Impact of Capital-Intensive Informal Sector Policy in Burkina Faso: A Computable General Equilibrium Analysis

Jean Abel Traoré[1], PhD & Idrissa Mohamed Ouedraogo[2], PhD

Abstract:

Since the 1990s, intensive economic reforms have been implemented in Burkina Faso to increase capital intensity in the informal sector. This paper uses a computable general equilibrium (CGE) model to explore the impact of these reforms on production, employment, and income through the inter-linkages lens between the informal, the formal and the agricultural sectors. We find that a gradual increase in the capital stock in the informal sector mainly leads to paradoxical negative spillovers on sector a productions, on employment particularly in the formal sector, while incomes improve slightly only for the farmers and the own account workers.

JEL Classification: E26, E16, H81, O17

Keywords: Economic reforms, Informal sector, Capital intensity, CGE model

1. Introduction

The risks and opportunities embedded in the informal sector[3]remain a challenge for policy makers in Africa. Indeed, the informal sector represents a potential source of incomes but also the place of choice for precarious jobs that could impede poverty and social inequalities alleviation (ILO, 2016).Furthermore, there are strong empirical evidence that the informal sector undermines economic growth through its relatively low productivity ,low contribution to tax revenues and unfair competition with the formal sector (Benjamin, Mbaye & Diop, 2012; Cassim et al., 2016; Gelb et al., 2009; La Porta & Shleifer, 2008; Levy, 2007; Loayza, 1997; Mbaye et al., 2017; Perry et al., 2007). However, the informal sector is also recognized as an alternative and a buffer to unemployment as well as a promising opportunity for African Governments to broaden the tax base needed to mobilize more domestic resources for development outcomes (Benjamin, Mbaye & Diop, 2012; Cassim et al., 2016; NEPAD & ECA, 2014). Besides, as a draw for transformational outmigration from agriculture as well as a large component of trade, services and manufacturing, the informal sector could be a threat or a driver of structural transformation in Africa (Benjamin & Mbaye, 2020; ECA& AUC, 2014).

In light of these challenges, a large body of recent literature gives credit to the structuralist approach championed by Weeks (1975) who early advocated targeted policies to improve the informal workers' skills and their access to capital with a view to harness the potential of the informal sector (Benjamin et al., 2016; ECA& AUC, 2015). In line with this policy recommendation, Burkina Faso[4]has been implementing, since the 1990s, intensiveeconomic reforms to enhance productivity in the informal sector with a view to improving incomes and job creation.

---

[1] Assistant Professor , Department of Economics, Université Norbert Zongo, Koudougou, Burkina Faso traorejeanabel@gmail.com

[2] Professor, FORGE Afrique, Ouagadougou, Burkina Faso idriss_mo@yahoo.fr

[3] In 1993, the International Labour Organization defined the informal sector as a group of production units comprised of unincorporated enterprises owned by households, including informal own-account enterprises and enterprises of informal employers (typically small and non-registered enterprises). The informal economy encompasses the informal sector and the informal employment

[4] According to the National Office of Statistics and Demography, in 2015, the informal sector (including agriculture)accounted for41.9% of GDP and employed around 90.5% of workforce in Burkina Faso.

One of the main programs deals with public funds providing credit at preferential rates to increase the capital stock in the informal enterprises facing strong credit constraints. Indeed, around 96.3% of the capital stock in the informal sector is financed mainly from own savings, donation or inheritance (INSD, 2003; INSD & AFRISTAT, 2019).However, both theoretical and empirical studies provided evidence that a capital subsidy policy to the informal sector could lead to perverse spillovers on the informal and formal sectors outcomes as well as on economic growth (Alia, Ndjana, & Nghogue, 2009; Arvin-Rad, Basu & Willumsen, 2010; Banerji & Jain, 2007; Chaudhuri, 2000; Chaudhuri & Mukhopadhyay, 2010; Datta-Chaudhuri, 1989; Gupta, 1993; Kelley, 1994; Montaud, 2000; Roy, 2006; Traoré & Ouedraogo, 2021). These negative effects are mainly related to the informal-formal linkages, the informal-formal competition on the products market as well as the elasticity of substitution between capital and labour in the informal sector.

It is therefore relevant to question the effectiveness of a capital-intensive informal sector policy in Burkina Faso where strong informal-formal linkages prevail (Böhme & Thiele, 2014;Grimm & Günther, 2005; INSD, 2003; INSD & AFRISTAT, 2019).Doessuch policy actually induce positive or negative spillovers on sectoral production, sectoral employment, households' incomes as well as GDP? The relevance of that question is reinforced by recent stylized facts. Indeed, despite almost two decades of policies supporting the informal sector, the latest survey on household living conditions[5] in Burkina Faso, reveals that around 89.5% of the poor people live-in households headed by own account workers (INSD, 2022). In addition, the average monthly remuneration in the informal sector was about 46,000 FCFA which is very lower than that in the formal sector which stood at 153,500 FCFA(INSD, 2015). So there is a need to explore the effects of a capital-intensive informal sector policy on the informal workers' incomes. Yet, in Burkina Faso, while the pervasive informal sector has been the subject of various studies, research to address the effects of a capital-intensive policy for the informal sector is scarce. A few as BIT (2012) analyzed through a microeconomic approach, the effects of micro-lending programs serving the informal sector and found positive, but limited, effects on earnings and employment within this sector. However, a microeconomic analysis is limited to capture the indirect effects that are more likely to be negative on other sectors and GDP.

More recently, Traoré & Ouedraogo (2021) overcame this gap by using a Computable General Equilibrium (CGE) approach suitable to capture the multiple inter-sectoral effects due to a policy shock (Robinson, 1989).They simulate a 10% increase in the capital stock in the informal sector in Burkina Faso. They found that such policy reform leads to a paradoxical contraction of the informal sector and the formal sector while the agricultural sector expands. Also, employment decreases in the formal sector while it increases particularly in the informal sector. Furthermore, only the incomes of the farmers and the own account workers incomes improve. Finally, according to their findings, this policy reform generates negative spillovers on the real GDP of Burkina Faso. However, a 10% increase in the capital stock may not be high enough to trigger a virtuous effect on the informal sector outcomes.

That is the reason why this paper aims to deepen the analysis by experimenting a gradual increase in 10%, 25% and 50% in the capital stock of the informal sector. For that purpose, we used a CGE model (Decaluwé et al., 2013) where the formal sector, the (non-agricultural) informal sector and the agricultural sector combine unskilled and skilled labour as well as capital through a constant elasticity of substitution (CES) production technology. This allows us to consider different values of elasticity of substitution between capital and labour across sectors and perform a sensitivity analysis. The segmentation in labour market is also taken into account through the skill specificity across different categories of labour (Agenor & Aizenman, 1994). Besides, the households are assumed to have a Stone-Geary utility function that takes into account the income-inelasticity of demand for informal goods (Böhme & Thiele, 2012).

Differently from Traoré & Ouedraogo (2021), we perform a sensitivity analysis to check whether the effects of policy interventions in the informal sector depend on the elasticity of substitution between capital and labour being greater or less than 1 in that sector (Arvin-Rad, Basu & Willumsen, 2010). Our results, almost in line with Traoré & Ouedraogo (2021),point out negative spillovers on sectoral output and real GDP combined with a low increase in incomes for own account workers and farmers. The sensitivity analysis confirms that the capital-intensive informal sector policy is sensitive to the value of the elasticity of substitution between capital and labour in the informal sector.

---

[5]http://www.insd.bf/contenu/enquetes_recensements/EHCVM_2018/EHCVM_2018_Diagnostic%20de%20la%20Pauvrete.pdf

The remainder of the paper is structured as follows. Section 2 provides a relevant literature review. Section 3 depicts the main points of the CGE model whereas the following section presents the data and model calibration. Section 5 presents the policy simulations and the discussed results. Finally, the last section concludes with policy implications.

2. Literature Review

Given its predominance in the developing countries, the informal sector has gradually occupied a privileged place in development policies. Since 1975, authors like Weeks (1975) advocated capital and price subsidy policies to harness the potential of this sector. Therefore, inspired by the Harris-Todaro model (1970),several theoretical analyzes have explored, through a general equilibrium framework, the effects on production, employment and wages of different subsidy policies to the informal sector (Bhattacharya, 1998; Chaudhuri, 2000; Chaudhuri & Mukhopadhyay, 2010; Datta-Chaudhuri, 1989; Fields, 1975; Ghosh & Sarkar, 1989; Gupta, 1993).Most of these studies assumed that the informal sector produces only intermediate goods for the formal sector. In other words, the formal sector sub-contracts intermediate stages of production to the informal sector. Based on this assumption, Ghosh & Sarkar (1989) and Datta-Chaudhuri (1989) provided evidence that a credit subsidy policy to the informal sector leads to a contraction of the industrial formal sector while it expands the informal sector in terms of production and employment. However, in their approach all rural migrants failing to get jobs in the formal sector are automatically employed in the informal sector. Thus, there is no any open unemployment in the urban sector. Yet, theoretical and empirical evidence questions this argument (Fields, 1975).Gupta (1993) has taken into account an open urban unemployment and found that an increase in capital subsidy to informal sector improves wage rate in this sector but decreases employment in the formal and informal sectors. In addition, he has provided evidence a capital subsidy policy to the informal sector reduces the social welfare. Chaudhuri (2000) questions these findings by arguing that the important role of aggregate demand in determining the level of production and employment is missing in Gupta (1993) analysis. By including this aspect, Chaudhuri (2000) confirmed a capital subsidy policy to the informal sector increases wage rate and output price in this sector. However, production and employment improve in urban formal sector and rural sector making the net effect on unemployment uncertain.

