

Macroeconomics implications of female entrepreneurs facing
financial frictions to access to credit: a DSGE Model
approach in Cameroon *

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February 17, 2017

*This research was carried out with financial and scientific support from the Department of International Development (DFID) of the United Kingdom (or UK Aid), the government of Canada through the International Development Research Center (IDRC). Authors gratefully acknowledge Kevin Moran for its technical support and guidance, as well as, Martin Cicowiez, Erwin Corong, Helene Maisonnave and Bernard Decaluwe for valuables comments, inputs and suggestions.

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[‡]This research has been awarded the 2015 Best Practice Award in Development Macroeconomics. All the views expressed in this paper are those of the authors, as well as Errors and omissions.

Abstract

This research assesses the effects of financial frictions faced by female entrepreneurs on macroeconomics performances in Cameroon. We address this important issue, using a Dynamic Stochastic General Equilibrium model with financial micro-foundations. The model features two sectors such as, a production sector dominated by female entrepreneurs and a production sector dominated by male entrepreneurs. Financial frictions appear because entrepreneurs face collateral constraints when borrowing from the banking sector. The dynamic analysis demonstrates that the female sector is labor-intensive whereas the male sector is capital intensive. But, when the female sector is granted loans to the same extent as in the male sector, Cameroonian economy records an increase in investment, job creation and GDP growth. The benchmark analysis reveals the adverse effect of financial frictions on macroeconomics outcomes. The scenarios analyses emphasize the expansionary effect of the loosening financial constraint, with female entrepreneurs acting as main driver of the economy activity. Thus, institutional frameworks that relax collateral constraints, grant exemptions for enormous requirements, enforce properties right law, and promote transparency and credit-information sharing can make big inroads in alleviating borrowing constraints, increasing financial inclusion and enhancing macroeconomic outcomes.

Keywords: Female Entrepreneurs, Financial Frictions, Macroeconomics Implications, DSGE Model, Cameroon.

JEL classification: C61, D21, E32, E44, O11.

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1 Introduction

Female entrepreneurs still faced financial frictions in accessing to credit in Cameroon, despite progress made towards achieving gender equality.¹ The constraints of gender credit access refer to both endogenous factors and exogenous factors (Essel 1996; Fondo and Mbaye 2010; Oluwu 2012; Esta 2013).

Endogenous constraints due to female are first related to their financing capabilities to undertake an activity. The existence of information asymmetry related to the different types of entrepreneurship within financial institutions reduces accessibility to credits for female. Most of societies in Africa are patriarchal and the man hold the property of the family and it can easily improve the guarantee process. So it is difficult for female to use the wealth of the family as collateral without the agreement of their husband. In addition, a specific socio-cultural constraint is the number of children each female entrepreneur has. There is a positive relationship between the number of child of a female and a risk of default. The commercial banks take into account this default risk in the evaluation of the loans contracts related to hazard moral and adverse selection. The hazard moral reveals the choice done by female entrepreneur. Their choice is based on the family's vital needs where the priority is given to the well being of their children (Asiedu and al. 2012; Ifelunini and Wosowei 2013; Damiano and Mwakubo 2014; Wekwete 2014).

Exogenous constraints are directly related to the rigidity of the banking sector in granting credit in developing countries. This rigidity is explained by the conditions imposed by banks on the one hand and the time of acquisition of the credit on the other hand. In fact, female entrepreneurs are easily engaged in agricultural and commercial sectors. Despite the fact that their activities are small in term of capital assets and remain in a start-up development process, a minimum capital is required to develop them. Nonetheless female entrepreneurs' equities are insufficient and they usually need credit to finance those activities. Banks, to protect themselves against risk of default related to female entrepreneurs type of activities, require high interest rate in exchange for loans. Moreover, the time, which elapses between the demand for loans and their supply by banks, is sometimes very long when the borrowers are female entrepreneurs (Bird and Sapp 2004; Asiedu and al. 2012; Angelucci and others 2013; Seguinto and Were 2014).

Overall, Cameroon's authorities have done enough this last decades to achieve gender equality and have succeeded in the area of education, health, employment and political participation.² Hence, the ratio of girls to boys' enrollment at the primary level is one of

¹Progress towards achieving gender equality at the global level include the Convention on the Elimination of all forms of Discrimination against Women (CEDAW) of 1991; the Global Platform for Action; the Beijing Declaration of 1995; the Millennium Development Goals (MDG); the 1994 International Conference on Population and Development (ICPD). At the regional level, the African Union Protocol of the Rights of Women in Africa adopted in 2005. At the National level, the preeminence role-plays by women, in the Cameroon Growth and Employment Strategy Paper of 2009.

²Cameroon's Constitution upholds the principle of gender equality. Cameroon ratified the Convention on the Elimination of All Forms of Discrimination against Women (CEDAW) in 1994. In 2005, Cameroon

the Millennium Development Goal (MDG), which was attained in 2015 in Cameroon. However, local traditional practices continue to restrict female's access to factors of production. Due to inequitable inheritance practices, very few female owns land, particularly in rural areas. Moreover, female are not fully entitled to use, enjoy or sell their property without their husband's consent. Those factors restrict female entrepreneurs' capacity to offer guarantees and get access to bank loans. Although female have the freedom to establish their own businesses, the Commercial Code allows husbands to end up their wives' commercial activity by simply notifying the clerk of the commerce tribunal of their opposition based upon the family's interest (Fonjong 2001; Evou et al. 2006; Kuepie et al. 2013). Efforts to alleviate female entrepreneurs financial frictions matter therefore to macroeconomics outcomes and economic development. As result, the proposed research seeks to answer the following questions:

How does female entrepreneurship financial constraint affects macroeconomic outcomes in Cameroon?

What type of financial sector reform is needed to overcome this constraint for broader macroeconomic performances and economic development in Cameroon?

2 Literature Review

The literature that studies macroeconomic implications of financial frictions emerges right after the great depressions. On the one hand, authors highlight the prominence of financial frictions and the intrinsic instability of the financial system (Fisher 1933; Keynes 1936; Gurley and Shaw 1955; Minsky 1957; Kindleberger 1978). On the other linking, they emphasized the core implication of financial stability for monetary economics (Patinkin 1956; Tobin 1969). Recently, the mid-2007 global financial crisis renewed the role of financial frictions as the foremost driver of business cycle fluctuations (Brunnermeier et al. 2012). Hence, economist recognized that financial sector imperfections are relevant not only to explain economic developments and the impact of financial shocks on real economy, but also to design appropriate stabilizations policy (Calza et al. 2009; Gerali et al. 2010; Iacoviello and Neri 2010; Brzoza-Brzezina and Kolasa 2012).

The financial frictions are empirically documented by two alternatives approaches. The first approach is the External Finance Premium version, which represents the Price of Loans based financial frictions. The second approach is the Collateral Constraints version, which represents the Quantity of Loans based financial frictions (Brzoza-Brzezina and Kolasa 2012). The literature offers different micro-foundations for different financing frictions. The first micro-foundation is the costly state verification framework of Townsend (1979) where the basic friction is due to information asymmetry about the future payoff of the project. The second micro-foundation is the quantity-rationing framework as in Stiglitz and

also ratified the Optional Protocol to the Convention, which came into effect in the same year.

Weiss (1981) for non-collateralized credit. The third micro-foundation is the incomplete markets framework of Hart and Moore (1994) for collateralized constraints.

The External Finance Premium version of financial frictions grounds its micro-foundation from the costly state verification of Townsend (1979), because monitoring a loan applicant is costly, which drives an external finance premium between the lending rate and the risk free rate.³ This version originates from the seminal paper of Bernanke and Gertler (1989). The model of Bernanke and Gertler (1989) reveals that temporary shocks have a much stronger persistence through feedback effects of tightened financial frictions. Thus, negative shocks to entrepreneurs net worth increase the financial frictions and force the entrepreneurs to invest less. As result, the level of capital and the entrepreneur net worth decline in the following period. Subsequently, this decline leads once more to decrease investment and lower net worth in the following periods. However, this original model uses a framework where agents lived only for two periods.

Carlstrom and Fuerst (1997) further developed this model by considering agents who are infinitely lived. They demonstrates that the endogenously agency cost could potentially alter the business-cycle dynamics, because agency-cost model replicates the empirical facts that output growth displays positive autocorrelation at short horizons. The fact that households delay the investment decisions until agency costs are at their lowest motivates the hump-shape output growth behavior. Agency cost fall with time because the productivity shock increases the return to internal funds, which in turn redistributes wealth from households to entrepreneurs. However, the shift in the supply of capital caused by the lower net worth of entrepreneur also leads to a higher price of capital. This increase in price has a dampening effect on the propagation of the net worth shock. Nevertheless, the amplification effect of shocks is inexistent in the Carlstrom and Fuerst (1997) model.

Bernanke et al (1999) made thus several changes to the Carlstrom and Fuerst (1997) model to capture the complete dynamic of the New-Keynesian framework. The Bernanke et al (1999) model becomes thus the workhorse financial accelerator model in the 2000s. Authors introduce nonlinear capital adjustment costs in the model, which are the driving force of the amplifications effects. In fact, similarly Bernanke and Gertler (1989) model and Carlstrom and Fuerst (1997) model, shocks to entrepreneurs net worth are persistent, but the particularity in the Bernanke et al (1999) model is the amplification effect of the shock. Hence, following a negative shock to entrepreneur net worth, the decrease in aggregate capital reduces the price of capital due to the convex adjustment costs. This lower price further decreases entrepreneur net worth, amplifying the original shock. Overall, the three models, such as, the Bernanke and Gertler (1989) model, the Carlstrom and Fuerst (1997) model and the Bernanke et al (1999) model, do not solve the complete dynamic of their models. Instead they log-linearized the model around the steady state and study

³The costly state verification of Townsend (1979) arises from the standard information asymmetry problem where the borrower or entrepreneur has private information about its performance contrast to lender or bank that does not have any information. To obtain this information, the lender should pay a monitoring cost, which justifies an external finance premium for the borrower.

the impulse response of the endogenous variable in the linearized model. Consequently the baseline Bernanke et al (1999) New Keynesian model has been generalized during last decade in several directions, such as, to emphasize the prominence role of financial accelerator mechanism (Greave 2008; Christensen and Dib 2008; Queijo Von Heideken 2009; Gilchrist et al 2009), to analyze the role of financial frictions during the Great depression (Christiano et al. 2003), to study business cycle implication of financial frictions (Christiano et al. 2010), to provides an endogenous explanations for steady state differentials between lending and money market rates (Goodfriend and McCallum 2007), to derive optimal monetary policy in the presence of time-varying interest rate spreads in a simple model with heterogeneous households and bank capital channel (Badarau and levieuge 2011).

The Collaterals Constraints version of financial frictions grounds its micro-foundation from the incomplete markets framework of Hart and Moore (1994), because the amount of credit issuance by lenders to entrepreneurs is limited through collaterals constraints. This second version of financial frictions have been introduced by the innovative paper of Kiyotaki and Moore (1997), where a model is constructed to capture how credit constraints interact with aggregate economic activity over the business cycle. Agents are heterogeneous in terms of their rate of time preference, which divides them into lenders and borrowers. The financial sector intermediates between these groups and introduces frictions by requiring that borrowers provide collateral for their loans. The need of collateral is motivated by the absence of contract enforcement in the economy and collateral constraint is set exogenously. Authors highlighted that, the dynamic interaction between financing constraints and assets prices is a powerful transmission mechanism by which the effect of shocks persists, amplify, and spill over to other sectors. The strand of literature following Kiyotaki and Moore (1997) has stressed the relevance of the link between the value of borrower's collateral and their access to funds in amplifying the economy's response to shocks.

Iacoviello (2005) extended the seminal model of Kiyotaki and Moore (1997) by introducing balance sheet channel. In a DSGE framework with households, banks and entrepreneurs each facing endogenous borrowing constraint, he assesses how repayment shocks undermine the flow of funds between savers and borrowers in the recent recession. Iacoviello and Neri (2010) go forward by introducing housing as collaterals. In fact they introduced an ad hoc collateral constraint into a DSGE model with two households where impatient households borrow from the patient households against their housing wealth used as collateral, in order to study the role of housing market shocks on the economy. However, the exact form of the collateral constraint is not derived based on the optimal actions of agents and the model does not leave space for household' default. Gerali et al. (2010) and Brzoza-Brzezina and Makarsi (2010) use DSGE models with collateral constraints and monopolistic competition in the banking sector to examine the impact of financial frictions on monetary transmission and a credit crunch scenario. Carlstrom et al. 2010 study the linear quadratic optimal monetary policy in DSGE model in which risk-neutral entrepreneurs pay some of their workers after production and must therefore commit some collateral to back the promised wages.

Brunnermeier and Sannikov (2011), Jeanne and Korinek (2010), Mendoza (2010), advanced the development of Collateral Constraints by allowing for occasionally rather than eternally binding collateral constraints. Guerrieri and Iacoviello (2014) use a non-linear DSGE model where occasionally binding collateral constraints on housing wealth drive an asymmetry in the link between housing prices and economy activity. The key result is that as collateral constraints become slack, expanding housing wealth makes a small contribution to consumption growth. All these developments leave no doubt that a successful macroeconomic model that aims at capturing the salient features of the business cycle should be able to account for financial frictions developments and the linkages between these features with the rest of the economy. The collateral constraint version of financial frictions improves in many areas the business cycle properties than external finance premium version and is more suitable for DSGE model with financial frictions (Chari et al. 2007; Brzoza-Brzezina et al. 2011; Brzoza-Brzezina and Kolasa 2012).

Overall, the study of macroeconomics implications of financial frictions is exclusively based on DSGE models. The framework can be Real Business Cycles (RBC) approach or New-Keynesian approach depending of the objective of the research. The type of financial frictions can be External Finance Premium version or Collaterals Constraints version, depending of the context of the studied economy. Nevertheless, all the previous models until now mainly focus on the heterogeneity of households, or the heterogeneity of financial system or banking sector. None of the models put emphasize on entrepreneur side. This research would goes beyond this limit by highlighting the entrepreneur heterogeneity, and specifically by introducing gender issue in the financial frictions. To the best of our knowledge this is the first attempt to develop a DSGE model with financial frictions in Africa, namely in Cameroon.

3 Some stylized facts

This section provides an overview of thinking on the connection between gender and entrepreneurship in Cameroon, by emphasizing on the constraints to female entrepreneurship.

