WP/18/212

IMF Working Paper

Closing Gender Gaps in India: Does Increasing Womens' Access to Finance Help?

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INTERNATIONAL MONETARY FUND

 WP/18/212

IMF Working Paper

Asia and Pacific Department

Closing Gender Gaps in India: Does Increasing Womens' Access to Finance Help?

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September 2018

Abstract

Gender gaps in womens' economic opportunities—labor market and entrepreneurship—have remained high in India. Lack of adequate collateral limits women entrepreneurs' ability to access formal finance, leaving them to rely on informal sources, constraining their growth. A small-open economy DSGE model is built to investigate the long-run macroeconomic impacts from closing gender gaps in financial access. Results suggest that an increase in women entrepreneurs access to formal credit results in higher female entrepreneurship and employment, which boosts India's output by 1.6 percent. However, regulations and gender-specific constraints in the labor market limit potential gains as females' access to quality jobs in the formal sector remains restricted. The paper shows that the factors influencing the number of females are different from those influencing the share of females in formal economic activity. Combining gender-targeted financial inclusion policies with policies that lower constraints on formal sector employment could boost India's output by 6.8 percent.

JEL Classification Numbers: E24, E26, J16, J71, O15

Keywords: gender inequality, informality, DSGE, Indian economy, Bayesian estimation

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[1] I wish to thank Paul Cashin, Volodymyr Tulin, Sonali Das, and Himanshu Joshi at the IMF for their valuable suggestions and feedback. I am grateful to Prof. Caren Grown at the World Bank for her guidance. I also thank Chetan Ghate and participants at the Fifth Macroeconomics Workshop held at the Indian Statistical Institute (Delhi); participants at the 2017 IMF Gender and Macroeconomics Conference (D.C).; and participants at seminars in the IMF Asia and Pacific Department, for their helpful comments and suggestions.

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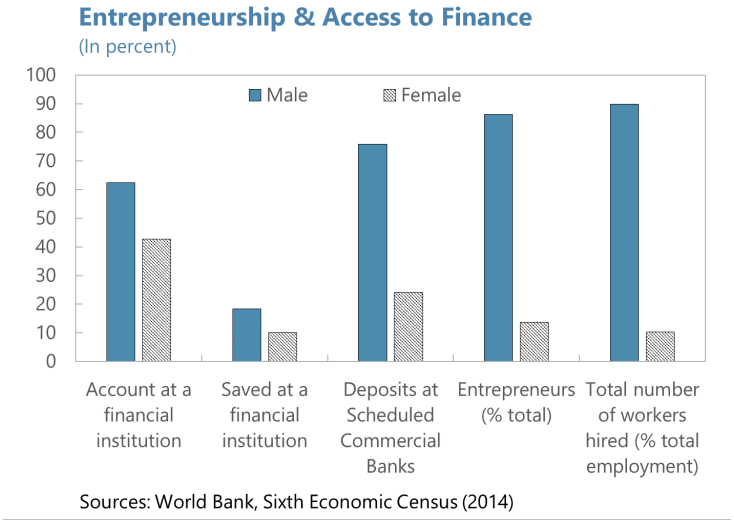
1 Introduction

Female entrepreneurs are considered important for economic development and make a significant contribution to the Indian economy (IFC, 2014). Despite the economic importance of female entrepreneurs, their number still lags behind that of male entrepreneurs (Figure 1). Women entrepreneurs comprise about 10 percent of the total number of entrepreneurs in India, and they are largely skewed towards smaller sized firms (98 percent of women-owned businesses are micro-enterprises) with approximately 90 percent of them operating in the informal sector. Financial constraints and limited access to formal finance is the key barrier to growth of women-owned enterprises, leaving them to rely on informal sources of finance (over 90 percent).

Although constraints to financial access is shown to play an important role for both male and female entrepreneurs, the level of financial exclusion of females (in comparison to males) is higher due to a number of demand and supply side constraints specific to women entrepreneurs' ability to access finance (Gonzales et al. 2015). On the demand side, limited awareness and social restrictions around inheritance and land ownership rights, as well as limited financial awareness turn female entrepreneurs towards finance from informal sources. Consequently, on the supply side, women in India rarely own property that they might use as collateral for borrowed start-up capital. Banks generally consider women-owned enterprises as a high-risk sub-segment, as these enterprises operate mostly in the informal sector and are usually micro in scale.

Figure 1: India - Gender inequality in entrepreneurship and access to finance

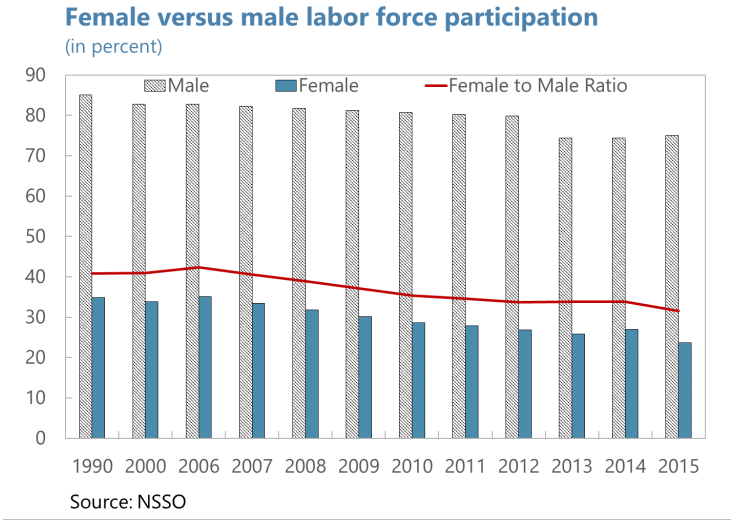


India also faces large gender gaps in labor market opportunities. Female labor force participation (FLFP), which is at one-third of male labor force participation, has been falling over time. Lack of employment opportunities in the formal (organized) sector is an important contributor to the declining trend in female labor force participation (Khera, 2016, 2016a; Das et al, 2015;

Chatterjee et al, 2015). Informal (unorganized) sector employment constitutes more than 90 percent of total employment, and females are largely employed in low productivity informal jobs in the agriculture and services sector. In addition, women receive lower wages for equal work, have lower average years of schooling, and are responsible for a much larger share of household-related work in comparison to males (India, 2016).

The large size of the informal sector in India has been attributed to tightly regulated formal sector which encourages firms to: a) remain small and informal to avoid regulations; and b) hire labor on an informal basis to avoid high costs of hiring and firing (see Khera and Anand, 2016).

Figure 2: India - Gender inequality in the labor market



The evidence that gender inequality is impeding economic growth is growing, and the potential gains from greater inclusion of women in the Indian economy are estimated to be large. For instance, according to Cuberes and Teignier (2016), closing the gender gap in India -- defined as closing gender gaps in occupational choices including entrepreneurship, participation in the labor market, and worker employability – could boost GDP in the long run by more than 33 percent.[1] Although, in terms of relative magnitudes, India's gains should be and are indeed found to be larger than most countries, a GDP boost of 33 percent is very likely an overestimate. This is because the Cuberes and Teignier (2016) results are based on a model simulation that does not take into account the rigidities in the formal labor market, formal goods market and formal credit markets, which are not only the drivers of the large informal sector in India, but also the drivers of the gender gaps in the labor market, in access to credit and in entrepreneurship.[2] Instead, they model these gender gaps as exogenously given restrictions on womens' occupational choice. Moreover, they abstract from modeling the decision of

[1]With respect to the long run total income losses from gender gaps, Yemen, Saudi Arabia, Syria, Qatar, and Iran are the countries with the largest ones, all of them over 40 percent, while Ghana, Liberia, and Rwanda are the countries with the smallest figures, all of them around 1 percent.

[2]The extended version of the Cuberes and Teignier (2016) model for developing economies takes into account

agents to participate in the labor force (assume no unemployment), assume perfect substitution between male and female labor, as well as abstract from introducing a household production sector.[3] Correctly taking into account these rigidities would dampen the overall gains from any gender-based reforms (see Khera, 2016).

The inter-linkages of gender gaps with the informal sector has largely been ignored in previous theoretical work. In addition, the effect of gender-based financial resource restrictions on women's labor market outcomes has been less explored. Recent empirical work has highlighted that access to finance helps increase female labor force participation, along with availability of infrastructure, transportation, better roads and mobile networks which help women access work (Elborgh-Woytek et al., 2013; and Kochhar et al., 2017).

As a result, this paper seeks to answer the following question: What is the impact of an increase in female entrepreneurs' access to formal finance (i.e. no gender gaps in financial access) on: i) gender gaps in business opportunities (entrepreneurship); ii) gender gaps in the labor market (female labor force participation, female informality in employment, and wage gaps); and on iii) macroeconomic outcomes (GDP, unemployment, and overall formality)? In this regard, we build a two sector small-open economy dynamic stochastic general equilibrium (DSGE) model with both gender inequality in entrepreneurship and in the labor market, along with its inter-linkages with the informal sector. The model is calibrated to match Indian data.

The main contribution of this study is to analyze not only the direct effect of financial frictions faced by female entrepreneurs on their business opportunities but also the indirect spillover on their labor market outcomes and on macroeconomic performance in India. It is important to note that since the policy scenarios in this paper correspond to permanent structural shifts, we use a deterministic version of the DSGE model.[4] While DSGE models are increasingly playing an important role in the formulation and communication of monetary policy at many of the world's central banks, for studying the impact of permanent structural changes in policy, a DSGE framework is useful as it allows us to model and capture the interaction between various sectors and agents of the economy, thus encapsulating well the different transmission channels through which a policy change impacts aggregate economic outcomes.

The theoretical framework is an extension of the model presented in Khera (2016), to which we add financial micro-foundations (i.e. a banking sector) based on the modeling technique in Babilla et al (2016). Khera (2016) builds a DSGE model with gender inequality and informality in the labor market and examines the impact of gender-targeted policies on females' labor market outcomes. However, they do not model the gender gaps in financial access and entrepreneurial activity. On the other hand, Babilla et al. (2016) assess the effects of financial frictions faced by female entrepreneurs on macroeconomics performances in Cameroon.