Rather than exploring the impact of subsidy policies other studies have focused, in a broader way, on economic reforms affecting productivity in the informal sector. Indeed, according to Arvin-Rad, Basu & Willumsen (2010), a positive technological shock on the informal sector represents any policy such as vocational and entrepreneurship trainings, access to new capital or production technology which lead to improve workers' productivity in this sector. They captured this increase in productivity within a general equilibrium model by reducing the input–output coefficients in the informal sector. They found that a positive technological shock on the informal sector tends to improve wages while output price remains unchanged in this sector. Furthermore, assuming that the formal sector is relatively more capital intensive in the informal employment adjusted gross sense than the rural sector, an increase in productivity in the informal sector leads to a contraction of output in both informal and formal sectors while it increases in the rural sector. However, it occurs if and only if the elasticity of substitution between capital and labour in the informal sector is greater than unity. Likewise, employment declines in the informal and formal sectors while it increases in the rural sector. Besides, Arvin-Rad, Basu & Willumsen (2010) showed that a credit subsidy to the informal sector generates similar effects on sectoral production and employment. However, no condition needs to be imposed on the elasticity of substitution between capital and labour in the informal sector as long as it is greater than zero.

Empirical and theoretical evidence criticizes the conventional view of the informal sector as a primarily inputs producer for the formal sector (Banerji & Jain, 2007; Roy, 2006). Indeed, the informal sector also uses intermediate input from the formal sector to produce goods and services sold in the products market. By taking into account informal-formal competition on products market, Roy (2006) showed that a cost subsidy to the informal sector increases its market share at the expense of the formal sector. However, such a policy could lead to a decrease in incomes in the informal sector if the entire market demand is served or if the elasticity of changes in quantity with respect to change in cost is higher than the elasticity of changes in price with changes in cost. Following a similar analytical framework, Banerji & Jain (2007) developed a model where the informal sector is assumed to produce lower quality goods compared to the formal sector. The formal sector is assumed to have low cost of capital combined with high cost of labour due to minimum wage.

Conversely, the informal sector faces with high cost of capital due to credit constraints and low cost of labour due to wage flexibility. In other words, the formal sector has a comparative advantage in producing high quality capital intensive goods while the informal sector is doing better in producing low quality labour intensive goods. Then, Banerji & Jain (2007) showed that a credit subsidy to the informal sector improves its advantage in producing relatively low-quality goods. Therefore, the informal sector expands in terms of production and market share while the formal sector contracts.

The above theoretical analyzes, whether focused on the informal-formal production linkages or the informal-formal competition on products market have provided evidence of positive and negative spillovers due to policy interventions in the informal sector. However, it is hard to include both perspectives in a theoretical approach and derive effects of policy changes. This is where a CGE model informed by a Social Accounting Matrix is useful to capture the multiple supply and demand side effects due to a policy shock (Robinson, 1989). Indeed; Kelley (1994) used a CGE model to explore the impact of capital accumulation in the informal sector as reflected in higher labour productivity in Peru. By taking into account the imperfect substitution between informal and formal output, he found that such a policy decreases output in both sectors and reduces also real incomes for informal producers. However, Montaud (2000) found different results through a CGE model for Equator. In fact, an increase in capital stock in the informal sector improves output and incomes in this sector and tends to increase its demand for intermediate input. This stimulates production and employment in the formal sector and the overall economy in Equator.

Alia, Ndjana, & Nghogue (2009)also used a CGE model to shed light on the impact of increase in investment by informal households due to the Integrated Program of Support for Informal Sector Actors in Cameroon. They found that a 27.4% increase in investment by informal actors improves the informal sector performance in terms of production, employment and incomes. However, this expansion was associated with a low contraction of production and incomes in the formal sector as well as a reduction in tax revenues. However, one of the main limits of their CGE model is found in the Cobb-Douglas production specification which constrains the value of the elasticity of substitution between capital and labour to 1 in all sectors. However, there is strong empirical evidence that the elasticity of substitution between capital and labour differs across sectors and is hardly equal to 1 (Amaral & Quintin, 2006). Also, Arvin-Rad, Basu & Willumsen (2010) has underlined how sensitive the effects of policy interventions in the informal are sensitive to the value of elasticity of substitution between capital and labour in this sector.

More recently, Traoré & Ouedraogo (2021)overcame these limits by using a CGE model (Decaluwé et al., 2013) where the formal sector, the (non-agricultural) informal sector and the agricultural sector combine unskilled and skilled labour as well as capital through a constant elasticity of substitution (CES) production technology. This allows them to consider different values of elasticity of substitution between capital and labour across sectors and perform a sensitivity analysis. They simulate a 10% increase in the capital stock in the informal sector in Burkina Faso. They found that such policy reform leads to a paradoxical contraction of the informal sector and the formal sector while the agricultural sector expands. Also, employment decreases in the formal sector while it increases particularly in the informal sector. Furthermore, only the incomes of the farmers and the own account workers incomes improve. Finally, according to their findings, this policy reform generates negative spillovers on the real GDP of Burkina Faso. However, a 10% increase in the capital stock may not be high enough to trigger a virtuous effect on the informal sector outcomes. This is why this paper deepens the analysis by experimenting a gradual increase in 10%, 25% and 50% in the capital stock of the informal sector. We used a CGE model (Decaluwé et al., 2013) in line with (Traoré & Ouedraogo, 2021) in which the segmentation in labour market is also taken into account through the skill specificity across different categories of labour (Agenor & Aizenman, 1994). However, differently from Traoré & Ouedraogo (2021),in our model, the households are assumed to have a Stone-Geary utility function that takes into account the income-inelasticity of demand for informal goods (Böhme & Thiele, 2012).

3. CGE model

The analytical framework used is theCGE model PEP[6]-1-1 (Decaluwé et al., 2013) informed by a SAM (2008) developed by the International Food Policy Research Institute (IFPRI) for Burkina Faso. It is assumed that the local production technology is represented by a nested function with several levels.

---

[6]For more details about the model see Decaluwé et al. (2013) from the Partnership for Economic Policy (PEP)

At the top level, the sectors namely formal industry, formal services, informal industry, informal services and agriculture combines value added and total intermediate consumption in fixed shares following a Leontief input-output function. At the second level, the value added of each sector combines composite labour and capital according to a constant elasticity of substitution (CES) specification. At the lower level on the value added side, the different categories of labour are imperfect substitutes in aggregate labour according to a constant elasticity of substitution (CES) technology.

Composite labour includes six categories according to informality and quality: rural formal labour; urban formal skilled labour; urban formal unskilled labour; rural informal labour; urban informal skilled labour; and urban informal unskilled labour (Balma et al., 2010). We assume a perfect mobility of each category of labour between sectors. However, capital is assumed to be sector-specific (Marjit &Kar, 2011).In addition, products from the different sectors are tradable including the informal goods and services mostly concerned with informal cross-border trade (Benjamin, Mbaye,& Diop, 2012). Therefore, the sectors' products face competition in domestic and foreign markets that is captured by a constant elasticity of transformation (CET) aggregation function between domestic supply and export.

On the demand side, following the Armington hypothesis, the composite products demanded on the domestic market are a combination of local and imported products according to a constant elasticity of substitution (CES). The output demand for intermediate consumption for each good and services is a fixed proportion of total input consumption by economic sectors. The demand of each goods and service for investment purposes is a fixed value share of total investment. Inventory changes are assumed to be exogenous. Households derive their incomes from labour and capital remunerationas well as transfers received from other agents included the rest of the world. Total capital income is distributed between the agents, including the households, in fixed shares. The household consumption demand function follows a Linear Expenditure System (LES).Government's revenues include tax revenues on household incomes, tax revenues on economic activities, capital remuneration, and official development assistance.

With regard to the equilibrium, according to the neoclassic perfect competitive market, the equilibrium between the supply and the demand of each commodity on the domestic market must be verified. Also, total demand for each factor (labour and capital) must equal available supply which is exogenous. Likewise, total investment expenditure must equal total savings from agents. The model closure is based on the neoclassic rule which means total investment is endogenous and driven by total savings which is a function of the full-employment of resources income. The income distribution is then determined only from the supply side. Once the full-employment income is determined, consumption is derived before savings and investment. The exchange rate is defined as the numeraire, with Government's spending and the current account balance fixed.