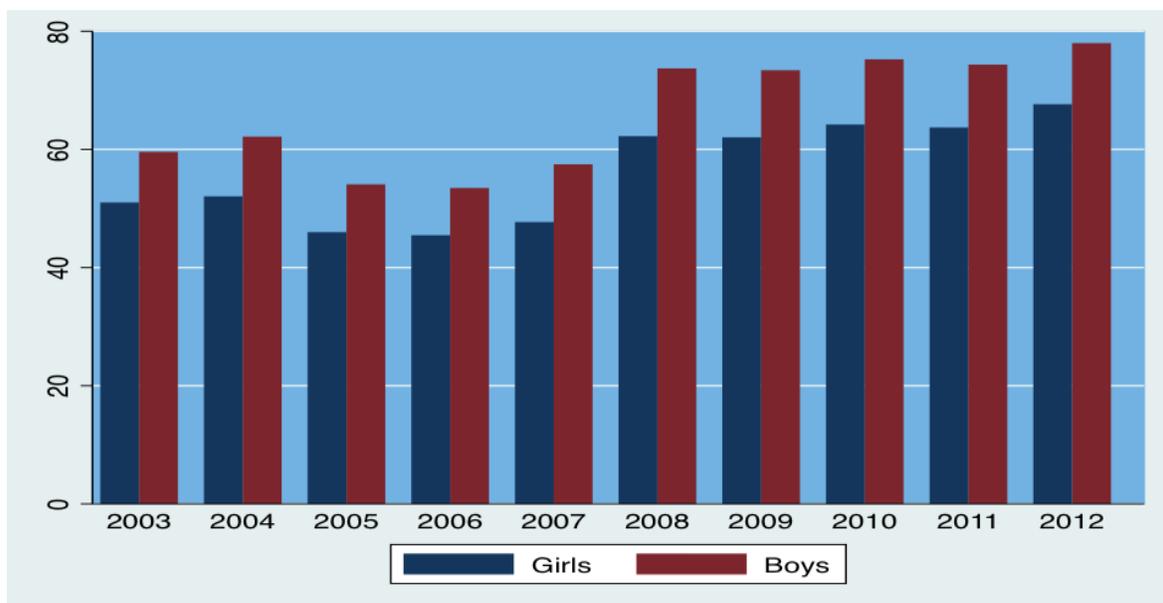
3.1 Gender analysis in Cameroon

Cameroonian authorities have done a lot in recent decades to work towards gender equality. One of the noticeable achievements is the launch in 1997 of the Ministry in charge of female promotion. The aims of gender policy in Cameroon is thus based on four mains pillars, namely, ease female access to productive resources and ensure control, enhance and encourage female labor productivity and in turn their revenues, increase basic infrastructures quality, and promote female fundamental rights.

Efforts to reduce the education gap between male and female are thus increasing the level of female enrolment and their school performances in Cameroon. At the basic education level, in average, the completion rate of girls increased by 19.6 percent from 2003 to 2012,

more than the increase in the boys completion rate, which increased by only 9 percent over the same period (Figure 1). In the secondary cycle, the net rate of school attendance for female pupils increased from 35.7 percent in 2001 to 51.5 percent in 2010, relative to male school attendance rate, which increases from 33.9 percent to 47.8 percent (Table 1 in appendix). This growing rate of female school attendance can be explained by the policy of ‘Education for all’ engaged in by the authorities and the expansion of public school in local communities. Likewise, the female rate of enrolment in higher education rose from 4 percent in 2002 to 10 percent in 2011, while male rate of enrolment rose from 7 percent to 14 percent in the same period (Figure 2 in appendix).

Figure 1. Completion rate of basic education



Source: Authors using World Bank Gender Indicators (2014)

Concerning employment, females have entered the labor market in massive numbers during these past decades, even if the male labor force participation is still much higher than the female labor force participation. Figure 3 reveals that male labor force participation averaged 76 percent during 1990 to 2012, against 62 percent for females. However, active females (93.8 percent) are over-represented in the informal sector compared to active males (6.2 percent), (ILO 2010). Self-employment in informal enterprises accounted for 24.3 percent of female’s nonagricultural employment in 2001 against 38.9 percent in 2010. Meanwhile self-employment in informal enterprises accounted for 23.6 percent of male’s non-agricultural employment against 35.9 percent in the same period. In contrast, self-employment in informal enterprises accounted for 52.4 percent of female’s agricultural

employment in 2001 against 48.5 percent in 2010. Also, self-employment in informal enterprises accounted for 68.5 percent of males' agricultural employment in 2001 against 57.9 percent in 2010 (Table 2 in appendix).

Female participation in political life in Cameroon is also increasing over the years (Table 3 and Table 4 in appendix). Overall, the proportion of females involved in political positions increases from 6.7 percent in 2001 to 11.7 percent in 2011. Specifically, the ratio of female Ministers increased from 9.1 percent in 2001 to 16.1 percent in 2011. The ratio of female Secretaries of State rose from 8.3 percent in 2001 to 20 percent in 2011. The four main governance agencies in Cameroon, such as the National Anti-Corruption Commission (CONAC), the Elections Cameroon (ELECAM), the National Agency of Financial Investigation (ANIF) and the Cameroon Supreme Court, reveal that females are present for policy advice and political decisions. Since 2007, 25 percent of ELECAM members, 9.8 percent of Supreme Court judges and 32 percent of ANIF members are female. The ELECAM goes forward by increasing this ratio to 27.8 percent in 2011 (Table 5 in appendix). Nonetheless, the 2016 Global Gender Gap data reveals that even if there is an improvement in female political empowerment, the percentage of females in parliament and Ministerial Positions remain low with rates of 31 and 14 percent, against 69 and 86 percent for men.

3.2 Entrepreneurship and gender issues in Cameroon

The 2015 Global Gender Gap report emphasizes that, in Cameroon, the ability of females to become entrepreneurs sits at 4.1 percent, the rate of firms with female top managers is at 10 percent and the rate of firms with female participation in ownership is 16 percent, while these rates are respectively, 95 percent, 90 percent and 84 percent for male entrepreneurs. This sluggish ratio of female entrepreneurs in Cameroon can be explained by several factors. Basically, the substantial constraints in entrepreneurship are taxation, corruption, credit access, administrative procedures, unfair competition, infrastructure, financial costs, lack of dialogue between private sectors and Government, energy supply, transport and justice. Among those 14 constraints, 58.7 percent of surveyed enterprises believe that taxation remains the primary obstacle in entrepreneurship, 50.6 percent of surveyed enterprises consider corruption as the second constraint, and 37.8 percent of surveyed enterprises believe that access to credit is the third constraint of entrepreneurship in Cameroon (Figure 4 in appendix).

Regarding female entrepreneurship, it appears that among the three key constraints of entrepreneurship in Cameroon, access to credit is the greatest factor in inhibiting the development of female entrepreneurship. Table 7 reveals that access to financing and corruption are ranked as the two major constraints of female entrepreneurship in Cameroon. Notably, despite the authorities' efforts, 23 percent of survey responses identify that in Cameroon female entrepreneurship continues to register poor access to financing. More precisely, the Cameroon Households Survey demonstrated that female entrepreneurs in Cameroon are mostly affected by the lack of production credit. According to Figure 5

in appendix, the weak production financing access of female entrepreneurs in Cameroon decreased from 4 percent in 2001 to 3.4 percent in 2011. In contrast, male entrepreneurs' access to production financing increased from 12 percent in 2001 to 14 percent in 2011.

Table 7. Female entrepreneurship constraints factors (2013-2014)

Cameroon		
	Rank of constraints	Percent of responses
Corruption	1 st	24
Access to financing	2 nd	23
Inadequate supply of infrastructure	3 rd	14
Tax regulations	4	9
Inefficient government bureaucracy	5	8
Tax rates	6	6
Poor work ethic in national labor force	7	4
Insufficient capacity to innovate	8	3.5
Crime and theft	9	3
Restrictive labor regulations	10	2.5
Foreign currency regulations	11	2
Inflation	12	1.5
Inadequacy educated workforce	13	0.5
Poor public health	14	0.4
Policy instability	15	0.3
Government instability or coups	16 th	0.1

Source: Authors from World Economic Forum data (2014)

This financial constraint encountered by female entrepreneurs can be explained by four majors factors, namely, the shallowness of financial system, the business environment, the vulnerability of female entrepreneurs and the financial frictions in credit markets. Basically, the financial sector is dominated by a less competitive banking sector, which is composed of 13 banks subdivided in three subgroups, such as, foreign banks, domestic private banks, and state-owned banks.⁴ Cameroon, as a member state of CEMAC, faces the existence of two competing financial markets, which do not represent significant alternatives to bank lending, since they are shallow and fragmented. These are the Securities Exchange of Central Africa launched in 2003 in Libreville-Gabon and the Douala Stock Exchange inaugurated in 2003 in Douala-Cameroon.

In the banking sector, access to financial services remains feeble. The bank density and the banking rate explain the shallowness of banking sector. The share of the adult population with a formal bank account increased from 20.41 percent in 2012 to 23 percent in 2015. However, this banking rate lags behind the average of LICs (24 percent), even

⁴The 13 banks represented in Cameroon are Afriland First Bank, Cameroon International Bank of Saving and Credit, Citibank Cameroon, Commercial Bank of Cameroon, Cameroon, Commercial Society of Bank, Ecobank Cameroon, National Financial Credit Bank, General Society of Banks in Cameroon, Union Bank of Cameroon, United Bank for Africa Cameroon, Antlantic bank Cameroon, and BGFI Bank Cameroon.

if it is above the average of the CEMAC region (18.51 percent). Importantly, the female banking rate was around 9 percent in 2016 while male banking rate was 14 percent.

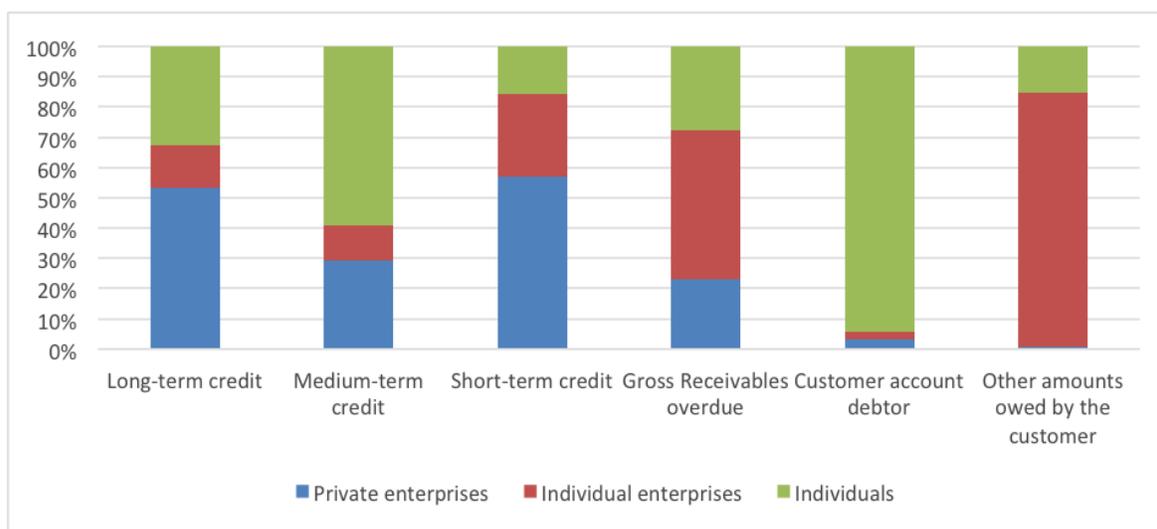
Table 8. Banking rate in Cameroon

Table 8: Banking rate in Cameroon				
	Banking Rate of active population		Bank Density	
Years	2012	2013	2012	2013
Cameroon	20.41%	20.68%	49 869	49 096
Female	-	11%	-	-
Male	-	19%	-	-
CEMAC	17.71%	18.51%	24 489	23 203

Source: Authors using BEAC data (2014) and the Global Gender Gap data (2013)

The low level of the banking rate is also related to the weak bank density in Cameroon. On average, there is one bank desk per 49,096, leading the level of Cameroonian bank density well behind the CEMAC level, where there is one bank desk per 23,203 people on average in CEMAC. Hence, given this low level of bank density, it becomes difficult to target entrepreneurs around the country for potential credit bargaining, both in rural and urban area. Consequently, the role of banks in saving mobilization is limited and bank lending remains a marginal source of funding, with long-term lending constituting less than 1.5 percent of total loans (Table 9 in appendix).

Figure 6: Distribution of credit by duration and type of bank’s customer

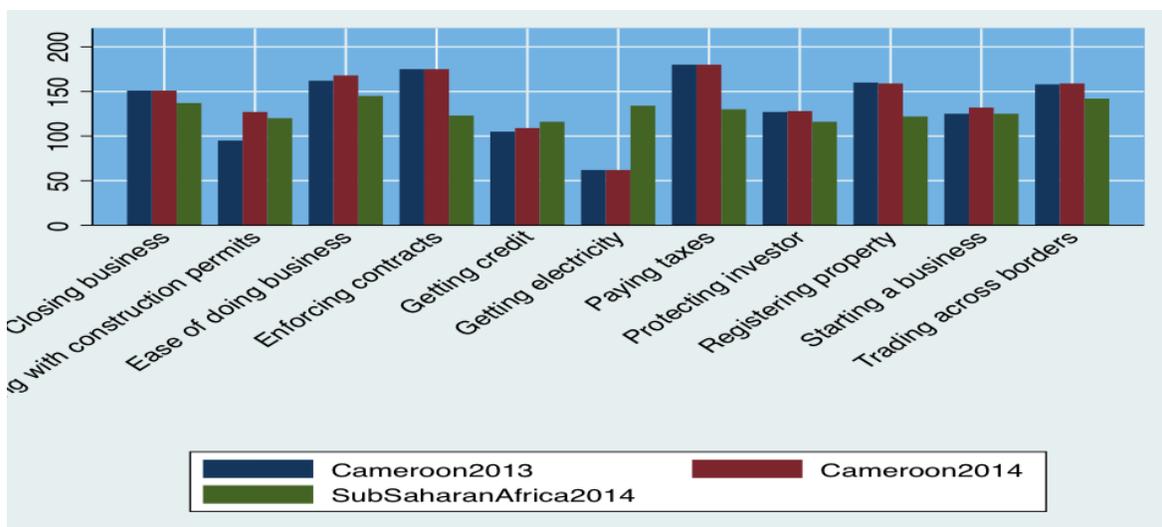


Source: Authors using data from National Council of Credit (2014)

In fact, private enterprise represents the main base of customers of banks in Cameroon with a ratio of credit granted of more than 60 percent, followed by individuals (14.12 percent) and individual enterprises (7.61 percent). However, short-term credits are the most granted credit to private enterprises (38.07 percent) rather than long-term credit (1.7 percent). Even for individual enterprises, short-term credits are the main type of credit granted (18.36 percent) rather than long-term credit (0.44 percent). The distribution of credit by bank customers partly explains the difficulties encountered by female entrepreneurs, both self-employed and those running small- or medium-scale enterprises to access to long-term financing (Figure 6).

The vulnerability of female entrepreneurship is the second reason explaining why female entrepreneurs are most exposed to financial frictions. Self-employment and informal business dominate female entrepreneurship in Cameroon. As a result, their productive activities are governed to a limited extent by formal laws, regulations and social protections. Due to high risk surrounding such activities, female businesses tend to be less profitable and generate lower sales turnover than those owned by men. The predominance of small-scale business among their activities is seen as symptom of wide uncertainty, which negatively affects the probability of success. Moreover, to provide for their families, females work in farms or run small-scale trade. This is another factor which limits the productivity of female entrepreneurs, since those activities are day-to-day businesses to smooth consumption over time.