'self-employment out of necessity' for males and females who are not able to become workers. This can be interpreted as informal employment in our model. However, they model it as an exogenous fraction of both males and females that are not allowed to become workers and become 'self-employed out of necessity' instead of modeling it as endogenous frictions in the labor, goods and credit markets that are the endogenous drivers of this outcome.

[3] Cuberes and Teignier (2018) builds on Cuberes and Teignier (2016) by adding a household sector and quantify the effects of these gender gas on income in Europe.

[4] A deterministic model assumes perfect foresight and no uncertainty.

Their analysis is based on a DSGE model with male and female entrepreneurs who face collateral constraints in access to finance (Kiyotaki and Moore, 1997). However, their study only focuses on gender gaps in entrepreneurship and abstracts from modeling gender gaps in the labor market. Moreover, they do not take into account informality. Hence, while both provide significant contributions, they do lack in some respect or the other. Our goal in this paper is to build on Khera (2016) and add the gender gaps in access to credit in spirit of the financial frictions literature.

Our framework integrates the features of both, where we model two sectors— regulated formal sector and unregulated informal sector—in the goods, labor and financial markets. The economy consists of: a) households with male and female members, where each member either owns a firm (i.e. entrepreneur), supplies labor to entrepreneurs (i.e. participates in the labor market), or stays at home. The labor supply decision of each individual is an outcome of an optimal allocation among entrepreneurial opportunities, paid market-good production, unpaid home-good production (household-related work), job search, and leisure; while also being dependent on their relative intra-household bargaining power; b) male and female owned entrepreneurs in each sector, who hire male and female workers and rent capital (financed by bank loans) to produce final goods which are sold domestically or exported to the rest of the world.; c) capital producers who invest in new capital; d) formal and informal sector banks that provide loans to firms in their corresponding sector; e) the government who taxes formal wage income to fund social spending and sets the interest rate; and f) the rest of the world.

To capture rigidities (see Table 1) - firms in the formal sector face higher entry costs (to set up a new business), higher costs of hiring and firing workers, and workers employed formally have a higher wage bargaining power (i.e. unionized labor). In addition, the size of informal finance in the economy is positively related to: i) the degree of financial frictions in the formal sector; and to the ii) the overall share and size of informal firms (which is linked to the extent of regulations in the formal sector). Gender issues are introduced in the model via heterogeneity in access to finance, skills, safety, social norms, contribution to household activities, and discrimination (Table 2). Based on the lines of Kiyotaki and Moore (1997), 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 value of this collateral.[5] As in this framework, we allow for a dual role of capital, as an investment good and as a collateral for borrowers.[6]

Using this framework, we study and quantify the impact of policies that lower financial frictions (i.e. lower collateral constraint) faced by female entrepreneurs on: gender gaps in entrepreneurship and in the labor market (female labor force participation, female formal employment, and gender wage gaps), as well as its impact on the overall macroeconomic outcomes (GDP, formality in the labor market, and unemployment). In addition, the impact of

[5] Kiyotaki and Moore (1997) have stressed the relevance of the link between the value of borrower's collateral and their access to funds in amplifying the economy's response to shocks.

[6] Physical capital is used both as collateral to obtain loans and as an input to production. A shock that reduces the productive capacity of entrepreneurs also reduces their ability to borrow, forcing them to cut back on their investment expenditures and, thus, on their demand for capital. This situation can spill over to the subsequent periods, reducing revenues, production and investments even further.

Table 1: Characterizing Informality

	Formal sector	**Informal sector**
Labor & Product Market	Regulated	Unregulated
Wage bargaining of workers	High	Low
Hiring/ firing cost of workers	High	Low
Entry cost to set up a new firm	High	Low
Financial Market Frictions	High	Low
Traded good	✔	✖
Taxation	✔	✖

Table 2: Characterizing Gender Inequality

	Male	**Female**
Access to productive inputs:		
Credit	High	Low
Skill	High	Low
Time use: household care responsibilities	Low	High
Institutional failure & social norms:		
Wage bargaining power in the labor market	High	Low
Safety/ mobility outside home	High	Low
Discrimination in employment	✖	✔

the former under the following two scenarios is also analyzed: a) combined with lower regulations (i.e. higher flexibility) in the formal sector labor market; and b) combined with policies that lower gender-specific constraints faced by females in the labor market - for instance, on the demand side, skill development policies (i.e. no gender gap in skills) and on the supply side, increase in female safety.

Policy analysis reveals the following results. First, consistent with the empirical literature, greater financial inclusion of female entrepreneuers (i.e. no gender gaps in access to formal finance) along with promoting higher female entrepreneurship, also leads to an increase in female labor force participation, which leads to higher GDP and lower unemployment. An increase in access to formal finance incentivizes more entrepreneurs to set up business in the formal sector resulting in a higher share of formal sector output. However, informality in the labor market increases, as these entrepreneurs choose to hire workers informally due to stringent formal labor market regulations. Hence, although employment and labor participation in the economy is now higher, a larger share of the new labor market participants find employment in low paying informal jobs. Second, we find that when labor markets are more flexible (i.e. lower regulations in the labor market), closing gender gaps in access to finance not only leads to a higher share of formal sector employment for both females and males, but also leads

to larger gains in GDP and unemployment. However, male workers gain more as firms prefer to hire male workers in comparison to female workers as females on average have lower skills (education) and/ or are subjected to discrimination (gender specific constraints faced by females). Hence, gender gaps in formal employment and labor force participation widen. Lastly, when combined with policies that lower demand-side constraints faced by females in the formal labor market, increasing females' financial access gives the Indian economy a substantially larger boost, while also leading to higher gender parity in labor force participation, wages and formal sector employment.

Our numerical results show that, with respect to the long-run GDP gains in India, closing gender gaps in access to formal credit leads to only a 1.6 percent increase in GDP. When combined with policies that lower labor market rigidities in the formal labor market (calibrated as a 10 percent reduction in hiring/ firing costs), the gain in GDP increases to 4.7 percent. The largest gains are when the former is combined with policies that close gender gaps in the level of worker skills (i.e. education) leading to a 6.8 percent gain in GDP.

What do the above results imply for policy making in India? While inclusive policies that focus on lowering barriers faced by females in obtaining formal sources of finance are necessary to promote higher female entrepreneurship which will also benefit the economy, the full benefits of such structural policies will only be achieved under a more flexible formal labor market regime as well as by lowering other gender-specific structural constraints faced by females in the formal labor market. Recent financial sector initiatives of the Indian government have seen some success in enhancing various aspects of financial inclusion (Box 10 in India, 2016; Box 4 in India, 2017). More than 240 million previously unbanked individuals, among whom about 47 percent are females, have gained access to bank accounts since the launch of the Pradhan Mantri Jan Dhan Yojana (PMJDY) in August 2014. Moreover, the Pradhan Mantri MUDRA[7] Yojana (PMMY) scheme has been successful in enabling women-led businesses to access collateral-free finance.[8] However, going forward labor market structural reforms should be prioritized to reap the full benefits of such reforms. Recently, the Indian government has made some progress in this direction such as by allowing fixed-term employment across sectors which is aimed towards easing hiring and firing of workers, as well as changes to women-oriented policy such as by increasing maternity benefits from 12 to 26 weeks.[9] The government should measure the success of its interventions by the extent of rise in females' formal entrepreneurship, mobility of their firms to medium and large sizes, and by the extent of improvement in females' labor market participation (Box 6 and 7 in India, 2017).

One caveat of our analysis is that it only focuses on the steady-state analysis, i.e. changes in the long-run equilibrium after a reform, and abstracts from analyzing the transitional impact from one steady state to another. Thus, while these reforms are shown to be beneficial in the long-run, there could be transitional costs to some of them, leaving scope for future research

[7] Micro Units Development and Refinance Agency.

[8] Womens' businesses accounted for about one-half of the total amount lent under the scheme, and about four-fifths of the number of loans, in part reflecting scheme's support to new business undertakings led by women.

[9] Under fixed-term employment, workers are entitled to statutory benefits available to a permanent worker in the same factory, including work hours, wages, and allowances. However, employers need not give notice to fixed-term workers on non-renewal or expiry of contracts.

(see Khera, 2016).

The remainder of this paper is organized as follows. In Section 2 we outline the theoretical framework, and Section 3 discusses the calibration method and the equilibrium (steady state) of the model. Section 4 presents an analysis of several policy experiments and Section 5 concludes the paper.

2 The Model

This section presents the Baseline model. Our starting point is the DSGE model presented in Khera (2016) to which we add financial micro-foundations in the form of a collateral constraint based on Kiyotaki and Moore (1997). We provide a brief description before specifying the details of the model in the following subsections.

The small open economy consists of households, entrepreneurs, retailers, capital producers, and a government. Two goods are produced in the economy: market-good and a home-good. Market-good consist of formal tradable goods (F), informal non-tradable goods (I), and imported goods (f^*). The first two are produced domestically by formal and informal retailers in each sector $s\varepsilon(F,I)$, respectively, while the latter is produced in the foreign economy and sold domestically by import retailers in the formal sector. On the other hand, home goods (H^0) are produced by individuals of the household who work at home, and is for household consumption only.

Households consist of male (m) and female (f) members who derive utility from consuming market goods, home goods, and leisure. Each member either owns a firm (i.e. entrepreneur), supplies labor (i.e. participates in the labor market) to entrepreneurs, or stays at home. The ones that participate in the labor market are either employed or stay unemployed. The employed work in either one of the four types of firms: 1) a male entrepreneuer in the formal sector, 2) a female entrepreneuer in the formal sector, 3) a male entrepreneuer in the informal sector; or 4) a female entrepreneuer in the informal sector; or stay unemployed. The employed engage in paid market-good production, whereas the unemployed work in unpaid home-good production in the residual time when unoccupied by job search. On the other hand, the ones that stay at home, are either working in home-good production, or consuming leisure.

