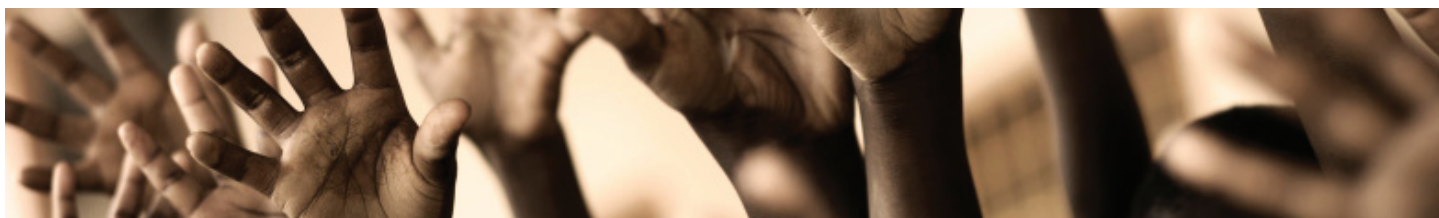


working paper
2016-02

Macroeconomics Implications of Female Entrepreneurs Facing Financial Frictions to Access to Credit: A DSGE Model Approach in Cameroon

**Thierry Kame Babilla
Sandra Kendo
Martin Jaures Ndzana Eloundou
Adele Ngo Bilong**

January 2016



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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 steady state and the calibration analysis demonstrate 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, it performs better in term of value-added in GDP. The benchmark analysis reveals the complementary role of both sectors in sustaining economic activity during a downturn. The Scenarios analysis emphasizes 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.

JEL Classification: C11, C61, D21, E32, E44, O11

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

Authors

Thierry Kame Babilla

Lead Researcher
CEREG_University of Yaounde II
Yaounde, Cameroon
thierrykamebilla@yahoo.fr

Sandra Kendo

Member
CEREG_University of Yaounde II
Yaounde, Cameroon
sandra2172003@yahoo.fr

Adele Ngo Bilong

Member
CEREG_University of Yaounde II
Yaounde, Cameroon
adelebilong1@yahoo.fr

Martin Ndzana Eloundou

Member
CEREG_University of Yaounde II
Yaounde, Cameroon
nadzaeloundou_2009@yahoo.fr

Acknowledgements

This research is carried out with financial and scientific support from the Partnership for Economic Policy (PEP) (www.pep-net.org) with funding 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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Executive summary

Financial inclusion in developing economies remains a main concern nowadays for national policymakers as well as international stakeholders. In Cameroon, which is aspiring to an emergence by 2035, the key challenge is to identify and overcome obstacles in financial access for vulnerable sectors, such as the female entrepreneurs sector.

Basically, Cameroonian authorities have done enough in recent decades to achieve progress towards gender equality and have succeeded in the area of education, health, employment and political participation. However, despite government efforts to promote female entrepreneurship, the ability of females to become entrepreneurs remains at 4.1%, the rate of firms with female top managers is at 10% and the rate of firms with female participation in ownership is 16%. This sluggish ratio of female entrepreneurs can be explained by 14 constraints of entrepreneurship in Cameroon. Among those 14 constraints, it appears that the financial constraint is the most severe in blocking the development of female entrepreneurship in Cameroon. Importantly, the presence of financial frictions in the credit market represents one of the fundamental factors explaining the low access to financing by female entrepreneurs.

Theoretical literature justifies the relationship between female entrepreneurship and macroeconomics variables, by the Keynesian and Kaleckian approach on the one hand and the neo-classical and structuralist approach on the other hand. The mainstream message is that female entrepreneurship enhances economic efficiency and improves macroeconomics outcomes. Empirical literature for its part emphasizes that the study of macroeconomics implications of financial frictions is exclusively based on DSGE models, which can be the RBC approach or the New Keynesian approach.

This research thus aims to assess the effects of financial frictions faced by female entrepreneurs on macroeconomics performance in Cameroon, and to examine policies likely to waive those frictions. We capture this key issue by means of a DGSE model with financial micro-foundation, which grounds its analytical framework on the Real Business Cycle approach. 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 steady state and calibration analyses demonstrate that:

- Collateral constraints appear as the key financial frictions faced by female entrepreneurs in the credit market in Cameroon.
- The less financially constrained sector is capital intensive in the production process.
- The most financially constrained sector is labor intensive in the production process.
- Female entrepreneurs are labor intensive whereas male entrepreneurs are capital intensive.
- When the female sector is granted credit as much as the male sector, it performs better in term of value-added in GDP than the male sector.

The benchmark analysis reveals:

- Financial frictions in the credit market matters in the sluggishness of macroeconomic outcomes.
- The female sector contributes to shrinking aggregate labor demand, investment, consumption and output due to financial constraint.

The counterfactual scenarios analyses provide the following findings:

- Loosening financial constraints by 30% improves female entrepreneurs productivity by 40% and job creation by 50% with expansionary implications in the macroeconomic outcomes.
- The male sector and the female sector are complementary in sustaining economic activity during a downturn.
- Furthermore, when financial constraints are symmetric and small in both sectors, the Cameroonian economy gains 5% in GDP, investment increases by 50% and job creation increases by 60%.
- The banking sector plays a key role in amplifying the magnitude by which macroeconomic indicators respond to shocks through the collateral constraints channel and the asset-price channel.

The policy implications which arise from the results of the research are:

- Financial incentives are critical for female entrepreneurship to adopt the productivity-enhancing technologies and practices that drive investment development and broader economic growth.
- Female entrepreneurs' access to financing should be eased by at least 40%, via, for instance, inclusion in the Douala Stock Exchange Market as well as the Central Africa Exchange Market.
- A National Agency which plays a role of collateral and guarantees female entrepreneurs' debt contract outside of the banking sector, can help to alleviate frictions in the credit market and enhance female entrepreneurship.
- Law enforceability is needed to guarantee equal rights between males and females regarding family properties, such as, land, real estate or shares, in order to allow female entrepreneurs which 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 between both types of entrepreneurs.
- Cameroonian authorities can adopt a National Policy of loosening female entrepreneurship financing by 30%, using public bonds or securities with end of collecting financings from citizens and directly finance female entrepreneurs' projects.

1. Introduction

Female entrepreneurs still face 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 relating to females 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 credit for female. Most societies in Africa are patriarchal and the man holds the property of the family and it can easily improve the collateral guarantee process. So, it is difficult for females 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 children 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 moral hazard 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 et al., 2012; Ifelunini and Wosowe, 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 a 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 et al., 2012; Angelucci et al., 2013; Seguino and Were, 2014).

Overall, Cameroon's authorities have done enough recent 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 the Millennium Development Goals (MDGs), which is likely to be attained by 2015 in Cameroon. However, local traditional practices continue to restrict female's access to factors of production. Due to inequitable inheritance practices, very few females own land, particularly in rural areas. Moreover, females 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 females have the freedom to establish their own businesses, the Commercial Code allows husbands to put an end to their wife's commercial activity by simply notifying the clerk of the commerce tribunal of their opposition based upon the family's interest (Fonjong, 2001; Kuepie et al., 2013). Efforts to alleviate female entrepreneurs' financial frictions therefore matter to macroeconomics outcomes and

¹ Progress 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, there is the African Union Protocol of the Rights of Women in Africa adopted in 2005. At the national level, the key role of women is given place in the Cameroon Growth and Employment Strategy Paper of 2009.

² Cameroon'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 also ratified the Optional Protocol to the Convention, which came into effect in the same year.

economic development. As a result, the proposed research seeks to answer the following questions:

How do female entrepreneurship financial constraints affects macroeconomic outcomes in Cameroon?

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

2. Literature review

2.1. Theoretical literature review

Originally, the related literature defines entrepreneurship as the creation of a business or the innovation process. Schumpeter (1950, 1961) was the first to lay a stone in this literature by defining entrepreneurship as the creative destructive process where the entrepreneur coordinates production and agent change. This seminal definition has been expanded and entrepreneurship is currently defined as a catalyst of structural transformation and institutional evolution, which is concerned not only with business success, but also with subjective factors and non-economic welfare (Acs and Naude, 2012; Naude, 2014). Entrepreneurship is thus beneficial for productivity, employment and economic growth. As a result, given the key role of women in development processes, female entrepreneurship in developing countries has recently seen a surge of interest (Berik et al., 2008; Loko and Diouf, 2009; Bazika and Christophe, 2012; Brunnermeier et al., 2012).

In fact, two broad bodies of literature can justify the link between female entrepreneurship and macroeconomics gains, namely, the Keynesian and Kaleckian approach on the one hand, and the neo-classical and structuralist approach on the other hand. Keynesian and Kaleckian macroeconomics emphasize the demand side effects of intergroup inequality on growth and development (Keynes, 1936; Kalecki, 1954; Dutt, 2010; Damiano and Mwakubo, 2014; Seguino and Were, 2014). However, Kaleckian and Keynesian research does not explore the role of gender credit inequality, nor focus on the supply side effects of inequality. Seguino and Were (2014) look at both demand and supply side effects of gender inequality when considering the relationship between gender and macroeconomics in Sub-Saharan Africa. The authors also look at the transmission mechanism on the macro-economy both in the short and the long run, to understand the extent to which macro policies are socially sustainable. Stotsky (2006) examines the implications of gender differences in economic behavior for macroeconomic policy, and finds that reducing gender inequality and improving the status of females may contribute to higher rates of economic growth and greater macroeconomic stability. Nevertheless, their research does not take into account the limited access of credit faced by female entrepreneurs in Africa.

The effect of absolute and relative gender inequality on macroeconomics is also based on the neo-classical and structuralist approaches. The mainstream neo-classical approaches explore the long-run effects of inequality on economic growth and largely focus on the impact of capabilities inequality.³ In contrast, structuralist macroeconomics and feminist economists emphasize the short-run effects as well as long-run effects, and the role of inequality in livelihoods (Were and Kiringai, 2003; Doss, 2006; Berik et al., 2009; Damiano and Mwakubo, 2014; Seguino and Were, 2014).

However, lack of financing access and higher start-up costs is a significant constraint hindering females' entrepreneurial entry in developing countries (Yueh, 2009). This could contravene the process of physical capital accumulation. This is because investments in capital are determinants of economic growth and development. Thus, by constraining the accumulation of these assets, gender can hamper growth and development (Oduro, 2012).

³ Capabilities refers to the requisite functioning's necessary to enter into productive work, be it paid or unpaid, and includes such measures as educational attainment and health.

Gender inequality in access to credit may also slow down the adoption of new technologies and the pace of growth. Thus, structural transformation can be undermined by gender-biased access to necessary inputs or credit. In turn, economic development would be inhibited because development requires a structural transformation from low value-added, low productivity and rural-based activities to higher value-added, more productive activities in services and manufacturing located in cities (Oduro, 2012; Naude, 2014).