4. SAM and model calibration

This section highlights the main characteristics of the SAM used to inform the CGE model as well as the model calibration.

4.1 SAM for Burkina Faso

The SAM[7]2008 developed by IFPRI for Burkina Faso represents economic interactions through six groups of accounts: (i) 28 production activity accounts; (ii) 28 accounts for products (each activity produces a single goods or service and each commodity is produced by a single activity); (iii) 7 factors of production (6 types of labour and a single class of capital); (iv) 6 categories of households according to activity; (v) 2 other institutional agents: Government and the rest of the world; (vi) 1 savings-investment account. Based on the objectives of our study, the 28 branches of production have been grouped into five sectors: Agriculture; Formal industry; Formal services; Informal industry and Informal services[8].

We used the SAM data to highlight the main characteristics of Burkina Faso economy related to GDP composition, factor intensity by sector, sectoral linkages and income distribution. Indeed, Table 1 depicts an economy driven by the formal services and agricultural sectors which represent 39.5% and 32.24% of GDP, respectively.

---

[7] The SAM is available upon request to the corresponding author
[8] We have taken agriculture out of the informal sector to focus on the informal non-agricultural sector which is the main target of public employment funds in Burkina Faso

The two informal sectors (industry and services) account for 19.05% of GDP. Likewise, the agricultural and formal services sectorsprovide37.48% and 33.30% of total labour income, respectively, while the informal sectors pay for 23.91%. Concerning capital income, the two formal sectors provide around 64.43% of total capital income followed by the agricultural sector (24.08%) while the informal sectors payonly 11.49%.

By paying particular attention to the labour income by work category, it appears that the formal labour income is largely paid by the formal sectors. For instance, about 95.67% of total urban formal skilled labour income and 89% of total rural formal labour income are provided by the both formal sectors. That could suggest the formal labour force is mostly confined in the formal sector. Conversely, the agricultural and informal sectors mainly absorb the informal labour. Indeed, these sectors account respectively for 54.62%and 43.92% of the total rural informal labour income. However, it is interesting to note that 67.82% of total urban informal skilled labour income is provided by the formal services sector.

Table 1: Sectoral repartition of GDP and factors remuneration (%)

	Agriculture	Formal industry	Formal services	Informal industry	Informal services
GDP	32.24	9.21	39.5	11.49	7.56
Total capital income	24.08	15.28	49.15	7.49	4
Total labour income	37.48	5.31	33.3	14.05	9.86
Total rural formal labour income	3.38	15.47	73.53	6.77	0.85
Total urban formal unskilledlabour income	21.95	11.77	65.31	0.74	0.23
Total urban formal skilledlabour income	2.77	15.02	80.65	1.20	0.36
Total rural informallabour income	54.62	0.31	1.15	28.53	15.39
Total urban informal unskilledlabour income	51.60	3.31	25.76	0.03	19.29
Total urban informal skilled labour income	27.33	3.48	67.82	0.22	1.16

Source: Authors' calculations based on SAM 2008

With regard to the sectoral factor intensity, we compare the relative share of capital and labour in the total value added of each sector. It is appears clearly in Table 2 that production in the formal sector is more capital intensive compared to the agricultural sector and the informal sector. Conversely, production in the agricultural sector and the informal sector is more labour intensive compared to the formal sector. The agricultural sector is slightly more capital intensive compared to the informal sector.

Table 2: Relative share of capital and labour in sectoral value added

	Agriculture	Formal industry	Formal services	Informal industry	Informal services
Relative share of capital (θ_K)	0.86	0.96	0.93	0.83	0.79
Relative share of labour (θ_L)	0.14	0.04	0.07	0.17	0.21
Capital intensity (θ_K/θ_L)	6.00	26.87	13.78	4.98	3.78
Labour intensity (θ_L/θ_K)	0.17	0.04	0.07	0.20	0.26

Source: Authors' calculations based on SAM 2008

To shed light on the sectoral linkages, we based on Hirschman (1958) and Jones (1976) to calculate the total backward linkages (BL) and forward linkages (FL) for each sector. Table 3 below, shows that the agricultural sector, the formal industry and services sectors have backward and forward linkages greater than 1. Thereby, these sectors represent the key or leading sectors strongly connected to other

sectors with a greater impact on the overall economy when their final demands change. The informal industry and services sectors are rather backward-oriented (BL>FL)meaning that these sectors have a higher than average purchasing capacity for intermediate goods and services from others. Therefore, an increase in final demand of informal goods and services will generate a magnified increase in total output in the economy. Figure 1 (see Appendix) illustrates the dispersion of the sectors according to their backward and forward linkages values.

Table 3:Backward and Forward Linkages

	Agriculture	Formal industry	Formal services	Informal industry	Informal services
Backward Linkages (BL)	1.156	1.084	1.059	1.117	1.123
Forward Linkages (FL)	2.432	1.124	1.259	0.993	0.627
Weighted Backward Linkages	1.186	1.104	1.099	1.132	1.114
Weighted Forward Linkages	2.526	1.177	1.398	0.983	0.558

Source: Authors' calculations based on SAM 2008 with SimSIP SAM

With regard to households' income, labour remuneration represents the main source of income for all salaried households (Table4). It accounts more than 70% of their total income (transfers being excluded).Contrariwise, the own account workers mainly derive their income from the remuneration of capital which represents about 61.18% of their total income. By paying particular attention to total labour income, it can be noted that all wage earners largely derive their wages by providing formal skilled or unskilled labour. Indeed, about 75% of the public salaried households' labour incomes stems from the supply of the formal labour (rural, skilled and unskilled). Likewise, around 77% of the formal private salaried households' labour income comes from the formal labour. For the informal private salaried households, around 50% of their labour income is derived also from the formal labour. At the opposite, rural informal work accounts for 72.79% of the total labour income of farmers. For own account workers, urban informal unskilled labour constitutes 50.34% of their total labour income. These insights are useful for better understanding how changes in factors demand at the level of sectoral productions could affect households' income.

Table 4: Repartition of household's income by factor (%)

	Public salaried households	Formal private salaried households	Informal private salaried households	Farmers	Own account workers
Share of capital in total income	28.48	12.58	12.10	40.24	61.18
Share of labour in total income	71.52	87.42	87.90	59.76	38.82
Share of labour category in total labour income					
Rural formal labour	37.42	65.62	28.62	1.31	31.33
Urban formal unskilled labour	17.79	6.29	16.93	8.87	9.93
Urban formal skilled labour	20.63	6.52	6.32	0.52	0.71
Rural informal labour	0.05	0.18	0.78	72.79	0.47
Urban informal unskilled labour	0.63	0.69	9.75	13.20	50.34
Urban informal skilled labour	23.48	20.70	37.60	3.32	7.21

Source: Authors' calculations based on SAM 2008

4.2 Model calibration

The calibration is about the determination of numerical values of parameters and coefficients to reconstitute the SAM equilibrium situation. Some of the parameters such as elasticities of substitution are fixed according to the literature and others are calculated based on the values provided by the SAM. Based on recent literature of CGE model applied to Burkina Faso (Sawadogo et al., 2015), we assumed that the elasticity of substitution between capital and composite labour is greater than unity in the 2 formal sectors and lower in the informal sectors and the agricultural sector. Indeed, it is more difficult to these latter sectors to substitute capital for labour due to credit constraints when the relative price changes. However, to perform a sensitivity analysis, we run again the model with an elasticity of substitution between capital and composite labour greater than unity in the informal sectors. The elasticity of substitution between the different categories of labour is assumed to be lower than unity. The households' income elasticities for formal and informal goods and services are derived from Böhme and Thiele (2012). The values of some parameters are summarized in Table 5below.

Table 5: Initial values of the CGE model parameters

Elasticities

Elasticity of substitution between capital and composite labour in formal sectors	Elasticity of substitution between capital and composite labour in informal and agricultural sectors	Elasticity of substitution between types of labour in sector j	Elasticity of transformation between exports and local sales	Elasticity of substitution between local supply and imports	Household Income elasticity for formal goods	Household Income elasticity for formal services	Household Income elasticity for informal goods	Household Income elasticity for informal services	Household Income elasticity for agricultural goods
1.5	0.95	0.8	2	2	1.38	1.89	0.56	1.00	0.76

Prices

Price of the local commodity i	Price of exported commodity i	World price of imported product i	Wage rate of type l labor	Rental rate of capital in sector j	Price elasticity of indexed values	exchange rate (numeraire)	Consumer price index	Frisch parameter	
1	1	1	1	1	1	1	1	-1.5	

i, j: formal industry; formal services; informal industry; informal services; agriculture. l: rural formal; formal unskilled; formal skilled; rural informal; informal unskilled; formal skilled. Source: Compiled by the authors from relevant literature

5. Policy simulations and results

Since the 1990s, Burkina Faso has accelerated economic reforms to promote job creation by facilitating access to financing and vocational training for microenterprises. The main employment programs include the Informal Sector Support Fund, the Job Creation Support Fund, the Youth Initiatives Support Fund and the Vocational Training and Learning Support Fund. For instance, the main objective of the Informal Sector Support Fund is to improve access to capital for informal enterprises by providing microcredit at preferential interest rates lower than the requirements of microfinance institutions and commercial banks. This program was expected to grant 700 million FCFA credit per year to finance 1,500 microenterprises. However, in practice, the amount of credits granted was quite volatile depending on Government's budget. Moreover, due to the heterogeneity of informal activities, there is no doubt that the informal sector funding from different programs overlaps and makes it difficult to accurately estimate the total amount allocated to this sector. However, whatever the amount granted, all of these programs aim to improve capital intensity in the informal sector. That's the reason why, we have chosen a range of ad hoc simulations namely: a 10% (SIM 1), 25% (SIM 2) and 50% (SIM 3) increase in the capital stock in the informal sector. The results of these policy simulations are summarized below in terms of input and output effects, income effects and macroeconomic effects.

