical validity of the presence of Dutch disease, but the most widely used remain those which use econometric methods. As opposed to econometric methods, calculable general equilibrium (CGE) models enable to account for direct and indirect effects of a natural resource boom on the entire economy. The few studies using CGE models tend to focus on specificities of the labour market and taxation (Levy 2007; Qiang 1999; Breisinger et al. 2009; Wiebelt et al. 2011; Lay et al. 2008; Go et al. 2013; Robichaud et al. 2014; Sangare et al. 2016). To our knowledge, applications of the method to the economy of Burkina Faso include responses to questions on trade liberalization (Cockburn et al. 2010); public education spending and poverty (Balma et al. 2010); to analyse the effects of increasing public education spending on monetary and caloric poverty of children (Cockburn et al.2013; Gottschalk et al.2009); and the 2007/2008 economic and financial crisis (Balma et al.2010). Among CGE studies applied to Burkina Faso, none have yet addressed the question of the mining boom. An analysis of the impact of the mining boom on the labour market

which uses these theories will be more focused on the resource allocation effect. In agricultural developing countries, the term "deagriculturalisation" is used by Koutassila (2000) to refer to the same phenomenon which has the main effect of reduction the production of agricultural market goods. Koutassila (2000) finds that the oil boom in the Netherlands in the 1970s led to an increase in the unemployment rate from 1.1% to 5.1% and a 16% decline in employment in the manufacturing sector. Sangaré et al. (2015) used a CGE model to analyze the impact of expansion of the uranium and petroleum sectors on the labour market in Niger. They show that the increase in the stock of capital in the uranium sector leads to an 11.7% reduction in labour demanded in the industrial sector due to two effects: a first effect is due to the loss of competitiveness of this sector which leads to a decline in product (-3.6%) and labour demand. A second effect results from the reallocation of demand for labour in favour of higher productivity sectors, in this case especially construction and services, as well as into public administration. The authors simulate a subsidy in the agricultural sector and in electricity and find growth in demand for labour in the economy, in particular in the agricultural and industrial sectors. They show that mining and petroleum resources do not necessarily lead to Dutch disease if the state implements the necessary policies in the appropriate sectors. Zavaleta (2003) shows that in Bolivia, the mining boom led to an increase in inequality in the distribution of income between production factors. They find an increase in incomes of qualified workers (6.8%) and among informal unqualified workers and also an increase in income from capital (3.2%) (other than land), at the same time as a 10.7% decline in remuneration to land capital and a 2.5% decline in remuneration to rural workers. But what about the impact of natural resources on public revenues?

3.2. Natural resources and tax receipts

For many African countries which have experienced booms in the mining sector, the challenge is in the capacity of government to determine how to develop tax regimes which can best respond to their objectives. Mobilization of fiscal revenues in this country is limited by the predominance of the agricultural and informal sectors in the economy, the size of tax and customs exemptions and incentives, the weak capacity of the tax administration to collect revenues, and corruption. Socio-political shocks (civil wars), climate shocks (floods and droughts) and fluctuations in international prices of primary materials make it more difficult to mobilize tax revenues. Logically, the "boom" periods of export receipts from primary products leads to an increase in public levies through the combined effect of expanding the fiscal space and the addition of significant non-tax revenues that the state can draw from exploitation of primary products (petroleum, mining and agricultural products). Theoretically, we expect the boom in export receipts to lead to an increase in public revenues as a share of GDP through increased tax and non-tax revenues.

An aspect of the natural resources curse which has attracted little attention in the literature is the impact of natural resources on the incentive for a country to mobilize tax revenues. According to Moore (1998, 2007), countries which depend on natural resource rents are less likely to mobilize more revenues from other sources. These counterintuitive results can mostly be explained by the wealth effect and insecurity risks related to politics. Thus, during "booms" in

export receipts from primary materials, the volume of additional revenues leads some governments to agree to numerous tax exemptions.

Zavaleta (2003) used a static CGE model to analyze the impact of an increase in mining capital on the Bolivian economy. He finds that Dutch disease is manifested through a major increase in exports from the mining sector and a significant decline in exports in traditional sectors linked to international trade. This is accompanied by depreciation in the real exchange rate and appreciation of domestic currency. In the scenario where capital is considered as exogenous, a major decline in it leads to a major reduction in tax revenues. The author suggested that this paradoxical result can be explained by the fact that the increase in exports in the mining sector led to a major reduction in exports from other sectors and thus a decline in fiscal revenues in these sectors and the economy as a whole.

Moore (2007), Bornhorst et al. (2009) and Diarra (2012) also found a decline in mobilization of fiscal revenues in other sectors of the economy. Countries which depend on natural resource rents are less likely to mobilize more revenues from other sectors in the economy because they receive significant resources from exploitation of natural resources and considerably reduce their fiscal mobilization efforts. Diarra (2012) recommends Sub-Saharan African countries to adopt a budget smoothing policy by creating sovereign wealth funds that invests excess revenues into shares of firms or more generally investments in equity markets. Then, in times of declining receipts, the sovereign fund can finance budget expenditures. The author also suggests to avoid investment projects during the boom if they have low economic returns.

As for negative shocks on export receipts, they significantly reduce public receipts and countries are unable to compensate for lost receipts due to the negative shock, for example through higher effort for fiscal mobilization. This situation can be explained by the fact that the crisis in the boom sector affects all other sectors and makes fiscal mobilization difficult in terms of collection and increasing taxes, and thus implementation of tax policies. According to Guillaumont et al. (2011), the increase in official development aid in periods of low prices of primary materials reduces the impact on public finances.

Generally speaking, taxation is applied on the economic rent of mining firms. The economic rent, according to Guj (2012), is the difference between gross revenues from mineral exploitation and production costs (recurring costs and capital recovery costs). It must be greater than the minimum return to capital (normal profits) corresponding to the compensation to investors to give up the best alternative investment opportunities, in consideration of timing and the risk of uncertain treasury flows linked to the project. Taxation is thus on the net value of mining resources after deduction of production costs including normal profits (minimum return to capital). However, a high tax on firms reduces investment by firms, because it decreases after-tax profitability of investment, with negative effects on growth. Also, a very high tax rate on firms can affect relative production prices, making capital relatively more expensive than capital, which leads to a decline in labour productivity, wages, and eventually the supply of workers. It can also reduce incentives of firms to invest in new activities, and discourage foreign direct investment and thus the presence of foreign multinational firms (Bloom et al; OECD 2013).

According to the principle of tax neutrality, an economically efficient tax should promote a reallocation of economic resources into productive sectors. This would not lead to additional costs for firms facing the tax and does not change their behaviour or investment decisions. Also, an econometrically efficient tax in the mining sector should not affect exploration or mining production activities. This is as opposed to an inefficient tax, which has the effect of causing under-exploitation or over-exploitation of mineral reserves. Since the economic rent is the surplus after deducting production costs and minimum returns to capital, an increase in the tax on this rent is more feasible.

Revenue volatility is especially associated with high volatility in mineral prices. If the objective of the government is to ensure stability of receipts, the tax on profits (the rent) is not ideal because they fluctuate with mineral prices. The only options in such a case are to set a fiscal quota which becomes unprofitable in the case of a decline in international gold prices or to implement non-fiscal strategies. Non-fiscal strategies may involve reduction of public spending or establishing a sovereign wealth fund. A sovereign wealth fund is a financial investment fund (shares, bonds, etc.) held by the state. The objective is thus to stabilize these revenues through products derived from hedges in financial markets in order to meet the needs of the country. The funds can reduce losses linked to falling prices by using instruments uncorrelated to financial markets which produce stable and sustainable income.

In sum, the literature shows that African countries which experience a mining boom can avoid Dutch disease by implementing suitable economic and institutional policies. Revenues from natural resources should also be invested in human capital and in diversification of economic activities, in particular in rural areas. These investments should eliminate dependence on exports of mining products, absorb the diffusion of knowledge brought by foreign firms, and increase the level of employment in the economy. Similar to how studies which have used a CGE model to evaluate the effects of natural resource discoveries, this study evaluates the impact of the decline in international gold prices and the effects of tax reforms in the gold sector by using a CGE model. To our knowledge, this is a first for Burkina Faso. It involves capturing the direct and indirect effects of the decline in international gold prices, and also the increase in the tax on production and the tax on profits of mining firms, on the economy of Burkina Faso.

IV. Methodology and data

4.1. Data

4.1.1. Social accounting matrix (SAM)

To perform an analysis by using a CGE model, a social accounting matrix (SAM) is used. It is developed using data from input-output tables and groups together all macroeconomic information in an economy. The SAM used in this study was built by the World Bank in collaboration with the National Institute of Statistics and Demographics (INSD). The research team made a few changes to this SAM to account for the specificities of the study. This SAM has two production factors, labour and capital. Labour is comprised of qualified and unqualified labour. Capital is comprised of mining capital, other capital and land. Each sector uses capital and labour to produce goods and

services. The accounts for sectors of activity and products (initially 19 of each) were reduced to 15 production sectors and 15 products. Initially in the SAM, there was only one account for firms, but in the new SAM, the firms account was disaggregated into a gold firm and a non-gold firm.

The gross operating surplus (EBITDA) of the extractive industry was used as the revenues of the gold firm agent with a capital distribution in the gold sector (90% of EBITDA) and dividends paid to the state (10% of EBITDA). Some information on mobilization of tax receipts in Burkina Faso (2012 SAM) is found in section C.1.2.3.1 of annex C.

Domestic public revenues (total excluding transfers from the rest of the world) is mostly drawn from other sectors of the economy (62.4%), and the gold sector accounts for 11.1% of government revenues. However, the gold sector accounts for 62.2% of taxes on production, 96% of export taxes and 33.3% of direct taxes (direct taxes on gold firms and direct taxes on households working in the mining sector), which is not negligible in terms of the contribution from industry. In Burkina Faso, externally dependent public revenues (transfers received from abroad and taxes on international trade) account for about 40% of revenues (2014 SAM), which makes the country vulnerable to external conditions. Annex C1.1.e presents the statistical data on mining taxation, which are used to introduce specifics of the mining sector into the SAM.

4.1.2 Interaction of the extractive sector with the labour market and job opportunities

The gold industry provides a small share of total employment in Burkina Faso (0.2%). The only additional opportunities in terms of employment are upstream and downstream interactions of this industry with the rest of the economy.

a. Upstream from production

The upstream market precedes the production activities of the firm and the upstream market thus generally refers to the market which provides goods and services as suppliers. It mostly involves contracting relations that the gold industry has with other industries in the economy (intermediate demand for production).

In the case of Burkina Faso (2012 SAM), the intermediate demand of the gold industry is mostly for products from other industrial activities (60.4%), other services (28.4%), transport and communications services (7.0%) and electricity (3.0%). A shock to the gold sector can have a considerable impact in terms of employment in these sectors, in particular other industrial activities and other services (see Table 2).

Table 2: Upstream from gold production

Type of intermediate consumption	Share of total intermediate demand
Products of other industrial activities	60.4%
Electricity	3.0%
Construction	0.2%
Transport and communication services	7.0%
Financial services	1.2%

Other services	28.4%
Total intermediate demand and mining extraction industry	100.0%

Source: SAM, authors, 2016.

b. Downstream from production

The downstream market refers to the market after the production activity of the firm and is comprised of final consumers and distributers. In the case of the gold industry, aside from international exports which account for 99% of gross production, production going to the domestic market is very low (1%) (Table 3). Domestic demand is mostly from very small transformation industries (jewellery) with low capacity to create employment (although it accounts for 90% of domestic demand). In terms of employment policy, downstream from the gold sector is not a major provider of employment at the local (or national) level.

Table 3: Downstream from gold production

		production for domestic market	production for external market	total production
Share of total production		**1**	**99**	**100**
Distribution of domestic production	**Jewellery (other industrial activities)**	90		
	Final consumption among households	10		
	Total	100		

Source: SAM, authors, 2016.