Female entrepreneurs' access to credit matters thus as an instrument for development as it enhances economic efficiency and improves macroeconomics outcomes in several ways (Berik et al., 2008; Damiano and Mwakubo, 2014). Productivity differentials among companies owned by men and by women have been found to be mainly the result of differences in access to productive inputs, such as credit. A reduction of this productivity gap through equal access to productive resources yields considerable output gains (Muravyev et al., 2009; Revenga and Shetty, 2012). Also, better opportunities for females to earn and control income contribute to broader economic development in developing economies. In particular, higher female credit access can boost growth by mitigating the impact of a shrinking wealth creation (Baliamoune-Lutz and McGillivray, 2007; Miller, 2008; Hansen and Rand, 2012; Henrik and Rand, 2012; Bandiera and Natriaj, 2013).

2.2. Empirical literature review

The literature that studies macroeconomic implications of financial frictions emerges right after the Great Depression. 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). Authors also emphasized the core implication of financial stability for monetary economics (Patinkin, 1956; Tobin, 1969). Recently, the 2008 global financial crisis renewed the role of financial frictions as the foremost driver of business cycle fluctuations (Brunnermeier et al., 2012). Hence, economists recognized that financial sector imperfections are relevant not only to explain economic developments and the impact of financial shocks on the real economy, but also to design appropriate stabilization policies (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 on financial frictions. The second approach is the Collateral Constraints version, which represents the Quantity of Loans based on 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 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.⁴ 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 a result, the level of capital and the entrepreneur's net worth decline in the following

⁴ The costly state verification of Townsend (1979) arises from the standard information asymmetry problem where the borrower or entrepreneur has private information about their performance in contrast with the lender or bank which 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.

period. Subsequently, this decline leads once more to decreased investment and lower net worth in the following periods. However, this original model uses a framework where agents live only for two periods. Carlstrom and Fuerst (1997) further developed this model by considering agents who are infinitely lived. They demonstrate that the endogenous agency cost could potentially alter business-cycle dynamics, because the agency-cost model replicates the empirical fact that output growth displays positive autocorrelation over short time horizons. The fact that households delay the investment decisions until agency costs are at their lowest motivates the hump-shaped output growth behavior. Agency cost falls 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 entrepreneurs 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) thus made 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 thus became the workhorse financial accelerator model in the 2000s. The authors introduce nonlinear capital adjustment costs in the model, which are the driving force of the amplifications effects. In fact, similar to the Bernanke and Gertler (1989) model and the 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 entrepreneurs' net worth, the decrease in aggregate capital reduces the price of capital due to the convex adjustment costs. This lower price further decreases entrepreneurs' net worth, amplifying the original shock. Overall, the three models, 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 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 the last decade in several directions, such as to emphasize the prominence role of financial accelerator mechanism (Greave, 2008; Christensen and Dib, 2008; Gilchrist et al., 2009), to analyze the role of financial frictions during the Great Depression (Christiano et al., 2003), to study the business cycle implications of financial frictions (Christiano et al., 2010), to provide endogenous explanations for steady-state differentials between lending and money market rates (Goodfriend and McCallum, 2007), and to derive optimal monetary policy in the presence of time-varying interest rate spreads in a simple model with heterogeneous households and a 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 due to collateral constraints. This second version of financial frictions has 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 for collateral is motivated by the absence of contract enforcement in the economy and collateral constraint is set exogenously. The authors highlighted that the dynamic interaction between financing constraints and assets prices is a powerful transmission mechanism by which the effects 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 a 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 the balance sheet channel. In a DSGE framework with households, banks and entrepreneurs each facing an 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 collateral. 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 allow for households to default. Gerali et al. (2010) and Brzoza-Brzezina and Makarski (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 a 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) and 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 to capture 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 on the business cycle properties compared to the external finance premium version and is more suitable for a DSGE model with financial frictions (Chari et al., 2007; Brzoza-Brzezina et al., 2011; Brzoza-Brzezina and Kolasa, 2012).

Overall, the study of macroeconomic implications of financial frictions is exclusively based on DSGE models. The framework can be the Real Business Cycles (RBC) approach or the New-Keynesian approach depending on the objective of the research. The type of financial frictions can be the External Finance Premium version or the Collaterals Constraints version, depending on the context of the studied economy. Nevertheless, all the previous models until now mainly focus on the heterogeneity of households, or the heterogeneity of the financial system or banking sector. None of the models emphasizes entrepreneurs. This research would go beyond this limit by highlighting heterogeneity among entrepreneurs, and specifically by introducing the gender issue into 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.

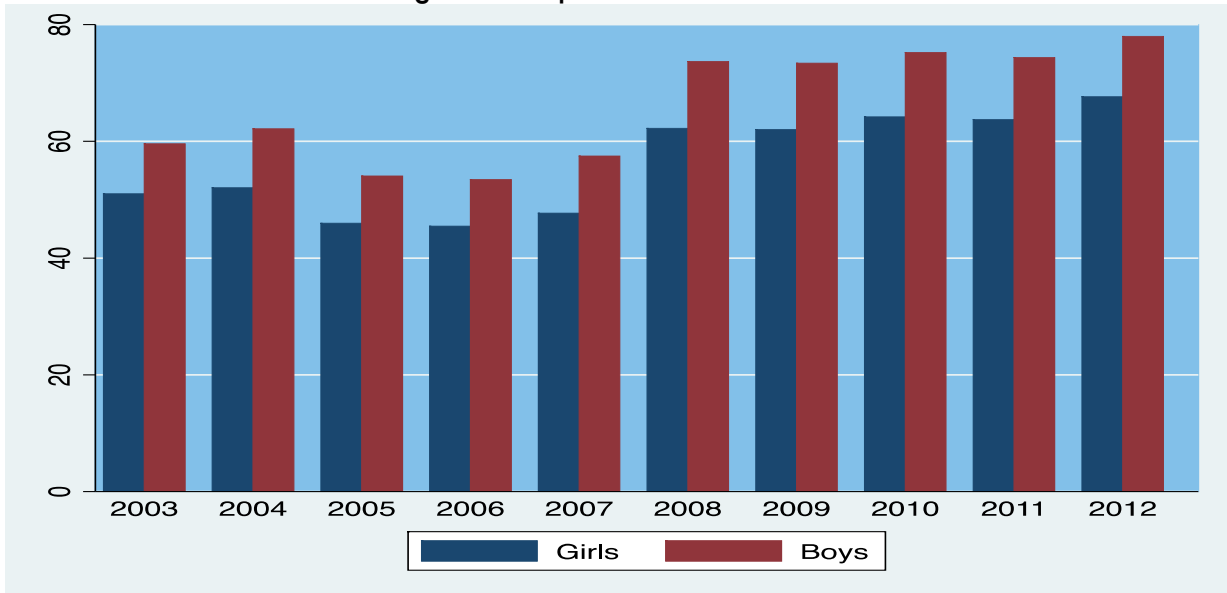
3. Some stylized facts

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 main 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.

Figure 1: Completion Rate of basic education



Source: Authors using World Bank Gender Indicators (2014)

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% from 2003 to 2012, more than the increase in the boys completion rate, which increased by only 9% over the same period (Figure 1). In the secondary cycle, the net rate of school attendance for female pupils increased from 35.7% in 2001 to 51.5% in 2010, relative to male school attendance rate, which increases from 33.9% to 47.8% (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% in 2002 to 10% in 2011, while male rate of enrolment rose from 7% to 14% in the same period (Figure 2 in appendix).

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% during 1990 to 2012, against 62% for females. However, active females (93.8%) are over-represented in the informal sector compared to active males (6.2%), (ILO 2010). Self-employment in informal enterprises accounted for 24.3% of female’s non-agricultural employment in 2001 against 38.9% in 2010. Meanwhile self-employment in informal enterprises accounted for 23.6% of male’s non-agricultural employment against 35.9% in the same period. In contrast, self-employment in informal enterprises accounted for 52.4% of female’s agricultural employment in 2001 against 48.5% in 2010. Also, self-employment in informal enterprises accounted for 68.5% of males’ agricultural employment in 2001 against 57.9% 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% in 2001 to 11.7% in 2011. Specifically, the ratio of female Ministers increased from 9.1% in 2001 to 16.1% in 2011. The ratio of female Secretaries of State rose from 8.3% in 2001 to 20% in 2011. The four mains 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% of ELECAM members, 9.8% of Supreme Court judges and 32% of ANIF members are female. The ELECAM goes forward by increasing this ratio to 27.8% in 2011 (Table 5 in appendix). Nonetheless, the 2013 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 a rate of 14% against 86% 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%, the rate of firms with female top managers is at 10% and the rate of firms with female participation in ownership is 16%, while these rates are respectively, 95%, 90% and 84% 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% of surveyed enterprises believe that taxation remains the primary obstacle in entrepreneurship, 50.6% of surveyed enterprises consider corruption as the second constraint, and 37.8% of surveyed enterprises believe that access to credit is the third constraint of entrepreneurship in Cameroon (Figure 4 in appendix).

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 0.6	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)

Regarding female entrepreneurship, it appears that among the three keys 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% 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% in 2001 to 3.4% in 2011. In contrast, male entrepreneurs' access to production financing increased from 12% in 2001 to 14% in 2011.

This financial constraint encountered by female entrepreneurs can be explained by four major 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.⁵ 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% in 2012 to 23% in 2015. However, this banking rate lags behind the average of LICs (24%), even if it is above the average of the CEMAC region (18.51%). Importantly, the female banking rate was around 9% in 2015 while male banking rate was 14%.

Years	Banking rate of active population		Bank density	
	2012	2015	2012	2015
Cameroon	20.41%	23%	49 869	49 096
Female	-	9%	-	-
Male	-	14%	-	-
CEMAC	17.71%	18.51%	24 489	23 203

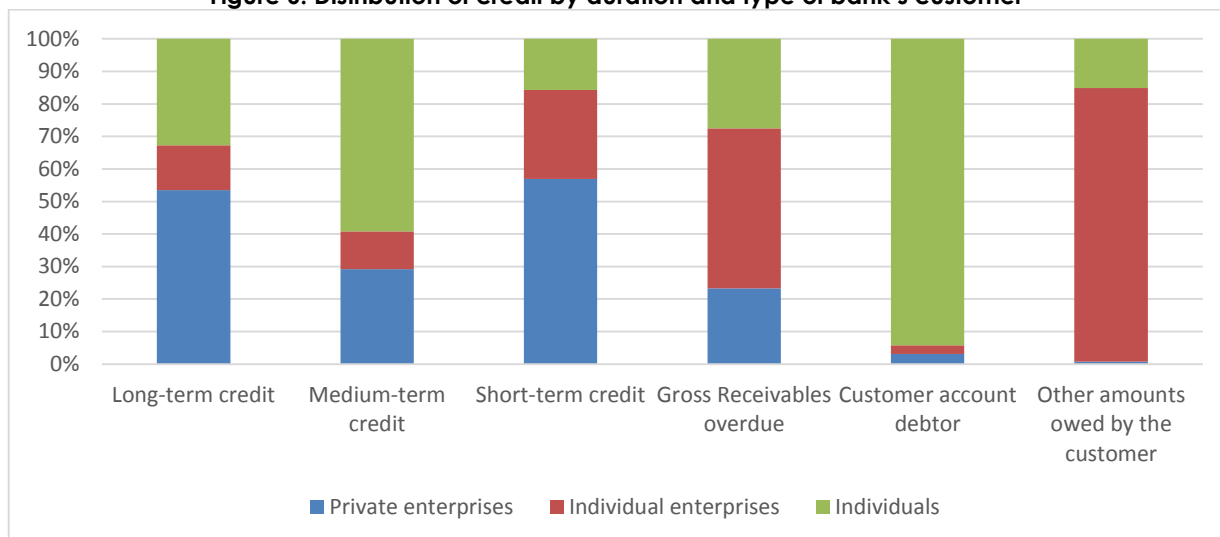
Source: Authors using BEAC data (2014) and the Global Gender Gap data (2015)

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% of total loans (Table 9 in appendix).