5.1 Input Effects

A 10% increase in the capital stock in the informal sectors (SIM 1) leads to a decrease in the rental rate by 6.454% and 6.311% in the informal industry and services, respectively (Table 6, below). This sharp fall tends to increase the capital-labour ratio at minimum cost and the wage rate of composite labour in these sectors. Indeed, the wage rate improves by 1.446% and 1.260% in the informal industry and services, respectively (Table 6). This improvement attracts labour force from other sectors and tends to increase the demand for composite labour by 1.845% and 2.170% in the informal industry and services,

respectively. Thereby, the demand for all categories of labour increases and also tends to reduce their respective wage rates with the exception for rural informal labour and urban informal unskilled labour which represent the largest share of labour force in the informal sectors. In fact, the wage rates of the rural informal labour and the urban informal unskilled labour increases by 1.616% and 0.522%, respectively (Table 7, below).

Within the formal sectors, rental rates tend to decrease marginally and make capital cheaper compared to labour. Therefore, capital is substituted for labour since the elasticity of substitution between capital and labour is greater than unity in these sectors. The composite labour demand decreases weakly by 0.01% and 0.327% in the formal industry and services, respectively (Table 6). Likewise, the average wage rate falls by 0.238%and 0.259% in the formal industry and services, respectively. The demand for all categories of labour declines, particularly in the formal services sector. However, it can be noted that the two formal sectors released mainly the rural informal and the urban informal unskilled labour. For instance, the demand for rural informal labour decreases by 1.560% and 1.8% in the formal industry and services, respectively. In the agricultural sector, the composite labour declines by0.962% while the average wage rate increases by 1.084% (Table 6). The rural informal and the urban informal unskilled labour force are declining to migrate towards the informal sectors.

SIM 2 and SIM 3 lead to effects similar to SIM1 but in a magnified manner (Tables 6 and 7).For instance, with SIM 2, the demand for composite labour increases by 4.356% and 5.134% in the informal industry and services sectors, respectively. Likewise, the average wage rate improves by 3.493% and 3.045% in the same sectors. With SIM 3, the positive spillovers on employment and wage rate in the informal sector are more important. In summary, a gradual increase in capital stock in the informal sector leads to a simultaneous increase in wage rate and employment in this sector. At the opposite, employment and wage rate decline particularly in the formal sector. Our results are in line with the findings of Traoré & Ouedraogo (2021),Alia, Ndjana, & Nghogue (2009), Arvin-Rad, Basu & Willumsen (2010), Chaudhuri (2000), Datta-Chaudhuri (1989), Ghosh & Sarkar (1989), who provided evidence that increasing capital in the informal sector tends to increase the wage rate and the employment (or probability of employment)in this sector. The decline in the formal sector employment also finds an echoinTraoré & Ouedraogo (2021),Alia, Ndjana, & Nghogue (2009), Arvin-Rad, Basu & Willumsen (2010) and Gupta (1993)while it questions the conclusions of Chaudhuri (2000)and Montaud (2000).

5.2 Output effects

Intuitively, the increase in capital and labour demand in the informal sector should enhance its output. However, the increase in capital stock also leads also to an increase in output price in the informal sector. For instance, with SIM 1, the output price raises by 2.475% and 2.862% in the informal industry and services, respectively (Table 8, below). Thereby, the domestic demand for informal goods and services tends to decline by 1.189% and 0.916%, respectively. Likewise, the supply of informal goods and services falls implying also a decrease in the value added and the total intermediate consumption in the informal sector. Knowing that the informal sectors are backward-oriented (Table 3 in Section 4), the reduction of their outputs implies also a decrease in their demands for the formal and agricultural goods as and services as intermediate inputs. This tends to pull down production of formal goods and services by 0.854% and 0.168%, respectively (Table 8).Likewise, agricultural production also declines by 0.556%. Table 8 shows that SIM 2 and SIM 3 generate effects similar to SIM1 but in a magnified way. For instance, with SIM 2, the informal industry and services sectors' output decline by 2.821% and 2.216% respectively, while output in the formal industry and services decreases by 2.106% and 0.415%.With SIM 3, the negative spillovers on the sectoral production are more important.

To summarize, a progressive increase in capital stock in the informal sector leads to a "paradoxical" contraction of output inthe informal, formal and agricultural sectors. Our results question the conclusions of Traoré & Ouedraogo (2021) who found a contraction of both informal and formal sectors along with an expansion of the agricultural sector. Likewise, our results are not in line with Alia, Ndjana, & Nghogue (2009), Chaudhuri (2000), Datta-Chaudhuri (1989), Ghosh &Sarkar (1989) who instead highlighted an expansion of the informal sector associated with a contraction of the formal sector. Also, ours findings are different from Chaudhuri (2000) and Montaud (2000) who provided evidence of positive spillovers on output in all sectors. However, our results find echo in Arvin-Rad, Basu & Willumsen (2010) and Kelley (1994).

Table 6: Percentage change in demand and price of input factors

	SIM 1					SIM 2					SIM 3				
	Agriculture	Formal industry	Formal services	Informal industry	Informal services	Agriculture	Formal industry	Formal services	Informal industry	Informal services	Agriculture	Formal industry	Formal services	Informal industry	Informal services
Capital	0	0	0	10	10	0	0	0	25	25	0	0	0	50	50
Composite labour	-0.962	-0.01	-0.327	1.845	2.17	-2.264	-0.170	-0.807	4.356	5.134	-4.142	-0.148	-1.579	8.00	9.462
Rural formal labour	0.105	-0.080	-0.325	3.237	3.415	0.289	-0.125	-0.802	7.814	8.241	0.638	-0.058	-1.565	14.844	15.648
Urban formal unskilled	0.272	0.086	-0.158	3.409	3.588	0.690	0.274	-0.405	8.244	8.674	1.391	0.690	-0.828	15.703	16.514
Urban formal skilled	0.326	0.139	-0.105	3.465	3.643	0.827	0.411	-0.269	8.392	8.822	1.673	0.970	-0.552	16.025	16.838
Rural informal	-1.376	-1.560	-1.800	1.708	1.884	-3.239	-3.638	-4.291	4.021	4.433	-5.923	-6.573	-7.982	7.357	8.109
Urban informal unskilled	-0.519	-0.704	-0.946	2.593	2.770	-1.223	-1.631	-2.297	6.188	6.609	-2.244	-2.920	-4.383	11.555	12.337
Urban informal skilled	0.253	0.067	-0.177	3.390	3.5684	0.648	0.232	-0.447	8.199	8.628	1.321	0.621	-0.896	15.624	16.434
Wage rate of composite labour	1.084	-0.238	-0.259	1.446	1.260	2.615	-0.583	-0.633	3.493	3.045	4.959	-1.124	-1.217	6.642	5.791
Rental rate of capital	0.061	-0.303	-0.476	-6.454	-6.311	0.171	-0.696	-1.168	-14.416	-14.118	0.388	-1.221	-2.259	-24.530	-24.069

Source: Authors' calculations from the simulations results

Table 7: Percentage change in wage rate of labour categories

Categories of labour	SIM 1	SIM 2	SIM 3
	Wage rate		
Rural formal labour	-0.261	-0.640	-1.235
Urban formal unskilled labour	-0.469	-1.134	-2.151
Urban formal skilled labour	-0.536	-1.302	-2.491
Rural informal labour	1.616	3.909	7.448
Urban informal unskilled labour	0.522	1.265	2.417
Urban informal skilled labour	-0.445	-1.082	-2.067