Figure 7: Cameroon Doing Business Indicators (2013-2014)



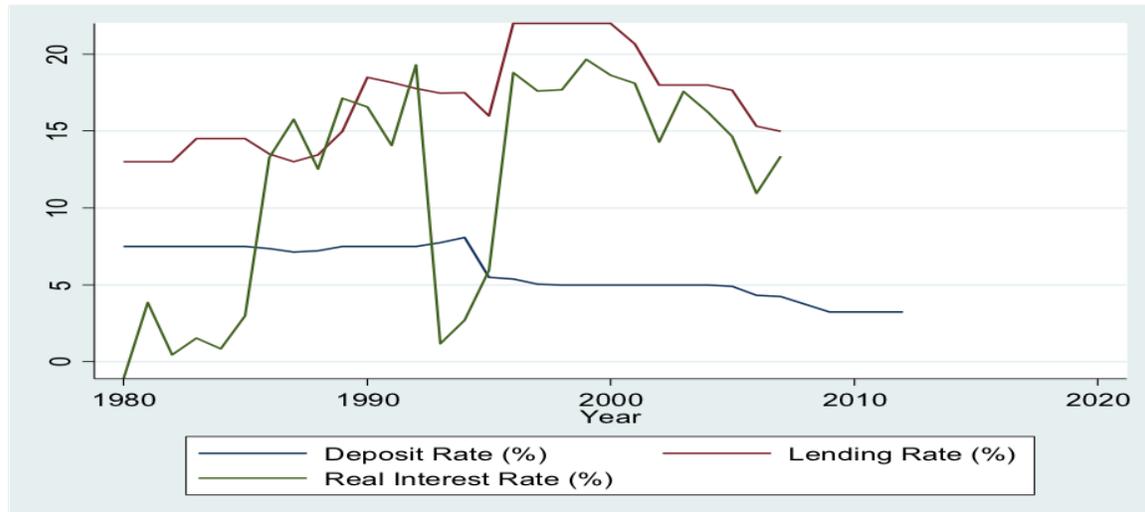
Source: Authors from World Bank Doing Business Indicators (2014)

The business environment is another key factor explaining the insufficient credit access. Despite some marginal reforms, the business climate in Cameroon continues to evolve be-

low its potential. Overall, with the exception of access to electricity, all of the Cameroon's doing business indicators rank behind the SSA average in 2014. The country's rating has deteriorated significantly regarding access to credit (109th in 2014 rather 105th in 2013), starting business (132nd rather 125th in 2013) and construction permits (127th rather than 95th). The 800 days needed in Cameroon to resolve a legal dispute versus 652 days on average in SSA explained the country's 175th ranking with respect to enforcing contracts. However, marginal improvement has been made concerning the process of registering property, with a rank of 159th out of 189 in 2014 rather than 160th out of 189 in 2013.

The shallowness of financial sector, the vulnerability of female entrepreneurs and the poor business environment highlight the presence of financial frictions in the credit market as one of the fundamental factors explaining the low access to financing by female entrepreneurs. The existing frictions can be found through collateral, interest rates, bank's commissions and fees. The general idea that female entrepreneurs are less creditworthy is fully justified when looking at collateral. The lack of female-owned properties, such as land, real estate, paid-employment or wages (which are assets generally used as collateral by the banking sector in Cameroon) inhibits their ability to offers collateral and obtain credit from the banking sector. Sometimes, female entrepreneurs need the approval of the head of the family or of their husband to use their owned assets as collateral. Hence, female entrepreneurs are less likely to have the required collateral and become less creditworthy than male entrepreneurs for credit demand.

Figure 8: Evolution of interest rates in Cameroon (percent)



Source: Authors using World Bank Financial data (2014)

Financing constraints sometimes also comes from high interest rates. In fact, to preserve themselves from risk and uncertainty of less creditworthy customers, the banking sector

tends to increase the commissions and fees of banks operations, which account for about 40 percent of the income of banking sector in Cameroon. Given this high level of commissions and fees, female entrepreneurs are less likely to have banks accounts, overdraft protection and loans. As Figure 8 demonstrates, there has been a huge gap between the deposit rate and the lending rate in Cameroon during the last three decades. As a result, financial intermediation involves high costs that create disincentives for female entrepreneurs who might wish to establish a business, invest in it or increase their productivity.

4 Methodology: a DSGE Model with Gender-Specific Financial Frictions

This research uses a Dynamic Stochastic General Equilibrium (DSGE) model with financial micro-foundations to analyze the problem of gender-specific financial frictions and their macroeconomic implications for Cameroon. The model grounds its analytic framework from the Real Business Cycle (RBC) approach and extensions of this approach that include financial frictions (Cooley and Hansen 1989; Stadler 1994; Carlstrom and Fuerst 1997; Kiyotaki and Moore 1997; Gertler and Kiyotaki 2010; Gilchrist and Zakrajcek 2011).

The general features of the model are as follows. First, gender issues are introduced in the model via heterogeneity in production. To this end, the model features two sectors, and we interpret the first as being populated by female entrepreneurs and the second by male entrepreneurs. Second, while both sectors are financially constrained, the one populated by female entrepreneurs is more constrained than the one populated by male entrepreneurs. Third, our model's financial sector is characteristic of African economies and is dominated by a banking sector that finances entrepreneurs' operations via bank loans sourced through households' deposits. Fourth, the financial intermediation process between banks and entrepreneurs is subject to financial frictions that affect how much entrepreneurs can borrow. Finally, households supply labor to both sectors and use their wages, as well as dividends from banks, to consume, save and pay government taxes. Figure 6 in Appendix A.2. presents a flow chart depicting the various structural elements of the model economy.

In the model, financial frictions appear because both types of entrepreneurs face a collateral constraint when borrowing from the bank and credit limits are affected by the quantity and the value of this collateral. In turn, the collateral's value can be affected by the size of the credit limits. This dynamic interaction between credit limits and collateral is a powerful transmission mechanism by which the shocks affecting the financial sector spillover to the real sector. Specifically, since physical capital is used both as collateral to obtain loans and as an input to produce intermediate goods, a shock that reduces the productive capacity of entrepreneurs also reduces their ability to borrow and forces them to cut back on their investment expenditures and, thus, on their demand for capital. This situation can therefore have important repercussions on their activities even in the

subsequent periods: they would earn less revenue, their production would fall even more, and, again because of credit constraints, they would further reduce investment.

4.1 Households

A continuum of infinitely-lived households obtain utility from consumption c_t^H and labor supply n_t . Their intertemporal optimization problem is to maximize lifetime utility:

$$U_0 = E_0 \sum_{t=0}^{\infty} \beta_H^t (\varpi_t \log c_t^H + \vartheta_t \log(1 - n_t)). \quad (1)$$

Here ϖ_t stands for a preference shock affecting the marginal utility of household, β_H denotes the household's discount factor and ϑ_t represents a preference shock affecting the marginal utility of the labor supply.⁵

Households allocate their labor to the two production sectors of the economy: the composite labor index, n_t , thus consists of hours worked in the production sector dominated by female entrepreneurs, n_t^F , and in the sector dominated by male entrepreneurs, n_t^M , following the CES aggregator:

$$n_t = [(1 - \theta_H)^{1/\tau} (n_t^F)^{\tau-1/\tau} + (\theta_H)^{1/\tau} (n_t^M)^{\tau-1/\tau}]^{\tau/\tau-1}, \quad (2)$$

where θ_H stands for the share of employment in the production sector dominated by male entrepreneurs and $1 - \theta_H$ the share of employment in the production sector dominated by female entrepreneurs. In addition, τ is the elasticity of substitution between the two production sectors for labor supply.

This form of labor market specification is justified by the way we capture the concept of representative agent in the model. The assumption of representative agent does not literally mean that one unique household divides its work time in both sectors; rather it is meant to represent a situation where a continuum of agents coexist but these different agents are sufficiently similar that treating them as one introduce no first-order problems. In such a context, equation (2) is simply interpreted as reflecting the presence of heterogeneity, mainly related to skills or education in the case of Cameroon, that makes the substitution of labor from one sector to another imperfect. As result, skilled or educated households mostly supply labor hours to the male entrepreneurs sector, by contrast, unskilled or uneducated households mostly supply their labor hours to the female entrepreneurial sector.

The representative household maximizes (1) subject to the intertemporal budget constraint:

$$c_t^H + D_t = w_t^F n_t^F + w_t^M n_t^M + R_{D,t-1} D_{t-1} + \Xi_t - T_t, \quad (3)$$

⁵Households have a discount factor β_H higher than both types of entrepreneurs. They are therefore more patient and are the model's economy natural lenders.

The right hand side of (3) describes the household's resources and the left hand side represents the uses of these resources. The household financial resources come from real wages received from the female-dominated sector, $w_t^F n_t^F$, and the male-dominated sector, $w_t^M n_t^M$, interest on deposits at the bank, $R_{D,t-1} D_{t-1}$, and profit from bank shares, Ξ_t . The household financial resources are used for consumption, c_t^H , deposits at the commercial banks, D_t , and lump sum taxes paid to government, T_t .

The Lagrangian for the household optimization problem is written as follows:

$$L = E_0 \sum_{t=0}^{\infty} \beta_H^t u(c_t^H, n_t) + \sum_{t=0}^{\infty} \beta_H^t \lambda_t (w_t^F n_t^F + w_t^M n_t^M + R_{D,t-1} D_{t-1} + \Xi_t - c_t^H - D_t - T_t), \quad (4)$$

Here λ_t is the Langrange multiplier on the representative household budget constraint (3) and optimization is subject to the definition of the composite labor effort, n_t , (2).

Households optimize over c_t^H , n_t^F , n_t^M , and D_t , taking prices and the initial values of the price level P_0 as well as the deposits D_0 as given. This yields the following first-order conditions for consumption, labor supply and deposits.⁶

$$\lambda_t = \varpi_t / (c_t^H); \quad (5)$$

$$\lambda_t w_t^F = \vartheta_t [(1 - \theta_H)^{1/\tau} (n_t^F)^{\tau-1/\tau} + (\theta_H)^{1/\tau} (n_t^M)^{\tau-1/\tau}]^{\tau/\tau-1-1} (1 - \theta_H)^{1/\tau} (n_t^F)^{\tau-1/\tau-1} / (1 - n_t); \quad (6)$$

$$\lambda_t w_t^M = \vartheta_t [(1 - \theta_H)^{1/\tau} (n_t^F)^{\tau-1/\tau} + (\theta_H)^{1/\tau} (n_t^M)^{\tau-1/\tau}]^{\tau/\tau-1-1} (\theta_H)^{1/\tau} (n_t^M)^{\tau-1/\tau-1} / (1 - n_t); \quad (7)$$

$$\lambda_t = \varpi_t (\beta_H)^t E_t [\lambda_{t+1} R_{d,t}]. \quad (8)$$

4.2 Production Sectors of Intermediate Goods

There is a continuum of infinitely lived agents involved in the production process. Some are female entrepreneurs and some are male entrepreneurs. Both female and male entrepreneurs produce intermediate goods, consume final goods, accumulate physical capital and pay wages to their workers, which are the households whose optimization problems have just been discussed. Female and male entrepreneurs are both financially constrained but evolve in two parallel production sectors that produce two imperfectly substitutable intermediate goods.

4.2.1 Production Sector Dominated by Female Entrepreneurs

Female entrepreneurs begin period t with capital holdings, k_{t-1}^F , which they purchased in the preceding period using bank loans. During period t they use that capital, alongside

⁶The derivative with respect to λ_t is omitted since it is equal to the budget constraint. This conditions result from the more general Kuhn-Tucker conditions assuming that all variables and multipliers are strictly positive.

hired labor, to produce intermediate goods; with the proceeds, she will pay labor, consume, pay back bank loans, and buy new capital for tomorrow subject to a financing constraint. Since female entrepreneurs are credit constrained, they discount the future more heavily than the households and the male entrepreneurs and this behavior guarantees that the credit constraints will bind in the neighborhood of the steady state we analyze.

In that context, the representative female entrepreneur maximizes expected utility as follows:

$$U_0 = E_0 \sum_{t=0}^{\infty} (\beta_F)^t \log c_t^F, \quad (9)$$

where β_F stands for the female entrepreneur's intertemporal discount factor and c_t^F is her individual consumption.

This entrepreneur maximizes (9) subject to the budget constraint:

$$c_t^F + w_t^F n_t^F + R_{L,t-1}^F L_{t-1}^F + q_t k_t^F = p_t^F y_t^F + L_t^F + q_t(1 - \delta)k_{t-1}^F. \quad (10)$$

The right hand side of (10) describes the entrepreneur's resources and the left hand side the uses of these resources. Financial resources come from sales of intermediated goods produced, $p_t^F y_t^F$, new bank loans, L_t^F , and the value of undepreciated physical capital she owns, $q_t(1 - \delta)k_{t-1}^F$. These resources are used to consume, c_t^F , to pay wage to workers, $w_t^F n_t^F$, pay back bank loans from last period, $R_{L,t-1}^F L_{t-1}^F$, and buy new capital for tomorrow, $q_t k_t^F$.

Each female entrepreneur has access to the following production function that takes labor and capital inputs and turns them into goods:

$$y_t^F = a_t^F (n_t^F)^{1-\alpha} (k_{t-1}^F)^\alpha, \quad (11)$$

where α represents the labor share in the production sector and a_t^F measures the total productivity factor (TPF) specific to the sector.

The law of motion for the stock of physical capital owned by the representative female entrepreneur is given by:

$$k_t^F = (1 - \delta)k_{t-1}^F + i_t^F, \quad (12)$$

where i_t^F represents investment in physical capital and δ is the depreciation rate of capital.

The financial frictions arise as follows. We assume that the amount of loans one entrepreneur can obtain is constrained by the value of the collateral he or she can pledge. In this model, collateral is materialized by physical capital holdings. The process implies that how much physical capital an entrepreneur can accumulate depends on the minimum loan return required by banks, which in turn depends on three main components: the LTV ratio, the expected future price $[E_t q_{t+1}]$ of capital pledged as collateral and the real

interest rate $R_{L,t}^F$ on loans. Consequently, variations in the quantity and in the value of collateral modify the transmission of shocks and can amplify their effects.

Written in equation term, this friction reads like:

$$R_{L,t}^F L_t^F \leq V_t^F ((1 - \delta)k_t^F) E_t[q_{t+1}], \quad (13)$$

where V_t^F stands for the maximum loan to value (LTV) ratio available to a given female entrepreneur. The borrowing constraint (13) shows that female entrepreneurs cannot borrow more than a fraction V_t^F of the expected future value of the stock of capital they pledged.⁷

The Lagrangian for the optimization problem is as follows:

$$\begin{aligned} L = & E_0 \sum_{t=0}^{\infty} (\beta_F)^t u(c_t^F) + \sum_{t=0}^{\infty} (\beta_F)^t \lambda_t^F (p_t^F y_t^F + L_t^F + q_t(1 - \delta)k_{t-1}^F - c_t^F - w_t^F n_t^F \\ & - R_{L,t-1}^F L_{t-1}^F - q_t k_t^F) + \sum_{t=0}^{\infty} (\beta_F)^t \lambda_{F,t}^V (V_t^F ((1 - \delta)k_t^F) E_t[q_{t+1}] - R_{L,t}^F L_t^F), \quad (14) \end{aligned}$$

where λ_t^F is the Lagrange multiplier on the budget constraint (10) and $\lambda_{F,t}^V$ is the Lagrange multiplier on the borrowing constraint (13).