In fact, private enterprise represents the main base of customers of banks in Cameroon with a ratio of credit granted of more than 60%, followed by individuals (14.12%) and individual enterprises (7.61%). However, short-term credits are the most granted credit to private enterprises (38.07%) rather than long-term credit (1.7%). Even for individual enterprises, short-term credits are the main type of credit granted (18.36%) rather than long-term credit (0.44%). 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).

⁵ The 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, Atlantic bank Cameroon, and BGF Bank Cameroon.

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

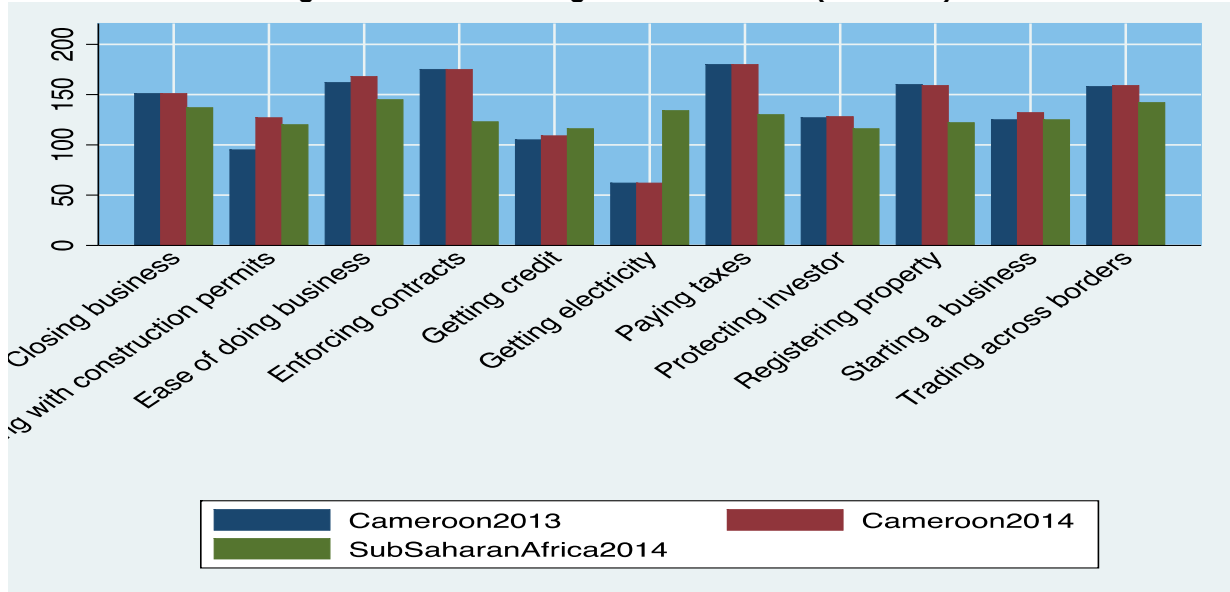


Source: Authors using data from National Council of Credit (2014)

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.

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

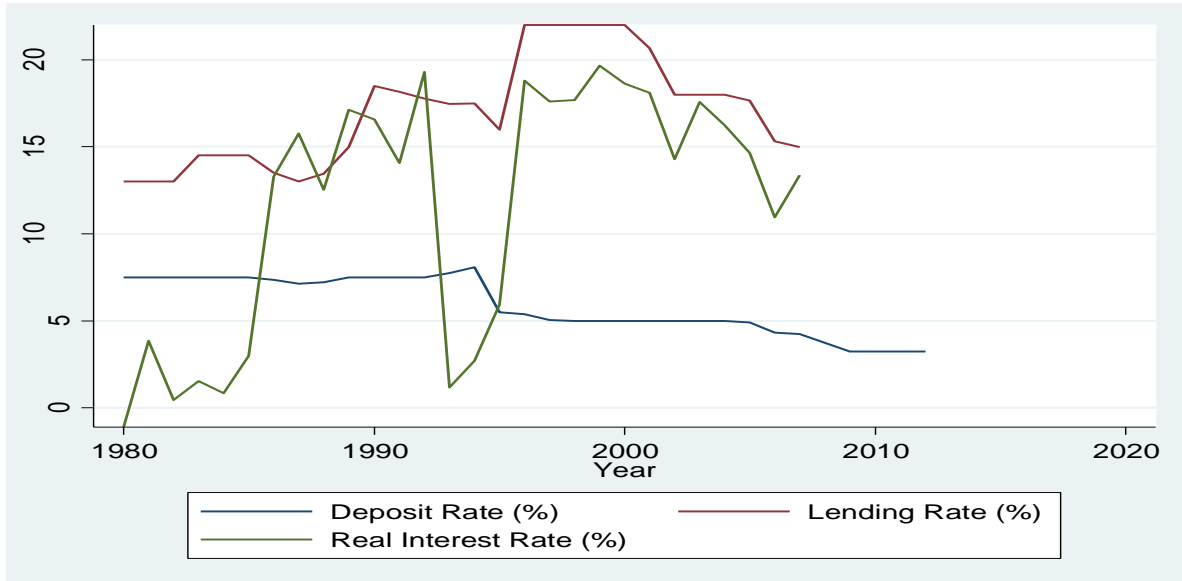
Figure 7: Cameroon Doing Business Indicators (2013-2014)



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

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 (%)



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% 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 in 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 as being populated 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 10 in Appendix A.1. 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 spill over into 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 households, β_H denotes the household's discount factor and ϑ_t represents a preference shock affecting the marginal utility of the labor supply.⁶

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:

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

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.

⁶ Households 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.

This form of labor market specification is justified by the way in which we capture the concept of a representative agent in the model. The assumption of a 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 introduces 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, which makes the substitution of labor from one sector to another imperfect. As a result, skilled or educated households mostly supply labor hours to the male entrepreneurs sector, and 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:

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

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:

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

Here λ_t is the Lagrange 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.⁷

$$\lambda_t = \frac{\vartheta_t}{c_t^H} \quad ; \quad (5)$$

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

⁷ The 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.

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

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

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 hired labor, to produce final 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:

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

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:

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

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 final 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.⁸

The Lagrangian for the optimization problem is as follows:

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

⁸ This type of collateral constraints is used in several contributions to the literature on financial frictions. See Iacovello (2005) for instance.

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:

$$\lambda_t^F = \frac{1}{c_t^F} , \quad (15)$$

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

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

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

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 sub-section will be written in a more concise manner. Within this production sector, the representative entrepreneur maximizes its expected utility described as follows:

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

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:

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

The Lagrangian for the optimization problem is as follows:

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

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

$$\lambda_t^M = \frac{1}{c_t^M} , (25)$$

$$w_t^M = \frac{(1-\alpha)Y_t^M}{n_t^M} , (26)$$

$$\lambda_t^M q_t^M = E_t \left[\beta_M \lambda_{t+1}^M \left(\frac{\alpha p_{t+1}^M y_{t+1}^M}{k_t^M} + (1 - \delta)q_{t+1} \right) + \lambda_{M,t}^V V_t^M (1 - \delta) \frac{q_{t+1}}{R_{L,t}^M} \right] , (27)$$

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

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't pledge their accumulated capital as efficiently as male entrepreneurs.⁹

4. 3. Final Goods Production Sector

Firms producing the economy's final goods 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:

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

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

Final goods 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 :

$$\max_{y_t^F, y_t^M} [y_t - (p_t^F y_t^F + p_t^M y_t^M)] , (30)$$

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

$$y_t^F = (1 - \theta_y)(p_t^F)^{-\mu} y_t , (32)$$

and its counterpart for the sector dominated by male entrepreneurs is:

$$y_t^M = (\theta_y)(p_t^M)^{-\mu} y_t . (33)$$

Because final goods producing firms operate under perfect competition, profits are zero. Further, inserting the demand functions, (32) and (33), 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

$$P_t = 1 = [(1 - \theta_y)(p_t^F)^{(1-\mu)} + \theta_y(p_t^M)^{(1-\mu)}] . (34)$$

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.

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:

$$\max_{I_t} E_t \left[q_t I_t - I_t - \frac{\Psi}{2} \left(\frac{I_t}{k_t} - \delta \right)^2 k_t \right] . (35)$$

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

$$E_t \left[q_t - 1 - \Psi \left(\frac{I_t}{k_t} - \delta \right) \right] = 0 . (36)$$

Since capital producers face an adjustment cost $\left(\frac{\Psi}{2}\left(\frac{I_t}{k_t} - \delta\right)^2 k_t\right)$ relation (36) 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 a supplier of loans to both entrepreneurial sectors. It solves the following problem:

$$\text{Max } E_0 \sum_{t=0}^{\infty} \left(\frac{\lambda_t}{\lambda_{t-1}}\right) \beta_H^t \text{DIV}_t \quad , \quad (37)$$

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 (37) 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

$$\text{DIV}_t + R_{D,t-1} D_{t-1} + L_t^F + L_t^M = D_t + R_{L,t-1}^F L_{t-1}^F + R_{L,t-1}^M L_{t-1}^M \quad , \quad (38)$$

and the balance sheet identity:

$$D_t = L_t^F + L_t^M \quad . \quad (39)$$

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:

$$L = E_0 \left[\sum_{t=0}^{\infty} \left(\frac{\lambda_t}{\lambda_{t-1}}\right) \beta_H^t (D_t + R_{L,t-1}^F L_{t-1}^F + R_{L,t-1}^M L_{t-1}^M - R_{D,t-1} D_{t-1} - L_t^F - L_t^M) \right] \quad , \quad (40)$$

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

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

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

$$(\lambda_t) = (\beta_H) E_t [\lambda_{t+1}] R_{L,t}^M \quad , \quad (43)$$

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:

$$g_t = T_t . \quad (44)$$

Note that this implies that the model does not take into account 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:

$$\varpi_t = \rho_{\varpi}\varpi_{t-1} + \eta_{\varpi_t} , \quad (45)$$

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:

$$\vartheta_t = \rho_{\vartheta}\vartheta_{t-1} + \eta_{\vartheta_t} , \quad (46)$$