Source: Authors' calculations based on the simulations results

Table 8: Percentage change in sectoral output and output price

	SIM 1					SIM 2					SIM 3				
	Agriculture	Formal industry	Formal services	Informal industry	Informal services	Agriculture	Formal industry	Formal services	Informal industry	Informal services	Agriculture	Formal industry	Formal services	Informal industry	Informal services
Output	-0.556	-0.854	-0.168	-1.189	-0.916	-1.419	-2.106	-0.415	-2.821	-2.216	-2.876	-4.092	-0.812	-5.212	-4.202
Value added	-0.556	-0.854	-0.168	-1.189	-0.916	-1.419	-2.106	-0.415	-2.821	-2.216	-2.876	-4.092	-0.812	-5.212	-4.202
Total intermediate consumption	-0.556	-0.854	-0.168	-1.189	-0.916	-1.419	-2.106	-0.415	-2.821	-2.216	-2.876	-4.092	-0.812	-5.212	-4.202
Basic price of sectoral output	0.735	0.774	-0.035	2.475	2.862	1.878	1.938	-0.085	6.054	7.00	3.838	3.864	11.726	-0.155	13.552
Price of local product	0.729	0.658	-0.037	2.468	2.860	1.863	1.642	-0.089	6.037	7.00	3.807	3.261	-0.164	11.691	13.544

Source: Authors' calculations based on the simulations results

5.3 Income effects

In general, the total income of all the wage earners decreases while it increases marginally for the farmers and the own account workers. For instance, under SIM 1, the farmers and own account workers' total income rises by 0.715% and 0.101%, respectively (Table 9, below).This difference between households could be explained by changes in labour income which show the same trend. In fact, around 72.79% of farmers' labour income stems from their rural informal work (Table 4 in Section 4). Also, the urban informal unskilled labour accounts for 50.34% of own account workers' labour income. Therefore, the combined improvement of the wage rate and the demand for rural informal and urban informal unskilled labour tends to increase the farmers and the own account workers' labour incomes. Besides, the wage earners mainly derive their income by offering formal work.Thus, the simultaneous reduction of wages and labour demand in the formal sector affects more severely their labour income. Indeed, the labour income for the public salaried households and the formal private salaried households decreases by 0.392% and 0.321%, respectively (Table 9).

However, when the consumer price index is taken into account, the real total income decreases for all the types of households which suggests a loss in social welfare (Gupta, 1993). Following the general decline of households' incomes, the consumption for all the goods and services also decreases. Only the farmers slightly increase their demand for formal goods and services by 0.09% and 0.613%, respectively (Table 10, below).The overall decline in households' consumption also accentuates the contraction of sectoral productions. Similar effects are found with SIM 2 and SIM 3 in a magnified manner (Tables 9 and 10). For instance, the farmers' total income improves by 1.732% and 3.305% with SIM 2 and SIM 3, respectively. As a summary, a gradual increase in capital stock in the informal sector leads to an increase in the farmers and own account workers' income while it decreases for the formal and informal wage earners. These results are in line with Traoré & Ouedraogo (2021),Alia, Ndjana, & Nghogue (2009), Arvin-Rad, Basu & Willumsen (2010) and Montaud (2000).However, the real income falls down for all categories of households in accordancewith Kelley (1994).

5.4 Macroeconomic effects

With regard to the macroeconomic effects, we focus on the tax revenues, the consumer price index and the real GDP at market price. Due to the overall decline of sectoral output, households' income and domestic demand, the total tax revenues on products and imports decrease by 1.031%, 2.590% and 5.186% in SIM 1, SIM 2 and SIM 3, respectively (Table 11, below). However, it is worth to underline that this decline is mainly due to the contraction of the formal sector which provides about 95% of the total tax revenues on products and imports in Burkina Faso. Likewise, the wage earners provide 83.7% of the total households' incomes taxes whereas the farmers and the own account workers accounts for 11.67% and 1.1%, respectively. Therefore, the decrease in wage worker's income leads to a decline in the total households' incomes taxes by 0.113% and 0.275% in SIM 1 and SIM 2, respectively (Table 11). As a consequence, Government's total taxes revenues also fall down. Alia, Ndjana, & Nghogue (2009) found similar results for Cameroon. Besides, the consumer price index enhances by 0.822% and 2.047% in SIM 1 and SIM 2, respectively (Table 11). At the end, the real GDP at market prices drops by 0.662% (SIM 1) and 1.640% (SIM 2) following the contraction of the sectoral value added. The negative spilloversare more important with SIM 3.This last result finds echo in Traoré & Ouedraogo (2021), inKelley (1994) but questions findings in Montaud (2000).

5.5 Sensitivity analysis

A sensitivity analysis is performed to check the robustness of our results. As highlighted in the above literature review, the effects of policy interventions in the informal sector depend on whether the elasticity of substitution between capital and labour is greater or less than 1 in that sector(Arvin-Rad, Basu & Willumsen, 2010). Therefore, we reiterate all the policy simulations with an elasticity of substitution between capital and labour equal to 1.5 in the informal sector (industry and services) while its value remains unchanged in the others sectors. Selected results are summarized in Table 12 in Appendix. At the input level, the results confirmed our previous findings: a simultaneous increase in wage and employment in the informal sector while it decreases in the formal and agricultural sector. However, at the output level, the informal and formal sectors contract while the agricultural sector expands.

This is slightly different from our previous results butit tends to confirm Traoré & Ouedraogo (2021), and Arvin-Rad, Basu & Willumsen (2010) who highlighted a contraction of the informal and formal sectors combined with an expansion of the rural sector if and only if the elasticity of substitution between capital and labour in the informal sector is greater than unity.Concerningthe income distribution, the sensitivity analysis confirms that only the farmers and the own account workers gain from an increase in capital stock in the informal sector. Finally, at the macroeconomic level, the negative spillovers on the real GDP are also confirmed but in a moderated way.

Table 9: Percentage change in households' incomes

Households categories	SIM 1				SIM 2				SIM 3			
	Labour income	Capital income	Total income	Real total income	Labour income	Capital income	Total income	Real total income	Labour income	Capital income	Total income	Real total income
Public salaried households	-0.392	0.074	-0.230	-1.043	-0.954	0.178	-0.560	-2.554	-1.825	0.341	-1.069	-4.924
Formal private salaried households	-0.321	0.074	-0.228	-1.041	-0.784	0.178	-0.555	-2.550	-1.505	0.341	-1.063	-4.918
Informal private salaried households	-0.292	0.074	-0.227	-1.04	-0.710	0.178	-0.552	-2.547	-1.358	0.341	-1.054	-4.909
Farmers	1.183	0.074	0.715	-0.105	2.861	0.178	1.732	-0.309	5.452	0.341	3.305	-0.720
Own account workers	0.106	0.074	0.101	-0.715	0.255	0.178	0.245	-1.766	0.484	0.341	0.471	-3.443
Inactive	0.111	0.074	0.120	-0.67	0.266	0.178	0.291	-1.721	0.503	0.341	0.562	-3.356

Source: Authors' calculations based on the simulations results

Table 10: Percentage change in households' consumption of goods and services

Households categories	SIM 1					SIM 2					SIM 3				
	Agriculture	Formal industry	Formal services	Informal industry	Informal services	Agriculture	Formal industry	Formal services	Informal industry	Informal services	Agriculture	Formal industry	Formal services	Informal industry	Informal services
Public salaried households	-0.655	-0.921	-0.893	-0.978	-1.944	-1.619	-2.258	-2.198	-2.318	-4.575	-3.158	-4.367	-4.283	-4.266	-8.355
Formal private salaried households	-0.625	-0.878	-0.850	-0.936	-1.859	-1.545	-2.152	-2.091	-2.217	-4.374	-3.014	-4.163	-4.075	-4.078	-7.988
Informal private salaried households	-0.720	-1.024	-1.014	-1.054	-2.087	-1.778	-2.509	-2.496	-2.495	-4.912	-3.464	-4.853	-4.862	-4.590	-8.971
Farmers	-0.147	0.090	0.613	-0.770	-1.635	-0.426	0.153	1.423	-1.842	-3.880	-0.982	0.130	2.555	-3.438	-7.169
Own account workers	-0.502	-0.628	-0.472	-0.895	-1.804	-1.256	-1.555	-1.179	-2.122	-4.252	-2.485	-3.043	-2.342	-3.914	-7.781
Inactive	-0.512	-0.631	-0.458	-0.928	-1.873	-1.283	-1.567	-1.148	-2.202	-4.418	-2.544	-3.076	-2.295	-4.064	-8.089

Source: Authors' calculations based on the simulations results

Table 11: Percentage change in tax revenues, consumer price index and real GDP

	SIM 1	SIM 2	SIM 3
Total tax revenues on products and imports	-1.031	-2.590	-5.186
Total households' incomes taxes	-0.113	-0.275	-0.526
Total taxes revenues	-0.841	-2.112	-4.224
Consumer Price Index	0.822	2.047	4.054
Real GDP at market prices	-0.662	-1.640	-3.209

Source: Authors' calculations based on the simulations results

6. Conclusion and policy implications

The main objective of this paper was to shed light on the impact of a capital-intensive informal sector policy in Burkina Faso.For this purpose, we used a CGE model (PEP-1-1) to simulate a 10%, 25% and 50% increase in the capital stock in the informal sector and to analyze their effects on sectoral output, sectoral employment, households' incomes and real GDP. We find that a gradual increase in capital stock in the informal sector leads to an increase in wage rate and employment in this sector whileit decreases particularly in the formal sector.The output price enhances in the informal sector and tends to decrease its domestic demand and supply. Based on the strong backward linkages of the informal sector, the production also declines in the formal and the agricultural sectors. This tends to erode the total taxes revenues and the real GDP at market prices. With regard to the income distribution, the farmers and own account workers' income increase while it decreases for the formal and informal wage earners. However, the real income falls down for all categories of households. In terms of policy implications, our findings suggest that a capital-intensive informal sector policywould hardly propel economic growth and job creation in Burkina Faso. However, this could, to some extent, improve the informal workers' incomes.Knowing that poverty is predominant in the informal sector,future research couldexplore the impact on poverty and inequality of policy interventions in this sector in Burkina Faso by taking into account the rural-urban migration, the unemployment and the minimum wage in the formal sector.