The first-order conditions for consumption, labor, physical capital and loans demanded are expressed as:

$$\lambda_t^F = 1/(c_t^F), \quad (15)$$

$$w_t = ((1 - \alpha)Y_t^F)/(n_t^F), \quad (16)$$

$$\lambda_t^F q_t = E_t[\beta_F \lambda_{t+1}^F ((\alpha p_{t+1}^F Y_{t+1}^F)/(K_t^F) + (1 - \delta)q_{t+1}) + \lambda_{F,t}^V V_t^F (1 - \delta)q_{t+1}/(R_{L,t}^F)], \quad (17)$$

$$\lambda_t^F - \lambda_{F,t}^V = \beta_F E_t[\lambda_{t+1}^F] R_{L,t}^F, \quad (18)$$

Equation (17) shows that physical capital in the sector dominated by female entrepreneurs depends on its future productive capacity (the first part of the right hand side of (17)) but also on its value as collateral (the second part). Equation (18) demonstrates that the lending rate $R_{L,t}^F$ determines the sign of the multiplier associated to the collateral constraint.

4.2.2 Production Sector dominated by Male Entrepreneurs

The male entrepreneur's problem is very similar to that of the female one, so this subsection will be written in a more concise manner. Within this production sector, the representative entrepreneur maximizes its expected utility described as follows:

⁷This type of collateral constraints is used in several contributions to the literature on financial frictions. See Iacovello (2005) for instance.

$$U_0 = E_0 \sum_{t=0}^{\infty} (\beta_M)^t \log c_t^M, \quad (19)$$

where β_M stands for the male entrepreneur's discount factor and c_t^M his consumption. Since male entrepreneurs are also credit constrained (but less so than female entrepreneurs) they also discount the future more heavily than households ($\beta_M < \beta_H$).

The representative male entrepreneur solves (19) subject to the intertemporal budget constraint:

$$c_t^M + w_t^M n_t^M + R_{L,t-1}^M L_{t-1}^M + q_t k_t^M = p_t^M y_t^M + L_t^M + q_t(1 - \delta)k_{t-1}^M, \quad (20)$$

He also has access to a production function that takes labor and capital inputs and turns them into goods:

$$y_t^M = a_t^M (n_t^M)^{1-\alpha} (k_{t-1}^M)^\alpha, \quad (21)$$

The law of motion for the stock of physical capital is given by:

$$k_t^M = (1 - \delta)k_{t-1}^M + i_t^M, \quad (22)$$

while the equation for the financial friction reads like:

$$R_{L,t}^M L_t^M \leq V_t^M ((1 - \delta)k_t^M) E_t[q_{t+1}], \quad (23)$$

The Lagrangian for the optimization problem is as follows:

$$\begin{aligned} L = & E_0 \sum_{t=0}^{\infty} (\beta_M)^t u(c_t^M) + \sum_{t=0}^{\infty} (\beta_M)^t \lambda_t^M (p_t^M y_t^M + L_t^M + q_t(1 - \delta)k_{t-1}^M - c_t^M - w_t^M n_t^M \\ & - R_{L,t-1}^M L_{t-1}^M - q_t k_t^M) + \sum_{t=0}^{\infty} (\beta_M)^t \lambda_{M,t}^V (V_t^M ((1 - \delta)k_t^M) E_t[q_{t+1}] - R_{L,t}^M L_t^M), \end{aligned} \quad (24)$$

The first-order conditions for consumption, labor, physical capital and loans demanded are expressed as:

$$\lambda_t^M = 1/(c_t^M), \quad (25)$$

$$w_t = ((1 - \alpha)Y_t^M)/(n_t^M), \quad (26)$$

$$\lambda_t^M q_t = E_t[\beta_M \lambda_{t+1}^M ((\alpha p_{t+1}^M Y_{t+1}^M)/(K_t^M) + (1 - \delta)q_{t+1}) + \lambda_{M,t}^V V_t^M (1 - \delta)q_{t+1}/(R_{L,t}^M)], \quad (27)$$

$$\lambda_t^M - \lambda_{M,t}^V = \beta_M E_t[\lambda_{t+1}^M] R_{L,t}^M, \quad (28)$$

The takeaways from this sub-section are the two key differences between female and male entrepreneurs. First, the discount factor for female entrepreneurs β_F is lower than its counterpart for male entrepreneurs β_M . This feature implies that the ability of female

entrepreneurs to save pledgeable capital is reduced. Second, the female entrepreneurs' maximal LTV ratio in their borrowing constraint V_t^F is lower than its counterpart for male entrepreneurs V_t^M . This second feature means that female entrepreneurs can not pledge their accumulated capital as efficiently as male entrepreneurs.⁸

4.3 Final Goods Production Sector

Firms producing the economy's final good use the intermediate goods supplied by the sector dominated by female entrepreneurs y_t^F and those offered by the male-dominated sector y_t^M , using the following CES production function:

$$y_t = [(1 - \theta_y)^{1/\mu} (y_t^F)^{\mu-1/\mu} + (\theta_y)^{1/\mu} (y_t^M)^{\mu-1/\mu}]^{\mu/\mu-1}, \quad (29)$$

Final good producers choose y_t^F and y_t^M to maximize profits, given the production function (29) and input prices p_t^F and p_t^M :

$$\text{Max}_{y_t^F, y_t^M} [y_t - (p_t^F y_t^F + p_t^M y_t^M)], \quad (30)$$

The first order conditions for this problem imply the following demand for the output of the sector dominated by female entrepreneurs:

$$y_t^F = (1 - \theta_y) (p_t^F)^{-\mu} y_t, \quad (31)$$

and its counterpart for the sector dominated by male entrepreneurs:

$$y_t^M = \theta_y (p_t^M)^{-\mu} y_t, \quad (32)$$

Because final goods producing firms operate under perfect competition, profits are zero. Further, inserting the demand functions, (31) and (32), into the profit function and imposing the zero profit condition reveal that the only price P_t that is consistent with this requirement is given by:

$$P_t = 1 = [(1 - \theta_y) (p_t^F)^{(1-\mu)} + \theta_y (p_t^M)^{(1-\mu)}]. \quad (33)$$

We shall recall that our model is based on an RBC approach and one of its key assumptions is the flexibility of price. Hence, P_t the price of final goods serves to set inputs price p_t^F and p_t^M . Since the final good is the economy's numeraire, we set its price P_t equal to 1.

⁸One should not need to make a literally interpretation here.

4.4 Capital Producing Sector

Capital producers purchase final goods as investment goods I_t and transform them into physical capital that they sell to both types of entrepreneurs. These producers choose the quantity of investment to maximize profits as follows:

$$Max_{I_t} E_t[q_t I_t - I_t - \Psi/2(I_t/k_t - \delta)^2 k_t]. \quad (34)$$

The first order condition (relative to investment I_t) is given by:

$$E_t[q_t - 1 - \Psi(I_t/k_t - \delta)] = 0. \quad (35)$$

Since capital producers face an adjustment cost $(\Psi/2(I_t/k_t - \delta)^2 k_t)$ relation (35) highlights the relationship between the price of physical capital q_t and the marginal cost of adjustment. Note however that, at the stationary state, those adjustment costs are not active and the price of capital therefore equals one.

4.5 Banking sector

The representative bank intervenes in the model as supplier of loans to both entrepreneurial sectors. It solves the following problem:

$$Max_{E_0} \sum_{t=0}^{\infty} (\lambda_t/\lambda_{t-1}) \beta_H^t DIV_t, \quad (36)$$

where DIV_t represents the dividends paid to households, which are the ultimate owners of bank shares. Note that as a result, the discount factor in problem (36) is the same as in the household program and λ_t therefore represents the marginal utility of wealth for households.

Banks optimize subject to the flow of funds constraint

$$DIV_t + R_{D,t-1} D_{t-1} + L_t^F + L_t^M = D_t + R_{L,t-1}^F L_{t-1}^F + R_{L,t-1}^M L_{t-1}^M, \quad (37)$$

and the balance sheet identity:

$$D_t = L_t^F + L_t^M. \quad (38)$$

Here D_t represents households' deposits collected by the banking sector, while L_t^F and L_t^M are loans to the sector dominated by female and male entrepreneurs, respectively.

The Lagrangian associated with the banker's optimization problem is therefore the following:

$$L = E_0 \sum_{t=0}^{\infty} (\lambda_t/\lambda_{t-1}) \beta_H^t (D_t + R_{L,t-1}^F L_{t-1}^F + R_{L,t-1}^M L_{t-1}^M - R_{D,t-1} D_{t-1} - L_t^F - L_t^M), \quad (39)$$

with the associated first-order conditions for the choice of D_t , L_t^F and L_t^M :

$$(\lambda_t) = (\beta_H)E_t[\lambda_{t+1}]R_{d,t}, \quad (40)$$

$$(\lambda_t) = (\beta_H)E_t[\lambda_{t+1}]R_{L,t}^F, \quad (41)$$

$$(\lambda_t) = (\beta_H)E_t[\lambda_{t+1}]R_{L,t}^M, \quad (42)$$

4.6 Government

The government intervenes in the economy by following a policy of public spending represented by the process g_t . This spending is financed via lump sum taxes T_t and the government budget always binds, so that:

$$g_t = T_t. \quad (43)$$

Note that this implies the model abstracts from government debt; this feature could be introduced later in future extensions of our analysis.

4.7 Exogenous Stochastic Variables

The seven exogenous stochastic variables include the preference shock affecting the marginal utility of household ϖ , the preference shock affecting the marginal utility of the labor supply ϑ , the productivity shock hitting the production sector dominated by female entrepreneurs a^F , the productivity shock hitting the production sector dominated by male entrepreneurs a^M , the loan-to-value ratio in the sector dominated by female entrepreneurs V^F , its counterpart in the sector dominated by male entrepreneurs V^M and, finally the fiscal policy shock g . We assume that these exogenous variables follow AR (1) processes, so we define:

- The shock affecting the marginal utility of household:

$$\varpi_t = \rho_\varpi \varpi_{t-1} + \eta_{\varpi_t}, \quad (44)$$

with ρ_ϖ the autoregressive coefficient and η_{ϖ_t} an i.i.d. zero-mean innovation with standard deviation σ_ϖ .

- The shock affecting the marginal utility of the labor supply :

$$\vartheta_t = \rho_\vartheta \vartheta_{t-1} + \eta_{\vartheta_t}, \quad (45)$$

with ρ_ϑ the autoregressive coefficient and η_{ϑ_t} an i.i.d. zero-mean innovation with standard deviation σ_ϑ .

- The productivity shock in the sector dominated by female entrepreneurs:

$$a_t^F = \rho_{a^F} a_{t-1}^F + \eta_{a_t^F}, \quad (46)$$

with ρ_{a^F} the autoregressive coefficient and $\eta_{a_t^F}$ an i.i.d. zero-mean innovation with standard deviation σ_{a^F} .

- The productivity shock in the sector dominated by male entrepreneurs:

$$a_t^M = \rho_{a^M} a_{t-1}^M + \eta_{a_t^M}, \quad (47)$$

with ρ_{a^M} the autoregressive coefficient and $\eta_{a_t^M}$ an i.i.d. zero-mean innovation with standard deviation σ_{a^M} .

- The Loan-to-Value ratio in the sector dominated by female entrepreneurs:

$$V_t^F = \rho_{V^F} V_{t-1}^F + \eta_{V_t^F}, \quad (48)$$

with ρ_{V^F} the autoregressive coefficient and $\eta_{V_t^F}$ an i.i.d. zero-mean innovation with standard deviation σ_{V^F} .

- The Loan-to-Value ratio in the sector dominated by male entrepreneurs:

$$V_t^M = \rho_{V^M} V_{t-1}^M + \eta_{V_t^M}, \quad (49)$$

with ρ_{V^M} the autoregressive coefficient and $\eta_{V_t^M}$ an i.i.d. zero-mean innovation with standard deviation σ_{V^M} .

- The fiscal policy shock:

$$g_t = \rho_g g_{t-1} + \eta_{g_t}, \quad (50)$$

with ρ_g the autoregressive coefficient and η_{g_t} an i.i.d. zero-mean innovation with standard deviation σ_g .

4.8 Market Clearing Conditions

The equilibrium of this model consists of , $\{Y_t; n_t; c_t^H; c_t^F; c_t^M; k_t^F; k_t^M\}_{t=0}^\infty$, sequences of allocations of quantities , of , $\{L_t^F; L_t^M; D_t\}_{t=0}^\infty$, loans and deposits , of , $\{w_t^F; w_t^M; q_t; p_t^F; p_t^M\}_{t=0}^\infty$, prices , of interest rates $\{R_t^F; R_t^M; R_{D,t}\}_{t=0}^\infty$, of multipliers $\{\lambda_t^F; \lambda_t^M; \lambda_t; \lambda_{F,t}^V; \lambda_{M,t}^V\}_{t=0}^\infty$ and of processes $\{\varpi_t; \vartheta_t; a_t^F; a_t^M; V_t^F; V_t^M; g_t\}_{t=0}^\infty$, such that, on the one hand, the allocations solve the optimizing problems of households, producers, entrepreneurs and the banking sector at the equilibrium prices, and, on the other, all markets clear. The market-clearing conditions are as follows:

- In the final goods market:

$$y_t = c_t + i_t + g_t, \quad (51)$$

where aggregate consumption c_t is given as:

$$c_t = c_t^H + c_t^F + c_t^M, \quad (52)$$

and the aggregate stock of capital k_t is:

$$k_t = k_t^F + k_t^M, \quad (53)$$

and where, finally, the equilibrium of the Government budget is:

$$g_t = T_t. \quad (54)$$

- In the labor market, the market clearing condition is:

$$n_t = n_t^F + n_t^M. \quad (55)$$

- In the credit market, the market clearing condition is:

$$L_t^F + L_t^M = D_t. \quad (56)$$

5 Calibration Procedure of the Model

Table 1 presents the calibrated, numerical values of the model's key parameters. The calibration procedure assigns these numerical values using a mix of previous evidence, appeals to the literature, or by seeking some specific ratios in the data. These appeals are to past experience, the validity of economic theories, opinion of senior experts in the field, stylized facts about the economy and existing empirical literature.

Table 1: Value of the Calibrated Parameters in the Benchmark

Time Preferences			
β_H	β_F	β_M	
0.99	0.94	0.98	
Loan-to-Value Ratios in the Female and Male Sectors			
V^F	V^M		
0.5	0.8		
Production			
θ_y	δ	α	μ
0.5	0.04	0.3	1.01
Labor Market			
θ_H	τ		
0.5	1.01		

We calibrate the discount factors according to the degree of patience of economic agents. Because households are patient, their discount factor β_H is set to 0.99, a value generally admitted in the literature. Female entrepreneurs are impatient and their discount factor β_F is calibrated to 0.94, which is in accord with the range suggested by Iacoviello (2005) and Iacoviello and Neri (2008) for impatient agents. Male entrepreneurs are more patient than female entrepreneurs, but less so than households; hence, we calibrate their discount factor β_M to 0.98. The lower value of discount factor for female entrepreneurs is meant to reflect aspects of the Cameroonian economy where in contrast to their male counterparts, female entrepreneurs may face difficulties, institutional or cultural, projecting themselves in the future; as a result they save less, thus accumulating less pledgeable collateral.⁹

The calibration of the Loan to Value ratio (LTV) of female entrepreneurs deserves some attention. Christensen et al. (2007), estimate a lower value of the LTV (0.32), in a model for Canada where firms can borrow against business capital. Iacoviello (2005) estimates a value of 0.89, but, in his model, only commercial real estate can be collateralized. In contrast to those previous studies in our economy entrepreneurs borrow against physical capital and we feature heterogeneity among entrepreneurs, with female entrepreneurs being more constrained than their male counterparts because they can not pledge their accumulated capital as efficiently as male entrepreneurs. As result, we calibrate a lower value of the LTV for female entrepreneur V^F , at 0.5, and a higher value of LTV of male entrepreneurs V^M , at 0.8.