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:

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

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:

$$a_t^M = \rho_{a^M} a_{t-1}^M + \eta_{a_t^M} , \quad (48)$$

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:

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

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:

$$V_t^M = \rho_{V^M} V_{t-1}^M + \eta_{V_t^M} , \quad (50)$$

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:

$$g_t = \rho_g g_{t-1} + \eta_{g_t} , \quad (51)$$

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

4.7. Market Clearing Conditions

The equilibrium of this model consists of sequences of allocations of quantities $\{Y_t, n_t, c_t^H, c_t^F, c_t^M, k_t^F, k_t^M\}_{t=0}^\infty$, of loans and deposits $\{L_t^F; L_t^M; D_t\}_{t=0}^\infty$, of prices $\{w_t^M; w_t^F; q_t; p_t^M; p_t^F\}_{t=0}^\infty$, of interest rates $\{R_{L,t}^F; R_{L,t}^M; R_{D,t}\}_{t=0}^\infty$, of multipliers $\{\lambda_t; \lambda_t^M; \lambda_t^F; \lambda_{M,t}^V; \lambda_{F,t}^V\}_{t=0}^\infty$ 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**:

$$y_t = c_t + i_t + g_t , \quad (52)$$

where aggregate consumption c_t is given as:

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

and the aggregate stock of capital k_t is:

$$k_t = k_t^F + k_t^M , \quad (54)$$

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

$$g_t = T_t . \quad (55)$$

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

$$n_t = n_t^F + n_t^M . (56)$$

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

$$L_t^F + L_t^M = D_t . (57)$$

5. Calibration Procedure of the Model

Table 10 presents the calibrated numerical values of the model's key parameters. The calibration procedure assigns these numerical values using a mix of previous evidence, by appealing 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 10: 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 0.97, 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 the 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, in suitably discounting the future; as a result they save less, thus accumulating less pledgeable collateral.¹⁰

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't pledge their accumulated capital as efficiently as male entrepreneurs. As a 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 11-13 present the steady state of the model for four versions of the economy. First, the benchmark case in Table 11 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.¹¹

Next, Table 12 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 to become more patient and save more capital. In addition, 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 13 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

¹⁰ One should not need to make a literally interpretation here.

¹¹ All the model's equation leading to the steady state are available in Appendix A.2.

male entrepreneurs. In addition, 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 tables 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 the discount factor ($\beta_F = \beta_M = 0.98$) and the same value for the LTV ratio ($V^F = V^M = 0.8$).

Table 11 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% of total hours, against 40% 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 11: 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
Proportion of value added from sector F ($p^F y^F/y$)	0.52
Proportion of value added from sector M ($p^M y^M/y$)	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

*Sector M is male entrepreneurs sector and Sector F is female entrepreneurs sector.

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%, against 3.1% 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 for those goods remains unchanged, this shift in supply implies that their prices rise, leading to an increase in the value 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 the F sector (0.52) is greater than the proportion for the M sector (0.47).

Table 12: Features of the economy's steady state when the female entrepreneurial sector is less severely financially constrained

Variables	Benchmark	Less severe financial constraint	Symmetric sight financial constraint
Capital-labor ratio in sector F (k^F/n^F)	6.31	10.53	12.03
Capital-labor ratio in sector M (k^M/n^M)	13.03	12.23	12.03
Proportion of value added from sector F ($p^F y^F/y$)	0.52	0.50	0.5
Proportion of value added from sector M ($p^M y^M/y$)	0.47	0.49	0.5
Household consumption-output ratio (c^H/y)	0.73	0.739	0.74
Sector F consumption-output ratio (c^F/y)	0.047	0.023	0.014
Sector M consumption-output ratio (c^M/y)	0.031	0.017	0.014
Total consumption-output ratio (c/y)	0.81	0.78	0.77
Sector F investment-output ratio (i^F/y)	0.080	0.10	0.11
Sector M investment-output ratio (i^M/y)	0.10	0.11	0.11
Sector F hours over total hours ($n^F/n^F + n^M$)	0.60	0.52	0.5
Sector M hours over total hours ($n^M/n^F + n^M$)	0.39	0.47	0.5

*Sector M is male entrepreneurs sector and Sector F is female entrepreneurs sector.

The results of Table 12 indicate that when the financial constraint on female entrepreneurs is looser (second column of Table 12), their production sector becomes more capital intensive in contrast to labor-intensive situation 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 sectors (third column of Table 12). The production sector dominated by male entrepreneurs itself becomes more labor intensive. The labor hours of the male entrepreneurs sector over total labor hours is 17% greater than in the benchmark case, an increase that reaches 22% under the case of very light and symmetric constraints in both sectors.

Moreover, the table shows that female entrepreneurs save more than in the benchmark case, as 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% 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 in 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 increases and this induces a rise of the sector's value added. The proportion of value added in the female entrepreneurs sector is 4% 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% greater than in the benchmark, an increase that reaches 6% under the last case.

The results depicted in Table 13 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 30 percent greater than under the benchmark.

Table 13: Features of the economy's steady state when the male entrepreneurs sector is more financially constrained than the female entrepreneurs sector

Variables	Benchmark	Sector M more financially constrained	Symmetric light financial constraint

Capital-labor ratio in sector F (k^F/n^F)	6.31	13.01	12.03
Capital-labor ratio in sector M (k^M/n^M)	13.03	11.92	12.03
Proportion of value added from sector F ($p^F y^F/y$)	0.52	0.49	0.5
Proportion of value added from sector M ($p^M y^M/y$)	0.47	0.50	0.5
Household consumption-output ratio (C^H/y)	0.73	0.74	0.74
Sector F consumption-output ratio (C^F/y)	0.047	0.0066	0.014
Sector M consumption-output ratio (C^M/y)	0.031	0.0117	0.014
Total consumption-output ratio (C/y)	0.81	0.76	0.77
Sector F investment-output ratio (I^F/y)	0.080	0.119	0.11
Sector M investment-output ratio (I^M/y)	0.10	0.114	0.11
Sector F hours over total hours ($n^F/n^F + n^M$)	0.60	0.48	0.5
Sector M hours over total hours ($n^M/n^F + n^M$)	0.39	0.51	0.5

*Sector M is male entrepreneurs sector and sector F is female entrepreneurs sector.

The expansion of access to credit to female entrepreneurs, relative to male entrepreneurs, and the increase of their savings provide the sector with the capacity to undertake more investment projects and increases their market share. 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 13).

Due the fact that the female entrepreneurial sector now has 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 intermediate goods because of lack of financing and the goods from this sector become scarce. This decrease of supply leads to an increase in their price, as the demand of those goods remains relatively unchanged. As a result, the value added of the sector increases relative to the female sector. The proportion of value added of the female entrepreneurial sector is thus 0.49 lower than the 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 lightly 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 alternative scenarios about the impacts 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 constraints of this type. 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.

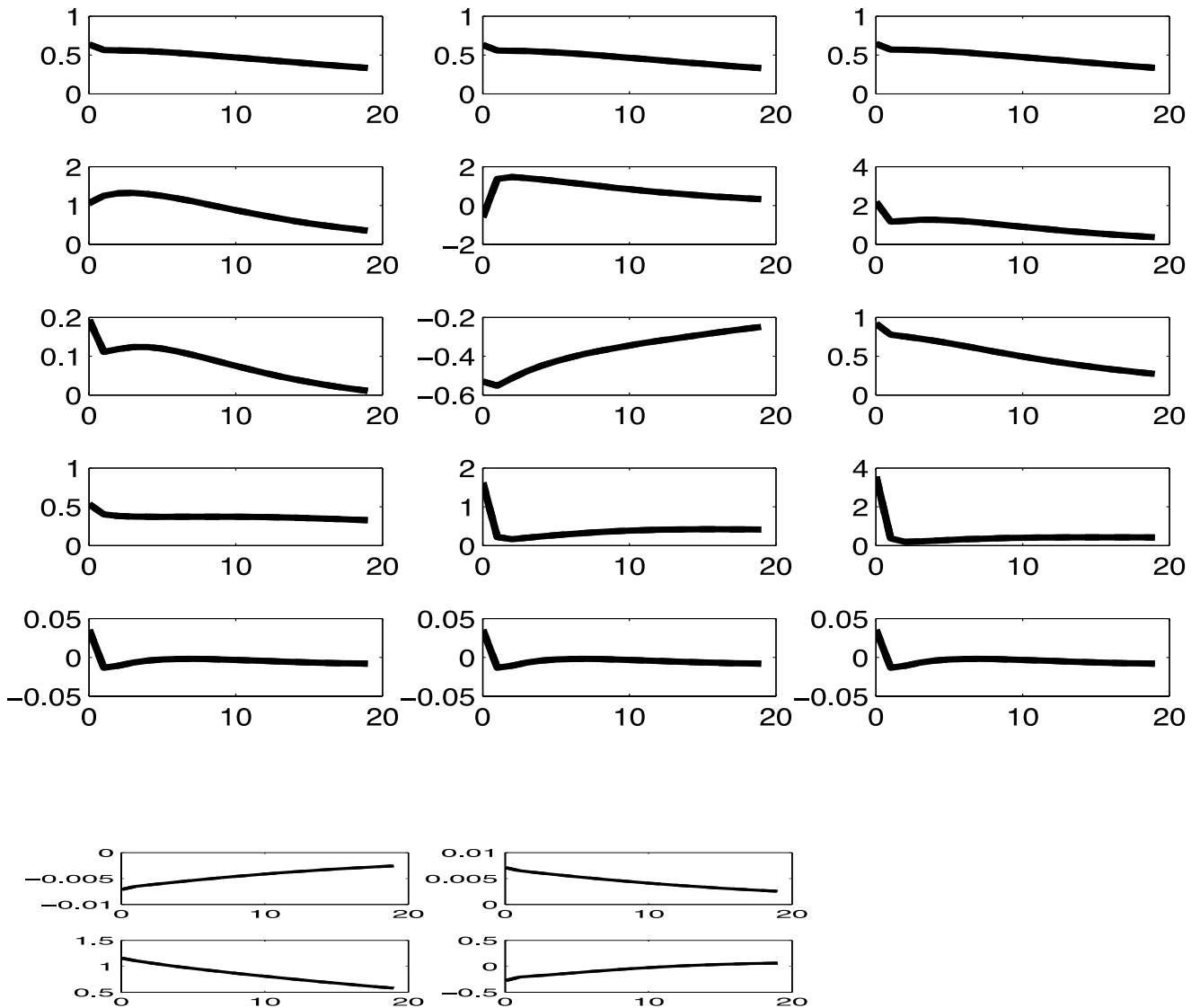
7.1.1. Productivity shock in the female entrepreneurial sector

Figure 10 depicts the response of the economy following a 1% 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 a guarantee. Hence, the accumulation of physical capital pushes up the price of physical capital, so that entrepreneurs also benefit from the wider access to credit that higher collateral values afford. As a result, investment is enhanced both by the technological improvement and by the eased access to credit, so that aggregate savings, labor demand and output all feature an 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, and its relative prices increase, 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. In response, in the female entrepreneurial sector, the increase in savings and investment induces a persistent increase of the sector's output. Likewise, increases in labor and consumption demand, as well as the increase of investment, lead to a sharp increase in the male entrepreneurial sector's output.