References

Agenor P. R., Aizenman J. (1994). *Macroeconomic adjustment with segmented labor markets. NBER Working Paper No. 4769*

Alia, D., Ndjana, W., & Nghogue, E. (2009). *Evaluation of the effects of economic policies on informal sector performance and poverty in Cameroon: A Computable General Equilibrium model analysis. MPRA Paper No. 30339.*

Amaral, P., & Quintin, E. (2006). The implications of capital-skill complementarity in economies with large informal sectors. *Journal of Monetary Economics*, *53*, 1541–1553.

Arvin-Rad, H., Basu, A. K., & Willumsen, M. (2010). Economic reform, informal–formal sector linkages and intervention in the informal sector in developing countries: A paradox. *International Review of Economics and Finance*, *19*(2010), 662–670.

Balma, L., Cockburn, J., Fofana, I., Kaboré S., & Tiberti L. (2010). *Simulation des effets de la crise économique et des politiques de réponse sur les enfants en Afrique de l'Ouest et du Centre: Le cas du Burkina Faso. Innocenti WorkingPaper, IWP-2010-03.*

Banerji, A., & Jain, S. (2007). Quality dualism. *Journal of Development Economics*, *84*(2007), 234–250.

Benjamin, N., Gueye, F., Haughton, D., Mbaye, A. A., Tchakoute, R., &Tinga, M. (2016). *The informal sector in Cameroon: Practices and productivity*, World Bank Publications.

Benjamin, N., &Mbaye, A. A. (2020). Failure of structural transformation in Francophone Africa,inMbaye, A. A., Benjamin, N., Golub, S., Gueye, F., (eds) *Formal and Informal Enterprises in Francophone Africa: Moving Toward a Vibrant Private Sector,*International Development Research Centre, Ottawa.

Benjamin, N., Mbaye, A., & Diop, I. T. (2012). *The informal sector in francophone Africa: Firm size, productivity, and institutions*. World Bank Publications.

Bhattacharya, P. C. (1998). The informal sector and rural-to-urban migration: Some Indian Evidence. *Economic and Political Weekly*, 33 1255-1257, 1259-1262.

BIT (Bureau International du Travail) (2012). *Burkina Faso: les fonds d'emploi, performance et impact.* Genève: BIT, 2012.

Böhme, M. H., & Thiele, R. (2012). Is the Informal Sector Constrained from the Demand Side? Evidence for Six West African Capitals.*World Development*, Vol. 40, No. 7, pp. 1369–1381, 2012.

Böhme, M. H., & Thiele, R. (2014). Informal-formal linkages and informal enterprise performance in urban West Africa. *European Journal of Development Research*, *26*, 473–489.

Cassim, A., Lilenstein, K., Oosthuizen, M., & Steenkamp, F. (2016). *Informality and inclusive growth in Sub-Saharan Africa. Development Policy Research Unit Working Paper 201602*, DPRU, University of Cape Town.

Chaudhuri, S. (2000). Rural–urban migration, informal sector, urban unemployment and development policies – A theoretical analysis. *Review of Development Economics*, 4, pp. 353–364.

Chaudhuri S., & Mukhopadhyay U. (2010). *Revisiting the informal Sector: A general equilibrium approach.*Springer, New York, NY.

Datta-Chaudhuri, T. (1989). A theoretical analysis of the informal sector. *World Development*, 17(3), pp. 351–355.

Decaluwé, B., Lemelin A., Robichaud, V., &Maisonnave H. (2013).*The PEP Standard Computable General Equilibrium Model Single‐Country, Static Version PEP-1-1.* Poverty and Economic Policy Research Network.

ECA (United Nations Economic Commission for Africa) & AUC (African Union Commission) (2014). *Economic Report on Africa 2014. Dynamic industrial policy in Africa: Innovative institutions, effective processes and flexible Mechanisms.*ECA, Addis Ababa, Ethiopia.

ECA (United Nations Economic Commission for Africa) &AUC (African Union Commission) (2015). *Economic Report on Africa 2015. Industrializing through Trade.* ECA, Addis Ababa, Ethiopia.

Fields, G. (1975). Rural-urban migration, urban unemployment and underemployment, and job search activity in LDCs. *Journal of Development Economics*, *2*, 165–187.

Gelb, A., Mengistae, T., Ramachandran, V., &Shah, M. K. (2009). *To formalize or not to formalize? Comparisons of microenterprise data from Southern and East Africa. CGD Working Paper.*

Ghosh M., &Sarkar, A. (1989).*A model of the informal sector. ISI Working Paper.*

Grimm M. & Günther I. (2005). Inter- and intra-household linkages between the informal and formal sector: A case study for urban Burkina Faso. *UNU WIDER Research Paper* No. 2005/14.

Gupta, M. R. (1993). Rural–urban migration, informal sector and development policies: A theoretical Analysis. *Journal of Development Economics*, 41, pp. 137–151.

Harris, J. R., & Todaro, M. P. (1970). Migration, unemployment and development: Atwo-sector analysis. *The American Economic Review*, *60*, 126–142.

Hirschman, A. (1958). *The strategy of economic development.* New Haven: Yale University Press.

ILO (International Labour Office) (2016). *World Employment and Social Outlook 2016: Transforming jobs to end poverty.* Geneva: ILO.

INSD (Institut National de la Statistique et de la Démographie) (2003). *Le Secteur informel dans l'agglomération de Ouagadougou: Performances, insertion, perspectives. Premiers résultats de la phase 2 de l'enquête 1-2-3. Version provisoire.* INSD. Ouagadougou, Burkina Faso.

INSD (2015).*Enquête multisectorielle continue (EMC) 2014 :Profil de pauvretéet d'inégalités.*INSD. Ouagadougou, Burkina Faso.

INSD& AFRISTAT (2019). *Enquête Régionale Intégrée sur l'Emploi et le Secteur Informel, 2018 : Rapport final.* Ouagadougou, Burkina Faso et Bamako, Mali : INSD et AFRISTAT.

Jones, L. P. (1976). The measurement of Hirschmanian linkages. The *Quarterly Journal of Economics,* Volume 90, Issue 2, May 1976, Pages 323–333.

INSD (2022).*Enquête Harmonisée sur les Conditions de Vie des Ménages de 2018 (EHCVM-2018) :Diagnostic de la pauvreté.*INSD. Ouagadougou, Burkina Faso.

Kelley, B. (1994). The informal sector and the macroeconomy: A computable general equilibrium approach for Peru. *World Development I*, *22*(9), 1393–2141.

La Porta, R., & Shleifer, A. (2008). *The unofficial economy and economic development. Brookings Papers.*

Levy S. (2007). *Good intentions, bad outcomes: Informality, productivity, and growth in Mexico.* Brookings Institution Press.

Loayza, N. V. (1997). *The economics of the informal sector: A simple model and some empirical evidence from Latin America.* Washington, DC: World Bank.

Marjit S., &Kar S. (2011). The outsiders: economic reform and informal labour in a developing economy, 1st edn. Oxford
UniversityPress, New Delhi.

Montaud, J.-M. (2000). *Deux approches macroéconomiques du secteur informel en Equateur, Centre d'économie dudéveloppement*. Université Montesquieu – Bordeaux IV – France.

Mbaye, A. A., Benjamin, N., & Gueye, F. (2017). The Interplay between formal and informal firms and its implications on jobs in Francophone Africa: Case studies of Senegal and Benin, in: Polese A., Williams C. C., Horodnic I. A., Bejakovic P. (Eds,), *Informal Economy in Global Perspective*, Basingstoke: Palgrave Macmillan.

NEPAD (New Partnership for Africa's Development) & ECA (2014). *Mobiliser les ressources financières intérieures à l'appui de la mise en œuvre des programmes et projets nationaux et régionaux du NEPAD-L'Afrique compte sur ses propres ressources*. NEPAD

Parra, J. C &Wodon, Q. (2010). *SimSIP SAM: A Tool for the Analysis of Input-Output Tables and Social Accounting Matrices*.The World Bank

Perry G. E., Maloney W. F., Arias O.S., Fajnzyblber P., Mason A., Saavedra-Chanduvi J. (2007). *Informality: Exit and Exclusion*. The World Bank, Washington DC.