4.2. Methodology

The method used in this study is CGE modelling calibrated with a 2012 social accounting matrix of Burkina Faso. The CGE model is a type of economic model which uses real economic data to analyse the performance of the economy of a country after a change in policy, technology or external shock. A CGE model is comprised of equations which describe the behaviour of producers, consumers and interactions with societal institutions (government, firms, households and the rest of the world). The equations in the model are neoclassical, and assume that producers minimise production costs and that households maximise their utility given a budget constraint.

4.2.1. Description of CGE model

The CGE model that we develop in this study is based on the standard PEP-1.1 model of Decaluwé et al. (2013).

The model considers a three-level production function. At the first level, the production output of each sector is a combination of value added and total intermediate consumption in fixed proportions. At this level, the model takes two aggregated inputs, which are strictly complementary with no possibility for substitution, following a Leontief-type production function. At the second level, the value added of each sector is a combination of composite labour

and composite capital with a constant elasticity of substitution (CES) function. The total intermediate consumption of each sector is a Leontief function. At the last level, composite labour combines different categories of labour according to a constant elasticity of substitution (CES) function.

Production goes either to the domestic market or exports. A constant elasticity of transformation (CET) type function makes it possible to account for imperfect substitutability between goods produced for different markets. This constant elasticity of transformation function captures the degree of heterogeneity of products sold by destination. As is the case for supply, domestic consumption demand is comprised of domestic goods and imported goods. We assume that foreign and domestic products are imperfect substitutes. The geographic differentiation is introduced using the classical Armington assumption with a constant elasticity of substitution function between imports and domestic products.

The model includes four agents: households, the state, firms and the rest of the world. Households draw their income from remuneration to factors (labour and capital) and transfers. Households make consumption expenditures, pay direct taxes to the government and save. As for the government, it collects taxes and makes expenditures. Its expenditures are comprised of spending on consumption and investment as well as transfers to households. Its revenues come from taxes, indirect taxes on domestic and international transactions and payments from the rest of the world. Firms receive a share of capital income, pay dividends to households and abroad, pay taxes on profits to the state and save.

In this standard model, Burkina Faso being a small country, international prices of imports and exports are exogenous. The exchange rate is considered as the numeraire of the model. The market of goods and services, and supply and demand, are in equilibrium reached through adjustments in relative prices. Total investment is the sum of savings of different economic agents. The current account balance, variation in stocks and government spending are exogenous and fixed in the model, as are tax rates. This model is distinguished by having an unemployment function to determine equilibrium on the labour market and specification of a labour supply function.

4.2.2. Introduction of unemployment into the model

To be able to account for the specificities of the economy of Burkina Faso, we need to change a few of the equilibria in the PEP-1.1 model. The modifications only concern the labour market where we consider the presence of unemployment. The equilibrium on the labour market in the standard model assumes that labour supply is equal to labour demand for each type of labour and by sector of activity; this assumption is not held in this study. In this study we assume that labour supply is equal to labour demand by labour type in each sector of activity, plus unemployment. In our model we have two types of workers, qualified and unqualified. The mathematical form is described as follows:

$$LS_l = \sum_j LD_{l,j} + UN_l * LS_l$$

where:

LS_l: labour supply by work type l

$LD_{l,j}$: labour demand by work type l and sector j

UN_l : is the unemployment rate by labour type l.

To introduce unemployment into the model we have used an unemployment-wage curve from Blanch flower and Oswald (1995), where the unemployment rate is linked to a scale parameter for wages, the unemployment rate and wage elasticity. According to Blanch flower and Oswald (1995) and Card (1995), studies on a number of countries show that the wage-unemployment curve is virtually identical from one country to the next and is stable over time with an elasticity generally in the range of -0.1 (Decaluwé et al. 2011). For the case of Burkina Faso, we use a value of -0.1 for the elasticity of unemployment. The mathematical form is thus as follows:

$$W_l = A\_w_l * UN_l^{\sigma_l}$$

with:

W_l : wage rate by category of labour;

A_w_l : scale parameter for the wage curve by labour category;

σ_l : elasticity of wage curve by labour category.

Finally, for closure of the model, we consider the supply on the market for goods and services as being equal to demand through adjustment of relative prices. The supply of capital is equal to demand, and total investment is the sum of savings of agents (households, government, firms and rest of world).

V.   Application and results

5.1.   Simulation scenarios

The impact of the mining boom can be evaluated in two stages: the phase of building mining sites and the production phase of mining industries (Phouphet et al. 2013). This study is interested in the production phase.

The simulations emulate the present context of the country marked by:

- –   instability of international gold prices;
- –   a set of tax policy reforms with increased tax rates on mining firms;
- –   future projections of an increase in mining capital after three new mining companies set up operations.

The present analysis does not cover an increase in mining capital.

The reference year is 2012, and the SAM used contains data from 2012.

Also in terms of mobilizing public revenues, two alternative solutions are available: the first consists of an increase in the supply of mining capital which is generally accompanied by a decline in the tax burden to incentivize future

investors. The second consists of an increase in the tax burden on mining firms which may be a disincentivizing factor for future investors. To maximize collection of mining tax revenues, Burkina Faso chose to combine these options, i.e., to increase the number of investors and increase the tax burden on the mining sector. This situation thus created tensions between the government and mining firms. The four simulation scenarios are presented in Table 4.

Table 4: Simulation scenarios

Scenario A	Description
Scenario 00	15% decline in world gold prices
Scenario 01	10% increase in production taxes in the mining sector
Scenario 02	10% increase in taxes on profits in the mining sector
Scenario 03	15% decline in world gold prices with tax reform. Application of tax reform. In reference scenario: 9% increase in direct taxes, 1% increase in production tax in mining sector

Source: authors, 2016.

Annex C.2.2.C presents the equivalence of the increase in taxes in the revised mining code in the model used for analysis.

5.2. Macroeconomic impacts

Annex C3.1 presents the macroeconomic results of the different simulation scenarios.

5.2.1. Decline in world gold prices

In the present context, Burkina Faso faces a 15% decline in international gold prices – scenario S00 (reference scenario) presents this negative shock on the economy in terms of macroeconomic effects. The real gross domestic product (GDP) used here is the GDP at base prices.

Using the simulation results (table below), we can see that the 15% decline in international gold prices leads to a 0.74% decline in real GDP. This contraction in real activity in the country is due to a reduction in gold production (-3.4%) and a 0.27% decline in total exports of the economy. The decline in returns to capital, in particular in gold production, leads to an increase in unemployment among both qualified (+17.8%) and unqualified (+10.0%) workers; this contributes to a 5.0% reduction in household income. This negative shock causes a major decline in living standards of the population because, despite the 3.0% decline in the consumer price index, real consumption nevertheless declined by 2.4%. We observe a decline in government revenues (-5.8%) due to the variation in fiscal revenues (-7.6%) and especially public revenues from mining (-16.0%), leading to a contraction in public spending (-7.6%). The decline in income of economic agents also caused a 5.4% decline in total investment and a 5.8% decline in demand for imported products.

5.2.2. Taxes on production and taxes on profits

To cope with the decline in mining tax revenues and its negative impact on the economy, a tax reform in the mining sector was adopted with a 10% increase in the tax on profits and a 10% increase in the tax on production. This

suggests that the tax on profits has a better impact on the economy than the tax on production. Scenarios S01 and S02 represent these two situations and attempt to provide some clarification of their likely effects on the Burkinabe economy.

Thus, all else equal, a 10% increase in the tax on production (S01) in the gold sector leads to a marginal 0.01% increase in real GDP, determined by the stability of imports (0.01%) and low growth in public spending (++0.23%) and real household consumption (0.02%). There is a negative effect on the economy according to the simulation results, with small growth in state revenues (+0.16%) brought by a 1.17% increase in tax revenues from mining. However, the increase in the tax on gold production caused a 0.68% decline in returns to capital and thus declines in gold production (-0.1%), exports (-0.08%) and total investment (-0.07%). The increase in real GDP was not sufficiently inclusive, considering that it was not accompanied by an increase in employment growth for all categories of workers, and thus contributed to a deepening of inequality in the distribution of income. There is also a small increase in unemployment among unqualified workers (+0.06%) and a decline in the unemployment rate among qualified workers (-0.17%). The reduction in unemployment is linked to the increase in labour demand, which leads to an increase in household income and thus real consumption (+0.02%). The increase in government revenues made it possible to support income growth of households, notably through public transfers. The 10% increase in the tax on profits of gold firms had similar effects to a 10% increase in tax on production in the gold sector, with a few differences. Such a shock leads to a 0.03% larger increase in real GDP and can be explained by a 0.08% increase in real consumption, the 0.02% decline in total imports and a 0.59% increase in public spending. This was possible due to increased income of economic agents, in particular the state (0.42%), with a 3.48% increase in public revenues from mining sector taxation. However, in this scenario, returns to capital decline by 0.05%, to the benefit of land capital (+1.6%) and other capital in the economy (+0.08%), leading to an overall decline in mining production (-0.03%). This situation causes expansion in other sectors of the economy and thus an increase in labour demand in these sectors which use labour relatively more intensively. The gold sector accounts for more than 60% of national exports, so the decline in activity in this sector leads to a 0.08% decline in exports from the economy and a 0.34% decline in investment. The increase in GDP is accompanied by a decline in the unemployment rate for both qualified workers (+0.72%) and unqualified workers (+0.04%), which leads to an overall increase in household income (+0.13%) and thus an increase in their real consumption. We also observe a 0.02% reduction in imports due to a combination of lower production in the gold sector, a major consumer of imported industrial products, and an increase in the consumer price index. Column S02-S01 shows the difference in macroeconomic aggregates between a scenario with an increase in the tax on production and the case of an increase on profits. We can see that, in the absence of a negative shock on the economy, the increase in taxes on profits is better in terms of GDP (+0.02%), mobilization of tax revenues (+0.45), increases in household incomes (+0.09%) and a reduction in the unemployment rate among both unqualified (-0.11%) and qualified (-0.55%) workers.

5.2.3. Application of the tax reform

Scenario S03 corresponds with the tax policy actually undertaken by the Burkinabe government to counter the decline in mining tax revenues following a 15% decline in gold prices. This scenario consists of applying a negative

external shock to the Burkinabe economy from the price decline, combined with an internal negative shock from the increase in taxation on the mining sector (+1% in tax on production and +10% in tax on profits of mining firms).

We find a 0.72% decline in real GDP due to a 3.42% decline in gold production and a 0.34% decline in total exports of the economy. The 25% decline in returns to gold capital leads to increases in unemployment among both qualified (+17.19%) and unqualified (+9.98%) workers, thus leading to a 4.86% decline in household incomes. This negative shock caused a major deterioration in the welfare of the population because, despite the 2.99% decline in the consumption price index, real consumption declined by 2.31%. We observe a 5.47% decline in government revenues due to the contraction in public revenues from mining (-13.39%), which leads to a 7.22% decline in public spending. The decline in income of economic agents caused a 5.67% decline in total investment and a 5.78% decline in imported products.

Column S04-S01 shows the marginal impact of applying the new mining code on the economy in a context of falling gold prices. It shows the results of the difference between macroeconomic aggregates in a scenario with just a decline in international gold prices and a scenario which combines a decline in the price of gold with tax reform. We thus find that economic returns from the tax reform are nearly insignificant due to the fact of the decline in gold prices. So, this policy only causes a 0.02% increase in real GDP and contributes to reduced investment in the economy (-0.03%). It enabled a 0.3% increase in government revenues, with a 2.57% increase in public revenues from mining which made it possible to increase public spending by 0.42%. The 0.08% decline in returns to capital in the gold sector improved the price competitiveness of other sectors, leading to an increase in labour demand in these other sectors and thus a reduction in unemployment among both unqualified (+0.03%) and qualified (+0.58%) workers. The model can predict the impact on macroeconomic aggregates under the assumption that investors do not change behaviour. But investors only carry out the activity if it is profitable.