Figure 10: A productivity shock in the female entrepreneurial sector



7.1.2. Fiscal policy shock

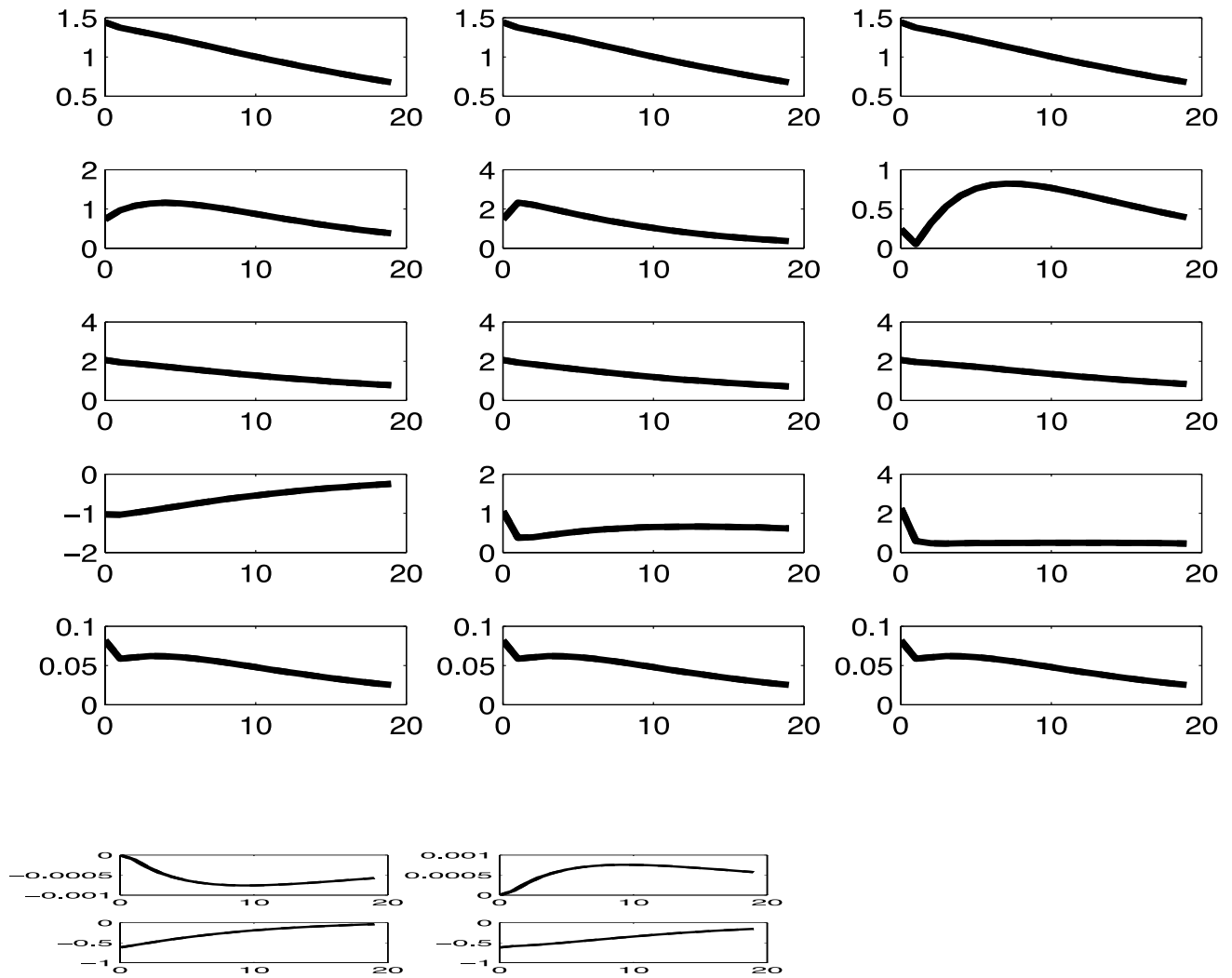
Figure 11 depicts the effect of an increase in public spending (a fiscal policy shock). An increase of public expenses financed by taxes paid by household increases the transfer from households to the government. The increase of taxes paid leads to a decrease in the disposable income of households. As a 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 groups of entrepreneurs, thus leading to a reduction in funds available to them.

This process is intensified by the collateral constraint channel, as the banking sector could increase the requirements for banks to supply loans, including collateral. Since the production sector dominated by female entrepreneurs is 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 savings due to the positive effect of the policy, which will increase investment, leading to an increase in the sector's 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 for the high cost of capital, the male entrepreneurs sector will increase its demand for labor. The rise in investment and consumption lead to an increase in the output of the sector.

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

Figure 11: A fiscal policy shock



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

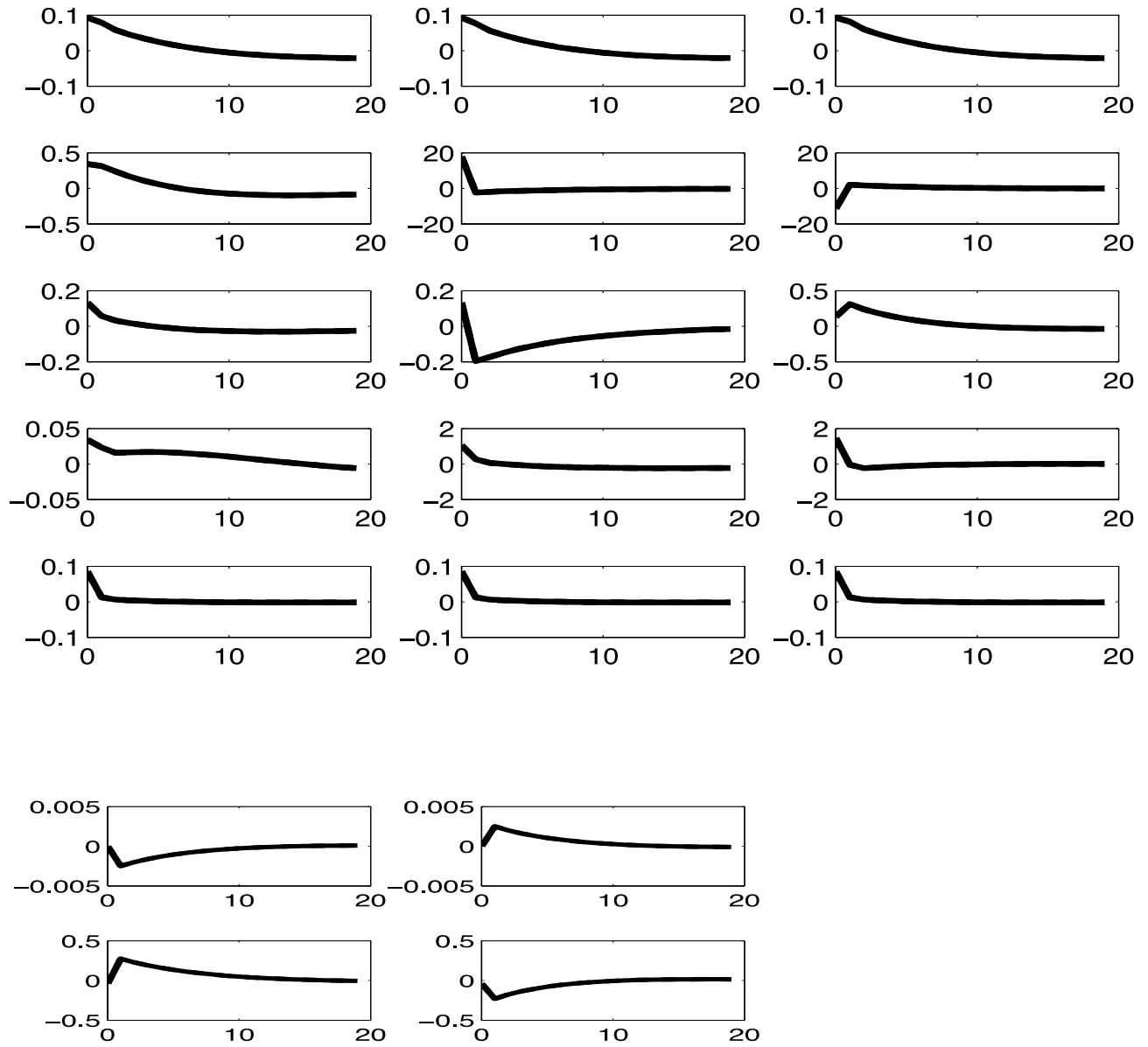
Figure 12 depicts the reaction of the economy following a 1% positive LTV shock in the female entrepreneurial sector. An increase in the loan-to-value ratio loosens the financial constraint and allows an increase in demand for loans. The resulting rise in investment induces an increase in labor hiring and capital demand. Higher demand for capital sharply increases its value, relaxing the collateral constraint further. There is a short-lived increase in deposits, which decreases sharply afterward and induces an increase of consumption. Thus, a loosening of the borrowing constraint has an expansionary effect on 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 to the increase in the economy's wealth in this case thus appears 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 increase savings. Subsequently, rising investment and savings lead to higher output in the sector. The lessening of the collateral constraints induced 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. This leads afterward to smooth investment level towards steady state over time. Luckily, the increase in consumption offsets the low level of investment and induces an increase of the sector's output. Moreover, as the female sector becomes competitive, relative prices in both sectors becomes similar and induce a similar and stable wage level in both sectors.

Figure 12: An LTV ratio shock in the female entrepreneurial sector



7.2. Scenarios Analysis

Two main scenarios are involved in this analysis. 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.