The shares of employment in both production sectors in composite labor θ_H is set to 0.5 and so is the share of intermediate goods produced in the production sector dominated by female entrepreneurs θ_y . The elasticity of substitution between employment in both sectors for labor supply τ is calibrated at 1.01 and so is the elasticity of substitution between the two sectors μ . The depreciation rate of physical capital δ is set to 0.04 and the share of capital in the production process α is set to 0.3 These parameter values represent a benchmark: an extended analysis could explore the consequences of using different calibrations.

6 The Steady-State of the model

Tables 2-4 present the steady state of the model for four versions of the economy. First, the benchmark case in Table 2 represents the economy's steady state when female entrepreneurs are more financially constrained than male entrepreneurs because of their lower LTV ratio and lower discount factor, as indicated in the calibration section above.¹⁰

Next, Table 3 illustrates the implications of lowering the severity of financial constraints on female entrepreneurs. To do this, the female sector (sector F for short) discount factor β_F changes from a value of 0.94 (benchmark case) to 0.97, causing female entrepreneurs

⁹One should not need to make a literally interpretation here.

¹⁰All the model's equation leading to the steady state are available in Appendix A.2.

to become more patient and save more capital. In addition, the sector F's LTV ratio, V^F , changes from a value of 0.5 (benchmark case) to 0.7, which allows female entrepreneurs to pledge their capital more efficiently.

Table 4 then illustrates the economy's steady state when the male entrepreneurial sector is more constrained than its female counterpart. To obtain this result, this discount factor for sector F, β_F , is set to 0.99, which causes female entrepreneurs to become more patient than male entrepreneurs. In addition, the sector F's LTV ratio V^F changes to 0.9, which again implies that male entrepreneurs are more severely constrained than female entrepreneurs.

Finally, in both table 12 and 13, a case is illustrated where both sector are equally, but very lightly constrained. This case is obtained by setting, in both sectors, the same value for discount factor ($\beta_F = \beta_M = 0.98$) and the same value for LTV ratio ($V^F = V^M = 0.8$).

Table 2 shows that in the benchmark economy, the M sector is capital intensive, with a capital-labor ratio equal to 13.03, in contrast to the much lower value of 6.31 in sector F. As a counterpart, the table shows that the sector F is labor intensive: the labor input in that sector is 60 percent of total hours, against 40 percent for the M sector. The M sector thus employs a relatively small portion of the economy's workforce but equips each worker with significantly more capital.

Table 2: Features of the Economy's Steady State

Variables	Benchmark
Capital-Labor ratio in sector F (k^F/n^F)	6.31
Capital-Labor ratio in sector M (k^M/n^M)	13.03
Sector F proportion of value-added ($p^F y^F/y$)	0.52
Sector M proportion of value-added ($p^M y^M/y$)	0.47
Household consumption to GDP (C^H/y)	0.73
Sector F consumption over GDP (C^F/y)	0.047
Sector M consumption over GDP (C^M/y)	0.031
Total consumption over GDP (C/y)	0.81
Sector F investment to GDP (I^F/y)	0.080
Sector M investment to GDP (I^M/y)	0.10
Sector F hours over total hours ($n^F/n^F + n^M$)	0.60
Sector M hours over total hours ($n^M/n^F + n^M$)	0.39

The table goes on to show that female entrepreneurs consume more (because they value the future less) and as result, they save less. Male entrepreneurs by contrast, consume less and save more. Hence, the consumption of female entrepreneurs over aggregate GDP is 4.7 percent, against 3.1percent for the male entrepreneurs. Male entrepreneurs therefore accumulate more pledgeable collateral, and can undertake more investment projects than female

entrepreneurs. The proportion of aggregate investment generated by male entrepreneurs over aggregate GDP is 0.10, in contrast to 0.08 for female entrepreneurs.

Furthermore, because the F sector is the most financially constrained, its costs are higher and it is relatively expensive to produce in this sector; goods in this sector thus become scarce. As the demand of those goods remains unchanged, this shift in supply implies that their prices rise, leading to an increase in the valued added of the sector. For the M sector by contrast, it is easier to produce, because the financial constraints are less severe; goods from this sector thus become abundant. This increase of M sector supply leads to a price decrease, and the value added of the sector therefore declines. Hence, the proportion of value added for F sector (0.52) is greater than the proportion for the M sector (0.47).

Table 3: Features of the Economy’s Steady State when the Female Entrepreneurial Sector is Less Severely Financially Constrained

Variables	Benchmark	Less Severe Fin. Constraint	Sym. Light
Capital-Labor ratio in sector F	6.31	10.53	12.03
Capital-Labor ratio in sector M	13.03	12.23	12.03
Sector F proportion of value-added	0.52	0.50	0.5
Sector M proportion of value-added	0.47	0.49	0.5
Household consumption to GDP	0.73	0.739	0.74
Sector F consumption over GDP	0.047	0.023	0.014
Sector M consumption over GDP	0.031	0.017	0.014
Total consumption over GDP	0.81	0.78	0.77
Sector F investment to GDP	0.080	0.10	0.11
Sector M investment to GDP	0.10	0.11	0.11
Sector F hours over total hours	0.60	0.52	0.5
Sector M hours over total hours	0.39	0.47	0.5

*Sector M is Male Entrepreneurs Sector and Sector F is Female Entrepreneurs Sector.

The results of Table 3 indicate that when the financial constraint on female entrepreneurs is looser, (second column of Table 3), their production sector becomes capital intensive contrast to labor intensive in the benchmark case. Thus, as female entrepreneurs are becoming less constrained, their sector becomes more capital intensive. The capital-labor ratio of the female sector increases from 6.31 to 10.53 and this increase reaches 12.03 in the case of very light and symmetric constraints in both sector, (third column of Table 3). The production sector dominated by male entrepreneurs is itself becoming labor intensive. The labor hours of male entrepreneurs sector over total labor hours is 17 percent greater than under the benchmark, an increase that reaches 22 percent under the case of very light and symmetric constraints in both sector.

Moreover, the table shows that female entrepreneurs save more than in the benchmark case, and so do Male entrepreneurs: the female entrepreneurial sector consumption-output ratio is 0.023 lower than it was in the benchmark, and even reaches 0.014 under the case of symmetric light constraints in both sectors.

Further, the loosening of the financial constraint affecting female entrepreneurs increases the investment capabilities of the sector. Investment of female entrepreneurs, as a proportion of output, is 25 percent greater than under the benchmark and now comes close to the case of symmetric light constraints in both sectors. Hence, as female entrepreneurs become less constrained, their investment level increases towards to the levels of their male counterparts.

The easier availability of resources facilitates the production of intermediates goods in the female entrepreneurial sector. As the demand of those goods remains relatively unchanged and their supply is increasing, their price declines alongside a gradual decrease of their value added. Male entrepreneurs meanwhile begin to lose market share and the relative supply of their good is decreasing. As result, the price of their goods increase and this induces a rise of the sector's value added. The proportion of value added in the female entrepreneurs sector is 4 percent lower than under the benchmark, a proportion equivalent to the case with symmetric lightly constraint in both sectors. In contrast, concerning the male entrepreneurs sector, the proportion of value added is 4 percent greater than in the benchmark, an increase that reaches 6 percent under the last case.

Table 4: Features of the Economy's Steady State when the Male Entrepreneurs Sector is More Financially constrained than Female Entrepreneurs Sector

Variables	Benchmark	Sector M More Fin. Const.	Sym. Light
Capital-Labor ratio in sector F	6.31	13.01	12.03
Capital-Labor ratio in sector M	13.03	11.92	12.03
Sector F proportion of value-added	0.52	0.49	0.5
Sector M proportion of value-added	0.47	0.50	0.5
Household consumption to GDP	0.73	0.74	0.74
Sector F consumption over GDP	0.047	0.0066	0.014
Sector M consumption over GDP	0.031	0.0117	0.014
Total consumption over GDP	0.81	0.76	0.77
Sector F investment to GDP	0.080	0.119	0.11
Sector M investment to GDP	0.10	0.114	0.11
Sector F hours over total hours	0.60	0.48	0.5
Sector M hours over total hours	0.39	0.51	0.5

*Sector M is Male Entrepreneurs Sector and Sector F is Female Entrepreneurs Sector.

The results depicted in Table 4 suggest that when female entrepreneurs are given easier access to credit than male entrepreneurs, their production sector is the one that becomes capital intensive. The capital-labor ratio for female entrepreneurs is 13.01, greater than the 6.31 level achieved in the benchmark case. By contrast, the production sector dominated by male entrepreneurs becomes labor intensive: labor hours of that sector relative to total labor hours is now 0.51 greater than under the benchmark.

The expansion of access to credit to female entrepreneurs, relative to male entrepreneurs, and the increase of their saving provide the sector with the capacity to undertake more investment project and increases their market share, as much as male entrepreneurs did. As a result, investment of female entrepreneurs over GDP is 0.119, greater than the benchmark, and even greater than in the case with symmetric light constraint in both sectors (third column of Table 4).

Due the fact that the female entrepreneurial sector has now more resources than its male counterpart, it becomes easier to produce intermediate goods in this sector and goods from this sector become abundant. As the demand for those goods has remained relatively unchanged, their supply increases and their prices decline, leading to a decrease of the valued added of the sector. For the male entrepreneurial sector it becomes difficult to produce intermediates goods because of lack of financing and the goods from this sector become scarce. This decrease of supply leads to an increase of their price, as the demand of those goods remains relatively unchanged. The value added of the sector increase in consequence relative to the female sector. The proportion of value added of the female entrepreneurial sector is thus 0.49 lower than benchmark, and by contrast, in the male entrepreneurial sector, this proportion is 0.50 greater that under the benchmark, a rate equivalent to the case where both sectors are symmetrically light constrained.

7 Simulations Results

This section provides an overview of the benchmark analysis against which counterfactual scenarios can be compared. DSGE models offer the possibility of examining alternatives scenarios about the impact of policies on macroeconomics variables. In what follows, we discuss the benchmark and three counterfactual scenarios.

7.1 Benchmark analysis

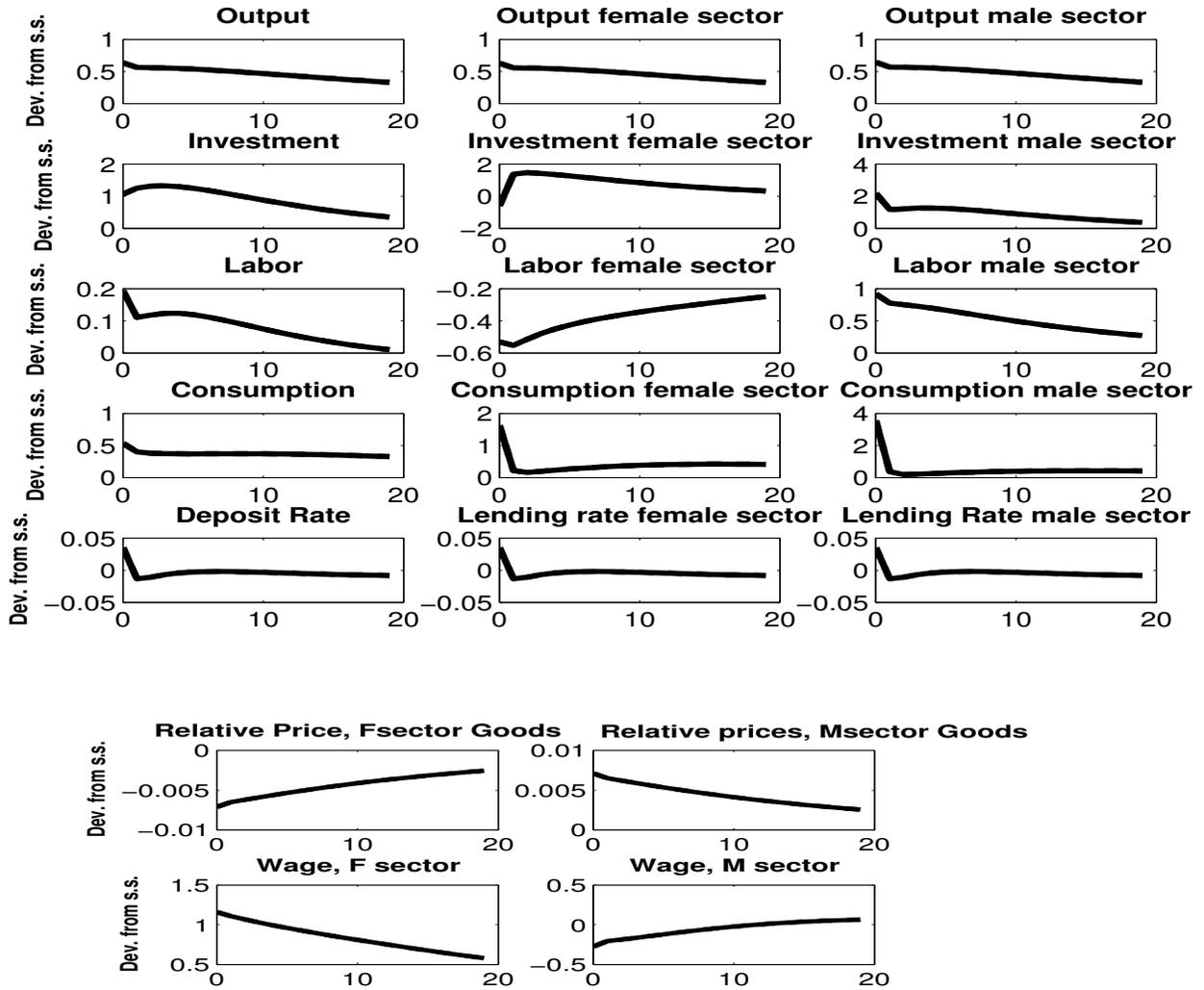
The benchmark analysis illustrates the macroeconomic consequences of the key idea of the paper: entrepreneurs face collateral constraints when assessing credit, and female entrepreneurs face particularly severe such constraints. Three shocks are examined, a productivity shock in the female entrepreneurial sector, a financial shock in the female entrepreneurial sector, and a fiscal policy shock.

7.1.1 Productivity shock in the female entrepreneurial sector

Figure 1 depicts the response of the economy following a 1 percent positive shock to a_t^F , the productivity in the female entrepreneurial sector. At first view, the figure shows that the increase in productivity leads to an expansion of the economy. This positive effect is boosted by the presence of the banking sector in the model and two channels are involved in the propagation of this mechanism: the collateral constraint channel, whereby an innovation changes the shadow value of loans and therefore consumption rises, and the assets-price effect, whereby changes in the value and levels of the capital alter their collateral value when entrepreneurs pledge them as guarantee. Hence, the accumulation of physical capital pushes the physical capital price up, so that entrepreneurs also benefit from the wider access to credit that higher collateral values affords. As result, investment is enhanced both by the technological improvement and by the eased access to credit, so that aggregate saving, labor demand and output feature a common increase.