5.3. Sectoral impacts

5.3.1. Production and labour demand

a. Sectoral evolution of production and labour demand

Table 5 presents the impact of different scenarios on sectors of activity in the economy in terms of production and labour demand. In this section, the analyses only deal with the cash crops (export-oriented), construction and gold sectors. Expansion of the gold sector led to a decline in the export share of cash crops (a major provider of employment) in total exports of the economy and growth in demand for non-market goods such as the construction sector. Next, we will see how these sectors evolve in response to the price decline and the increase in taxes in the gold sector.

Table 5: Impact on production and labour demand

	Price decline	Taxes on production	Taxes on profits	Tax reform
	S00	S01	S02	S03

	XST	LDC	XST	LDC	XST	LDC	XST	LDC
Food products	-0.77	-0.66	0.01	0.03	0.03	0.06	-0.74	-0.61
Export-oriented crops (e.g., cotton, sesame)	**4.52**	**4.89**	**-0.03**	**0.00**	**-0.09**	**-0.06**	**4.46**	**4.84**
Livestock	-0.15	-2.68	-0.01	0.04	-0.02	0.03	-0.17	-2.66
Forestry and related services	-0.14	-2.82	-0.02	0.03	-0.05	0.01	-0.18	-2.81
Other extractive activities	1.37	0.16	-0.12	-0.12	-0.45	-0.52	1.03	-0.21
Gold extraction activities	**-3.39**	**-19.90**	**-0.10**	**-0.64**	**-0.03**	**-0.19**	**-3.42**	**-20.06**
Agroindustry	0.95	-0.47	0.00	0.01	0.03	0.01	0.97	-0.46
Textiles industry	7.02	5.80	-0.04	-0.04	-0.14	-0.21	6.91	5.64
Other industries	5.60	4.23	-0.09	-0.08	-0.26	-0.29	5.39	4.01
Electricity, gas and water	0.41	-0.19	0.00	0.00	0.02	-0.02	0.43	-0.20
Construction	**-2.91**	**-4.09**	**-0.10**	**-0.10**	**-0.46**	**-0.51**	**-3.23**	**-4.44**
Trade	-1.84	-3.24	-0.02	-0.01	-0.05	-0.11	-1.88	-3.31
Hotels and restaurants	-2.49	-2.77	0.05	0.06	0.16	0.16	-2.36	-2.65
Transport	1.84	0.78	-0.02	-0.02	-0.06	-0.11	1.80	0.71
Finance	7.63	6.79	-0.06	-0.06	-0.17	-0.22	7.49	6.63
Public administration	-3.35	-3.85	0.18	0.18	0.44	0.40	-3.02	-3.54
Other services	0.42	-0.69	-0.04	-0.03	-0.09	-0.13	0.36	-0.77
TOTAL	**-0.39**	**-3.27**	**-0.01**	**0.03**	**0.00**	**0.12**	**-0.40**	**-3.17**

Source: authors' simulations.
Note: XST = Total aggregate output by industry; LDC = demand for composite labor

In scenarios S00-S03, we see that the decline in international gold prices directly causes a 3.39%. decline in production, and thus an approximately 20% decline in labour demand in the sector. We see a general decline in domestic prices of goods and services in the economy (+4.34%). Since the sector uses construction services as a consumption intermediary, the decline in gold sector activity has an indirect effect which reduces production (-3.23%) and labour demand (-4.44%) in the construction sector. The decline in demand for construction also comes from households, whose income declines by 4.9%. Thus, there is a reduction in labour demand in these two sectors (gold and construction) which leads to a decline in real wages in the economy and the surplus of workers on the labour market is partially absorbed through a reallocation effect towards cash crops (4.8%) which registers a 4.52% increase in its production and +4.84% labour demand in S03). The impact of the fall in gold prices is likely to show signs of Dutch disease as defined by Gordon (1984), but this time in the case of a negative shock.

In the case of increased taxation on the gold sector as presented in scenarios S00 and S01, we observe a decline in production in all three sectors : +0.03% in cash crops and +0.10% in both gold and construction. The indirect effects of the increase in the tax on production in the gold sector S01 as well as the scenario with a tax on profits of gold firms (S02) lead to increased demand for workers in the public administration sector (+0.18% in S01 and +0.40% in S02). These indirect effects occur through the decline in demand for intermediate consumption from the gold sector. The decline in intermediate consumption of construction services negatively affects real activity, and so labour demand declines in the construction sector (-0.10% in S01 and -0.51% in S02). However, the decline in production in the agricultural sector can, in addition to being affected by employment demand in the public sector,

can be due to higher domestic prices of other industrial products (fertilizers) (+0.02% in S01 and +0.06% in S02). This situation led to a reallocation of workers from productive and strategic sectors in the economy towards the public service, which tends to have lower productivity. This shows that a high level of taxation on production in the gold sector and a tax on profits of gold firms would be counterproductive because it would lead to negative effects on growth of the economy as a whole.

b. Comparative analysis in terms of job creation

According to the 2012 SAM, the gold sector accounted for 0.2% of employment. The indirect effect of the gold sector boom on other sectors occurs through intermediate consumption demand. Indirect job creation is generally linked upstream to production with subcontracting with other industries (in particular) in the economy, but there are also downstream effects. It should be noted that in "other industrial activities" we have the downstream sectors of activity (such as jewellery) and also upstream activities such as suppliers of equipment and consumables (e.g., chemical products, electricity), construction activities, etc. These suppliers provide their services to both the gold sector and other sectors in the economy. Annex C3.3 shows the impact of simulation scenarios in terms of job creation.

Also, the decline in international gold prices (S00) caused a 3.4% decline in gold product and so intermediate demand and upstream demand declined, leading, *ceteris paribus*, to a 3.27% decline in labour demanded across the economy. That leads to an approximately 20% decline in direct employment (jobs with mining firms) and a 0.29% increase in indirect employment. This surprising result can be explained by the fact that the decline in international gold prices causes a fall in domestic gold prices, which benefits small scale gold transformation industries downstream (jewellery) and development of domestic industry, and so we observe a 4.01% increase in labour demand in other industrial activities.

In scenarios S00 to S03, we see that the fall in gold prices led to a reduction in employment in the gold sector, which led to 2.4% lower real wages for unqualified workers and 4.1% lower for qualified workers. The increase in the profitability of other industrial sectors, combined with the decline in real wages, leads to a 1.26% increase in labour demanded in these sectors, with notable gains (4.8%) in the cash crops sector (cotton, sesame). However, in the services sector, we observe a 2.6% decline in labour demanded, with the largest effect being in construction (-4%). These results show indications of Dutch disease. Basically, we observe a reallocation effect of production resources from the gold sector to other industrial sectors. This fall in gold prices thus had a direct industrialization effect. We also observe a decline in demand and prices of non-market goods said through the spending effect leading to a transfer of workers from this sector (construction) towards other industrial sectors.

However, in the S00 and S01 simulation scenarios, we see that the increase in taxes in the gold sector only increase labour demand in the economy respectively by 0.03% and 0.12%. This can be explained by the returns to capital in other sectors of the economy to the detriment of the gold sector.

The increase on taxes on production of gold firms leads to a 0.02% reduction in wages of unqualified workers as compared to a 0.04% increase in wages among qualified workers. The productivity of capital rises in other sectors of the economy, which leads to declines in wages of unqualified workers and marginal growth in labour demand in

services sectors (+0.05%) except for in construction where labour demand declines (-0.10%). As for the tax on profits, it leads to a reduction in activity in the gold sector and thus a 0.19% decline in employment in this sector. This situation simultaneously leads to an increase in activities in the services sector, thus creating 0.14% additional labour demand. This results in 0.12% additional labour demand across the entire economy, and higher wages for both unqualified (+0.01%) and qualified (+0.19%) workers. All of these results confirm the research of Sangare et al. (2015) on the reallocation of productive resources and indications of Dutch disease in an economy which is rich in natural resources.

5.3.2. Impacts on households

The impact on households is through the labour market, the capital market and transfers, but also their real consumption and savings, the results of which are presented in Table 6. The decline in international gold prices (S00) thus had the effect of a decline in income for all categories of households ranging from -2.33% to -6.25% due to the increase in unemployment, the decline in real wages and lower returns to capital in the economy. Also, the decline in household income is dictated by the reduction of labour income (from -6.27% to -7.62%) and the decline of capital income (-2.15% to -5.44%). We see that the decline in gold prices has the largest effect on public (-6.25%) and private (-6.04%) employees. This shock is less among subsistence and cash crop farmers who respectively register -2.64% and -2.33% lower income. The final effect of this decline in gold prices is a reduction in real household consumption, with the exception of farmers of export-oriented and also food products who see their consumption respectively rise by 0.71% and 0.39%. These households depend on export receipts from agricultural products, which increased in export volume following the shock. However, real consumption and savings of households respectively declined by 8.4% and 3.13% for public salaried workers and by 3.1% and 8.12% for private salaried workers. We find similar results with application of the tax reform in the gold sector (S03).

Table 6: Impact on incomes of households

Households	Households Income				Capital Income				Labour Income				Transfers Income			
	S00	S01	S02	S03	S00	S01	S02	S03	S00	S01	S02	S03	S00	S01	S02	S03
Public employee	-6,25	0,06	0,19	-6,11	-5,41	0,04	0,08	-5,35	-7,62	0,08	0,34	-7,39	-3,51	0,03	0,06	-3,46
Private employee	-6,04	0,05	0,17	-5,92	-5,41	0,04	0,08	-5,35	-7,08	0,06	0,29	-6,88	-3,73	0,03	0,06	-3,68
Export Oriented agriculture	-2,33	0,02	0,06	-2,29	-2,13	0,02	0,06	-2,09	-5,51	0,02	0,16	-5,41	-3,03	0,02	0,06	-2,99
Unprocessed food products	-2,64	0,02	0,06	-2,59	-2,45	0,02	0,06	-2,41	-5,51	0,02	0,16	-5,41	-3,03	0,02	0,06	-2,99
Livestock	-5,26	0,04	0,09	-5,19	-5,24	0,04	0,08	-5,18	-5,51	0,02	0,16	-5,41	-3,03	0,02	0,06	-2,99
Fishing	-5,76	0,04	0,13	-5,67	-5,41	0,04	0,08	-5,35	-6,83	0,06	0,27	-6,65	3,03	0,02	0,06	-2,99
Self-employed	-5,52	0,04	0,12	-5,44	-5,41	0,04	0,08	-5,35	-6,21	0,04	0,21	-6,06	-4,07	0,03	0,07	-4,02
Inactive	-4,57	0,03	0,11	-4,49	-5,41	0,04	0,08	-5,35	-6,28	0,04	0,22	-6,12	-3,03	0,02	0,06	-2,99
Change in Unqualified wage W	-2,43	-0,02	0,01	-2,42												
Change in qualified wage W	-4,13	0,04	0,19	-4,01												

Source: authors, 2016.

In scenarios S01 and S02, we see +0.02 to 0.06 increases in household revenues from the production tax (from 0.06% to 0.19% for S02), mostly through the increase in real wages in the economy. This was possible due to the

0.02 to 0.08% increase in wage income (0.16% to 0.34% for S02), a 0.02 to 0.04% increase in capital income (from 0.06% to 0.08% in S02) and to a lesser extent income linked to transfers (+0.02% to 0.03% in S01 and +0.06% to 0.07% in S02). In the scenarios, we observe that the increase in the production tax and in the tax on profits are less beneficial for farmers (food products and export production). The increase in taxes in the mining sector led to 0.02% higher real consumption household consumption (+0.08%) and savings (+0.06%) in the case of the production tax, with the exception of farmers of food products and cash crops (+0.00% in S01 and +0.01 in S03 Table 29) who do not directly depend on the sector for their income.