Male and female entrepreneurs in each sector combine labor with capital to produce intermediate goods. In order to acquire capital, entrepreneurs in each sector borrow from formal and informal sector banks, respctively. Both types of entrepreneurs are financially constrained: their ability to invest is bound by the value of their collateral. Unemployment exists as wholesalers in each sector pay a hiring cost when hiring new labor *a la* Blanchard and Gali (2006). Wages in each sector are determined through Nash bargaining between workers and firms. Overall, we can think of the economy as having 4 sectors: female owned firms in the formal sector, male owned firms in the formal sector, female owned firms in the informal sector; and male owned firms in the informal sector (see Table 3).

Formal and informal retailers purchase wholesale goods from male and female entrepreneurs in the respective sectors, differentiate these into different varieties of market-goods, and set the

Table 3: Four sectors of the economy

		Form of establishment $s\varepsilon(F,I)$	
		Formal (F)	Informal (I)
Owner $h\varepsilon(m,f)$	Male (m)	male-formal (m,F)	male-informal (m,I)
	Female (f)	female-formal (f,F)	female-informal (f,I)

retail price for each individual variety in an environment of monopolistic competition and price adjustment costs *a la* Rotemberg (1982). A group of competitive capital producers combine formal market- and imported goods to produce final investment goods, which is then combined with the used capital goods rented from wholesalers to produce new capital. Government conducts monetary and fiscal policy: it sets the nominal interest rate using a Taylor-type rule, and receives tax wage income from households which is used to finance public spending and unemployment benefit payments.

Details regarding each agent's behaviour are described below.

2.1 The Labor Market

There are a continuum of households (0,1), out of which p^m proportion are males, and $p^f = 1 - p^m$ proportion are females.[10] Households either own a firm (i.e. entrepreneurship), or supply their labor to wholesale firms, which determines the labor market participation rate, or stay at home forming the pool of non-participants.

Hence, there are two types of workers and entrepreneurs $h\varepsilon(m,f)$ in the labor market where m denotes males and f denotes females. The ones who decide to participate in the labor market can either be employed in one of the two sectors $s\varepsilon(F,I)$, where F is the formal sector and I is the informal sector, or stay unemployed. In each sector, they are either employed by male entrepreneurs or by female entrepreneurs. The mass of male workers who are employed by male and female entrepreneurs in the formal sector is denoted by $L^m_{m,F,t}$and $L^m_{m,I,t}$, ones who are employed by male and female entrepreneurs in the informal sector denoted by $L^m_{m,F,t}$and $L^m_{m,I,t}$, and the unemployed, U^m_t. Similarly, the mass of female workers are denoted by $L^f_{m,F,t}$, $L^f_{m,I,t}$, $L^f_{f,F,t}$, $L^f_{f,I,t}$ and U^f_t. Non-participants consist of NP^m_t males and NP^f_t females. Total number of male and female workers employed in each sector can then be expressed as:

$$L^m_{s,t} = L^m_{m,s,t} + L^m_{f,s,t} \tag{2.1}$$

$$L^f_{s,t} = L^f_{m,s,t} + L^f_{f,s,t} \tag{2.2}$$

[10] As per the 2001 consensus, females in India constitutes half of the country's population and therefore we assume $p^m = p^f = \frac{1}{2}$.

The pool of male and female workers who participate in the labor market is then given by: $P_t^m = p^m - NP_t^m$ and $P_t^f = p^f - NP_t^f$, whereas the male and female unemployment is determined by: $U_t^m = P_t^m - L_{F,t}^m - L_{I,t}^m$ and $U_t^f = P_t^f - L_{F,t}^f - L_{I,t}^f$, respectively. Hence, we can express unemployment as:

$$U_t^m = p^m - NP_t^m - L_{F,t}^m - L_{I,t}^m \tag{2.3}$$

$$U_t^f = p^f - NP_t^f - L_{F,t}^f - L_{I,t}^f \tag{2.4}$$

The labor market dynamics closely follow the framework in Campolmi and Gnochhi (2014). The stock of employed labor varies because of the endogenous variation in hiring, and an exogenous probability of getting fired, σ_s, every period.[11]

Here, we describe details of the labor market framework for female workers. A similar set-up follows for male workers. At the end of period $t-1$, after all decisions have been taken and executed, $F_{m,F,t-1}^f = \sigma_F L_{m,F,t-1}^f$ and $F_{f,F,t-1}^f = \sigma_F L_{f,F,t-1}^f$ female workers are fired by male and female entrepreneurs in the formal sector, and by male and female entrepreneurs in the informal sector, $F_{m,I,t-1}^f = \sigma_I L_{m,I,t-1}^f$ and $F_{f,I,t-1}^f = \sigma_I L_{f,I,t-1}^f$. In period t, new female workers are hired, $H_{h,F,t}^f$ and $H_{h,I,t}^f$, from the pool of job searchers, S_t^f.[12] The evolution of female labor in the formal sector is given by:

$$L_{m,F,t}^f = L_{m,F,t-1}^f - F_{m,F,t-1}^f + H_{m,F,t}^f = (1-\sigma_F)L_{m,s,t-1}^f + p(H_{m,F,t}^f)S_t^f \tag{2.5}$$

$$L_{f,F,t}^f = L_{f,F,t-1}^f - F_{f,F,t-1}^f + H_{f,F,t}^f = (1-\sigma_F)L_{f,F,t-1}^f + p(H_{f,F,t}^f)S_t^f \tag{2.6}$$

and in the informal sector:

$$L_{m,I,t}^f = L_{m,I,t-1}^f - F_{m,I,t-1}^f + H_{m,I,t}^f = (1-\sigma_I)L_{m,I,t-1}^f + p(H_{m,I,t}^f)S_t^f \tag{2.7}$$

$$L_{f,I,t}^f = L_{f,I,t-1}^f - F_{f,I,t-1}^f + H_{f,I,t}^f = (1-\sigma_I)L_{f,I,t-1}^f + p(H_{f,I,t}^f)S_t^f \tag{2.8}$$

where female workers' probability of getting hired, $p(H_{h,s,t}^f)$ is determined endogenously by wholesalers' optimization.

The unemployed, the non-participants, and fired individuals, $U_{t-1}^f + NP_{t-1}^f + F_{m,F,t-1}^f + F_{m,I,t-1}^f + F_{f,F,t-1}^f + F_{f,I,t-1}^f$, form the pool of males and females that are not employed at the end of period $t-1$. Among these, some are job searchers in the following period t, and the remaining ones are non-participants:

$$S_t^f + NP_t^f = U_{t-1}^f + NP_{t-1}^f + \sigma_F L_{m,F,t-1}^f + \sigma_I L_{m,I,t-1}^f + \sigma_F L_{f,F,t-1}^f + \sigma_I L_{f,I,t-1}^f \tag{2.9}$$

[11] Probability of getting fired is allowed to vary across the two sectors, which corresponds to the relative difficulty in firing workers in the formal sector (i.e. employment protection policies).

[12] Assume instantaneous hiring, i.e. period t searchers can be matched and start producing in period t itself. This is a standard assumption in a sticky-price model, and seems reasonable if a period is interpreted as a quarter.

Substituting for the equations above gives us the following expressions for male and female job searchers in period t:

$$S_t^f = P_t^f - (1-\sigma_F)L_{m,F,t-1}^f - (1-\sigma_I)L_{m,I,t-1}^f - (1-\sigma_F)L_{f,F,t-1}^f - (1-\sigma_I)L_{f,I,t-1}^f \quad (2.10)$$

Evolution of female formal employment (Eq. 2.5 and Eq. 2.6 with $s = F$) by male and female entrepreneurs can then be written as:

$$L_{m,F,t}^f = (1-\sigma_F)(1-p(H_{F,t}^f))L_{m,F,t-1}^f + p(H_{m,F,t}^f)P_t^f - p(H_{m,F,t}^f)(1-\sigma_I)L_{m,I,t-1}^f \quad (2.11)$$

$$L_{f,F,t}^f = (1-\sigma_F)(1-p(H_{f,F,t}^f))L_{f,F,t-1}^f + p(H_{f,F,t}^f)P_t^f - p(H_{f,F,t}^f)(1-\sigma_I)L_{f,I,t-1}^f \quad (2.12)$$

Eq. 2.11 implies that in period t, total female workers employed in the formal sector by male entrepreneurs increases with higher female labor participation, P_t^f, and with a rise in their probability of getting hired in this sector, $p(H_{m,F,t}^f)$.[13] An analogous interpretation of Eq. 2.12 follows for female workers employed by female entrepreneurs in the formal sector.

Similarly, for the informal sector $(s = I)$, we get:

$$L_{m,I,t}^f = (1-\sigma_I)(1-p(H_{I,t}^f))L_{m,I,t-1}^f + p(H_{m,I,t}^f)P_t^f - p(H_{m,I,t}^f)(1-\sigma_F)L_{m,F,t-1}^f \quad (2.13)$$

$$L_{f,I,t}^f = (1-\sigma_I)(1-p(H_{f,I,t}^f))L_{f,I,t-1}^f + p(H_{f,I,t}^f)P_t^f - p(H_{f,I,t}^f)(1-\sigma_F)L_{f,F,t-1}^f \quad (2.14)$$

Probability of getting hired by male and female entrepreneurs in sector s is then given by the ratio of new hires to the pool of job searchers:

$$p(H_{m,s,t}^f) = \frac{H_{m,s,t}^f}{S_t^f} \qquad p(H_{f,s,t}^f) = \frac{H_{f,s,t}^f}{S_t^f} \quad (2.15)$$

Ratio of total job searchers to the pool of individuals not employed at the end of period $t-1$ determines the probability of searching for a job:

$$p(S_t^f) = \frac{S_t^f}{U_{t-1}^f + NP_{t-1}^f + F_{m,F,t-1}^f + F_{m,I,t-1}^f + F_{f,F,t-1}^f + F_{f,I,t-1}^f} \quad (2.16)$$

[13] For this to hold, female labor participation in period t should be greater than the sum of female workers that are still employed from the previous period $t-1$, i.e. $P_t^f > (1-\sigma_F)L_{F,t-1}^f + (1-\sigma_I)L_{I,t-1}^f$. This always holds true for all periods in our model.