Basically, the higher productivity in the female entrepreneurial sector increases production by firms. As production in the female entrepreneurial sector increases, wages also increase. However, because of the fall of relative prices, the sector cuts its demand for labor. By contrast, the male sector become less competitive, its relative prices increases, leading the sector to reduce wages in order to hire more workers and increase its productive capacities. Hence, while demand for capital increases in the female entrepreneurial sector, demand for labor increases in the male entrepreneurial sector. The initially stronger increase of demand induces an even stronger supply of loans due to asset-price effect. This improvement in credit conditions boosts real activity and allows both types of entrepreneurs to expand investment further, which in turn induces a higher price of capital and hence higher collateral valuations, reinforcing the initial effect. As response, in the female entrepreneurial sector, the increase in saving and investment induce a persistent increase of the sector output. Likewise, increases of labor and consumption demand, as well as the increase of investment, lead to sharp increase of the male entrepreneurial sector output.

Figure 1. A productivity shock in the female entrepreneurial sector



7.1.2 Fiscal Policy shock

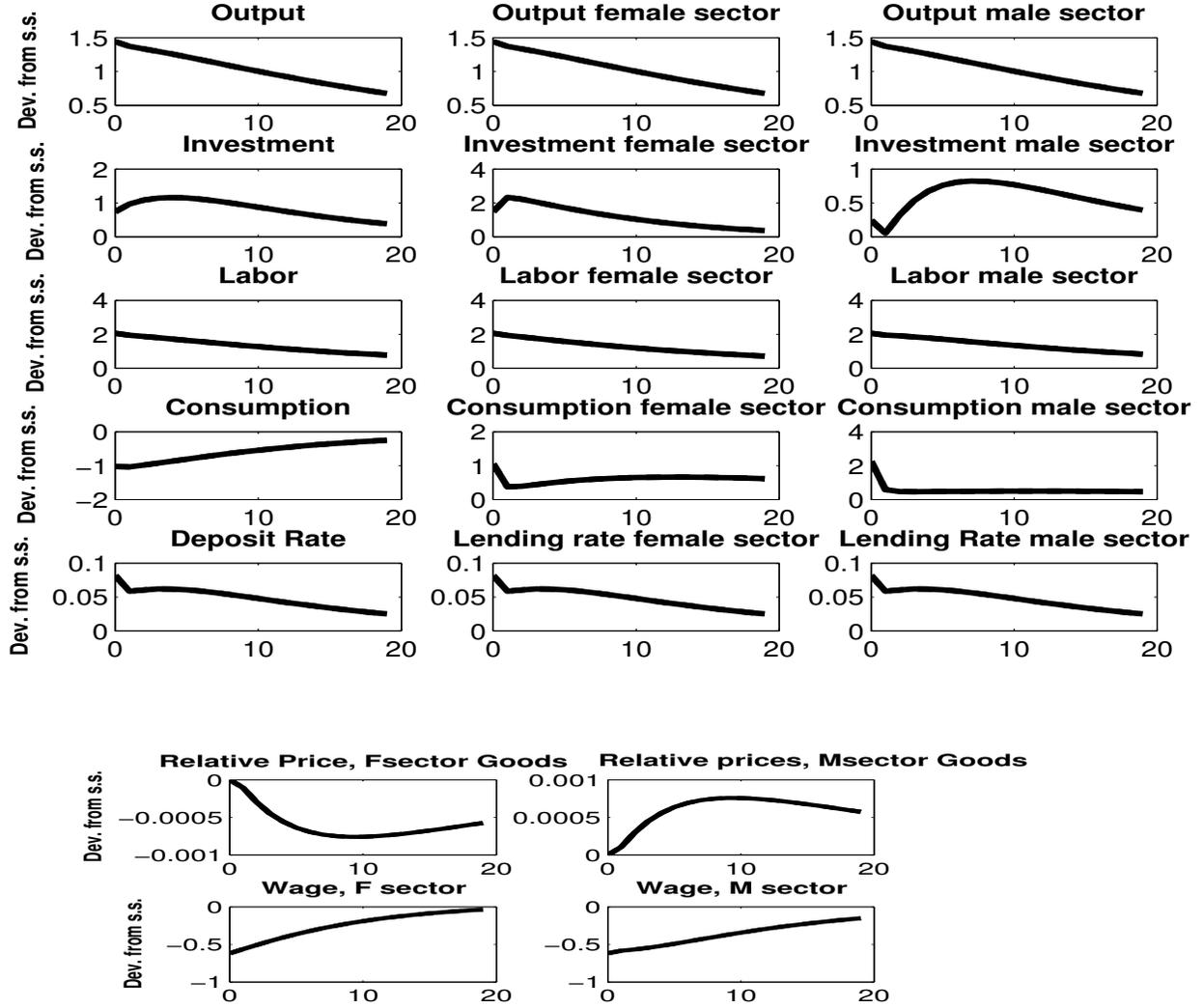
Figure 2 depicts the effect of an increase in public spending (a fiscal policy shock). An increase of public expenses financed by taxes paid by household increases the transfer from household to the government. The increase of taxes payment leads to the decrease of the disposable revenue of households. As result, the demand for deposits in the banking sector will be negatively affected. The fall of deposits induces the decline of banking sector assets. To re-balance its balance sheet, the banking sector will seek to reduce loans and increase deposits. Subsequently, the deposit rate as well as the lending rates will rise. Loans volumes decline for both entrepreneurs, and thus lead to the reduction of funds available for them.

This process is intensifying by the collateral constraint channel, as the banking sector could increase the requirements for banks loans supply, including collaterals. Since the production sector dominated by female entrepreneurs are more constrained, this will further accentuate their shortage in the credit market. Female entrepreneurs will cut their wage substantially because of the fall of their relative prices. At the same time they will increase labor demand and saving due to the positive effect of the policy, which will increase investment and leads to an increase of the sector output.

In contrast, the production sector dominated by male entrepreneurs is less constrained and will easily overcome the adverse effect of the policy via the collateral channel. The level of loans granted to the sector will be at least identical to level before the policy. The male entrepreneurs' sector will thus increase their investment and consumption demand. Also, to compensate the high cost of capital, the male entrepreneurs sector will increase the demand for labor. The rise on investment and consumption lead to an increase of the output of the sector.

Overall, the rise of the female sector saving offset the increase of consumption in the male sector and induce a sharp increase of aggregate savings. The increase of aggregate investment and saving limits the effect of the collateral channel in the female entrepreneurial sector and leads to an increase of aggregate output and job creation in the economy.

Figure 2. A fiscal policy shock



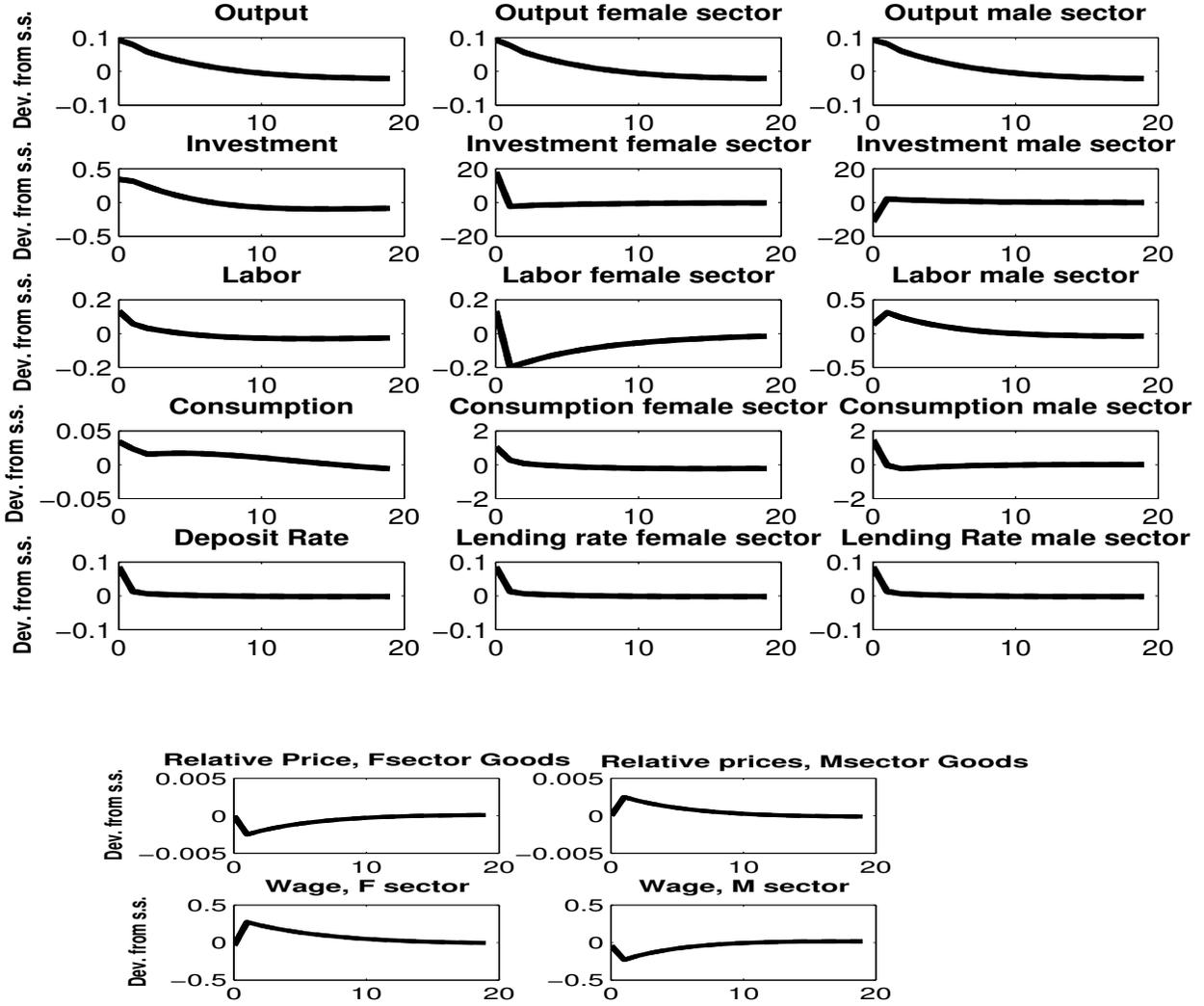
7.1.3 A Loan-to-value shock ratio in the female entrepreneurial sector

Figure 3 depicts the reaction of the economy following a 1 percent positive LTV shock in the female entrepreneurial sector. An increase of a Loan to Value ratio loosens the financial constraint and allows an increase in loans demand. The resulting rise in investment induces an increase in labor hiring and capital demand. Higher demand for capital sharply increases its value, relaxing the collateral constraint further. There is a short-lived increase in the deposit, which decreases sharply afterward and induces the increase of consumption. Thus, a loosening borrowing constraint has an expansionary effect in the economy, which leads to an increase in aggregate investment and savings, aggregate labor demand and the aggregate GDP.

Both sectors of production react differently following the shock. In the female sector, the shock has an expansionary effect. The main contributor of the economy's wealth in this case appears thus to be the production sector dominated by female entrepreneurs. Since the female entrepreneurs know that the shock is temporary and that they would not be able to sustain higher investment in the long run, they initially mostly increase investment and only slightly saving. Subsequently, rising investment and saving lead to higher output in the sector. The lessening of the collateral constraints induces by the shock further amplifies the effect by allowing an increase in labor demand by the female entrepreneurial sector.

The loosening of the financing constraint in the female entrepreneurial sector shrinks the quantity of loans available for the male entrepreneurial sector. The sector reacts by reducing its investment projects realizations. This leads afterward to smooth investment level towards steady state overtime. Luckily, the increase in consumption offsets the low level of investment and induces an increase of the sector output. Moreover, as the female sector is becoming competitive, relative prices in both sector becomes similar and induce a similar and stable wage level in both sectors.

Figure 3. A LTV ratio shock in the female entrepreneurial sector



7.2 Scenarios Analysis

Two main scenarios are involved in this analysis. At first we simulate an economy where the financial constraint is loosening in the female entrepreneurs sector. Secondly, we design a scenario where the financial constraint is symmetric and light in both sectors.

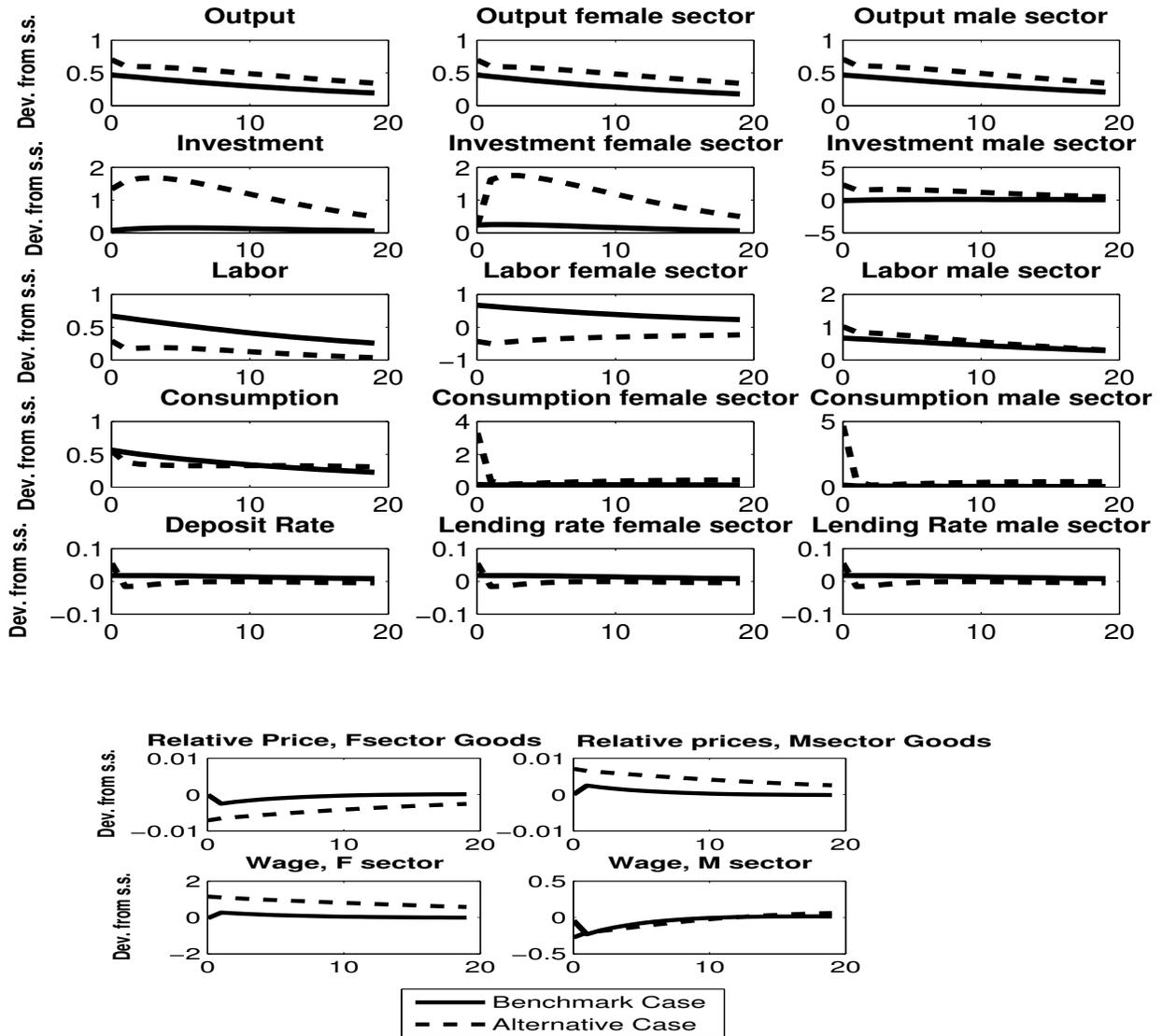
7.2.1 Productivity shock in the case of the First Scenario

Figure 4 denotes a 1 percent positive productivity shock to the female sector when the financial constraint is loosened in the same sector. Results reveal that, when financial constraint is loosening in the female sector, the expansionary effect of the positive productivity shock becomes larger than in the case where the financial constraint is tighter (benchmark). The asset-price effect leads to an increase of aggregate investment more than the case of tighter constraint. In addition, the collateral constraint channel induces an increase of aggregate consumption than under the benchmark case. Both channels lead to increases in aggregate output above what was the case under the tighter financial constraint.