A comparative analysis of the scenarios shows that the tax on profits has a larger impact on growth of household incomes than the tax on production. In terms of the policy choice to increase household incomes through fiscal policy, the tax on profits is a judicious choice so long as it does not make investment less profitable in Burkina Faso. Along these lines, Guj (2012) suggests that the tax should be levied on the rent. However, with respect to the context of only the decline in gold prices (S00), the mining tax reform only slightly improves household wellbeing in terms of incomes and consumption. In each of these scenarios, inequality rises among households because income increases more among public and private salaried workers, which amount to 20% of the active population, and the main economic activity of low income rural households are primarily in agriculture. This result shows that to improve the welfare of rural households, the government may for example, invest in the agricultural sector which provides 70% of income for rural households.

5.3.3. International trade and price variations

Tables 7 and 8 present the simulation results with respect to exports, imports and domestic demand, as well as price changes linked to the economy in each scenario (in percentage). In all the scenarios, we observed a decline in total exports of the economy, which means that the gold sector still accounts for most exports despite the negative shock in this sector (increase in taxation and decline in prices) that is felt in the country's trade with the rest of the world. The impact of the decline in the price of gold weighs more on exports than the tax increase scenarios. The sectoral analysis will focus on three sectors: construction, cash crops and gold mining activities.

Table 7: Simulation results – Exports

	S00				S01				S02				S03			
	Export	Export price	Domestic demand	Domestic price	Export	Export price	Domestic demand	Domestic price	Export	Export price	Domestic demand	Domestic price	Export	Export price	Domestic demand	Domestic price
Unprocessed food products	2,51	-0,82	-0,93	-2,26	-0,01	0,06	0,01	0,02	-0,05	0,02	0,034	0,059	2,47	-0,81	0,91	-2,58
Export oriented agriculture	5,4	-1,74	4,32	-2,29	-0,03	0,01	-0,03	0,01	-0,12	0,04	-0,08	0,06	5,32	-1,71	4,26	-2,25
Livestock	6,37	-2,04	-0,34	-5,09	-0,05	0,02	-0,01	0,04	-0,11	0,04	-0,02	0,08	6,28	-2,01	-0,36	-5,03
Sylviculture	6,75	-2,15	-0,15	-5,28	-0,06	0,02	-0,02	0,04	-0,13	0,04	-0,05	0,08	6,65	-2,12	-0,19	-5,22
Other Extractive activities	6,31	-2,02	0,45	-4,65	-0,11	0,04	-0,12	0,03	-0,37	0,12	-0,47	0,07	6,03	-1,93	0,10	-4,59
Gold Extraction activities	-4,77	-14,48	5,04	-7,72	-0,10	0,01	-0,08	0,03	-0,03	0,00	-0,22	-0,02	-4,81	-14,47	4,87	-7,73
Agroindustry	5,78	-1,85	0,86	-4,21	-0,04	0,01	0,00	0,03	-0,07	0,02	0,03	0,07	5,72	-1,84	0,89	-4,16
Textiles industy	8,47	-2,67	4,98	-4,32	-0,06	0,02	-0,03	0,03	-0,17	0,06	-0,09	0,09	8,34	-2,63	4,92	-4,25
Other industry	7,73	-2,45	5,26	-3,76	-0,08	0,03	-0,09	0,03	-0,23	0,08	-0,26	0,06	7,55	-2,4	5,06	-3,72
Construction	2,26	-0,74	-1,89	-3,41	-0,09	0,03	-0,1	0,02	-0,35	0,12	-0,44	0,06	2,00	-0,66	-2,2	-3,37
Transport	5,68	-1,82	1,16	-3,94	-0,05	0,02	-0,02	0,03	-0,12	0,04	-0,05	0,08	5,58	-1,79	1,13	-3,88
Finance	9,84	-3,08	6,05	-4,77	-0,08	0,03	-0,05	0,04	-0,22	0,07	-0,14	0,11	9,67	-3,03	5,94	-4,69
Public administration	3,08	-1,01	-3,39	-4,16	0,06	-0,02	0,18	0,04	0,12	-0,08	0,44	0,12	3,19	-1,04	-3,06	-4,08
Other Public service	4,72	-1,53	0,44	-3,77	-0,05	0,02	-0,03	0,03	-0,14	0,05	-0,08	0,07	4,62	-1,49	0,39	-3,72
Total	-0,27	-2,26	-0,43	-4,34	-0,08	0,01	0,01	0,03	-0,08	0,04	0,01	0,07	-0,34	-2,23	-0,42	-4,30

Source : auteurs, 2016

Note: S00 = reference scenario; S01 = production tax scenario; S02 = tax on profits scenario; S03 = projection of actual policy.

Table 8: Simulation results – Imports

	S00		S01		S02		S03	
	Import	Import price	Import	Import price	Import	Import price	Import	Import price
Unprocessed food products	-7,81	-0,25	0,06	0,002	0,2	0,004	-7,68	-0,25
Export oriented agriculture	-2,42	-0,09	0,01	0,001	0,09	0,002	-2,36	-0,09
Livestock	-13,33	-0,57	0,09	0,004	0,19	0,01	-13,2	-0,56
Sylviculture	-14,03	-0,43	0,09	0,003	0,17	0,01	-13,92	-0,43
Other Extractive activities	-7	-2,17	-0,07	0,02	-0,35	0,04	-7,24	-2,14
Gold Extraction activities	-9,7	-0,62	0,08	0,005	0,22	0,01	-9,55	-0,61
Agroindustry	-5,33	-0,96	0,05	0,01	0,14	0,02	-5,23	-0,95
Textiles industy	-4,1	-0,72	-0,03	0,01	-0,11	0,01	-4,18	-0,72
Other industry	-6,56	-0,86	0,06	0,01	0,18	0,01	-6,44	-0,85
Construction	-11,6		-0,03		-0,26		-11,77	
Transport	-10,33		0,07		0,19		-10,2	
Finance	-8,41		0,06		0,19		-8,28	
Public administration	-14,96		0,29		0,81		-14,45	
Other Public service	-10,49		0,05		0,15		-10,39	
Total	-5,76		0,002		-0,02		-5,78	

Source: authors, 2016.
Note: S00 = reference scenario; S01 = production tax scenario; S02 = tax on profits scenario; S03 = projection of actual policy.

The 15% decline in oil prices in the two scenarios (S00 and S03) lead to a 4.7% decline in gold exports driven by a price effect and an income effect. The price effect is due to the decline in the value of exports. The volume effect induced by the price effect leads to a decline in returns to gold sector capital and thus a temporary stoppage of some mining production. This situation reduces domestic prices, in particular of gold (-7.7%), export-oriented agriculture (-2.29%) and construction (-3.41%). The decline in domestic gold prices leads to a 4% increase in gold demanded domestically for existing industries such as jewellers. The decline in gold sector activity and its profitability led to a decline in incomes of economic agents, with an ensuing result of reduced domestic demand in construction (and investment) (-1.89%), which caused lower domestic (-3.41%) and export (-0.74%) prices. Given that domestic prices decline more than FOB prices, construction firms become more competitive internationally, leading to a 2.26% increase in exports. The international market thus becomes relatively more attractive for construction industries compared to the domestic market. The fall in gold prices makes export-oriented agriculture more attractive due to the increase in returns to land capital as well as the decline in FOB prices (+1.7%) and domestic prices (+2.2%), which leads to a 5.4% increase in exports and a 4.3% increase in domestic demand for cash crops (export-oriented agriculture).

The increase in the tax on production and the tax on profits (S01 and S02), as opposed to the scenario with the decline in gold prices, leads to appreciation of export and domestic prices of domestic production, which has the effect of reducing the price competitiveness of domestic products both domestically and internationally. These taxes are additional costs for gold mining firms which affect their sale price. A 10% increase in the tax on production leads to a 0.01% increase in export prices (0.04% for tax on profits: S02) and a 0.03% increase in domestic gold

prices (-0.03% for taxes on profits: S02), and a 0.08% increase in domestic demand (-0.22% for taxes on profits: S02). The tax on production increases gold prices (domestic and export) by more than the tax on profits, and thus leads to a larger decline in exports and domestic demand in the gold sector. However, the tax on profits causes larger appreciation of prices (domestic and export) in the other sectors of the economy than the tax on production, and hence leads to a larger loss of competitiveness and thus demand (exports and domestic) which is even larger in other sectors of the economy.

The last scenario involves a combination of three negative shocks and their effects on the gold sector and across the economy. With the tax reform, we see that, compared to the context of only the decline in gold prices (S00), there is a relatively larger reduction in exports from the economy (+0.34%), in particular of gold (+4.8%). The tax reform additionally reduces the level of exports. However, these three shocks have sometimes contradictory results which, when combined, enable to minimise losses for the economy. The tax reform also contributes to reduced competitiveness of the agricultural sector, a pillar of the Burkinabe economy, which experiences a relative decline in its exports (-0.08: S03-S00[8]). In the long run, that can lead to frictions on the labour market, because agriculture employs more than half of the active population, while the mining sector is relatively more intensive in its use of capital.

The evolution in imports in the simulations shows that the 15% decline in gold prices in the two scenarios (S00 and S03) leads to a decline in prices of imports (-5.7%) and domestic demand (-0.4%). This situation should theoretically lead to an increase in demand for imported and domestic products. However, the shock leads to lower income of economic agents, which reduces their capacity to make additional expenditures. Also, two phenomena explain the decline in imports. First, mining companies reduced intermediate consumption demand, and so reduced imports of chemical products used in mining production drove a 4% decline in imports of "other industrial products" (oil, fuel oil, etc.). Then, the income effect, due to the decline in real wages and thus household incomes, led to a reduction in imports. In the agro industry sector, we see a larger decline in domestic prices (-4.2%) compared to import prices (-0.62%), thus leading to improved competitiveness of domestic products. The decline in household income combined with the gain in competitiveness of domestic products will lead to a 9.7% reduction in agrifood imports and a 0.86% increase in domestic demand for this product.

However, the increase in the tax on production (S01) and the tax on profits (S02) leads to a larger increase in domestic prices compared to import prices, creating a gain in competitiveness of imported products. The increase in real wages combined with the increased competitiveness of imported products thus leads to higher consumption of imports. This leads to higher prices of agrifood imports (0.05% in S01 and 0.01% in S02), domestic agrifood prices (0.03% in S01 and 0.07% in S02, Table 8), food imports (0.08% in S01 and 0.22% in S02) and domestic demand (0.001% in S01 and +0.03% in S02). However, we observe a decline in imports in the construction and other industries sectors, due to the linkages with the gold mining sector which reduced its production following imposition of the tax.

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[8] S03-S00: difference between the simulation results in the S03 scenario and the S00 scenario. The same holds for S01 and S02.

We thus see that the tax on profits contributes to more reduction of domestic demand and increases the level of imports relative to the production tax scenario. In both scenarios S01 and S02, the increase in the tax burden negatively impacts the trade balance and causes disinvestment in industry in the domestic economy.

5.3.4. Government revenues: A fiscal revenues analysis

Columns S01-S02 shows the difference in growth of public revenues between the production tax and profits tax scenarios. The share of mining revenues in government revenues before the simulations was 11.11%. After the decline in international gold prices, this share went to 9.91%, a 1 percentage point decline. The results show that a 15% decline in world gold prices thus leads to a 4% reduction in gold production and exports, which leads to 18.56% lower mining revenues from export taxes and 17.8% lower in production taxes (a price effect and a volume effect). We also see a 24.9% reduction in the amount of taxes on profits and the tax on capital due to the decline in profitability in the gold mining sector. The decline in labour demand in the sector leads to a 23.08% reduction in taxes on wages.