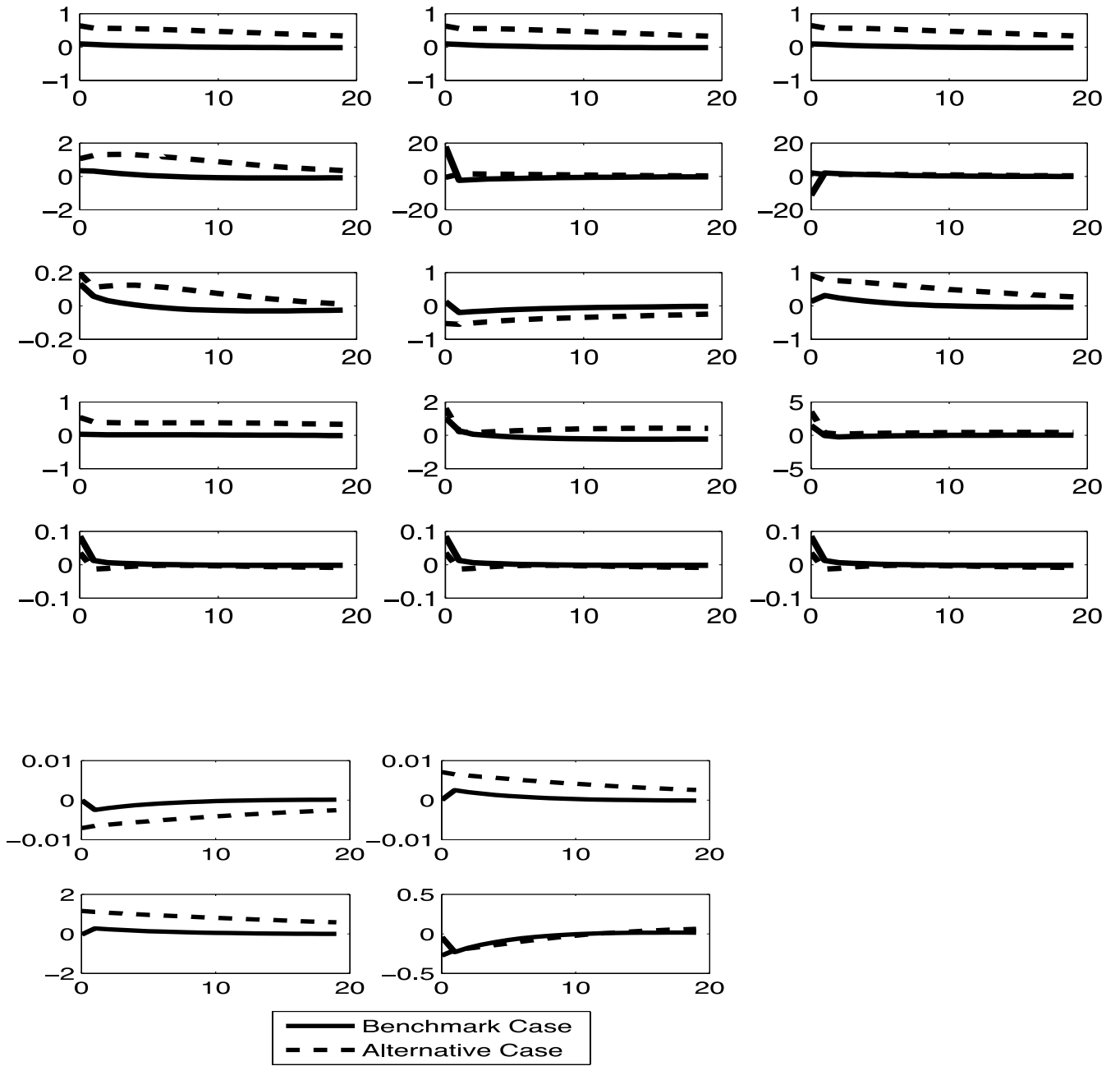
7.2.1. Productivity shock in the case of the first scenario

Figure 13 denotes a 1% positive productivity shock to the female sector when the financial constraint is loosened in the same sector. The results reveal that, when the financial constraint is loosened 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 a larger increase in aggregate investment than in the case of an initially tighter constraint. In addition, the collateral constraint channel induces an increase of aggregate consumption relative to the benchmark. 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, relative prices in the sector decline, allowing the sector to increase its wage above the benchmark level. However, because of the fall of its relative prices, the sector also cuts its demand for labor below the benchmark level. Increases in savings and investment raise the sector's output above the benchmark level. By contrast, the male sector becomes less competitive, its relative prices increases, leading the sector to reduce wages in order to hire more workers and increase its productive capacities.

The male sector reacts to the loosening of financial frictions in the female sector by increasing its relative prices and labor demand. Due to the lack of additional funding, the male sector invests nothing and its investment level remains around the steady state, lower than in the benchmark case. To compensate for this low level of investment and remain competitive, the male entrepreneurial sector will drastically reduce its wage below the benchmark level. As the sector adjusts to the new financing condition, the low labor cost and increase in savings leads to an increase of the output of the sector relative to the reference case.

Figure 13: Productivity shock in the female entrepreneurial sector



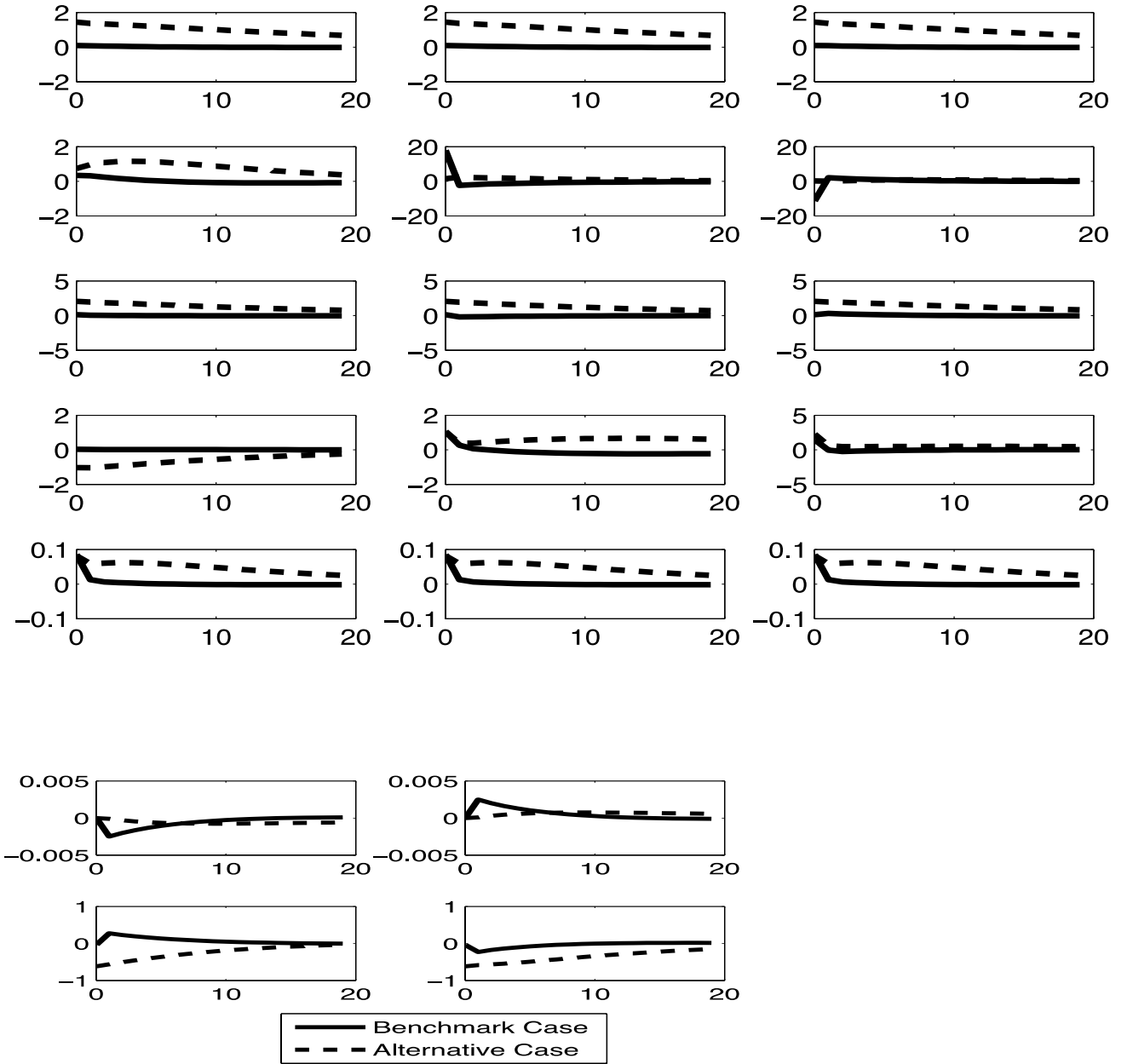
6.2.3. Fiscal policy shock second scenario

Figure 14 denotes the reaction of the economy following the 1% positive fiscal policy shock when both sectors face a symmetric and light financing constraint, the “alternative case” relative to our benchmark results. The increase of public expenditures induces an increase in the deposit rate, which leads to a rise in aggregate saving. The shock also leads to an increase in job creation relative to the benchmark level. In the presence of sufficient factors of production, aggregate investment rises above the benchmark and induces an increase in aggregate output and savings above the benchmark level.

From the sectorial point of view, the male sector responds to the positive fiscal shock by expanding its labor demand, as well as its consumption demand, above the benchmark level. However, the male sector stops additional investment and maintains the level of investment at a stable level around the steady state. The lack of additional investment induces stable relative prices in the sector around the steady state. Hence, to sustain its decision to hire more workers in face of stable investment and relative prices, male entrepreneurs will reduce salaries, which are then lower than the benchmark level. The combination of lower labor costs, and increases in consumption and labor input, 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 decreases to below the benchmark level. In fact, female entrepreneurs predict the upcoming increases of male sector investment and try to preserve their market share by maintaining their investment at a stable level around the steady state. To offset the no-additional-investment situation, the female entrepreneurial sector continues to hire more workers and increases its savings for upcoming investment. The sufficient factors of production induce an increase of output in the sector to above the benchmark level. This increase in savings in the female entrepreneurial sector compensates for the low level of savings in the male entrepreneurial sector and induces a sharp increase in aggregate savings. These results confirm that, when the financial constraint is symmetric and light in both sectors, the female entrepreneurial sector contributes more than the male entrepreneurial sector to the improvements in macroeconomic outcomes.

Figure 14: A fiscal policy shock



5. 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.

Two broad bodies of theoretical literature can justify the link between female entrepreneurship and macroeconomics gains, namely, the Keynesian and Kaleckian approach on the one hand, and the neo-classical and structuralist approach on the other hand. Empirical literature for its part emphasizes that the study of macroeconomic implications of financial frictions is exclusively 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 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 steady-state and calibration analysis demonstrates that collateral constraints appear as the key financial frictions faced by female entrepreneurs in the credit market in Cameroon. The less financially constrained sector is relatively capital intensive and the more financially 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 by 30% improves female entrepreneurs' productivity by 40% and job creation by 50% 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 5% in GDP, investment increases by 50% and job creation increases by 60%.

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

- *Female entrepreneurs' access to financing should be eased by at least 40%, via, for instance, inclusion in the Douala Stock Exchange Market as well as the Central Africa Exchange Market.*
- *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 is needed to guarantee 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 between these two types of entrepreneurs.*
- *Cameroonian authorities can adopt a National Policy of loosening female entrepreneurship financing by 30%, 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. 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 country as a case study. The model assesses the steady-state and dynamic implications of these differentiated frictions.