2.2 Entrepreneurs

There are a continuum of male and female entrepreneurs, $h\varepsilon(m,f)$, operating in each sector $s\varepsilon(F,I)$ who produce formal and informal intermediate goods, respectively, by combining labour hired from households, and capital purchased from capital producers. They sell these intermediate goods to retailers in their respective sectors, under perfect competition. Entrepreneurs operating in each sector, differ along two dimensions: available technology and labor market regulations. In order to acquire capital, entrepreneurs borrow from banks. Both types of entrepreneurs are financially constrained: their ability to invest is bound by the value of their collateral. Male and female entrepreneurs also differ along two dimensions: financial frictions and in their relative preference for male versus female workers.

Below we provide details regarding the optimization problem and the financial frictions faced by female entrepreneurs. Similar set-up follows for the production sector dominated by male entrepreneurs.

2.2.1 Female Entrepreneurs

We have a continuum of female wholesalers (0,1) in each sector s producing different intermediate goods, $Y^W_{f,F,t}$ and $Y^W_{f,I,t}$, with access to different technologies, $\theta_{F,t}$ and $\theta_{I,t}$. By the beginning of period t, they are assumed to acquire capital, $K_{f,F,t-1}$ and $K_{f,I,t-1}$, from capital producers, which is combined with labor hired from households, $L_{f,F,t}$ and $L_{f,I,t}$, to produce these goods over period t, using a Cobb-Douglas function:

$$Y^W_{f,F,t} = \theta_{F,t}\left(K_{f,F,t-1}\right)^{\psi_F}\left(L_{f,F,t}\right)^{1-\psi_F} \tag{2.17}$$

$$Y^W_{f,I,t} = \theta_{I,t}\left(K_{f,I,t-1}\right)^{\psi_I}\left(L_{f,I,t}\right)^{1-\psi_I} \tag{2.18}$$

where ψ_s is the capital intensity related to capital income share in sector s. They sell their goods to retailers in their respective sectors at a price of $P^W_{f,F,t}$ and $P^W_{f,I,t}$.

Total labor in each sector is a constant elasticity of substitution (CES) aggregate of male and female workers, where $\rho_s\varepsilon(-\infty,1]$ determines the substitution elasticity:

$$L_{f,F,t} = [\omega_{f,F,t}(skill^m_F L^m_{f,F,t})^{p_F} + (1-\omega_{f,F,t})(skill^f_F L^f_{f,F,t})^{p_F}]^{1/p_F} \tag{2.19}$$

$$L_{f,I,t} = [\omega_{f,I,t}(skill^m_I L^m_{f,I,t})^{p_I} + (1-\omega_{f,I,t})(skill^f_I L^f_{f,I,t})^{p_I}]^{1/p_I} \tag{2.20}$$

$\omega_{h,s,t}\varepsilon(0,1)$ is the firms' relative preference for male workers over female workers in sector s.[14] Differences in skill level of male and female workers, $skill^m_s$ and $skill^f_s$, corresponds to the gender gaps in education. These skills also vary across sectors, which relates to the differences in worker training and efficiency of workers across the formal and informal sector.

[14] One can interpret this as the male gender bias in employment which determines the extent of gender discrimination in employment. $\omega_{s,t} = 0.5$ implies no gender discrimination, whereas firms discriminate against females when $\omega_{s,t} > 0.5$.

Labor Market Regulations

Female entrepreneurs in each sector s face real hiring costs, $HC^h_{f,s,t}$, when hiring new labor and the real wage, $W^h_{f,s,t}$, paid to this worker is decided by the generalized Nash bargaining solution. In addition, entrepreneurs are assumed to borrow from banks, $Loan_{f,s,t}$, in their respective sectors at the rate of $R^K_{s,t}$ to finance capital acquisition. Per period real profit is equal to the revenue net costs spent on employing labor (wages and hiring costs), renting capital, and the interest paid on borrowings, where P_t is the aggregate price level and R^K_t is the real rental rate of capital:

$$\begin{aligned}\Pi^W_{f,F,t} = \frac{P^W_{f,F,t}}{P_t} Y^W_{f,F,t} - W^m_{f,F,t} L^m_{f,F,t} - W^f_{f,F,t} L^f_{f,F,t} - R^K_t K_{f,F,t-1} \\ - HC^m_{f,F,t} H^m_{f,F,t} - HC^f_{f,F,t} H^f_{f,F,t} + Loan_{f,F,t} - R^K_{F,t-1} Loan_{f,F,t-1}\end{aligned} \tag{2.21}$$

$$\begin{aligned}\Pi^W_{f,I,t} = \frac{P^W_{f,I,t}}{P_t} P^W_{f,I,t} Y^W_{f,I,t} - W^m_{f,I,t} L^m_{f,I,t} - W^f_{f,I,t} L^f_{f,I,t} - R^K_t K_{f,I,t-1} \\ - -HC^f_{f,I,t} H^f_{f,I,t} - HC^f_{f,I,t} H^f_{f,I,t} + Loan_{f,I,t} - R^K_{I,t-1} Loan_{f,I,t-1}\end{aligned} \tag{2.22}$$

Following Blanchard and Gali (2006), hiring costs depend positively on the total number of new hires, and negatively on the pool of unemployed at the beginning of period t:

$$HC^h_{f,F,t} = \left(\beta_{HC_F,t}\right) \left(p(H^h_{f,F,t})\right)^{\alpha_{HC_F}} \tag{2.23}$$

$$HC^h_{f,I,t} = \left(\beta_{HC_I,t}\right) \left(p(H^h_{f,I,t})\right)^{\alpha_{HC_I}} \tag{2.24}$$

hiring cost shocks, and $\alpha_{HC_s} > 0$ is the elasticity of hiring cost with respect to hiring probability.

Financial Frictions

In order to invest in capital, female entrepreneurs in the formal and informal sector borrow from banks in their respective sectors. Following Kiyotaki and Moore (1997), the amount of loans that an entrepreneur can obtain is constrained by the value of their collateral. Collateral is determined by the physical capital holdings of each entrepreneur. The borrowing constraint in each sector is determined by the minimum return on loans required by the banks where $LTV_{f,s,t}$ is the maximum loan-to-value ratio available to a female entrepreneur in sector s:

$$R^k_{f,F,t} Loan_{f,F,t} \geq LTV_{f,F,t} \left[(1-\delta_K) K_{f,F,t-1} E_t(q_{t+1})\right] \tag{2.25}$$

$$R^k_{f,I,t} Loan_{f,I,t} \geq LTV_{f,I,t} \left[(1-\delta_K) K_{f,I,t-1} E_t(q_{t+1}) \right] \tag{2.26}$$

The amount of loans a female entrepreneur can obtain increases with an increase in the expected value of their collateral (i.e. capital), with an increase in the minimum loan-to-valu ratio, and with a decrease in the interest rates on loans charged by banks.

Demand for Capital, Labor and Loans

Female entrepreneurs in sector s choose $L^m_{f,s,t}$, $L^f_{f,s,t}$, $H^m_{f,s,t}$, $H^f_{f,s,t}$, $K_{s,t-1}$, and $Loan_{f,s,t}$ by maximising their expected discounted value of future profits:

$$\max_{L_{f,s,t}, K_{f,s,t-1}, H_{f,s,t}} E_t \sum_{k=0}^{\infty} (\beta_f)^t \Pi^W_{f,s,t+k} \tag{2.27}$$

subject to the law of motion of male and female employment (Eq. 2.5 and Eq. 2.6), and the borrowing constraint. $\rho_{t,t+k}$ is the stochastic discount rate obtained from the households' optimization problem discussed below.

Capital and labor demand functions in sector s are obtained from the first order conditions as follows:

$$R^K_t = \psi_s \frac{P^W_{f,s,t}}{P_t} \frac{Y^W_{f,s,t}}{K_{f,s,t-1}} + \frac{(1-\delta_K) LTV_{f,s,t} E_t \left[(q_{t+1})(1-(\beta_f) R^k_{s,t+1}) \right]}{R^k_{s,t}} \tag{2.28}$$

$$(1-\psi_s)\omega_{f,s} \frac{P^W_{f,s,t}}{P_t} \frac{Y^W_{f,s,t}}{L^m_{f,s,t}} \left(skill^m_s \frac{L^m_{f,s,t}}{L_{f,s,t}} \right)^{\rho_s} = W^m_{f,s,t} + HC^m_{f,s,t} - E_t \left(\beta_f HC^m_{f,s,t+1} (1-\sigma_s) \right) \tag{2.29}$$

$$(1-\psi_s)(1-\omega_{f,s}) \frac{P^W_{f,s,t}}{P_t} \frac{Y^W_{f,s,t}}{L^f_{f,s,t}} \left(skill^f_s \frac{L^f_{f,s,t}}{L_{f,s,t}} \right) \rho_s = W^f_{f,s,t} + HC^f_{f,s,t} - E_t \left(\beta_f HC^f_{f,s,t+1} (1-\sigma_s) \right) \tag{2.30}$$

The demand for capital (Eq. 2.28) is now not only determined by the marginal product of capital and rental rate, but also by the collateral constraint. Demand for capital is higher when the rental rate, R^K_t is lower; loan-to-value ratio,$LTV_{f,s,t}$, is higher; interest rate on loans in the current period, $R^k_{s,t}$ and the next period, $R^k_{s,t+1}$ is lower; and when the expected value of collateral, q_{t+1}, is higher. This implies that a financial inclusion policy that increases the loan-to-value ratio will need to higher demand for capital which will also lead to higher price of collateral and further amplify investment and demand in the economy.