However, the increase in the tax on production and that on profits of mining firms enables improved mobilization of tax receipts (respectively +0.28% and +0.72%). The increase in the production tax is an additional cost on the mining firms' account and leads to a 1.72% decline in direct taxes paid by households and a 0.68% reduction in taxes on profits. This shock on the economy leads to improved productivity in other industrial sectors and an increase in labour demand, and enabled an increase in total tax receipts of the economy. The tax on profits causes a 0.02% contraction in employment and thus taxes on production paid by gold mining firms and a 1.6% decline in payments of the income tax on wages (IUTS). In the comparative analysis, the production tax provides less tax revenues and employment than the tax on profits (+0.45%) and so the second of these is a better alternative in terms of mobilizing tax revenues than the case of a production tax only (S01). However, the tax on profits reduces profits of gold mining firms by more than then tax on production, and in a context of lower gold prices has a disincentivizing effect on investment, as highlight by Bloom (2007) and a report by the OECD (2013).

We also observe that the scenarios with lower international gold prices and application of the updated mining code make it possible to obtain the same level of public revenues from mining. These results confirm those obtained by Diarra (2012), Moore (2007) and Bornhorst et al. (2009). These authors show that the decline in international prices of primary materials lead to a reduction in export receipts and public receipts, and countries do not manage to compensate for this loss through higher tax mobilization efforts. Also, the relationship between the gold mining sector and other sectors of the economy make it difficult to implement tax mobilization strategies.

5.3.5. Mining firms' revenues

The simulation results show that gold firms lose a quarter (-24.93%) of their incomes following the decline in gold prices and application of the tax reform, which confirms the results found by the KPMG study (2013). It may then be worth considering application of a progressive tax according to gold prices and a profitability threshold of gold mining firms. Regarding this profitability threshold, it was defined by KPMG at $1425 per ounce of gold (KPMG, 2013), while in our simulations the price of gold fell from $1669 per ounce to $1419 per ounce. In other words,

this represented an increase in the tax burden in the sector when the price of gold is above $1425 per ounce and to keep it constant (with respect to 2012) at prices below $1425 per ounce.

Table 9: Profitability of gold mining firms

	Results of 2013 KPMG study			Results of simulations		
	change after tax reform	competitiveness compared to Mali	competitiveness compared to Ghana	decline in price of gold	tax reform	difference with tax reform
Mining firms' profitability	-39	+1	-3	-24.93	-25.01	-0.08

Source: KPMG, 2013, authors, 2016.

VI.   Conclusions and policy implications

Since the end of 2012, the price of gold has fallen drastically, leading to a decline in revenues for both investors and the Burkinabe government. This has led to a decline in economic investment and more poverty among the population.

According to the study by KPMG, the profitability threshold of a mining firm in Burkina Faso is $1425 per ounce, while the present price of gold is $1200 per ounce. Applying a 10% tax on profits of gold sector firms in this context may lead to closure of some mining activity due to effects on profitability, which would reduce fiscal revenues and the employment rate in the country.

The present study had the objective of evaluating the impact of the decline in international gold prices on expansion in the gold mining sector, with an emphasis on tax receipts and employment in the economy. To do this, a static multi-sectoral CGE model was used to perform the economic analysis to measure the effects of a decline in international gold prices and the tax reform on the economy. The simulation results implemented in this research enable us to draw a few conclusions.

The 15% decline in the international export price of gold had the effect of reduced employment among both qualified (-3.81%) and unqualified (-1.72%) workers. We also see reductions in incomes of households (-4.97%), firms (-13.14%) and government revenues (-5.79%). A 10% increase in the tax on production in the gold mining sector increases the level of employment among both qualified (+0.03%) and unqualified (+0.01%) workers. Such a policy applied to the economy of Burkina Faso contributes to increasing government revenues by +0.16 %, alongside a 0.24% decline in firms' income. It also leads to a 0.45% decline in the unemployment rate among qualified workers and a 0.15% increase in unemployment among unqualified workers. However, the 10% increase in income taxes on mining firms increases demand for both qualified (+0.14%) and unqualified (+0.01%) workers. The increase in this direct tax leads to a 0.42% increase in government revenues and a 0.03% increase in firms'

income (with a 0.05% decline in the income of gold mining firms). Finally, the tax reform led to a reduction in both qualified (+3.68%) and unqualified (+1.72%) unemployment, which then led to a reduction in income of households (-4.88%) and firms (-13.14%), as well as government revenues (-5.49%). The better option in terms of employment and collection of public revenues seems to be this last scenario.

1. The implications of the economic policies are the following: these results confirm the hypothesis of Guj (2012) according to which a tax on rents in the best policy option in terms of economic efficacy. However, while the increase in the tax on profits is the best option, in future research a profitability threshold should be calculated to determine at which point it becomes an excessively disincentivizing factor for investors. Moreover, in a context of lower gold prices, the incomes of mining firms and the state have declined, and thus returns in this activity are lower. A progressive taxation approach should then be considered to account for periods of low returns from mineral exploitation and periods of high returns.

2. The results showed that, at the sectoral level, the gold mining sector is only weakly linked to the rest of the economy, which means that it does not create many indirect jobs. The government could then, through contracts added to mining contracts, encourage collaboration between mining firms and domestic industries. This option promotes development of domestic industries, job creation and an increase in tax receipts from mining.

Shortcomings and future research orientations

An alternative option which could be a better policy option for employment and mobilization of fiscal resources which was not studied in this research was to explore the option of increasing the supply of capital in the gold sector and investment of public revenues from mining into the education sector, in addition to access to credit to encourage self-employment among youth. These different approaches will be undertaken as a further development of this document in the near future.

In the near future, the authors would like to use a dynamic model to extend upon the modelling developed in the production of this document. In Burkina Faso, two gold sectors co-exist: the formal (modern) sector and the informal (artisanal) sector. It would be very interesting to be able to perform analyses which account for this, for example after collection of data in the field. Also, in terms of modelling, it would be interesting to incorporate firm's behaviour in terms of tax fraud which occurs when the price is not high enough and when taxes form the majority of government revenues. Another possibility for the state to deal with instability of public revenues from mining is to save a share of revenues in a sovereign wealth fund. A future study could explore the feasibility of such an option. Another possibility is to analyse the effect of governmental uses of fiscal resources and to study the tax threshold in the gold sector beyond which taxes become prohibitive to growth of the economy as a whole.

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Annexes

ANNEX A

Table 10: Macroeconomic contribution of mining sector to economy of Burkina Faso

	2007	2008	2009	2010	2011	2012
Total gold production in tonnes	**1**	**5.8**	**12.6**	**23.6**	**33.1**	**31.14**
industrial production of gold in tonnes	0.7	5.4	12.1	23	32.6	30.17
Artisanal production of gold in tonnes	0.3	0.4	0.5	0.6	0.5	0.97
Gold exports in billions FCFA	**16.1**	**74.2**	**190.32**	**436.45**	**852.16**	**805.74**
Share of gold in total exports (%)	5	24	46	67	77	72
Revenues from mining in billions FCFA (MEF, 2014)	**3.3**	**7.4**	**15.7**	**46.6**	**127.4**	**189.5**
Share of contribution to budget revenues	1	2	3	8	18	21
Number of declared employees in mine	**492**	**1763**	**4465**	**6222**	**6380**	**5784**
Share of employment (%)	0.3	1.2	2.4	3.7	3.5	3
Share of investment in internal resources (%)	**29**	**34**	**33**	**42**	**34**	**34**
Share of real growth (%)	**0.3**	**1.4**	**1.7**	**1**	**-0.6**	**0.4**

Source: INSD, 2015; IAP, 2015; DGEP, ITIE, 2014; MEF, 2014; Chambre des mines, 2014.

ANNEX C: DATA SOURCES

C.1. Social Accounting Matrices (SAM)

The base social accounting matrix (SAM) used is that built by the World Bank in 2015 in partnership with the National Institute of Statistics and Demographics (INSD). It reflects the economic situation in Burkina Faso in 2012. The matrix was modified to account for the specificities of the theme addressed in this study. For the different changes, we have used 2012 data from the National Institute of Statistics and Demographics (INSD), the Automated Forecasting Instrument (IAP) which condenses input-output tables (IOT) and integrated economic accounts (TCEI / IEA) from 2012 and the Financial and Economic Operations table (TOFE / FEOT). In this part of the presentation, the data allow us to show, in section C1.1, the changes made to the matrix followed by a brief description of the economy in the second section.

C1.1. Social accounting matrix structure and changes made to it

The changes made to the SAM first consist of:
- grouping together certain accounts;
- introducing a representative gold mining firm;
- introducing capital specific to gold mining firms;
- introducing gold as a product in the economy of the country

C1.1.a. Sector and product accounts

The account for sectors of activity and products (initially 19 each) were reduced to 15 sectors of activity and 15 products.

Table 11: Sector accounts

	Sector of activity in the economy			
No	**Industries in old SAM**	**Industries in study SAM**	**No**	**Abbreviation in the study SAM**
1	Food products	Subsistence agriculture	1	**AGVIV**
2	Export-oriented or industrial agriculture	Export-oriented or industrial agriculture	2	**AGXP**
3	Livestock and hunting	Livestock and hunting	3	**ELVG**
4	Forestry and related services	Forestry and related services; fishing	4	**SYL**
5	Fishing			
6	Extractive activities	Other extractive activities (salt, granitic sand, etc.)	5	**EXTRCTOTH**
7		Gold mining activities	6	**EXTRCTOR**
8	Agroindustry	Agroindustry	7	**INDAL**
9	Manufacturing of textiles, clothing and leather working	Manufacturing of textiles, clothing and leather working	8	**TEXT**
10	Other industrial activities	Other industrial activities	9	**INDOTH**
11	Electricity, gas and water	Electricity, gas and water	10	**ELCT**
12	Construction	Construction	11	**CONST**
13	Commerce	Commerce	12	**COMRC**
14	Hotel and restaurant activities	Hotel and restaurant activities	13	**HEB**
15	Transport and communications	Transport and communications	14	**TRANS**
16	Financial activities	Financial activities	15	**FINANC**
17	Public administration activities	Public administration services; Education; and Health and social work services	16	**ADPUB**
18	Education			
19	Health and social work activities			
20	Other services	Other services	17	**OTHSERV**
Total sectors	**19**	**17**		

Table 12: Product accounts

No	Industries in old SAM	Industries in study SAM	No	Abbreviation in the study SAM
Products in the economy			
1	Food products	Food products	1	**PAGVIV**
2	Export-oriented or industrial agriculture	Export-oriented or industrial agriculture	2	**PAGXP**
3	Products from livestock and hunting	Products from livestock and hunting	3	**PELVG**
4	Products from forestry and related services	Products from forestry and related services; and fishing	4	**PSYL**
5	Products from fishing			
6	Products from extraction	Products from other extractive activities	5	**PEXTRCTOTH**
		Products from gold mining activities	6	**PEXTRCTOR**
7	Products from agroindustry	Products from agroindustry	7	**PINDAL**
8	Textiles and clothing articles	Textiles and clothing articles	8	**PTEXT**
9	Products from other industrial activities	Products from other industrial activities	9	**PINDOTH**
10	Electricity, gas and water	Electricity, gas and water	10	**SELCT**
11	Construction	Construction	11	**SCONST**
12	Commerce	Commerce	12	**SCOMRC**
13	Hotel and restaurant services	Hotel and restaurant services	13	**SHEB**
14	Transport and communications services	Transport and communications services	14	**STRANS**
15	Financial services	Financial services	15	**SFINANC**
16	Public administration services	Public administration services; Education; and Health and social work services	16	**SADPUB**
17	Education			
18	Health and social work services			
19	Other services	Other services	17	**SOTHSERV**
Total Products	**19**	**17**		

C1.1.b. Production factor accounts

In terms of production factors, private and public capital is aggregated into capital. Capital was then disaggregated into gold mining capital (CAPOR) and non-gold mining capital (CAPOTH), by simply separating capital in extractive industries from the rest of the economy. Qualified and semi-qualified labour was aggregated into qualified labour to have two labour factors: qualified and unqualified labour.