Robinson, S. (1989). Multisectoral models. Handbook of Development Economics, in: Hollis Chenery & T.N. Srinivasan (ed.), *Handbook of Development Economics*, edition 1, volume 2, chapter 18, pages 885-947, Elsevier.

Roy, M. (2006). Effect of subsidy and entry into the informal sector with inter-linkage. *International Review of Economicsand Finance*, *15*(2006), 383–397.

Sawadogo B., Nana, T. J., Natama, H. M., Bama, F., Tapsoba, E., & Zerbo K. (2015). *Impact de l'expansion économique et commerciale de la Chine sur la croissance et l'emploi au Burkina Faso: Une analyse en équilibre général calculable. Poverty and Economic Policy (PEP) Research Network*.

Traoré J.A. & Ouedraogo M.I (2021). Public policies promoting the informal sector: Effects on incomes, employment and growth in Burkina Faso.*Journal of Policy Modeling*, Volume 43, Issue 1, January–February 2021, Pages 56-75

Weeks, J. (1975). Policies for expanding employment in the informal urban sector of Developing Economies. *International Labour Review*, 3 (1), pp. 1–13.

Appendix

Figure 1: Backward and forward linkages, Burkina Faso, 2008

Source: Authors' calculations based on SAM 2008 for Burkina Faso with SimSIP SAM

Table 12:Percentage change of selected variables from the sensitivity analysis

	Elasticity of substitution between capital and labour equals 1.5 in the informal sectors														
	SIM 1					SIM 2					SIM 3				
Total tax revenues	-0.035					-0.089					-0.180				
Real GDP at market prices	-0.036					-0.090					-0.177				
	Agriculture	Formal industry	Formal services	Informal industry	Informal services	Agriculture	Formal industry	Formal services	Informal industry	Informal services	Agriculture	Formal industry	Formal services	Informal industry	Informal services
Value added	0.120	-0.052	-0.005	-0.355	-0.145	0.275	-0.129	-0.011	-0.833	-0.343	0.483	-0.253	-0.019	-1.519	-0.633
Composite labour demand	-0.172	-0.163	-0.008	0.202	0.483	-0.393	-0.374	-0.021	0.453	1.120	-0.690	-0.661	-0.038	0.772	2.004
Wage rate for composite labour demand	0.079	-0.085	-0.086	0.117	0.102	0.173	-0.204	-0.206	0.260	0.226	0.284	-0.384	-0.386	0.437	0.380
Rural formal labour demand	-0.038	-0.159	-0.006	0.367	0.637	-0.084	-0.365	-0.013	0.836	1.477	-0.141	-0.644	-0.022	1.453	2.646
Urban formal unskilled	-0.011	-0.132	0.021	0.394	0.664	-0.023	-0.305	0.047	0.897	1.539	-0.036	-0.541	0.082	1.559	2.754
Urban formal skilled demand	-0.015	-0.136	0.017	0.390	0.660	-0.031	-0.313	0.039	0.889	1.531	-0.05	-0.554	0.07	1.546	2.741
Rural informal demand	-0.219	-0.340	-0.187	0.185	0.454	-0.500	-0.781	-0.430	0.415	1.054	-0.877	-1.377	-0.760	0.705	1.889
Urban informal unskilled demand	-0.134	-0.256	-0.103	0.270	0.540	-0.310	-0.590	-0.239	0.608	1.248	-0.550	-1.052	-0.432	1.037	2.226
Urban informal skilled demand	-0.026	-0.147	0.006	0.379	0.649	-0.058	-0.340	0.012	0.861	1.504	-0.01	-0.603	0.020	1.495	2.689

Source: Authors' calculations based on the simulations results

The CGE model

All sectors: i; All commodities: j, ij; Labor categories: l; All agents: ag, agj; Households categories: h, hj; Non-government agent: $agng$; domestic agents: agd

Production

$$VA_j = v_j XS_j \quad (1)$$

$$CI_j = io_j XS_j \quad (2)$$

$$VA_j = B_j^{VA} \left[\beta_j^{VA} LDC_j^{-\rho_j^{VA}} + \left(1 - \beta_j^{VA}\right) KD_j^{-\rho_j^{VA}} \right]^{-\frac{1}{\rho_j^{VA}}} \quad (3)$$

$$LDC_j = B_j^{LD} \left[\sum_l \beta_{l,j}^{LD} LD_{l,j}^{-\rho_j^{LD}} \right]^{-\frac{1}{\rho_j^{LD}}} \quad (4)$$

$$LD_{l,j} = \left[\frac{\beta_{l,j}^{LD} WC_j}{W_{l,j}} \right]^{\sigma_j^{LD}} \left(B_j^{LD}\right)^{\sigma_j^{LD}-1} LDC_j \quad (5)$$

$$D_{i,j} = aij_{i,j} CI_j \quad (6)$$

Incomes and savings

$$YH_h = YHL_h + YHK_h + YHTR_h \quad (7)$$

$$YHL_h = \sum_l \lambda_{h,l}^{WL} \left(W_l \sum_j LD_{l,j} \right) \quad (8)$$

$$YHK_h = \lambda_h^{RK} \sum_j R_j KD_j \quad (9)$$

$$YHTR_h = \sum_{ag} TR_{h,ag} \quad (10)$$

$$YDH_h = YH_h - TDH_h \quad (11)$$

$$CTH_h = YDH_h - SH_h - \sum_{agn} TR_{agn,h} \quad (12)$$

$$SH_h = s_h YDH_h \quad (13)$$

Government

$$YG = YGK + TDHT + TICT + TIMT + YGTR \quad (14)$$

$$YGK = \lambda_G^{RK} \sum_j R_j KD_j \quad (15)$$

$$TDHT = \sum_h TDH_h \quad (16)$$

$$TICT = \sum_i TICT_i \quad (17)$$

$$TIMT = \sum_i TIMT_i \quad (18)$$

$$TDH_h = ttdh_h YH_h \quad (19)$$

$$TIMT_i = ttim_i PWM_i \, e \, IM_i \quad (20)$$

$$SG = YG - \sum_{agng} TR_{agng,gvt} - G \quad (21)$$

Rest of the world

$$YROW = e \left(\sum_i PWM_i \times IM_i \right) \quad (22)$$

$$SROW = YROW - \sum_i PWX_i \times EX_i - \sum_{agd} TR_{agd,row} \quad SR \quad (23) \quad = -CAB \quad (24)$$

Transfers

$$TR_{agng,h} = Pixcon^{\eta} TR_{agng,h}^{0} \quad (25)$$

$$TR_{agng,gvt} = Pixcon^{\eta} TR_{agng,gvt}^{0} \quad (26)$$

$$TR_{agd,row} = Pixcon^{\eta} TR_{agd,row}^{0} \quad (27)$$

Demand

$$PC_i C_{i,h} = PC_i C_{i,h}^{Min} + \gamma_{i,h}^{LES} \left(CTH_h - \sum_{ij} PC_{ij} C_{ij,h}^{Min} \right) \quad (28)$$

$$GFCF = IT - \sum_i PC_i VSTK_i \quad (29)$$

$$PC_i INV_i = \gamma_i^{INV} GFCF \quad (30)$$

$$PC_i INVP_i = \gamma_i^{INVPT} INVPT \quad (31)$$

$$PC_i INVG_i = \gamma_i^{INVGT} INVGT \quad (32)$$

$$PC_i CG_i = \gamma_i^{GVT} G \quad (33)$$

$$DIT_i = \sum_j DI_{i,j} \quad (34)$$

Supply and international trade

$$XS_{j,i} = B_{j,i}^{X} \left[\beta_{j,i}^{X} EX_{j,i}^{\rho_{j,i}^{X}} + \left(1 - \beta_{j,i}^{X}\right) DS_{j,i}^{\rho_{j,i}^{X}} \right]^{\frac{1}{\rho_{j,i}^{X}}}$$

$$(35)$$

$$EX_{j,i} = \left[\frac{1 - \beta_{j,i}^{X}}{\beta_{j,i}^{X}} \frac{PE_i}{PL_i} \right]^{\sigma_{j,i}^{X}} DS_{j,i} \quad (36)$$

$$Q_i = B_i^{M} \left[\beta_i^{M} IM_i^{-\rho_i^{M}} + \left(1 - \beta_i^{M}\right) DD_i^{-\rho_i^{M}} \right]^{\frac{-1}{\rho_i^{M}}} \quad (37)$$

$$IM_i = \left[\frac{\beta_i^{M}}{1 - \beta_i^{M}} \frac{PD_i}{PM_i} \right]^{\sigma_i^{M}} DD_i \quad (38)$$