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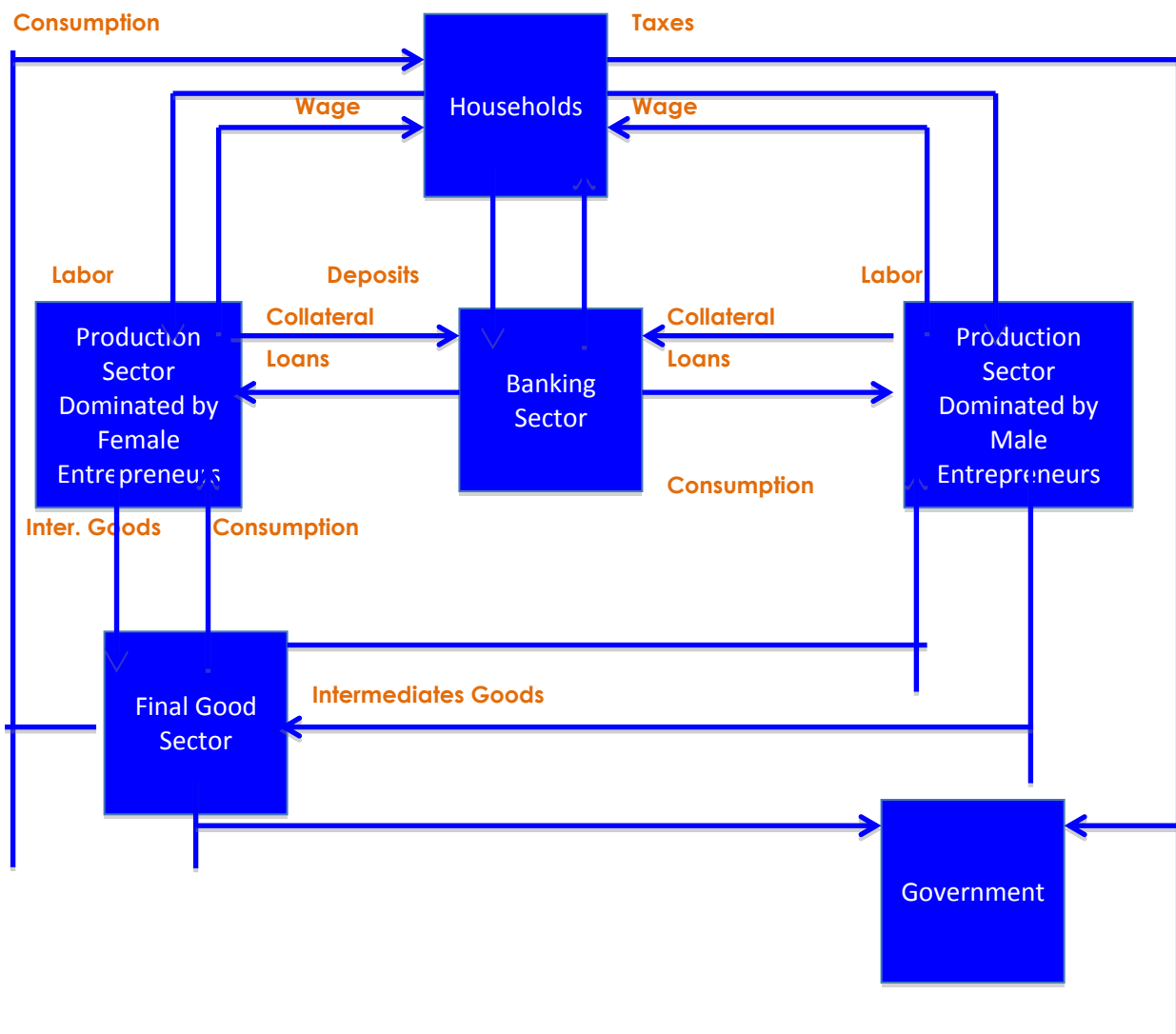
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Annex

A.1. The pictogram of the DSGE model

Figure 9: The pictogram of the theoretical DSGE model



A.2. The steady-state of the model

All the algebraic developments for the analytical determination of the steady state of the model are available in the Technical Appendix upon request.

- **Interest rates**

$$R_D = \frac{1}{\beta_H} \quad (1)$$

$$R_L^F = R_d \quad (2)$$

$$R_L^M = R_d \quad (3)$$

$$q = 1 \quad (4)$$

- **Capital/output ratios**

$$k^F / y^F = \frac{\alpha p^F}{\frac{1}{\beta_F} - (1-\delta) - \frac{(1-\beta_F R_L^F) v^F (1-\delta)}{\beta_F R^F}} \quad (5)$$

$$\left(\frac{k^F}{n^F}\right) = \left(\frac{k^F}{y^F}\right)^{\frac{1}{1-\alpha}} \quad (6)$$

$$w^F = (1 - \alpha) \left(\frac{k^F}{n^F}\right)^\alpha \quad (7)$$

$$k^M / y^M = \frac{\alpha p^M}{\frac{1}{\beta_M} - (1-\delta) - \frac{(1-\beta_M R_L^M) v^M (1-\delta)}{\beta_M R^M}} \quad (8)$$

$$\left(\frac{k^M}{n^M}\right) = \left(\frac{k^M}{y^M}\right)^{\frac{1}{1-\alpha}} \quad (9)$$

$$w^M = (1 - \alpha) \left(\frac{k^M}{n^M}\right)^\alpha \quad (10)$$

$$\left(\frac{n^F}{n^M}\right) = \left(\frac{w^F}{w^M}\right)^{-\tau} \left(\frac{1-\theta_H}{\theta_H}\right) \quad (11)$$

- **Relative price**

$$\frac{p^F}{p^M} = \left[\frac{\left(\frac{k^F}{n^F}\right)^\alpha \left(\frac{n^F}{n^M}\right) \left(\frac{\theta_y}{1-\theta_y}\right)}{\left(\frac{k^M}{n^M}\right)^\alpha \left(\frac{n^M}{n^M}\right) \left(\frac{\theta_y}{1-\theta_y}\right)} \right]^{-\frac{1}{\mu}} \quad (12)$$

$$p^M = \left[(1 - \theta_y) \left(\frac{p^F}{p^M} \right)^{(1-\mu)} + \theta_y \right]^{\frac{1}{(\mu-1)}} \quad (13)$$

$$p^F = \left(\frac{p^F}{p^M} \right) p^M \quad (14)$$

- All others variables

$$\frac{y}{n^F} = \frac{\left(\frac{k^F}{n^F} \right)^\alpha (p^F)^\mu}{(1-\theta_y)} \quad (15)$$

$$\frac{c}{n^F} = \frac{y}{n^F} - \frac{\delta k^F}{n^F} - \frac{\delta k^M}{n^M} \frac{1}{n^F/n^M} \quad (16)$$

$$\frac{c^F}{n^F} = p^F \left(\frac{k^F}{n^F} \right)^\alpha + (1 - R_L^F) \frac{V^F(1-\delta) k^F}{R_L^F n^F} - \delta \frac{k^F}{n^F} - w^F \quad (17)$$

$$\frac{c^M}{n^M} = p^M \left(\frac{k^M}{n^M} \right)^\alpha + (1 - R_L^M) \frac{V^M(1-\delta) k^M}{R_L^M n^M} - \delta \frac{k^M}{n^M} - w^M \quad (18)$$

$$\frac{c^H}{n^F} = \frac{c}{n^F} - \frac{c^F}{n^F} - \frac{c^M}{n^M} \frac{1}{n^F/n^M} \quad (19)$$

$$\frac{1}{n^F} = \frac{n}{n^F} + \frac{\frac{c^H}{n^F} \vartheta (1-\theta_H)^{\frac{1}{\tau}} \left(\frac{n}{n^F} \right)^{\frac{1}{\tau}}}{w^F} \quad (20)$$

$$L^M = \frac{V^M(1-\delta)k^M}{R_L^M} \quad (21)$$

$$L^F = \frac{V^F(1-\delta)k^F}{R_L^F} \quad (22)$$

$$\lambda = \frac{1}{c^H} \quad (23)$$

$$\lambda^F = \frac{1}{c^F} \quad (24)$$

$$\lambda^M = \frac{1}{c^M} \quad (25)$$

$$\lambda_M^V = \beta_M \lambda^F R_L^F + \lambda^F \quad (26)$$

$$\lambda_M^V = \beta_M \lambda^M R_L^M + \lambda^M \quad (27)$$

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: Cameroon's Gender Gap Index

	Rank (out of 136 countries)	Score (0.00 = inequality 1.00 = equality)	Sample average	Female	Male	Female to male ratio
Political empowerment	99	0.090				
Women in Parliament	93	0.16	0.24	14	86	0.16
Women in ministerial in positions	73	0.16	0.19	14	86	0.16

Source : The Global Gender Gap Report (2013)

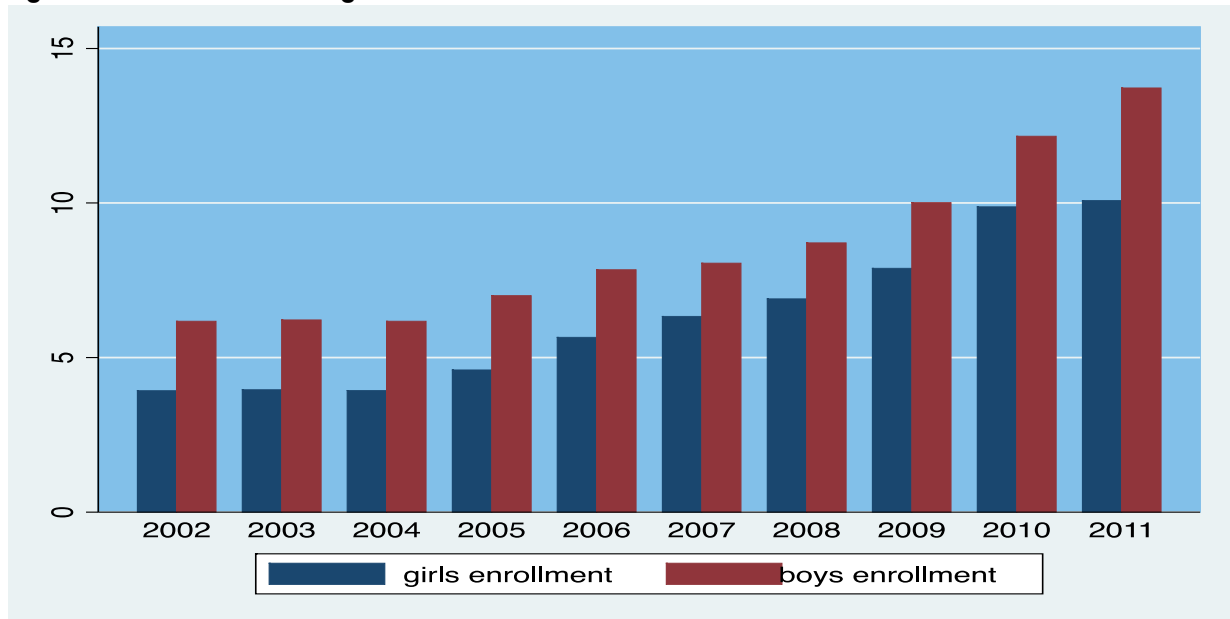
Table 9: Distribution of credit by nature and duration

	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).