Table 13: Production factor accounts

Production factors				
No	**Factors in old SAM**	**→**	**Sectors in study SAM**	**Abbreviation in study SAM**
1	Unqualified labour	Unqualified labour	Unqualified labour	**USK**
2	Semi-qualified labour	Qualified labour	Qualified labour	**SK**
3	Qualified labour			
4	Land capital	Land capital	Land capital	**LAND**
5	Private capital	Mining capital	Mining capital	**CAPOR**
		Private capital in non-mining sector	Other capital	**CAPOTH**
6	Public capital	Public capital		
total	**6**		**5**	

Sources: INSD, 2015; authors, 2016.

C1.1.c. Firm accounts

Initially in the SAM, there was only one Firm account, but in the new SAM, the Firm account was disaggregated into FIRMOR and FIRMOTH. The EBITDA of extractive industry was used as the income of the FIRMOR agent which is distributed among capital (90% of EBITDA) and dividends to the state (10% of EBITDA).

Table 14: Firm accounts

Accounts of firms in the economy		
No	**Industries in old SAM**	**Industries in study SAM**	**Abbreviation in study SAM**
1	Other entreprises (firms)	Entreprises (firms)	**FIRMOTH**
		Gold firms	**FIRMOR**
Total	**1**	**2**	

Sources: INSD, 2015; authors, 2016.

C1.1.d. Household account

Table 15: Household accounts

Household types in economy		
No	**Sectors in old SAM**	**Sectors in new SAM**	**Abbreviations in new SAM**
1	Public employees	Public employees	**MPUB**
2	Private employees	Private formal employees	**MPRIV**

3	Private informal employees		
4	Export-oriented or industrial agriculture	Export-oriented or industrial agriculture	**MAGXP**
5	Food product farmers	Food products farmers	**MAGVIV**
6	Livestock	Livestock	**MELVG**
7	Fishing	Fishing	**MSYL**
8	Self-employed and non-agricultural employers	Self-employed and non-agricultural employers	**INDPT**
9	Inactive	Inactive	**INACT**
Total	**9**	**8**	

Sources: INSD, 2015; authors, 2016.

C1.2. Description of economy using SAM

C1.2.1. Sector GDP shares

In 2012, the GDP of the economy (at market price) rose to 5,753,158 million FCFA according to data in the social accounting matrix of the study. The public administration sector is the largest contributor to GDP, at 16.36%, followed food products (13.18%), livestock (10.6%), extractive industry (10.21%) and commerce (9.55%).

Figure 1: Sector GDP shares
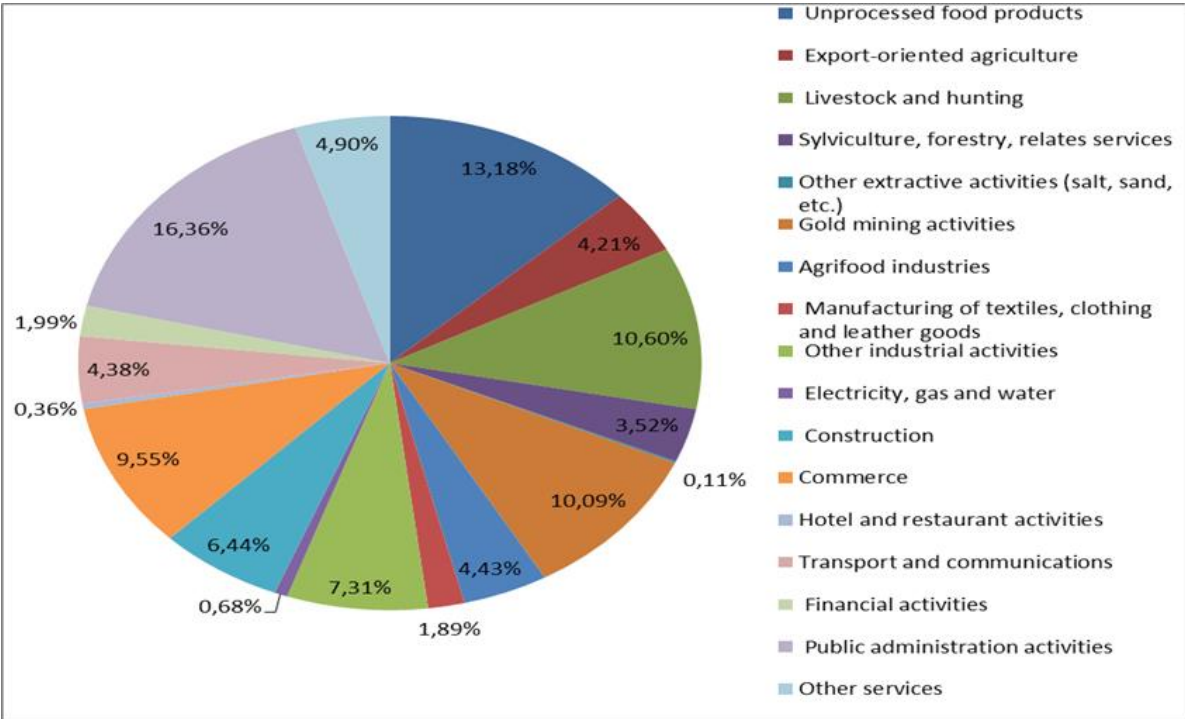
Source: Drawn from the SAM produced by the authors.

C1.2.2. Distribution of value added between production factors and sectors (%)

In Burkina Faso, market sectors with strong contributions to value added are food products (14.72%), livestock (11.85%), the gold mining sector (11.27%) and commerce (10.50%).

Table 13 shows that with the exception of the sectors of public administration, hotels and restaurants, and electricity, gas and water, most sectors do not pay much to labour, and more than 60% of value added is allocated to capital. This fact corroborates that in Burkina Faso, the public service plays a major role in the labour market (especially in terms of remuneration to labour). The gold mining sector only allocate 14% of its value added to labour, and the remainder goes to capital, which is not surprising considering that this modern sector only accounts for 0.2% of total employment in the economy.

Table 16: Distribution of value added between production factors (%)

	Unqualified labour	Qualified labour	Land	Other capital	Gold capital	Total	Value added by sector
Food products	9.17	0.96	73.70	16.18	0.00	100.00	**14.72**
Export-oriented agriculture	10.60	0.84	80.58	7.97	0.00	100.00	4.71
Livestock	0.01	0.00	4.80	95.19	0.00	100.00	**11.85**
Forestry and related services	0.53	0.02	0.00	99.45	0.00	100.00	3.94
Other extractive activities (salt, sand, etc.)	1.73	12.57	0.00	85.70	0.00	100.00	0.11
Gold extraction activities	1.70	12.40	0.00	0.00	85.90	100.00	**11.27**
Agroindustry	10.39	14.20	0.00	75.41	0.00	100.00	3.59
Textiles industry	1.46	14.03	0.00	84.52	0.00	100.00	1.96
Other industry	8.18	16.61	0.00	75.20	0.00	100.00	1.57
Electricity, gas and water	4.95	50.26	0.00	44.79	0.00	100.00	0.74
Construction	4.71	16.64	0.00	78.65	0.00	100.00	5.21
Commerce	1.29	5.07	0.00	93.64	0.00	100.00	**10.50**
Hotels and restaurants	23.99	58.58	0.00	17.43	0.00	100.00	0.31
Transport	3.09	22.07	0.00	74.84	0.00	100.00	4.43
Finance	3.68	38.28	0.00	58.04	0.00	100.00	1.64
Public administration	0.46	57.04	0.00	42.50	0.00	100.00	**18.03**
Other public services	6.10	22.26	0.00	71.65	0.00	100.00	**5.42**
Value added by factor	3.70	17.69	15.21	53.72	9.68	100.00	100.00

Source: SAM 2015; authors' calculations.

C1.2.2. Household

C1.2.2.1. Structure of household incomes

The main sources of household incomes are qualified labour income (21.55%), income to land (18.53%) and capital income (45.78%).

Table 17: Structure of household incomes

Household type	Income, unqualified labour	Income, qualified labour	Income, land	Income, other capital	Income, gold capital	Transfers received from other firms	Transfers received from government	Transfers received from rest of world	TOTAL
Public employees	0.02	44.8	0	47.01	0	1.65	5.92	0.6	100
Private employees	6.65	38.55	0	47.41	0	2.17	3.75	1.47	100
Export-oriented agriculture	2.54	1.93	81.33	8.04	0	0	0.84	5.31	100
Food products	2.05	1.55	68.34	15	0	0	7.08	5.97	100
Livestock	7.15	5.43	4.17	82.6	0	0	0.34	0.32	100
Fishing	5.3	19.54	0	75.1	0	0	0.06	0	100
Self-employed	9.74	15.81	0	65.96	1.25	3.16	2.05	2.03	100
Inactive	9.74	17.09	0	28.14	0	0	39.11	5.92	100
Total households	**4.51**	**21.55**	**18.53**	**45.78**	**0.14**	**1.12**	**5.91**	**2.45**	**100**

Source: 2015 SAM, authors' calculations.

C1.2.2.2. Structure of household spending

Looking at the structure of Burkinabe household spending shows that they have a low propensity to save (18% of income), consume nearly 79.5% of their income and generally avoid taxation. Only 1.8% of total household income is paid as direct taxes. Households paying direct taxes are most often those registered with social security. They are employees in the public service and in the private formal sector who respectively pay 4.39% and 4.51% of their income in direct taxes – these numbers being very low indicates the complexity and precariousness of the labour market as well as weak job security in Burkina Faso. In terms of consumption of household consumption of domestically products, we see high consumption of agro industry products (24.51% of household consumption) due to increasing urbanization and of food products (15.41%). As for final demand for gold products by Burkinabe households, it is very marginal, at only 0.02% of their budget.

Table 18: Structure of household spending

Type of expenditure	Public employee	Private employee	Export-oriented agriculture	Food products	Livestock	Fishing	Independent	Inactive	Share of consumption of production in total expenditures
Food products	2.50	6.36	22.97	36.72	15.85	18.83	13.03	21.19	**15.41**
Agricultural products for industry or export	0.16	0.64	1.51	0.68	1.04	1.23	0.45	1.39	0.67

|									
Products from livestock and hunting	3.06	8.91	8.61	7.86	10.06	10.55	12.28	17.35	8.30
Products from forestry and related services	2.03	1.06	2.05	1.33	1.32	1.46	1.04	2.40	1.52
Products from other extractive industries (salt, sand)	0.0002	0.0003	0.0004	0.000	0.000	0.000	0.0004	0.000	0.0002
Products from gold mining (OR)	0.02	0.03	0.05	0.00	0.00	0.00	0.05	0.00	**0.02**
Products from agroindustry	11.59	24.88	32.09	33.92	19.38	18.67	32.43	39.51	**24.51**
Textiles and clothing articles	0.09	1.78	0.66	0.09	1.14	0.47	2.36	2.60	0.98
Products from other industrial activities	9.18	19.71	19.05	7.57	11.17	9.15	21.97	31.19	**14.19**
Electricity, gas and water	0.80	1.51	1.56	1.96	0.23	1.39	0.13	1.39	1.05
Construction	0.06	0.01	0.15	0.18	0.08	0.06	0.02	0.13	0.09
Hotel and restaurant services	1.66	4.92	2.63	1.28	0.90	0.57	5.20	6.29	2.72
Transport and communications services	2.53	4.95	1.69	1.20	1.09	1.41	3.66	4.75	2.64
Financial services	1.18	5.05	0.25	0.00	0.00	0.00	2.52	0.00	1.45
Public services and education	0.94	2.71	1.40	1.03	0.90	0.62	2.35	2.50	1.52
Other services	1.39	11.84	3.19	0.32	3.24	1.48	11.62	0.46	4.47
Consumption share of income	37.19	94.36	97.85	94.15	66.39	65.88	109.11	131.14	**79.52**
Direct taxes	4.39	4.51	0.00	0.00	0.00	0.00	0.00	0.00	**1.84**
Savings	**58.42**	1.13	2.15	5.85	**33.61**	**34.12**	-9.11	-31.14	**18.64**
Total spending	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: SAM 2015, authors' calculations

C1.2.3. Government

C1.2.3.1. Structure of government revenues

The government mainly derives its income from indirect taxes or taxes on products (34%), transfers received from other agents in the economy (27%) and income from capital (20%).