On the other hand, the labor demand for males and females (Eq. 2.29 and Eq. 2.30) is now determined by equating marginal product to the marginal cost of employing labor, which includes the real wage plus the cost generated by hiring.

Wage setting follows a Nash bargaining process between workers and wholesalers where wage bargaining Aower Af Aorker An Ahe Aormal And Anformal Aector As Aenoted Ay $\lambda^h_F \varepsilon (0,1)$ And

$\lambda_I^h \varepsilon(0,1)$, respectively. The bargaining power of formal workers is assumed to to be higher than informal workers. To capture gender gaps in access to labor unions, union leadership, and union priorities, we also allow for differences in bargaining power of male and female workers.

We obtain the expressions for wage rate of male and female workers and define average male and female wages, W_t^m and W_t^f, by the ratio of total after tax wage income divided by the total number of individuals employed:

$$W_t^m = \frac{W_{m,F,t}^m L_{m,F,t}^m (1-\tau_F) + W_{m,I,t}^m L_{I,t}^m + W_{f,F,t}^m L_{f,F,t}^m (1-\tau_F) + W_{f,I,t}^m L_{f,I,t}^m}{L_{m,F,t}^m + L_{m,I,t}^m + L_{f,F,t}^m + L_{f,I,t}^m}$$

$$W_t^f = \frac{W_{m,F,t}^f L_{m,F,t}^f (1-\tau_F) + W_{m,I,t}^f L_{m,I,t}^f + W_{f,F,t}^f L_{f,F,t}^f (1-\tau_F) + W_{f,I,t}^f L_{f,I,t}^f}{L_{m,F,t}^f + L_{m,I,t}^f + L_{f,F,t}^f + L_{f,I,t}^f}$$

where ratio of average male wages to average female wages, $\frac{W_t^m}{W_t^f}$, is defined as the 'gender wage gap'. The wage rate for female workers employed by female entrepreneurs in the formal sector is given by:

$$W_{f,F,t}^f (1-\tau_F) = \frac{\lambda_{F,t}^f}{1-\lambda_{F,t}^f}(1-\tau_F)(HC_{f,F,t}^f) + W_{U,t}$$
$$-(1-\sigma_F)E_t \left\{ \rho_{t,k} \left[\begin{array}{c} \frac{\lambda_{F,k}^f}{1-\lambda_{F,k}^f}\left[1-p(S_k^f)p(H_{f,F,k}^f)\right](1-\tau_F)HC_{f,F,k}^f \\ -\frac{\lambda_{I,k}^f}{1-\lambda_{I,k}^f}(p(H_{f,I,k}^f))HC_{f,I,k}^f - \frac{\lambda_{F,k}^f}{1-\lambda_{F,k}^f}(p(H_{m,F,k}^f))HC_{m,F,k}^f \\ -\frac{\lambda_{I,k}^f}{1-\lambda_{I,k}^f}(p(H_{m,I,k}^f))HC_{m,I,k}^f + (1-p(S_k^f))W_{U,k} \\ +(1-p(S_k^f))p(le_k^f)MRS_{le,C_k}^f \\ +(1-p(S_k^f))\left[1-p(le_k^f)-\tau_U\right]MRS_{HP,C_k}^m \end{array} \right] \right\}$$

We obtain analogous expressions for $W_{f,I,t}^f$, $W_{m,F,t}^f$,$W_{m,I,t}^f$, $W_{m,I,t}^m$,$W_{f,I,t}^m$, $W_{m,F,t}^m$, and $W_{f,F,t}^m$.

2.3 Retailers

Retailers are incorporated in the model for the sake of introducing nominal rigidity. A continuum j_F and j_I of monopolistically competitive formal and informal retailers buy wholesale goods supplied by female entrepreneurs, $Y_{f,F,t}^W$ and $Y_{f,I,t}^W$, and male entrepreneurs, $Y_{m,F,t}^W$ and

$Y^W_{m,I,t}$, and combine it using the following CES production function, to produce different final market-good varieties, $Y_{F,t}(j_F)$ and $Y_{I,t}(j_I)$, and sell these at different prices, $P_{F,t}(j_F)$ and $P_{I,t}(j_I)$, respectively:[15]

$$Y_{F,t}(j_F) = \left[\alpha_F^{\frac{1}{\eta_F}} Y^W_{m,F,t}{}^{\frac{\eta_F-1}{\eta_F}} + (1-\alpha_F)^{\frac{1}{\eta_F}} Y^W_{f,F,t}{}^{\frac{\eta_F-1}{\eta_F}} \right]^{\frac{\eta_F}{\eta_F-1}} \tag{2.31}$$

$$Y_{I,t}(j_I) = \left[\alpha_I^{\frac{1}{\eta_I}} Y^W_{m,I,t}{}^{\frac{\eta_I-1}{\eta_i}} + (1-\alpha_I)^{\frac{1}{\eta_I}} Y^W_{f,I,t}{}^{\frac{\eta_I-1}{\eta_I}} \right]^{\frac{\eta_I}{\eta_I-1}} \tag{2.32}$$

where $\alpha_s \in (0,1)$ is the relative weight on intermediate goods produced by male entrepreneurs, and $\eta_s > 1$ is the elasticity of substitution between goods produced by male entrepreneurs and goods produced by female entrepreneurs. Price charged by each retailer can be expressed as a composite of male entrepreneurs' good price $P^W_{m,s,t}$ and female entrepreneurs' good price $P^W_{f,s,t}$, and is given by the following CES form:

$$P_{F,t}(j_F) = \left[\alpha_F P^W_{m,F,t}{}^{1-\eta_F} + (1-\alpha_F) P^W_{f,F,t}{}^{1-\eta_F} \right]^{\frac{1}{1-\eta_F}} \tag{2.33}$$

$$P_{I,t}(j_I) = \left[\alpha_I P^W_{m,I,t}{}^{1-\eta_I} + (1-\alpha_I) P^W_{f,I,t}{}^{1-\eta_I} \right]^{\frac{1}{1-\eta_I}} \tag{2.34}$$

By minimizing expenditure on the total composite demand, we can derive the following optimal demand functions for male entrpreneurs' goods and female entrpreneurs' goods in each sector:

$$Y^W_{f,F,t} = (1-\alpha_F)\left(\frac{P^W_{f,F,t}}{P_{F,t}}\right)^{-\eta_F} Y_{F,t} \qquad Y^W_{m,F,t} = \alpha_F \left(\frac{P^W_{m,F,t}}{P_{F,t}}\right)^{-\eta_F} Y_{F,t} \tag{2.35}$$

$$Y^W_{f,I,t} = (1-\alpha_I)\left(\frac{P^W_{f,I,t}}{P_{I,t}}\right)^{-\eta_I} Y_{I,t} \qquad Y^W_{m,I,t} = \alpha_I \left(\frac{P^W_{m,I,t}}{P_{I,t}}\right)^{-\eta_I} Y_{I,t} \tag{2.36}$$

Total composite output in each sector s, $Y_{s,t}$, produced by retailers is a Dixit-Stiglitz (1977) CES aggregate of different varieties of goods produced by individual retailers, $Y_{s,t}(j_s)$.

$$Y_{s,t} = \left(\int_0^1 Y_{s,t}(j_s)^{\frac{\varepsilon_s-1}{\varepsilon_s}} dj_s \right)^{\frac{\varepsilon_s}{\varepsilon_s-1}} \tag{2.37}$$

ε_s stands for the elasticity of substitution between different varieties of goods. The corresponding price of the composite consumption good, $P_{s,t}$ is:

$$P_{s,t} = \left(\int_0^1 P_{s,t}(j_s)^{1-\varepsilon_s} dj_s \right)^{\frac{1}{1-\varepsilon_s}} \tag{2.38}$$

[15] We assume zero cost of differentiation.

The demand function facing each retailer can be written as:

$$Y_{s,t}(j_s) = \left(\frac{P_{s,t}(j_s)}{P_{s,t}}\right)^{-\varepsilon_s} Y_{s,t} \tag{2.39}$$

Formal final good, $Y_{F,t}$, is exportable where it is consumed both domestically $Q^d_{F,t}$, by households, capital producers and government, and is also exported Q^x_t to the rest of the world. On the other hand, the informal sector good $Y_{I,t}$ is nontradable and is only consumed domestically by households, $Q^d_{I,t}$.

Retailer j_s sets its price, $P_{s,t}(j_s)$ that maximizes its expected discounted stream of future profits subject to costs of price adjustment following Rotemberg (1982):

$$\begin{aligned}\frac{P_{s,t}(j_s)}{P_t} = {} & \frac{\varepsilon_s}{\varepsilon_s - 1} MC^W_{j,t} + \frac{\phi^{adj}_s}{\varepsilon_s - 1}\left(\frac{\pi_{s,t}}{\pi} - 1\right)\frac{\pi_{s,t}}{\pi} \\ & - E_t\left\{\rho_{t,t+1}\left[\left(\frac{\phi^{adj}_s}{\varepsilon_s - 1}\right)\left(\frac{\pi_{s,t+1}}{\pi} - 1\right)\left(\frac{\pi_{s,t+1}}{\pi}\right)\frac{Y_{s,t+1}(j_s)}{Y_{s,t}(j_s)}\right]\right\}\end{aligned} \tag{2.40}$$

$\frac{\varepsilon_s}{\varepsilon_s - 1}$ is the desired (gross) mark-up, resulting from the imperfections in the retail market. .