As financing conditions in the female entrepreneurial sector become easier, its relative prices diminishes below the benchmark level. The sector responds to the productivity shock by reducing its demand for unskilled workers and increasing in turn its demand for physical capital. The acquisition by the sector of more physical capital relative to unskilled labor leads to an expansion of its investment level above the benchmark level. In addition, the accumulation of physical capital pushes the price of physical capital up, and induces higher collateral valuations, which amplify the initial effect. The positive effect of higher collateral valuation raises the sector output above the benchmark level. Furthermore, because the female entrepreneurial sector is becoming competitive, it will raise its wages above the benchmark level in order to attract more skilled workers.

By contrast, in presence of loosening financing frictions in the female entrepreneurial sector, the male sector will face an increase of its relative prices above the benchmark. The male sector which has become less competitive, reacts to the productivity shock by hiring more workers than under the benchmark case with end of enhancing its productive capacities. Due to the lack of additional funding, the male sector invests less than the female entrepreneurial sector, and its investment level remains slightly above the benchmark level. To sustain its investment decisions and stay competitive, the male entrepreneurial sector will reduce its wage below the benchmark level. As the sector adjusts to the new financing condition, the low labor cost and increase in labor demand lead to an increase of the output of the sector above the reference case.

Figure 4. Productivity shock in the female entrepreneurial Sector



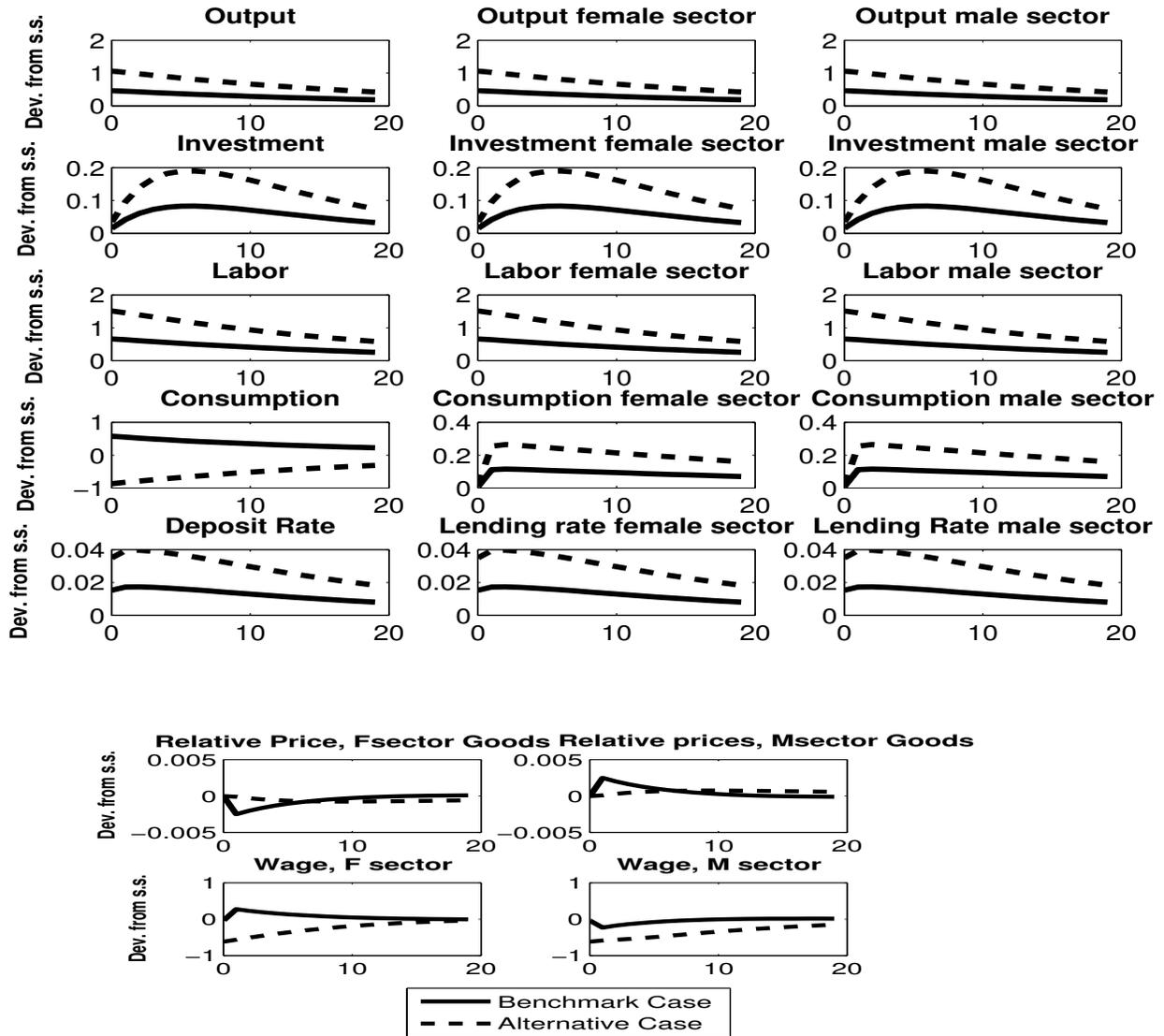
7.2.2 Fiscal Policy Shock in case of Second Scenario

Figure 5 denotes the reaction of the economy following the 1 percent positive fiscal policy shock when both sectors face symmetric and light financing constraint, alternative case by contrast to our benchmark results. The increase of public expenses induces increases of the deposit rate, which leads to a rise in aggregate saving. The shock also leads to an increase of job creation above the benchmark level. In presence of sufficient factors of production, aggregate investment rises up above the benchmark and induces an increase of aggregate output and savings above the benchmark level.

In the sectorial point of view, the male sector responds to the positive fiscal shock by expanding its investment capabilities, as well as its labor demand above the benchmark level. However, the increase in investment in the male sector leads to an increase of its goods supply. In presence of stable demand of goods, the male sector relative prices fall below the benchmark level. Hence to sustain its decision of hiring more workers in face of high investment and low prices, male entrepreneurs will reduce the salaries, which collapse below the benchmark level. The combination of low labor cost and increases in employment level raise the male sector output above the benchmark level.

By contrast, the female sectorial responds to the positive fiscal shock by reducing its labor cost which decrease below the benchmark level. In fact, female entrepreneurs discount the upcoming increases of male sector investment and try to preserve their market share by expanding their investment level above the benchmark level. To sustain its high investment level, female entrepreneurial sector enhances its labor demand above the benchmark level. The high labor inputs combined with the low labor cost stimulate an increase in labor productivity of the female entrepreneurial sector. This increase in the female entrepreneurial sector labor productivity amplifies its investment decision and induces a sharp increase of aggregate output of the sector above the benchmark level. The increase of goods production of the female entrepreneurial sector in a face of a stable demand of goods, induces a sharp decline of its relatives prices. Theses results confirm that, where financial constraint is symmetric and light in both sectors, the economy records an increase in investment, job creation, labor productivity and overall output.

Figure 5. A Fiscal Policy shock



8 Conclusions and policy implications

Economists recognize that financial sector imperfections are relevant not only to explain economic development and the impact of financial frictions on real economy, but also to help design appropriate stabilization policy. In this research we took a closer look at exactly which financial frictions impact female entrepreneurship in its borrowing operations and which policies are more effective for overcoming these frictions and allowing sustainable macroeconomic outcomes.

The related literature emphasizes that the study of macroeconomic implications of financial frictions is based on DSGE models. The framework can be an RBC approach or a New-Keynesian approach. The type of financial frictions can be an External Finance Premium version or a Collaterals Constraints version.

This research uses thus a DSGE model with financial micro-foundation to assess the problem of female entrepreneurs facing financial frictions and its macroeconomics implications. The model features two sectors, namely, a production sector dominated by female entrepreneurs and a production sector dominated by male entrepreneurs. Financial frictions appear because entrepreneurs face collateral constraints when borrowing from the banking sector. The dynamic analysis confirms collateral constraint as the key financial friction faced by female entrepreneurs in the credit market in Cameroon. The less collateral constrained sector is relatively capital intensive and the more collateral constrained sector is relatively labor intensive.

The benchmark analysis reveals that financial frictions in the credit market matter in the sluggishness of macroeconomics outcomes. The counterfactual scenarios analyses show that loosening financial constraints improves female entrepreneurs' productivity and job creation with expansionary implications in the macroeconomic outcomes. In addition, the male sector and female sector are complementary in sustaining economy activity during a downturn. Furthermore, when the financial constraint is symmetric and light in both sectors, the Cameroonian economy gains in terms of GDP growth and increases in investment, job creation and labor productivity.

The policy implications arising from the results of the research are:

- Female entrepreneurs' financial inclusion should be fostering.
- A National Agency which plays a role for collateral and guarantees female entrepreneurs' debt contracts from the banking sector, can help to alleviate frictions in the credit market and enhance female entrepreneurship.
- Law enforceability should overcome remaining cultural obstacles so as to defend equal rights between males and females regarding family properties, such as land, real estate or shares, in order to allow female entrepreneurs who own them to directly use them as collateral.

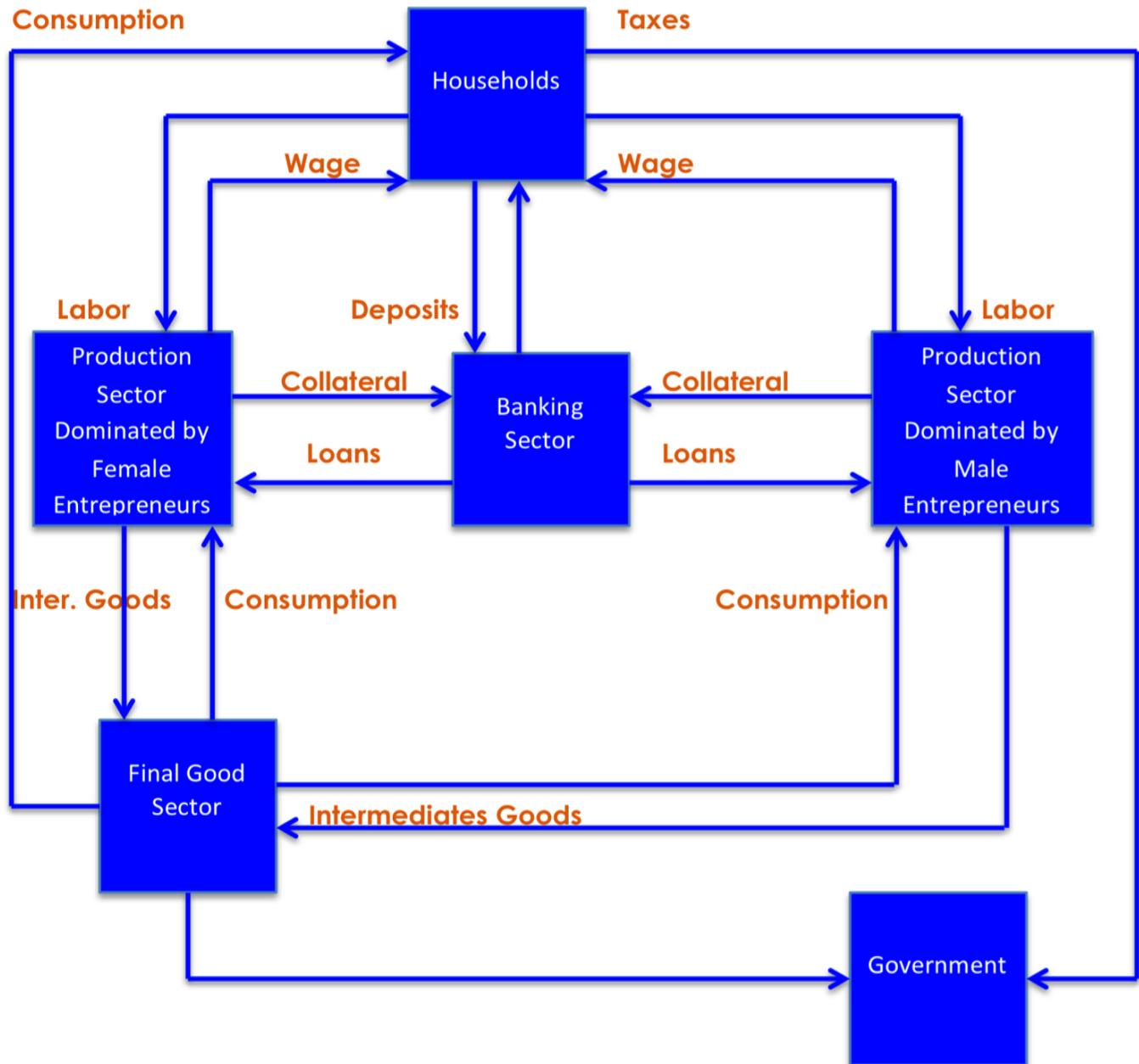
- The Central Africa Banking Commission should adopt a new strategy that relaxes collateral constraints, in order to avoid the banking sector implicitly discriminating female entrepreneurs.
- Cameroonian authorities can adopt a Targeted Policy of loosening female entrepreneurship financing, using public bonds or securities by collecting financing from citizens and directly financing female entrepreneurs' projects.

For further research, we recommend introducing financial frictions in the banking sector to feature the potential weakness of the banking sector and also to capture the external sector by adopting an open economy model. In addition, it would be important to include monetary policy in the model to feature the effect of a mix of policies in the face of financial frictions, something that was prevented by the specification of the model. Furthermore, it would be also relevant to model government behaviour endogenously, contrast to the simple specification of government in our model, in order to feature government debt, which is a reality in Cameroon and in other low-income developing countries. Compared to other models built for other countries, this model features gender-specific financial frictions in a two-sector DSGE model. The model reveals that frictions are severe in the female dominated sector, but less so in the male-dominated sector. The model is calibrated to a low-income developing country as a case study. The model assesses the dynamic implications of these differentiated frictions.