Prices

$$PP_j = \frac{PVA_j VA_j + PCI_j CI_j}{XS_j} \quad (40)$$

$$PCI_i = \frac{\sum_i PC_i DI_{i,j}}{CI_j} \quad (41)$$

$$PVA_j = \frac{WC_j LDC_j + R_j KD_j}{VA_j} \quad (42)$$

$$P_{j,i} = \frac{PE_i EX_{j,i} + PL_i DS_{j,i}}{XS_{j,i}} \quad (43)$$

$$PD_i = (1 + ttic_i) PL_i \quad (44)$$

$$PM_i = (1 + ttic_i)(1 + ttim_i) e\, PWM_i \quad (45)$$

$$PC_i = \frac{PM_i IM_i + PD_i DD_i}{Q_i} \quad (46)$$

$$PIXCON = \frac{\sum_i PC_i \sum_h C_{i,h}^o}{\sum_{ij} PC_i^o \sum_h C_{ij,h}^o} \quad (47)$$

$$PIXINV = \prod_i \left(\frac{PC_i}{PC_i^o} \right)^{\gamma_i^{INV}} \quad (48)$$

$$PIXGVT = \prod_i \left(\frac{PC_i}{PC_i^o} \right)^{\gamma_i^{GVT}} \quad (49)$$

$$PIXGDP = \sqrt{\frac{\sum_j PVA_j VA_j^o \sum_j PVA_j VA_j}{\sum_j PVA_j^o VA_j^o \sum_j PVA_j^o VA_j}} \quad (50)$$

Equilibrium

$$Q_i = \sum_h C_{i,h} + CG_i + INV_i + VSTK_i + DIT_i \quad (51)$$

$$LS(l) = \sum_j LD_{l,j} \quad (52)$$

$$KS = \sum_j KD_j \quad (53)$$

$$IT = \sum_h SH_h + SG + SROW \quad (54)$$

Gross Domestic Product

$$GDP^{BP} = \sum_j PVA_j VA_j \quad (55)$$

$$GDP^{MP} = GDP^{MP} + TICT + TIMT \quad (56)$$

Real (volume) variables

$$CTH_h^{REAL} = \frac{CTH_h}{PIXCON} \quad (57)$$

$$G^{REAL} = \frac{G}{PIXGVT} \quad (58)$$

$$GDP^{BP-REAL} = \frac{GDP^{BP}}{PIXGDP} \quad (59)$$

$$GDP^{MP-REAL} = \frac{GDP^{MP}}{PIXGDP} \quad (60)$$

$$GFCF^{REAL} = \frac{GFCF}{PIXINV} \quad (61)$$

Volume variables

$C_{i,h}$: Consumption of commodity i by type h households

$C_{i,h}^{MIN}$: Minimum consumption of commodity i by type h households

CG_i : Public consumption of commodity i

CI_j : Total intermediate consumption of industry j

CTH_h^{REAL} : Real consumption expenditures of household h

DD_i : Domestic demand for commodity i produced locally

$DI_{i,j}$: Intermediate consumption of commodity i by industry j

DIT_i : Total intermediate demand for commodity i

$DS_{j,i}$: Supply of commodity i by sector j to the domestic market

$EX_{j,i}$: Quantity of product i exported by sector j

EXD_i : World demand for exports of product i

G^{REAL} : Real government expenditures

$GDP^{BP-REAL}$: Real GDP at basic prices

$GDP^{MP-REAL}$: Real GDP at market prices

$GFCF^{REAL}$: Real gross fixed capital formation

IM_i : Quantity of product i imported

INV_i : Final demand of commodity i for investment purposes

$INVP_i$: Final demand of commodity i for private investment purposes

$INVG_i$: Final demand of commodity i for public investment purposes

KD_j : Demand for capital by industry j

KS : Supply of capital

$LD_{l,j}$: Demand for type l labor by industry j

LDC_j : Industry j demand for composite labor

$LS(l)$: Supply of type l labor

Q_i : Quantity demanded of composite commodity i

VA_j : Value added of industry j

$VSTK_i$: Inventory change of commodity i

$XS_{j,i}$: Industry j production of commodity i

Price Variables

ℓ : Exchange rate; price of foreign currency in terms of local currency

$P_{j,i}$: Basic price of industry j's production of commodity i

PC_i : Purchaser price of composite commodity i (including all taxes and margins)

PCI_j : Intermediate consumption price index of industry j

PD_i : Price of local product i sold on the domestic market (including all taxes and margins)

PE_i : Price received for exported commodity i (excluding export taxes)

PE_i^{FOB} : FOB price of exported commodity i (in local currency)

$PIXCON$: Consumer price index

$PIXGDP$: GDP deflator

$PIXGVT$: Public expenditures price index

$PIXIVN$: Investment price index

PL_i : Price of local product i (excluding all taxes on products)

PM_i : Price of imported product i (including all taxes and tariffs)

PP_i : Industry j unit cost

PT_j : Basic price of industry j's output

PVA_i : Price of industry j value added

PWM_i : World price of imported product i (expressed in foreign currency)

PWX_i : World price of exported product i (expressed in foreign currency)

R_j : Rental rate of capital in industry j

W_l : Wage rate of type l labor

WC_j : Wage rate of industry j composite labor

Nominal (Value) Variables

CAB : Current account balance

CTH_h : Consumption budget of type h households

G : Current government expenditures on goods and services

GDP^{BP} : GDP at basic prices

GDP^{MP} : GDP at market prices

$GFCF$: Gross fixed capital formation

IT : Total investment expenditures

SG : Government savings

SH_h :Savings of type h households

$SROW$:Rest-of-the-world savings

TDH_h :Income taxes of type h households

$TDHT$:Total government revenue from household income taxes

TIC_i :Government revenue from indirect taxes on product i

$TICT$:Total government receipts of indirect taxes on commodities

TIM_i :Government revenue from import duties on product i

$TIMT$: Total government revenue from import duties

$TR_{ag,agj}$:Transfers from agent agj to agent ag

YDH_h :Disposable income of type h households

YG :Total government income

YGK : Government capital income

$YGTR$:Government transfer income

YH_h :Total income of type h households

YHK_h :Capital income of type h households

YHL_h :Labor income of type h households

$YHTR_h$:Transfer income of type h households

$YGTR$: Rest of the World income

Parameters

s_h :Slope (type h household savings)

$ttdh_h$:Marginal income tax rate of type h households

$ttic_i$: Tax rate on commodity i

$ttim_i$:Rate of taxes and duties on imports of commodity i

$aij_{i,j}$:Input-output coefficient

B^{LD}_j :Scale parameter (CES – composite labor)

B^M_i :Scale parameter (CES – composite commodity)

B^{VA}_j Scale parameter (CES – value added)

$B^X_{j,i}$: Scale parameter (CET – exports and local sales)

$\beta^{LD}_{l,j}$: Share parameter (CES – composite labor)

β^M_i : Share parameter (CES – composite commodity)

β^{VA}_i : Share parameter (CES – value added)

$\beta^x_{j,i}$: Share parameter (CET – exports and local sales)

η : Price elasticity of indexed transfers and parameters

γ^{GVT}_i : Share of commodity i in total current public expenditures on goods and services

γ^{INV}_i : Share of commodity i in total investment expenditures

γ^{INVP}_i : Share of commodity i in total private investment expenditures

γ_i^{GVT} : Share of commodity i in total public investment expenditures

$\gamma_{i,h}^{LES}$: Marginal share of commodity i in type h household consumption budget

io_j : Coefficient (Leontief – intermediate consumption)

λ_{ag}^{RK} : Share of capital income received by agent ag

$\lambda_{ag,agj}^{TR}$: Share parameter (transfer functions)

$\lambda_{l,h}^{WL}$: Share of type l labor income received by type h households

ρ_j^{LD} : Elasticity parameter (CES – composite labor);

ρ_i^{M} : Elasticity parameter (CES – composite commodity);

ρ_j^{VA} : Elasticity parameter (CES – value added);

$\rho_{j,i}^{X}$: Elasticity parameter (CET – exports and local sales);

σ_j^{LD} : Elasticity of substitution (CES – composite labor);

σ_i^{M} : Elasticity of substitution (CES – composite commodity);

σ_j^{VA} : Elasticity of transformation (CES – value added);

$\sigma_{j,i}^{X}$: Elasticity of transformation (CET – exports and local sales);

$\sigma_{i,h}^{Y}$: Income elasticity (LES- households' consumption)

υ_j : Coefficient (Leontief – value added)

Exogenous variables

$C_{i,h}^{MIN}$: Minimum consumption of commodity i by type h households

CAB : Current account balance

ℓ : Exchange rate; price of foreign currency in terms of local currency

G : Current government expenditures on goods and services

$TR_{h,gvt}$: Transfers from Government to household h

KD_j : Demand for capital by industry j

KS : Supply of capital

$LS(l)$: Supply of type l labor

PWM_i : World price of imported product i (expressed in foreign currency)

PWX_i : World price of exported product i (expressed in foreign currency)

s_h : Slope (type h household savings)

$ttdh_h$: Marginal income tax rate of type h households

$ttic_i$: Tax rate on commodity i

$ttim_i$: Rate of taxes and duties on imports of commodity i

$VSTK_i$: Inventory change of commodity i