2.4 Banking sector

Banks in the formal sector and the informal sector receive deposits from the household, D_t, and use this to supply loans to both male and female entrepreneurs in each sector. Banks maximize their dividends paid to households who are the ultimate owners of the banks:

$$\max_{Loan_{m,s,t}, Loan_{f,s,t}} E_t \sum_{k=0}^{\infty} \rho_{t,t+k} \Pi^{Bank}_{s,t+k} \tag{2.41}$$

where $\Pi^{Bank}_{s,t+k}$ is the dividends paid to households given by:

$$\Pi^{Bank}_{s,t+k} = D_t - \left(\frac{1 + i_{t-1}}{\pi_t}\right) D_{t-1} + R^k_{m,s,t-1} Loan_{m,s,t-1} + R^k_{f,s,t-1} Loan_{f,s,t-1} - Loan_{m,s,t} - Loan_{f,s,t} \tag{2.42}$$

subject to the balance sheet identity where the total supply of loans is equal to the amount of deposits in the bank.

$$D_t = Loan_{m,s,t} + Loan_{f,s,t} \tag{2.43}$$

Supply of loans is given by the following first order conditions:

$$R^k_{m,s,t} = E_t\left(\frac{1+i_t}{\pi_{t+1}}\right)$$

$$R^k_{f,s,t} = E_t\left(\frac{1+i_t}{\pi_{t+1}}\right)$$

where the banks supply loans until the marginal return on issuing them, $R^k_{m,s,t}$ and $R^k_{m,s,t}$, is equal to the risk free real interest rate. Therefore, if there is monetary policy contraction, i.e. i_t increases, then the interest rate charged on loans will increase.

2.5 Household

Utility Function

The households aggregate utility function is a weighted sum of male utility, Λ^m_t, and female utility, Λ^f_t, where the weights are determined by the intra-household bargaining power of males and females:

$$\Lambda_t = E_t\sum_{t=0}^{\infty}\beta^t\left[(BP_t)(p^m)\Lambda^m_t + (1-BP_t)(p^f)\Lambda^f_t\right] \tag{2.44}$$

β is the nominal discount rate[16] and $BP_t\,\varepsilon\,(0,1)$ is the endogenously determined intra-household bargaining power of males relative to females.[17] Following Klaveren (2009), BP_t is an increasing function of male to female income ratio which includes both profits for entrepreneurs and wages for workers given by:

$$BP_t = \frac{exp\left[\frac{W^m(L^m_{m,F,t}+L^m_{m,I,t}+L^m_{m,F,t}+L^m_{m,I,t})+\Pi^W_{m,F,t}+\Pi^W_{m,I,t}}{W^m(L^f_{f,F,t}+L^f_{f,I,t}+L^f_{f,F,t}+L^f_{f,I,t}+\Pi^W_{f,F,t}+\Pi^W_{f,I,t}}\right]}{1+exp\left[\frac{W^f(L^m_{m,F,t}+L^m_{m,I,t}+L^m_{m,F,t}+L^m_{m,I,t})+\Pi^W_{m,F,t}+\Pi^W_{m,I,t}}{W^f(L^f_{f,F,t}+L^f_{f,I,t}+L^f_{f,F,t}+L^f_{f,I,t})+\Pi^W_{f,F,t}+\Pi^W_{f,I,t}}\right]}$$

Bargaining power of male increases with an increase in his own steady state wage income, whereas it decreases with a rise in the steady state wage income of females..

Each member derives utility from consuming market-produced goods C_t, home-produced goods H^0_t, and leisure le^h_t:

$$\Lambda^m(C_t,H^0_t,le^m_t) = (1-h_c)ln(C_t-h_cC_{t-1}) + \phi^m_t\left(\frac{(H^0_t)^{1+\nu^m_{H,t}}}{1+\nu^m_{H,t}} + \varphi^m_{le,t}\frac{(le^m_t)^{1+\nu^m_{le,t}}}{1+\nu^m_{le,t}}\right) \tag{2.45}$$

[16] In order for households to be the natural lenders in the economy, they are more patient and hence are assumed to have a higher discount factor in comparison to entrepreneurs.

[17] The higher the value of BP_t, the more the male utility function is weighted in the overall household utility.

$$\Lambda^f(C_t, H_t^0, le_t^f) = (1-h_c)ln(C_t - h_c C_{t-1}) + \phi_t^f \left(\frac{(H_t^0)^{1+\nu_{H,t}^f}}{1+\nu_{H,t}^f} + \varphi_{le,t}^f \frac{(le_t^f)^{1+\nu_{le,t}^f}}{1+\nu_{le,t}^f} \right) \quad (2.46)$$

Market and home consumption are public goods, and there is risk sharing within the household, so that all its members - males and females, consume the same amount of these goods. The disutility of working, on the other hand, accrues to each member individually. Therefore, males do not get any utility from female leisure and vice-versa. C_t denotes aggregate consumption at time t, while C_{t-1} is the average level of consumption in $t-1$, where $h_c \in [0,1)$ is the external habit formation parameter. $-\upsilon_{H,t}^h$ is the inverse inter-temporal elasticity of substitution between market-good consumption and home-good consumption, and $-\upsilon_{le,t}^h$ is the inverse inter-temporal elasticity of substitution between market consumption and leisure.

ϕ_t^h is an exogenously given weight each member places on their utility from consuming home goods and leisure (i.e. utility from staying at home) relative to consuming market goods (i.e. participating in paid market work). This coefficient captures the constraints on engaging in work outside home such as safety and mobility issues. φ_{le}^h determines the relative weight on utility from engaging in home-good production relative to utility from consuming leisure. This also varies across males and females, which corresponds to the deeply ingrained gender biased social norms and lack of childcare facilities in developing countries.

Home-good Production

Home goods are produced by males and females working in home production (home workers), HP_t^m and HP_t^f, combined with the unemployed in the labor market who engage in home-good production in their residual time unoccupied by job search. After normalizing to one the total time available to each worker, the unemployed spend $\tau_U \varepsilon(0,1)$ proportion of their time working in home-good production, where $(1-\tau_U)$ is then the search cost. We assume a home-good production function with decreasing returns to scale, where $-\rho_H$ is a coefficient of the inverse inter-temporal elasticity between male and female home workers:[18]

$$H_t^0 = \theta_{H,t} \left\{ \left[(1-BP_t)(HP_t^m + \tau_U U_t^m)^{p_H} + BP_t (HP_t^f + \tau_U U_t^f)^{p_H} \right]^{1/p_H} \right\}^{1-\alpha_H} \quad (2.47)$$

$\theta_{H,t}$ is the exogenous shock to home productivity.[19] Intra-household bargaining power, BP_t, determines the weight on female relative to male workers in home-good production, where higher the bargaining power of males at home, i.e. higher BP_t, lower is the weight on male workers in home production.

Aggregate Market-good Consumption

Aggregate market-good consumption, C_t consists of domestically produced market goods, $C_{D,t}$, and imported market goods, $C_{f*,t}$ (in terms of domestic currency), and is given by the following Dixit-Stiglitz (1977) aggregator:

$$C_t = \left[\alpha^{\frac{1}{\eta}} C_{D,t}^{\frac{\eta-1}{\eta}} + (1-\alpha)^{\frac{1}{\eta}} C_{f*,t}^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}} \quad (2.48)$$

[18] Christiano et al. (2014) use a similar home production function in their framework.

[19] This corresponds to public provisions and infrastructure such as sanitation, access to water and electricity.

where $\alpha \in (0,1)$ can be interpreted as a measure of domestic bias in consumption, and $\eta > 1$ is the elasticity of substitution between domestic and foreign goods.

Aggregate price level P_t can be expressed as a composite of domestic price $P_{D,t}$ and import price $P_{f*,t}$, and is given by the following CES form:

$$P_t = \left[\alpha {P_{D,t}}^{1-\eta} + (1-\alpha){P_{f*,t}}^{1-\eta}\right]^{\frac{1}{1-\eta}} \tag{2.49}$$

Domestic market-good consumption is a composite of formal market-good consumption, $C_{F,t}$, and informal market-good consumption, $C_{I,t}$ expressed as:

$$C_{D,t} = \left[w^{\frac{1}{\mu}} C_{F,t}^{\frac{\mu-1}{\mu}} + (1-w)^{\frac{1}{\mu}} C_{I,t}^{\frac{\mu-1}{\mu}}\right]^{\frac{\mu}{\mu-1}} \tag{2.50}$$

where $w\varepsilon(0,1)$ is the weight on formal sector market-good, and $\mu > 1$ is the elasticity of substitution between the goods produced in the two sectors. Then, aggregate domestic market-good price, $P_{D,t}$, is determined by:

$$P_{D,t} = \left[wP_{F,t}^{1-\mu} + (1-w)P_{I,t}^{1-\mu}\right]^{\frac{1}{1-\mu}} \tag{2.51}$$

By minimizing household expenditure on the total composite demand, we can derive the following optimal consumption demand functions for aggregate domestic and imported market goods:

$$C_{D,t} = \alpha\left(\frac{P_{D,t}}{P_t}\right)^{-\eta} C_t \qquad C_{f*,t} = (1-\alpha)\left(\frac{P_{f*,t}}{P_t}\right)^{-\eta} C_t \tag{2.52}$$

Similarly, we derive the optimal consumption demand functions for domestically produced formal and informal market-goods:

$$C_{F,t} = w\left(\frac{P_{F,t}}{P_{D,t}}\right)^{-\mu} C_{D,t} \qquad C_{I,t} = (1-w)\left(\frac{P_{I,t}}{P_{D,t}}\right)^{-\mu} C_{D,t} \tag{2.53}$$