Figure 2: Main sources of government revenues
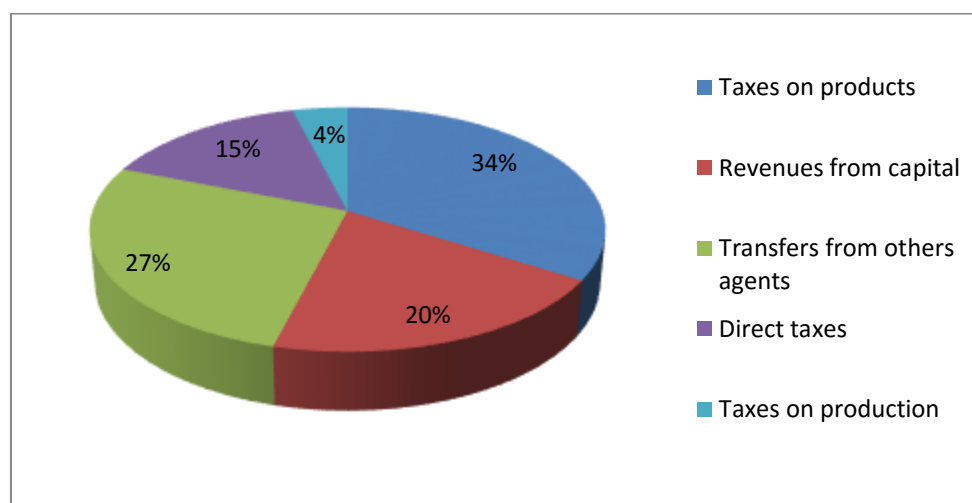
Source: 2015 SAM, authors' calculations.

Domestic public revenues (total revenues excluding transfers from the rest of the world) are mostly drawn from other sectors of the economy (62.38%), while 11.06% of government revenues are from the gold mining sector. However, the gold sector accounts for 62.19% of production taxes, 96% of export taxes and 33.28% of direct taxes (direct taxes on gold firms and direct taxes on households working in mines), which is non-negligible in terms of the contribution of industry. In Burkina Faso, externally-dependent public revenues (transfers received from abroad and taxes on international trade) which account for nearly 40% of revenues (2014 SAM, which makes the country more vulnerable to international trade liberalization and the external environment.

Table 19: Structure of government revenues (%)

	Mining sector		Other sectors of the economy		Rest of world	Total	Share of each as a part of total revenues
	Sector	House-holds	Sector	House-holds			
Taxes on production	62.19	0.00	37.81	0.00	0.00	100.00	3.53
Taxes on exports	96.09	0.00	3.91	0.00	0.00	100.00	0.92
Direct taxes	26.92	6.37	43.32	23.40	0.00	100.00	15.16
Indirect taxes	1.46	0.00	98.54	0.00	0.00	100.00	22.41
Taxes on imports	20.71	0.00	79.29	0.00	0.00	100.00	11.65
Transfers received	0.00	0.00	0.00	0.00	100.00	100.00	26.56
Income from capital	1.01	0.00	98.99	0.00	0.00	100.00	19.77
Subtotal	**10.10**	**0.97**	**58.83**	**3.55**	**26.56**	**100.00**	**100.00**
Contribution by sector and agent	**11.06**		**62.38**		**26.56**	**100.00**	**100.00**

Source: 2015 SAM, authors' calculations.

C1.2.3.2: Structure of government spending

Table 17 shows that the government spends most of its revenues (69.75%) on public services (education, health, other), while 15% of revenues are allocated to transfers and the remainder is saved or invested. The grey cells show that Burkina Faso is financially dependent on public development support to ensure growth and the basic needs of the economy.

Table 20: Structure of government spending

	Government spending
Government consumption	69.75
Transfers to households	14.51
Savings	15.74
TOTAL	100.00
Financing of spending through mining revenues	8.9
Financing of spending from public domestic revenues	73
Financing obtained from revenues from rest of world (trade taxes and transfers)	27

Source: 2015 SAM, authors' calculations.

C1.2.4. Rest of world

The table below summarizes some production relations that Burkina Faso has with the rest of the world. The first column of the table shows exports as share of total production (EX/XS) – 19.14% of goods and services produced by the economy are exported. We see that nearly all gold production is exported (94.81%). Nearly half of textiles production (57.35%) and financial services (41.34%) are exported. This situation shows the vulnerability of these three sectors to an external shock, in particular the mining sector. The following column of the table (EX/EXT) presents each sector's share of total exports. Gold is the largest export, accounting for 60.85% of all exports and 71.44% of goods exported (excluding services). The fourth column (im/Q) indicates the import penetration rate in the economy, which is 22.10%, which means that the country is 78% self-sufficient. The fifth column (IM/MT) shows that imports are mostly concentrated in industrial products (pharmaceuticals, chemicals, etc.) (84.42% of which imports), followed by financial services (45.57%), textiles (31.29%), other extracted products (29.31%) and industrial food products (21.04%). The "IM/MT" column represents imports by sector as a share of total imports, and shows that the three most imported industrial product categories are chemicals (69.72%), industrial food products (10.26%) and other public services (5.72%).

Table 21: Relations with rest of world (%)

	EX/XST	EX/EXT	EX/EXT by type (good or service)	IM/Q	IM/IMT	IM/IMT by type (good or service)
Food products	4.73	2.8	3.29	2.46	0.98	1.17
Export-oriented agriculture	18.64	3.82	4.48	1.62	0.19	0.23
Livestock	2.84	1.31	1.54	0.03	0.01	0.01
Forestry and related services	0.12	0.02	0.02	0.02	0.002	0.002
Other extractive activities (salt, sand, etc.)	12.93	0.07	0.08	40.65	0.2	0.24
Gold extraction activities (OR)	**94.81**	**60.85**	**71.44**	**0.00**	**0**	**0**
Agroindustry	1.52	0.87	1.02	21.04	10.26	12.35
Textiles industry	**57.35**	12.33	14.48	**31.29**	1.77	2.13
Other industries	15.24	3.11	3.65	**84.42**	**69.72**	83.86
All goods	**27.98**	**85.18**	**100**	**36.14**	**83.13**	**100**
Electricity, water and gas	0	0	0	16.03	1.26	7.47
Construction	4.91	2.16	14.6	5.18	1.66	9.83
Transport	14.87	4.83	32.57	16.80	3.82	22.67
Finance	**41.34**	3.96	26.73	**45.57**	3.23	19.15
Public administration	0.55	0.45	3.06	2.04	1.18	6.99
Other public services	8.75	3.41	23.03	18.54	5.72	33.89
Total services	**6.8**	**14.82**	**100**	**10.65**	**16.87**	**100**
Total	**19.14**	**100**		**22.1**	**100**	

Source: 2015 SAM; authors' calculations.

C1.2.5. Structure of demand

Table 19 presents the types of demands for products and services in the economy in terms of final and public consumption, intermediate consumption, investment and variations in stocks. As we can see in this table, there is high domestic demand for "other industrial products" (25.54% of total production), agro industry (13.14%) and other public services (12.90%) – however, there is low demand for products from extraction, which indicates a marginal integration of this sector into the economy of Burkina Faso. When looking by source of demand, we see that the largest sources of demand are from intermediate consumption for industry (34.62%) and households (34.17%), while investment demand and variation in stocks in the economy respectively only account for 17.18% and 1.83% of total demand. The variation in stock is mostly due to the inability of the economy to absorb textiles production (33.57% went to stocks), which had low value added (the contribution of this sector to value added in the economy is 2%).

Table 22: Structure of internal demand (%)

	Private consumption	Public consumption	Intermediate consumption	Investment	Variation of stock	Demand by product	TOTAL
Food products	72.04	0.00	23.47	0.00	4.49	8.94	100.00
Agricultural products for export	11.11	0.00	85.10	0.00	3.79	2.54	100.00
Products from livestock and hunting	46.26	0.00	34.37	14.00	5.37	7.43	100.00
Products from forestry and related services	26.45	0.00	73.55	0.00	0.00	2.51	100.00
Products from other extractive activities							
Products from gold extraction	2.66	0.00	97.34	0.00	0.00	0.30	100.00
Products from agroindustry	80.67	0.00	18.17	0.00	1.17	13.14	100.00
Textiles and clothing	23.36	0.00	43.07	0.00	33.57	1.22	100.00
Other industrial products	24.17	0.00	45.83	29.42	0.58	25.54	100.00
Electricity, gas and water	24.55	0.00	75.45	0.00	0.00	1.88	100.00
Construction	0.46	0.00	2.43	97.11	0.00	8.10	100.00
Hotel and restaurant services	75.86	0.00	24.14	0.00	0.00	1.57	100.00
Transport and communications services	22.10	0.00	77.90	0.00	0.00	5.23	100.00
Financial services	33.96	0.00	66.04	0.00	0.00	1.86	100.00
Public services and education	5.16	94.26	0.58	0.00	0.00	12.90	100.00
Other services	28.59	4.05	53.12	14.24	0.00	6.84	100.00
Total	**34.17**	**12.21**	**34.62**	**17.18**	**1.83**	**100.00**	**100.00**

Source: 2015 SAM, authors' calculations.

C.2. Other sources data

C.2.1. Level of unemployment in Burkina Faso

The level of unemployment used in the modelling is from an INSD (2015) report on employment and unemployment. Based on the definition of qualified labour (INSD 2015) (methodological document), a simple arithmetic average was taken to find the level of unemployment among qualified and unqualified workers. Unemployment among qualified workers was 17% and that among unqualified workers was 13.2%. The INSD (2015) defines qualified labour as workers with a level of education which exceeds the Primary Graduation Certificate (BEPC).

Table 23: Unemployment level in Burkina Faso

Level of education	Unemployment rate (%)
None	14.7
Preschool	13.4
Primary (grades 1-6)	11.5
Junior high school (grades 7-10)	13.2
Average unemployment rate among unqualified workers	13.2
Senior high school (grades 11-13)	11
Vocational	23
Post-secondary	15.9
Average unemployment rate nationally	17
Unemployment rate among qualified workers	14.5

Source: INSD, 2015; authors' calculations, 2016.

C.2.2. Statistics on mining taxes

The statistical data on taxation on mining was extracted from reports from "Initiative for Transparency in Extractive Industries – ITIE Burkina Faso" (*Initiative pour la Transparence dans les Industries Extractives ITIE Burkina Faso* – Stephens 2014) and the report "Analysis of Sharing of Profits of Gold Mining Activities in Burkina Faso" (*Analyse du partage des bénéfices des activités aurifères au Burkina Faso* – KPMG 2013).