9 Appendix

A.2. The pictogram of the DSGE model

Figure 6. The pictogram of the Theoretical DSGE model



A.3. Tables

Table 1. Net rate of school attendance in secondary cycle

	2001			2004			2007			2010		
	F	M	T	F	M	T	F	M	T	F	M	T
Urban area	52.9	54.6	53.7	49.1	49.1	49.1	59.6	60.5	60.0	67.8	66.4	67.8
Rural area	25.8	21.6	23.7	14.9	14.7	14.8	38.1	30.5	34.4	41.6	35.2	38.4
General	35.7	33.9	34.8	27.6	27.6	27.6	45.1	41.0	43.1	51.5	47.8	49.6

Sources: Authors using ECAMII (2001), ECAM III (2007), EESI 2 (2010).
 "F" refers to female. "M" refers to Male. "T" refers to total.

Table 2. Distribution of active males and females according to institutional sectors

	2001			2005			2007			2010		
	F	M	T	F	M	T	F	M	T	F	M	T
Public	8.7	3.4	6.1	6.7	2.9	4.9	5.7	2.4	4.1	7.2	4.3	5.8
Formal Private	14.7	4.5	9.7	7.5	1.8	4.7	6.9	2.0	4.5	5.3	1.9	3.7
Non-agricultural informal sector	24.3	23.6	23.9	34.7	35.7	35.2	30.9	28.5	29.7	38.9	35.9	37.5
Informal agricultural sector	52.4	68.5	60.3	51.0	59.6	55.2	56.5	67.1	61.7	48.5	57.9	53.0

Sources: Authors using ECAM II (2001), ECAM III (2007), EESI 1 (2005), EESI 2 (2010)

Table 3. Proportion of females involved in political positions

Position	2001/2002			2004/2005			2007/2009			2009/2010			2010/2011		
	T	F	%F	T	F	%F	T	F	%F	T	F	%F	T	F	%F
Prime Minister	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0
Vice-Prime Minister	-	-	-	-	-	-	-	-	-	2	0	0	1	0	0
Minister of State	7	0	0	5	0	0	3	0	0	3	0	0	2	0	0
Minister	22	2	9.1	32	4	12.5	31	5	16.1	31	5	16.1	31	5	16.1
Minister* delegate	3	0	0	10	0	0	8	0	0	9	1	11.1	15	0	0.0
Secretary of State	12	1	8.3	10	2	20	6	1	16.6	6	1	16.6	10	2	20
Total	45	3	6.7	58	6	10.3	51	6	11.8	52	7	13.5	60	7	11.7

Source: Authors using data from Prime Minister, CT N° 8242/4441 of 9/12/2004, CT N° 8930/5129 of 10/09/2007, CT N°9381/5582 of 01/07/2010, CT N° 9988/6189 of 10/12/2011.

*Minister in charge of Assignment are assimilated to Minister delegate

"F" refers to female. "%F" refers to in percentage to female. "T" refers to total.

Table 4. Distribution of positions within the Municipality Committee

Responsibilities position	2002/2007			2007/2012		
	Number of position	Number of position occupied by female	% of female	Number of position	Number of position occupied by female	% of female
Mayor	339	10	2.9	360	24	6.7
First Deputy-Mayor	339	37	10.9	360	57	15.8
First Deputy-Mayor	339	88	26	360	84	23.3
First Deputy-Mayor	67	16	24	98	16	16.3
First Deputy-Mayor	01	01	100.0	97	12	12.4
Municipal Advisers				10632	1651	15.5

Source : Authors using data of INS (2012) and CT N°9844/6045 of 11/05/2011

Table 5. Proportion of females in the Governance Agency

Agency	2007				2011			
	M	F	T	%F	M	F	T	%F
CONAC	11	0	11	0				
ELECAM	9	3	12	25	13	5	18	27.8
SUPREME COURT	55	6	61	9.8	55	6	61	9.8
ANIF	22	10	32	31.3	22	10	32	31.3

Source: Authors using data from Presidential Decrees N°2007/077, N°2007/078 and N°2007/079 for appointment of CONAC members; N°2008/463 and N°2011/204 for appointment of ELECAM members; N°2006/464 and N°2006/465 for appointment of Supreme Court Judges.

"M" refers to Male. "F" refers to female. "%F" refers to in percentage to female. "T" refers to total.

Table 6. The Cameroon's Gender Gap Index

	Rank (out of 144 countries)	Score (0.00 = inequality 1.00 = equality)	Sample average	Female	Male	Female to male ratio
Political empowerment	65	0.180	0.233			0.18
Women in Parliament	38	0.452	0.270	31	69	0.45
Women in Ministerial in Positions	88	0.163	0.247	14	86	0.16

Source : The Global Gender Gap Report (2016)

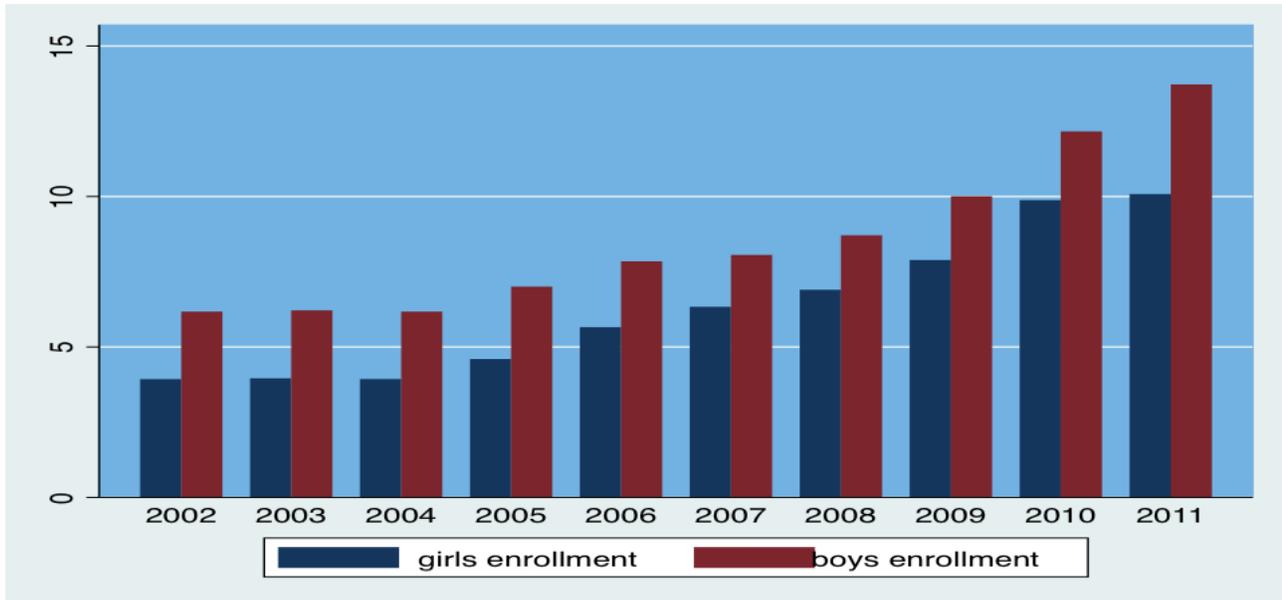
Table 9. Distribution of credit by nature and duration

	Percentage
Long-term credit	1.25%
Long-term credit to investment	0.48%
Long-term credit to real estate	0.12%
Long-term credit to equipment	0.06%
Long-term consolidated credit	0.00%
Long-term consolidated campaign credit	0.31%
Long-term credit to consumption	0.03%
Medium-term credit	34.77%
Medium-term credit to investment	10.86%
Medium-term credit to real estate	0.33%
Medium-term credit to equipment	12.37%
Medium-term consolidated credit	0.00%
Medium-term consolidated campaign credit	0.10%
Medium-term credit to consumption	9.22%
Short-term credit	35.26%
Discount cheque or immediate credit	0.26%
Negotiable certificate	2.79%
Cash credit	26.63%
Short-term credit to equipment	0.48%
Support credit	1.75%
Short-term campaign credit	1.64%
Short-term credit to consumption	1.53%
Short-term consolidated credit	0.00%

Source: Authors using data from National Council of Credit (2014).

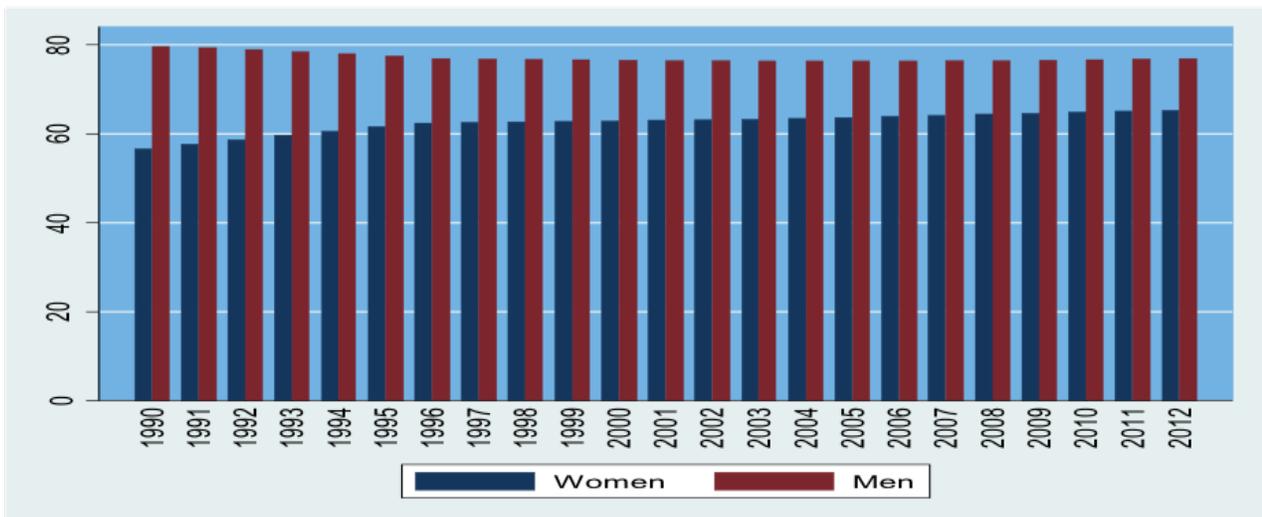
A.4. Figures

Figure 2. Enrollment rate in Higher Education level



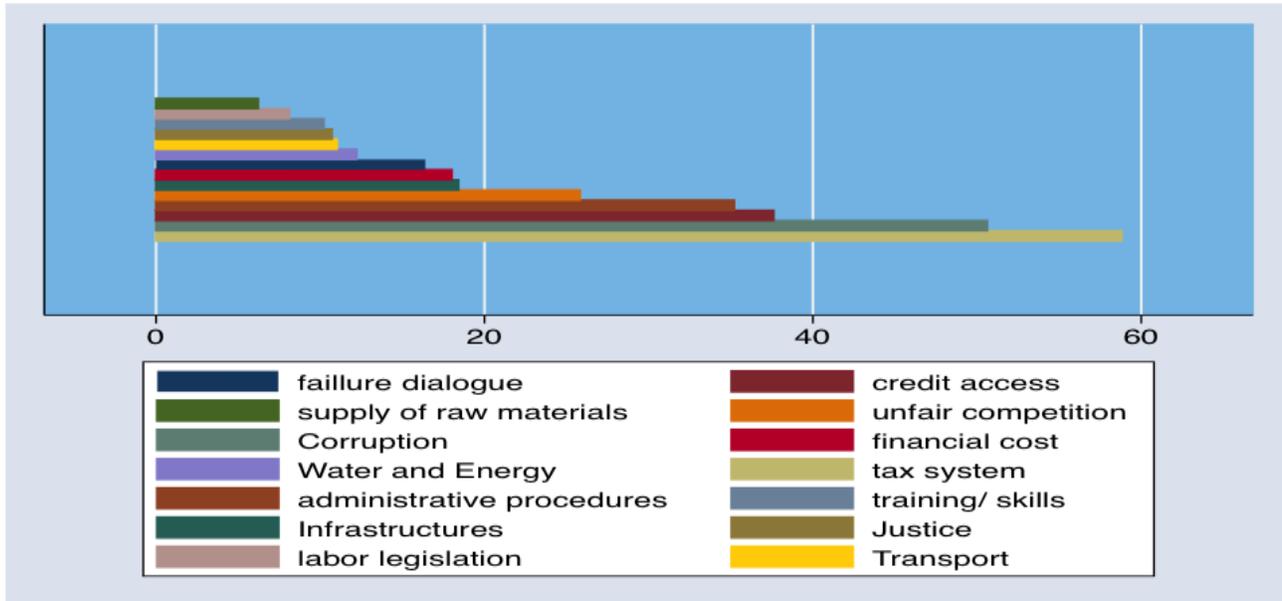
Source: Authors using World Bank Gender Indicators (2014)

Figure 3. Enrollment rate in Higher Education level



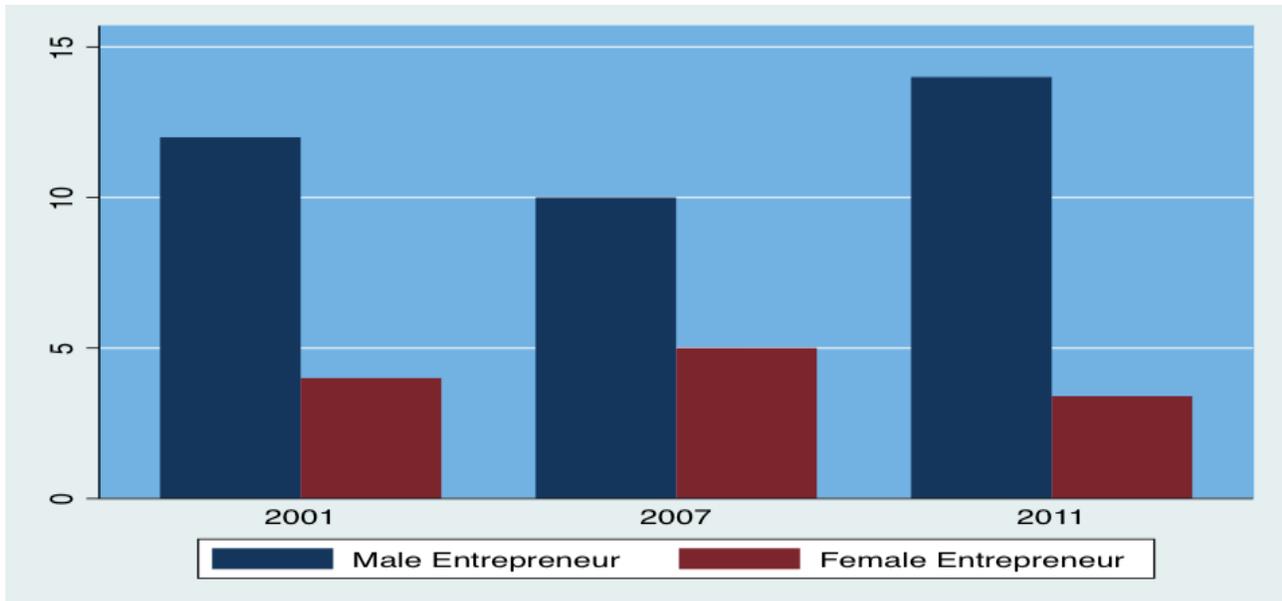
Source: Authors using World Bank Gender Indicators (2014)

Figure 4. Constraints to entrepreneurship in Cameroon



Source: Authors using Cameroon General Survey of Enterprises data (2009)

Figure 5. Access to production credit per entrepreneurs (percent)



Sources: Authors using from ECAM II (2001), ECAM III (2007), CERE (2011)

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