Budget Constraint

The representative household enters period t with one period (real) foreign and domestic bonds, B^*_{t-1}(in foreign currency) and D_{t-1}, both of which yield a nominal interest rate of i^f_{t-1} and i_{t-1} over the period t, respectively. In addition, during period t, individuals who are employed, earn after tax wage income of $\left(\sum_{h=m,f}\left[(1-\tau_F)W^h_{h,F,t}L^h_{h,F,t}\right]dh\right)$ in formal jobs and $\left(\sum_{h=m,f}\left[W^h_{h,I,t}L^h_{h,I,t}\right]dh\right)$ in informal jobs, and the unemployed receive social benefits, $(W_{U,t})(U^m_t + U^f_t)$. The ones who are entrepreneurs receive real dividends arising from the ownership of the firms, $\Pi^R_{F,t}$ and $\Pi^R_{I,t}$. The income is spent on the consumption of market goods, C_t, and the purchase of one period bonds for the subsequent period, B^*_t and D_t. Denoting e_t as the nominal exchange rate where an increase in its value implies depreciation of domestic currency, we have the following period budget constraint of the household in real terms, with $RER_t = \frac{e_t P^*_t}{P_t}$ as the real exchange rate::

$$C_t + RER_t B_t^* + D_t \tag{2.54}$$
$$= \left(\frac{e_t}{e_{t-1}}\right)\left(\frac{1+i_{t-1}^f}{\pi_t}\right)(RER_{t-1})B_{t-1}^* + \left(\frac{1+i_{t-1}}{\pi_t}\right)D_{t-1}$$
$$+ W_t^m(L_{m,F,t}^m + L_{m,I,t}^m + L_{m,F,t}^m + L_{m,I,t}^m)$$
$$+ W_{U,t}(U_t^m + U_t^f) + \Pi_{F,t}^R + \Pi_{I,t}^R$$
$$+ W_t^f(L_{m,F,t}^m + L_{m,I,t}^m + L_{m,F,t}^m + L_{m,I,t}^m) \tag{2.55}$$

The resulting first order conditions with respect to C_t, B_t, and D_t yield the standard Euler equation for consumption:

$$1 = \beta E_t\left\{\left(\frac{C_t - h_C C_{t-1}}{C_{t+1} - h_C C_t}\right)\left(\frac{1+i_t}{\pi_{t+1}}\right)\right\} \tag{2.56}$$

$$1 = \beta E_t\left\{\left(\frac{C_t - h_C C_{t-1}}{C_{t+1} - h_C C_t}\right)\left(\frac{1+i_t^f}{\pi_{t+1}}\right)\left(\frac{e_{t+1}}{e_t}\right)\right\} \tag{2.57}$$

Combining Eq. 2.56 and Eq. 2.57 (up to a log-linear approximation) gives us the uncovered interest rate parity (UIP) condition $\left(\frac{1+i_t}{\pi_{t+1}}\right) = \left(\frac{1+i_t^f}{\pi_{t+1}}\right)\left(\frac{e_{t+1}}{e_t}\right)$.

The remaining first order conditions for HP_t^m,HP_t^f, le_t^m, and le_t^f yield the labor supply equation:

$$MRS_{HP_t,C_t}^h = W_t^m(L_{m,F,t}^m + L_{m,I,t}^m + L_{m,F,t}^m + L_{m,I,t}^m) \tag{2.58}$$
$$+ W_{U,t}\left[1 - p(H_{F,t}^h) - p(H_{I,t}^h)\right]$$

$$MRS_{le_t,C_t}^h = W_t^f(L_{m,F,t}^m + L_{m,I,t}^m + L_{m,F,t}^m + L_{m,I,t}^m) \tag{2.59}$$
$$+ W_{U,t}\left[1 - p(H_{F,t}^m) - p(H_{I,t}^m)\right]$$

Finally, probability that a non-participant household member h consumes leisure, $p(le_t^h)$, is given by the ratio of the ones consuming leisure divided by the individuals who stay at home:

$$p(le_t^h) = \frac{le_t^h}{HP_t^h + le_t^h} \equiv \frac{le_t^h}{NP_t^h}$$

where $\left(1 - p(le_t^h)\right)$ is then the probability that a non-participant household member h engages in home-production.

2.6 Capital Producer

Capital producers combine the existing undepreciated capital stock, $(1-\delta_K)K_{t-1}$, leased from wholesalers, with investment goods, I_t, to produce new capital K_t, using a linear technology. The capital-producing sector is perfectly competitive. Capital evolves according to the following equation:

$$K_t = (1-\delta_K)K_{t-1} + \frac{P_t^{Inv}}{P_t} I_t - \frac{\kappa}{2}\left(\frac{P_t^{Inv}}{P_t}\frac{I_t}{K_{t-1}} - \delta_K\right)^2 K_{t-1} \tag{2.60}$$

where $\frac{\kappa}{2}\left(\frac{P_t^{Inv}}{P_t}\frac{I_t}{K_{t-1}} - \delta_K\right)^2 K_{t-1}$ is the capital adjustment cost. Here $\kappa \geq 0$ is the capital adjustment coefficient, and δ_K is the depreciation rate of physical capital.

Capital production is confined to the formal sector, and investment is thus a composite of domestic formal goods and foreign imports:

$$I_t = \left[\alpha^{\frac{1}{\eta}} {I_{F,t}}^{\frac{\eta-1}{\eta}} + (1-\alpha)^{\frac{1}{\eta}} {I_{f*,t}}^{\frac{\eta-1}{\eta}}\right]^{\frac{\eta}{\eta-1}} \tag{2.61}$$

and the price of investment is:

$$P_t^{Inv} = \left[\alpha {P_{F,t}}^{1-\eta} + (1-\alpha){P_{f*,t}}^{1-\eta}\right]^{\frac{1}{1-\eta}} \tag{2.62}$$

We assume that it is in the same proportion as in the consumption basket (Eq. 2.52 and Eq. 2.53), except that now weight on formal good is $w = 1$. Hence, optimal demand for domestic and imported investment goods is:

$$I_{F,t} = \alpha\left(\frac{P_{F,t}}{P_t^{Inv}}\right)^{-\eta} I_t \qquad\qquad I_{f^*,t} = (1-\alpha)\left(\frac{P_{f*,t}}{P_t^{Inv}}\right)^{-\eta} I_t$$

The capital producer invests such that its profit is maximized, where Q_t is the real price of capital:

$$\max_{I_t} Q_t\left(\frac{P_t^{Inv}}{P_t} I_t - \frac{\kappa}{2}\left(\frac{P_t^{Inv}}{P_t}\frac{I_t}{K_{t-1}} - \delta_K\right)^2 K_{t-1}\right) - \frac{P_t^{Inv}}{P_t} I_t$$

The corresponding first order condition w.r.t. to the choice of I_t determines the capital supply equation:

$$Q_t\left[1 - \kappa\left(\frac{P_t^{Inv}}{P_t}\frac{I_t}{K_{t-1}} - \delta_K\right)\right] = 1 \tag{2.63}$$

This is the Tobin's (1969) Q equation relating the price of capital to marginal adjustment costs. In the absence of capital adjustment costs ($\kappa = 0$), the price of capital is constant and equal to one.

Demand for capital by wholesalers in sector s must satisfy the following condition:

$$E_t\left(R_{t+1}Q_t\right) = E_t\left\{\psi_F\left(\frac{P^W_{s,t+1}}{P_{t+1}}\right)\left(\frac{Y^W_{s,t+1}}{K_{s,t}}\right) + (1-\delta_K)Q_{t+1}\right\}$$

2.7 Rest of the World

Foreign economy consumes domestic formal exports, Q^x_t, supplies foreign goods to domestic country as imports, Q^m_t, and sells foreign bonds, B^*_t to domestic households. We assume that the domestic economy is small, which implies that it cannot affect foreign output, Y^*_t, foreign inflation, $\pi^*_t = \frac{P^*_t}{P^*_{t-1}}$, and the foreign interest rate, i^*_t, all of which are assumed to be exogenously determined in the rest of the world.[20]

The demand for domestic exports by the foreign economy is assumed to have a similar structure to that of domestic consumption in Eq. 2.52:

$$Q^x_t = \alpha^*_x(\frac{P^*_{X,t}}{P^*_t})^{-\eta^*_x}Y^*_t \tag{2.64}$$

where $\alpha^*_x \varepsilon (0,1)$ is a parameter determining the share of domestic goods in foreign consumption bundle, and $\eta^*_x > 1$ is the substitution elasticity between exports and foreign domestic goods. We assume that law of one price (LOOP) holds for domestic goods, allowing us to express the price of exports in foreign currency as $P^*_{X,t} = \frac{P_{F,t}}{e_t}$.[21]

Interest rate on foreign bond, i^f_t, depends not only on the exogenous foreign interest rate, i^*_t, but also on the foreign currency borrowing premium, χ, whereby holders of foreign debt are assumed to face an interest rate that is increasing in the country's net foreign debt:

$$(1+i^f_t) = (1+i^*_t) - \chi\left(\frac{B^*_t - B^*}{\frac{P_F}{(RER)P}Q^x}\right) \tag{2.65}$$

This is a standard assumption in the small open economy literature.[22]

[20] We normalise the value of foreign output by assuming $Y^*_t = 1$.

[21] Substituting the LOOP condition, and $RER_t = \frac{e_t P^*_t}{P_t}$ in Eq. 2.64, we get the following $Q^x_t = \alpha^*_x(\frac{P_{F,t}}{P_t}\frac{1}{RER_t})^{-\eta^*_x}Y^*_t$. Therefore, a real depreciation of the currency increases exports.

[22] The need for such a friction is mainly technical, i.e. the country borrowing premium ensures that the model has a unique steady state and ensures stationarity.

2.8 Government Policy

Government consists of monetary and fiscal authorities. The monetary authority sets the nominal interest rate, i_t, based on a Taylor-type (1993) feedback rule. It responds to deviations in inflation and gross domestic product:

$$\frac{i_t}{i} = \left(\frac{i_{t-1}}{i}\right)^{\alpha_i} \left(\frac{\pi_t}{\pi}\right)^{\alpha_\pi} \left(\frac{Y_t}{Y}\right)^{\alpha_Y} \varepsilon_{i,t} \tag{2.66}$$

where α_i captures interest rate smoothing, and the Taylor rule coefficients, α_π and α_Y, are the relative weights on inflation and output stabilization respectively. i, π, and Y are the steady state values for nominal interest rate, inflation, and gross domestic product. $\varepsilon_{i,t}$ is a monetary policy shock to capture unanticipated changes in the nominal interest rate.