Table 24: Statistics linked to public revenues from mining

ELEMENTS OF REVENUES	Amount in FCFA	Share of total revenues	Amount after revision of code	
Fiscal revenues (FR)			**Projected change**	
Of which:				
FR1: Direct tax				
Direct taxes paid by households	**16 448**	**8.73%**		
Income tax on wages (IUTS)	16 448	8.73%		
Direct taxes paid by firms, of which:	**69 528**	36.90%		
Taxes on profits	55 828	29.63%	**10%**	5 582. 8
Tax on income from securities (IRVM)	4 060	2.15%	**6.50%**	263. 9
Internal withholding tax (RET / INT)	7 008	3.72%		
External withholding tax (RET/EXT)	2 632	1.40%		
FR1: Total direct taxes	**85 976**	45.63%		
FR2: International trade tax	**56 098**	29.77%		
Customs tariffs and related taxes	41 098	21.81%		
Export taxes	15 000	7.96%		
FR3: Indirect tax	**5 584**	2.96%		

Taxes on value added	5 584	2.96%		
Total (fiscal revenues)	**147 658**	78.36%		
Non-fiscal revenues (NFR)		0.00%		
Of which:		0.00%		
NFR1: Tax on production (PT)		0.00%		
PT1: Other taxes on production net of subsidies	**31 910**	16.93%		
Proportional royalties	**31 910**	**16.93%**	1%	319.1
PT2: Tax on capital	**5 216**	**2.77%**		
Land surface tax	4 000	2.12%		
Tax on property	1 216	0.65%		
PT3: Tax on labour/workers	**228**	0.12%		
Employers' apprenticeship tax (TPA)	228	0.12%		
Total NFR1= PT1+PT2+PT3	**37 354**	19.82%		
NTR2: Dividends	**3 418**	1.81%		
Total (non-fiscal revenues): NFR1+NFR2	**40 772**	**21.64%**		
TOTAL REVENUES (FR+NFR)	**188 430**	**100.00%**	**3.31%**	**6 165.8**

Source: 2015 SAM; authors.

The table above present the details of public revenues drawn from gold mining activities. Of a total of 189 billion FCFA collected by the state, 78.36% were fiscal revenues and 16.39% were from production taxes. The revision of the mining code should enable a 3.31% increase in total public revenues, c*eteris paribus*. This amounts to an 8.41% increase in direct taxes (taxes on incomes) of firms and a 1% increase in taxes in production. The tax on exports is 500,000 FCFA/kg.

The complexity of mining taxation and modelling it, the paucity of data leads us to calculate it arithmetically as the share of public revenues from the gold mining sector from different specific taxes in the sector already available in the PEP 1-1 model. This difficulty was particularly in terms of direct taxes paid by households working in mines (IUTS), customs tariffs on products imported by mining firms as a part of their production activities, and the VAT on other industrial products purchased by the mining sector. These taxes are an aggregate in the PEP-1-1 model, which does not specify those coming from the gold sector. To account for these three (03) taxes which are not applied directly on the mining sector, a quote is taken for each type of tax with respect to initial situation in the SAM. Also, direct taxes paid for by workers in the gold mining sector are 51% of direct taxes paid by private employees. The gold sector's share of customs tariffs collected is 24.15%, and other industrial products account for 3.42% of VAT collected. The related rates were applied on total VAT receipts, customs tariffs and the IUTS each time there is a shock on the economy. The table below shows how different taxes applied in the mining sector are accounted for in the SAM. It does not appear as though fiscal space can be created through the mining sector.

C2.2.b Statistics on mining taxes

Table 25: Accounting for different mining taxes in the SAM

Elements of public revenues from mining	Accounting for different mining taxes in the SAM
Income tax on wages (IUTS)	Direct taxes paid by households $TDH_h = PIXCON^\eta ttdh0_h + ttdh1_h YH_H$
Tax on profits	**Direct taxes paid by firms** $\boldsymbol{TDH_f = PIXCON^\eta ttdf0_f + ttdf1_f YFK_f}$
Tax on income from securities (IRVM)	
Internal withholding tax (RET / INT)	
External withholding tax (RET/EXT)	
Customs tariffs and related taxes	Import taxes (on petroleum products and other imported products) $TIM_i = ttim_i PWM_i e IM_i$
Export taxes	Export taxes $TIX_i = ttix_i(PE_i + \sum_{ij} PC_{ij} tmrg^X_{ij,i})EXD_i$
Value added tax (VAT)	Indirect taxes on products (gold sold domestically) $TIC_i =$ $ttic_i \left[\begin{array}{l} (PL_i + \sum_{ij} PC_{ij} tmrg_{ij,i})DD_i + \\ ((1 + ttim_i)PWM_i e + \sum_{ij} PC_{ij} tmrg_{ij,i})IM_i \end{array} \right]$
Proportional royalty	**Other taxes on production net of subsidies** $\boldsymbol{TIP_j = ttip_j PP_j XST_j}$
Land surface tax	Taxes on capital $TIK_{K,j} = ttik_{k,j} R_{k,j} KD_{k,j}$
Taxes on property	
Employers' apprenticeship tax (TPA)	Taxes on labour/workers $TIW_{l,j} = ttiw_{l,j} W_{l,j} LD_{l,j}$
Dividends	Remuneration to mining capital paid to government $YGK = \sum_k \lambda^{RK}_{gvt,k}(\sum_j R_{k,j} KD_{k,j})$

Sources: authors, 2016.

C2.2.c. Equivalence of levels of taxes revised in the database (2012 SAM)

Table 26: Application of mining tax reform in the model

Fiscal measures	Modification of code	Equivalent in the SAM
IBIC	+10%	Increase equivalent to 9% of the direct tax on mining firms
IRVM	+6.25%	
Tax for local development (ad valorem)	+1%	Increase equivalent to 1% of the value of production

Source: authors, 2016.

C.3. Simulation results

C3.1. Impacts on macroeconomic variables

Table 27: Impacts on macroeconomic variables (%)

VARIABLES	Price change	Taxes on income and production			Tax reform	
	S00	S01	S02	S02-S01	S03	S01-S03
Real GDP	**-0.74**	**0.01**	**0.03**	**0.02**	**-0.72**	**0.02**
Gold production	**-3.39**	**-0.1**	**-0.03**	**0.07**	**-3.42**	**-0.03**
Total investment	-5.44	-0.07	-0.34	-0.27	-5.67	-0.23
Returns to other capital	-5.41	0.04	0.08	0.04	-5.35	0.06
Returns to gold mining capital	-24.93	-0.68	-0.05	0.63	-25.01	-0.08
Returns to land capital	-1.8	0.01	0.06	0.04	-1.76	0.04
Exports	-0.27	-0.08	-0.08	0	-0.34	-0.07
Imports	-5.76	0	-0.02	-0.03	-5.78	-0.02
Unemployment of unqualified labour	**10.01**	**0.06**	**-0.04**	**-0.11**	**9.98**	**-0.03**
Unemployment of qualified labour	**17.77**	**-0.17**	**-0.72**	**-0.55**	**17.19**	**-0.58**
Income of other firms	-5.41	0.04	0.08	0.04	-5.35	0.06
Income of gold firms	-24.93	-0.68	-0.05	0.63	-25.01	-0.08
Government revenues	**-5.77**	**0.16**	**0.42**	**0.26**	**-5.47**	**0.3**
Mining tax revenues	**-15.96**	**1.17**	**3.48**	**2.31**	**-13.39**	**2.57**
Tax revenues, total	**-7.19**	**0.28**	**0.72**	**0.45**	**-6.67**	**0.52**
Public expenditures	-7.64	0.23	0.59	0.37	-7.22	0.42
Household income	-4.95	0.04	0.13	0.09	-4.86	0.09
Consumer price index	-3.03	0.02	0.06	0.03	-2.99	0.04
Real consumption	-2.37	0.02	0.09	0.06	-2.31	0.06

Sources: authors, 2016.

C3.2. Results of simulations in terms of employment (%)

Table 28: Simulation results – employment (%)

	Prix decline	Taxes on income and on production		Fiscal reform
	S00	S01	S02	S03
PRODUCTION				
Gold production	-3.39	-0.10	-0.03	-3.42
Cash crops (export-oriented) products	4.52	-0.03	-0.09	4.46
Construction	-2.91	-0.10	-0.46	-3.23
Services	-1.34	0.03	0.03	-1.31
Industry	1.49	-0.02	-0.04	1.46
LABOUR DEMAND				
Gold mining sector	**-19.90**	**-0.64**	**-0.19**	**-20.06**

Cash crops (export-oriented) sector (cotton, sesame)	4.89	0.00	-0.06	4.84
Construction sector	**-4.09**	**-0.10**	**-0.51**	**-4.44**
Services sector	-2.66	0.05	0.14	-2.55
Industrial sector	**1.26**	**0.00**	**-0.03**	**1.24**
Total demand for indirect employment	0.29	-0.05	-0.22	0.13
Total demand for direct employment (gold sector)	-19.90	-0.64	-0.19	-20.06
Total labour demand in rest of economy	16.63	0.67	0.31	16.89
Total labour demand of economy	**-3.27**	**0.03**	**0.12**	**-3.17**
Unemployment rate, unqualified workers	**10.01**	**0.06**	**-0.04**	**9.98**
Unemployment rate, qualified workers	**17.77**	**-0.17**	**-0.72**	**17.19**
Real wage, unqualified workers	-2.43	-0.02	0.01	-2.42
Real wage, qualified workers	-4.13	0.04	0.19	-4.01

Source: authors, 2016.

C.3.3. Impact on households

Table 29: Simulation results – household consumption and savings

Households	REAL CONSUMPTION				SAVINGS			
	S00	**S01**	**S02**	**S03**	**S00**	**S01**	**S02**	**S03**
Public employees	-8.37	0.09	0.35	-8.12	-3.13	0.02	0.06	-3.09
Private employees	-3.08	0.03	0.12	-3.00	-8.10	0.07	0.26	-7.93
Export-oriented agriculture	0.73	0.00	0.01	0.73	-2.93	0.02	0.06	-2.89
Food products	0.41	0.00	0.01	0.41	-2.76	0.02	0.06	-2.72
Livestock	-3.36	0.02	0.05	-3.33	-3.23	0.02	0.06	-3.18
Fishing	-4.16	0.03	0.11	-4.08	-3.27	0.02	0.06	-3.22
Independent	-2.29	0.02	0.05	-2.25	-2.21	0.02	0.04	-2.18
Inactive	-1.18	0.01	0.04	-1.15	-2.88	0.02	0.05	-2.84
Total	**-2.37**	**0.02**	**0.08**	**-2.31**	**-3.26**	**0.02**	**0.06**	**-3.22**

Source: authors, 2016.

C3.4. International trade

Table 30: Simulation results – fiscal revenues

Type of fiscal revenues	S00	S01		S02		S03	
	Result	**Result**	**Difference**	**Result**	**Difference**	**Result**	**Difference**
Taxes on products (VAT)	-3.80	-3.83	-0.03	-3.90	-0,07	-3,89	0,01
Taxes on imports	-4.10	-4.13	-0.02	-4.19	-0,06	-4,18	0,01
Taxes on exports	**-18.56**	-18.64	-0.08	-18.58	0,06	-18,59	-0,01
Total taxes on products	-7.54	-7.57	-0.04	-7.61	-0,03	-7,60	0,00
Taxes on capital	**-24.93**	-25.49	-0.56	-24.95	0,53	-25,01	-0,05

Personal income taxes on wages	**-23.08**	-23.60	-0.51	-23.10	0,50	-23,15	-0,05
Taxes on production	-16.79	-8.87	**7.92**	-16.80	**-7,93**	-16,00	0,80
Total taxes on production	-17.96	-11.28	6.68	-17.98	-0,02	-17,30	0,66
Income from capital (dividends)	-5.61	-5.58	**0.03**	-5.55	0,06	-5,55	0,06
Direct taxes on households	-7.70	-7.66	**0.04**	-7.57	0,13	-7,58	0,12
Direct taxes on firms	**-24.93**	-25.49	-0.56	-17.45	7,48	-18,26	6,67
Total public revenues from mining	-15.96	-14.86	1.10	-13.23	2,73	-13,39	2,57
Total government revenues	-5.77	-5.64	0.13	-5.45	0,32	-5,47	0,30
Mining revenues as a share of total public revenues	9.91	10.03		10.20		10.18	
Mining accounted for an 11.11% share of public revenues before the simulations. The definition of different taxes is given in Appendix C2.2							

Source: authors' simulations.