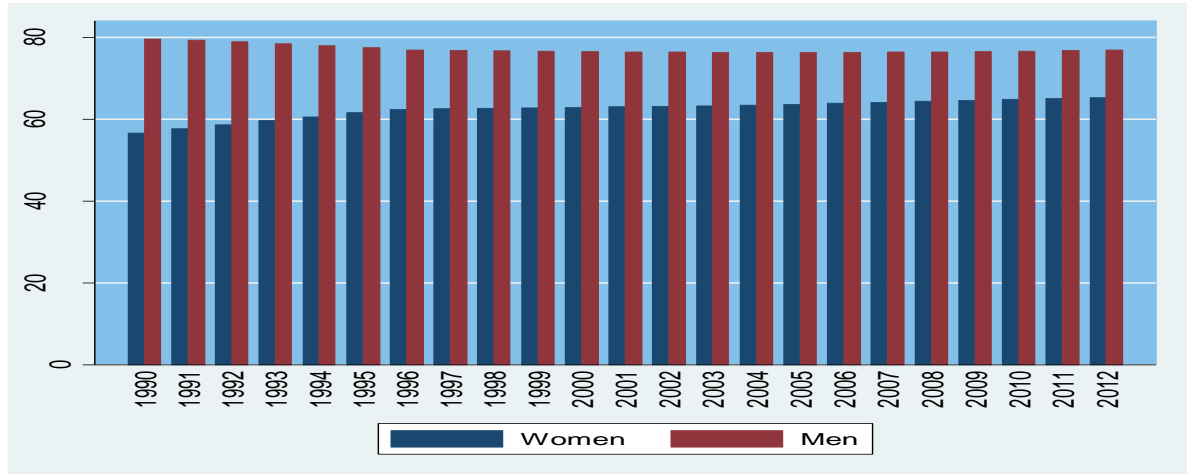
A.4. Figures

Figure 2: Enrollment rate in higher education



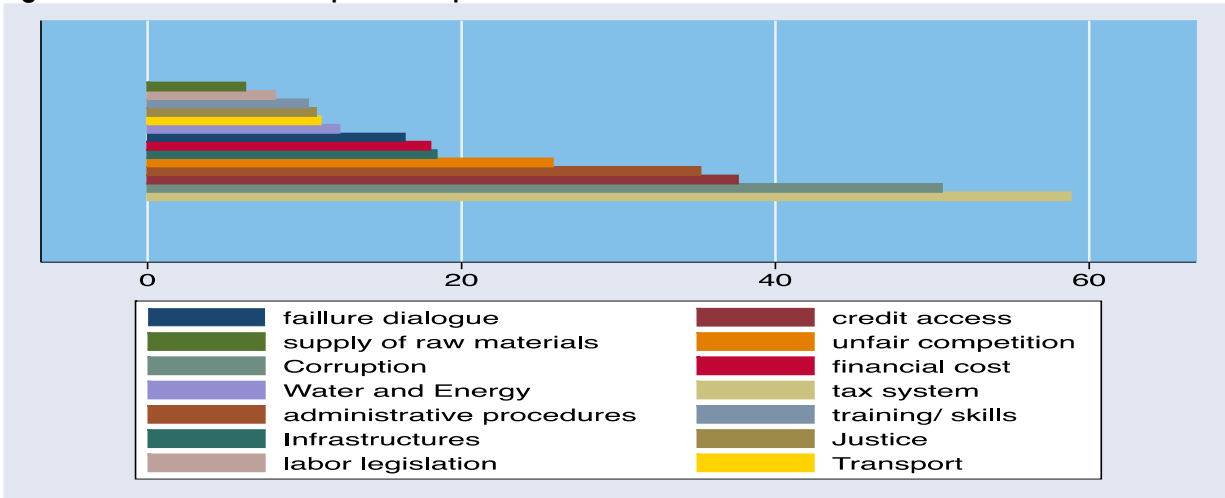
Source: Authors using World Bank Gender Indicators (2014)

Figure 3: Labor force participation rates



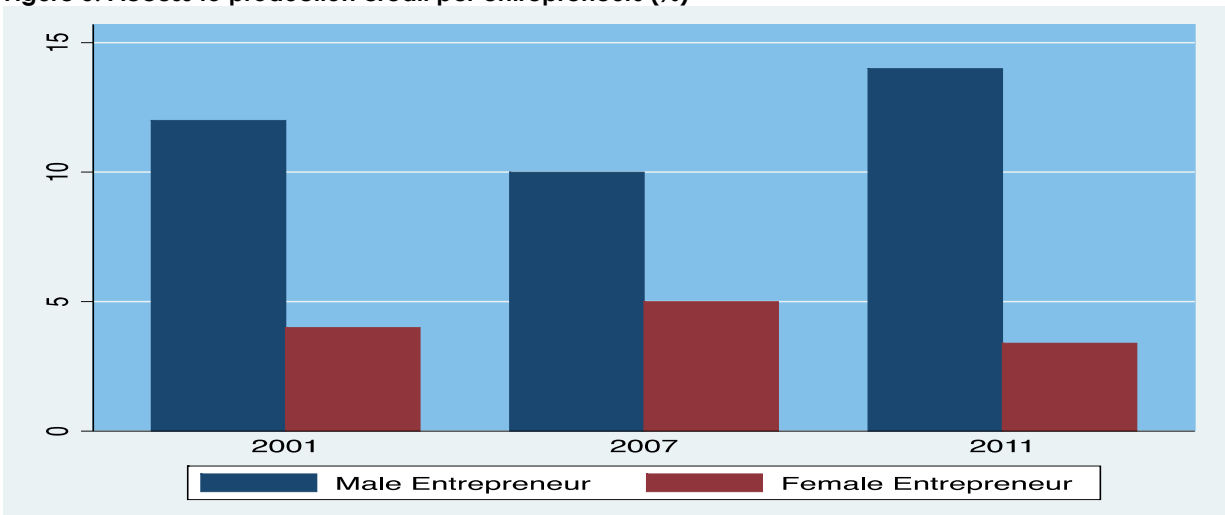
Source: Authors using World Bank Gender Indicators (2014)

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 (%)



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

A.5. The variables of the model

The variables of the model that have been used for empirical analysis are:

c_t : Consumption	$R_{L,t}^F$: The lending rate on loans granted to the production sector dominated by female entrepreneurs
c_t^H : The representative household consumption	$R_{L,t}^M$: The lending rate on loans granted to the production sector dominated by male entrepreneurs
c_t^F : The consumption of the production sector dominated by female entrepreneurs	q_t : The physical capital price
c_t^M : The consumption of the production sector dominated by male entrepreneurs	k_t : Physical capital
y_t : The composite index of final goods	k_t^F : The physical capital used by the production sector dominated by female entrepreneurs
y_t^F : The production of intermediary goods by the production sector dominated by female entrepreneurs	k_t^M : The physical capital used by the production sector dominated by male entrepreneurs
y_t^M : The production of intermediary goods by the production sector dominated by male entrepreneurs	i_t^F : The investment of the production sector dominated by female entrepreneurs
n_t : The composite index of labor supply by households	i_t^M : The investment of the production sector dominated by male entrepreneurs
n_t^F : Labor supply by households to the production sector dominated by female entrepreneurs	i_t : Aggregate investment
n_t^M : Labor supply by households to the production sector dominated by male entrepreneurs	L_t^F : Loans granted to the production sector dominated by female entrepreneurs
w_t^F : Wage given to households by the production sector dominated by female entrepreneurs	L_t^M : Loans granted to the production sector dominated by male entrepreneurs
w_t^M : Wage given to households by the production sector dominated by male entrepreneurs	P_t^F : Relative price of intermediate goods supplied by the production sector dominated by female entrepreneurs
λ_t : The marginal utility of households' consumption	P_t^M : Relative price of intermediate goods supplied of the production sector dominated by male entrepreneurs
λ_t^F : The marginal utility of the consumption made by the production sector dominated by female entrepreneurs	ϖ : The preference shock affecting the marginal utility of households
λ_t^M : The marginal utility of the consumption made by the production sector dominated by male entrepreneurs	ϑ : The shock affecting the marginal utility of the labor supply
$\lambda_{F,t}^V$: The marginal utility of the borrowing constraints of the production sector dominated by female entrepreneurs	a^F : The shock of the production sector dominated by female entrepreneurs
$\lambda_{M,t}^V$: The marginal utility of the borrowing constraints of the production sector dominated by male entrepreneurs	a^M : The shock of the production sector dominated by male entrepreneurs
$R_{D,t}$: The deposit rate	V^F : The loans-to-value ratio shock of the production sector dominated by female entrepreneurs
	V^M : The loans-to-value ratio shock of the production sector dominated by male entrepreneurs
	g : The public spending shock

A.6. the parameters of the model

The denomination of the parameters of the model is given as follow:

β_H : The households discount factor

β_F : The discount factor of the production sector dominated by female entrepreneurs

β_M : The discount factor of the production sector dominated by male entrepreneurs

θ_H : The share of employment in the production sector dominated by male entrepreneurs

θ_y : The share of intermediate goods produced in the production sector dominated by female entrepreneurs

μ : The constant elasticity price of demand of intermediates goods of each sector

τ : The elasticity of substitution between the two productions sectors

δ : The depreciation rate of capital

α : The labor share in the production sector

V^M : The loans-to-value (LTV) ratio of the production sector dominated by female entrepreneurs

V^F : The loans-to-value (LTV) ratio of the production sector dominated by male entrepreneurs

ρ_{ω} : The persistence of the preference shock affecting the marginal utility of households

ρ_g : The persistence of the preference shock affecting the marginal utility of the labor supply

ρ_{a^F} : The persistence of the productivity shock of the production sector dominated by female entrepreneurs

ρ_{a^M} : The persistence of the productivity shock of the production sector dominated by male entrepreneurs

ρ_{V^F} : The persistence of the loans-to-value ratio shock of the production sector dominated by female entrepreneurs

ρ_{V^M} : The persistence of the loans-to-value ratio shock of the production sector dominated by male entrepreneurs

ρ_g : The persistence of the public spending shock

$\hat{\varepsilon}_{\omega}$: The standard deviation shock of the preference shock affecting the marginal utility of household

$\hat{\varepsilon}_g$: The standard deviation shock of the preference shock affecting the marginal utility of the labor supply

$\hat{\varepsilon}_{a^F}$: The standard deviation shock of the productivity shock of the production sector dominated by female entrepreneurs

$\hat{\varepsilon}_{a^M}$: The standard deviation shock of the productivity shock of the production sector dominated by male entrepreneurs

$\hat{\varepsilon}_{\eta^{VF}}$: The standard deviation shock of the loans-to-value ratio shock of the production sector dominated by female entrepreneurs

$\hat{\varepsilon}_{\eta^{VM}}$: The standard deviation shock of the loans-to-value ratio shock of the production sector dominated by male entrepreneurs

$\hat{\varepsilon}_{\eta^g}$: The standard deviation shock of the public spending shock