In addition, the fiscal authority finances its consumption, G_t, and unemployment benefit payments by taxing wage income in the formal sector.[23] The government budget constraint every period is:

$$\frac{P_t^{Inv}}{P_t} G_t + W_{U,t}(U_t^m + U_t^f) = \tau_F (W_{F,t}^m L_{F,t}^m + W_{F,t}^f L_{F,t}^f) \tag{2.67}$$

We assume that exogenously given government consumption basket, G_t, analogous to the investment basket in Eq. 2.61, consists of domestic formal market goods, $G_{F,t}$, along with foreign imports, $G_{f*,t}$ (in domestic currency):

$$G_t = \left[\alpha^{\frac{1}{\eta}} G_{F,t}^{\frac{\eta-1}{\eta}} + (1-\alpha)^{\frac{1}{\eta}} G_{f*,t}^{\frac{\eta-1}{\eta}}\right]^{\frac{\eta}{\eta-1}} \tag{2.68}$$

Optimal demand for domestic formal, $G_{F,t}$, and imported government consumption, $G_{f^*,t}$, is given by:

$$G_{F,t} = \alpha \left(\frac{P_{F,t}}{P_t^{Inv}}\right)^{-\eta} G_t \qquad\qquad G_{f*,t} = (1-\alpha) \left(\frac{P_{f^*,t}}{P_t^{Inv}}\right)^{-\eta} G_t$$

2.9 Market Clearing and Aggregation

Sum of employment in the formal, $L_{F,t}$, and in the sector, $L_{I,t}$, is equal to aggregate employment L_t in the economy: $L_{F,t} + L_{I,t} = L_t$. Aggregate labor force participation in the economy (i.e. aggregate labor supply in the economy), P_t is a sum of the male and female labor participation: $P_t = P_t^m + P_t^f$.[24] Aggregate unemployment can then be written as aggregate labor

[23] For simplicity, we assume that the government does not invest in domestic or international bond markets, and do not take into account capital and consumption taxes.

[24] Note that the female labor force participation rate is determined by the ratio of the number of female participants P^f, divided by the aggregate female population, p^f in the economy. Similarly, the male labor force participation rate is determined by the ratio of the number of aggregate male participants P^m, divided by the aggregate male population, p^m.

supply, P_t minus aggregate employment, L_t: $U_t = P_t - L_t$, where the unemployment rate is obtained by dividing through by the total number of labor market participants, P_t.

Equilibrium in the labor market for males and females is given by equating aggregate supply of male and female labor, P_t^m and P_t^f, to the sum of their respective demands by formal and informal wholesalers, plus the ones unemployed:

$$P_t^m = L_{F,t}^m + L_{I,t}^m + U_t^m \qquad P_t^f = L_{F,t}^f + L_{I,t}^f + U_t^f$$

where total male and female employment in the formal and informal sector is:

$$L_{F,t}^m = L_{m,F,t}^m + L_{f,F,t}^m \qquad L_{I,t}^m = L_{m,I,t}^m + L_{f,I,t}^m$$

$$L_{F,t}^f = L_{m,F,t}^f + L_{f,F,t}^f \qquad L_{I,t}^f = L_{m,I,t}^f + L_{f,I,t}^f$$

Male and female unemployment is given by the ones searching for a job minus the ones that get hired:

$$U_t^m = S_t^m - H_{m,F,t}^m - H_{m,I,t}^m - H_{f,F,t}^m - H_{f,I,t}^m$$

$$U_t^f = S_t^f - H_{m,F,t}^f - H_{m,I,t}^f - H_{f,F,t}^f - H_{f,I,t}^f$$

Equilibrium in the asset market implies that the total number of bonds issued is equal to the cost of desired capital in the economy:

$$D_{t-1} = Q_{t-1}(K_{m,F,t-1} + K_{m,I,t-1} + K_{f,F,t-1} + K_{f,I,t-1}) \tag{2.69}$$

The resource constraint for female firm in the formal sector is:

$$\frac{P_{f,F,t}^W}{P_t} Y_{F,t}^W = (1-\alpha_F)\left(\frac{1}{P_t}\right)\left(\frac{P_{f,F,t}^W}{P_{F,t}}\right)^{-\eta_F} Y_{F,t}\left(1 + \frac{\phi_F^{adj}}{2}\left(\frac{\pi_{F,t}}{\pi} - 1\right)^2\right) + HC_{f,F,t}^m H_{f,F,t}^m + HC_{f,F,t}^f H_{f,F,t}^f \tag{2.70}$$

where total demand for formal good, $Y_{F,t}$, is the sum of its domestic demand by households, capital producers and government, $Q_{F,t}^d = C_{F,t} + I_{F,t} + G_{F,t}$, and foreign export demand Q_t^x, i.e. $Y_{F,t} = C_{F,t} + I_{F,t} + G_{F,t} + Q_t^x$.

Similarly, the resource constraint for the informal sector is:

$$\frac{P_{I,t}^W}{P_t} Y_{I,t}^W = \frac{P_{I,t}}{P_t} Y_{I,t}\left(1 + \frac{\phi_I^{adj}}{2}\left(\frac{\pi_{I,t}}{\pi} - 1\right)^2\right) + HC_{I,t}^m H_{I,t}^m + HC_{I,t}^f H_{i,t}^f \tag{2.71}$$

where informal-market good is only consumed by domestic households, $Y_{I,t} = Q_{I,t}^d = C_{I,t}$.

Total foreign imports is given by the sum of imports by households, capital producers, and the government, $Q^m = C_{f*,t} + I_{f*,t} + G_{f*,t}$. Finally, GDP in the economy is given by:

$$Y_t = C_t + \frac{P_t^{Inv}}{P_t}(I_t + G_t) + \frac{P_{F,t}}{P_t}Q_t^x - \frac{P_{f*,t}}{P_t}(C_{f^*,t} + I_{f^*,t} + G_{f^*,t})$$

3 Calibrating the Model

This section describes our calibration approach. Given the nonlinear nature of the equilibrium conditions, the decision rules that determine present and future values of all the variables cannot be solved for analytically. Thus, we must assign specific values to the model parameters and solve for the decision rules numerically.

Table 4 summarizes the calibrated values of parameter in our model for India, where we calibrate a set of parameters, and the steady state values for some endogenous variables, which characterise the model economy. We interpret periods as quarters and choose parameter values from the literature and to match features of Indian macroeconomic data from 1996:Q1 to 2008:Q2. Data is taken from the CEIC database for the following variables: GDP, private consumption expenditure, investment, government consumption expenditure, exports, imports (all expressed in constant prices), the real exchange rate, the wholesale price inflation (WPI), and the nominal interest rate.

We use standard values for all the parameters that are conventional in the business cycle literature, which directly follows from Khera (2016). We also follow the same approach as described in Khera (2016) for the calibration of parameters relating to the formal and informal sector, and hence abstract from an elaborate discussion here.

Table 4: Parameter calibration, Baseline model for India

Parameter	Value	Description
β	0.994	discount rate
δ_K	0.025	capital depreciation rate
α	0.8	share of home-good in consumption
η	1.2	substitutability between domestic and foreign goods
π	4.5	gross inflation in the steady state (% annually)
π^*	2.5	gross foreign inflation in the steady state (% annually)
$\left(\frac{P^{Inv}}{P}\frac{G}{Y}\right)$	0.11	government spending-to-GDP ratio in the steady state
W_U/Y	0.014	social spending-to-GDP ratio in the steady state
$\left(\frac{P_F}{P}\frac{Q^x}{Y}\right)$	0.19	export-to-GDP ratio in the steady state
$\left(\frac{P_{f*}}{P}\frac{Q^m}{Y}\right)$	0.21	import-to-GDP ratio in the steady state
μ	1.5	substitutability between formal and informal goods
w	0.39	share of formal goods in consumption
η_x^*	4.5	price elasticity of exports
ψ_F	0.34	capital share in formal production function
ψ_I	0.34	capital share in informal production function
$\frac{\varepsilon_F}{\varepsilon_F-1}$	1.2	price mark-up in formal sector
$\frac{\varepsilon_I}{\varepsilon_I-1}$	1.09	price mark-up in informal sector
$\frac{\theta_F}{\theta_I}$	1.5	relative formal-to-informal productivity
$\frac{HC^s_{m,F}}{W^s_{m,F}}$, $\frac{HC^s_{f,F}}{W^s_{f,F}}$	1.3	share of formal hiring costs in formal wages
$\frac{HC^s_{m,I}}{W^s_{m,I}}$, $\frac{HC^s_{f,I}}{W^s_{f,I}}$	0.2	share of informal hiring costs in informal wages
α_F, α_I	0.5	share of male intermediate good in final retail goods
η_F, η_I	1.1	substitutability between male and female intermediate goods
σ_F	0.1	formal worker firing rate in steady state
σ_I	0.75	informal worker firing rate in steady state

Matching Gender Inequality Statistics

Table 5 summarizes the calibration of gender-related parameters, which are chosen so as to match the Indian statistics on gender gaps in:

- *Entrepreneurship and financial access*: which includes share of output produced by female entrepreneurs in total output, $\frac{Y_f}{Y}$, share of employment generated by female entrepreneurs in total employment, $\frac{L_f}{L}$, and the share of formal bank loans in total financing of female entrepreneurs given by $\frac{Loan_{f,F}}{Loan_{f,F}+Loan_{f,I}}$.
- *Labor market*: this includes female participation, P^f, male participation, P^m, male formality in the labor market, $\frac{L^m_F}{L^m_F+L^m_I}$, female formality in the labor market, $\frac{L^f_F}{L^f_F+L^f_I}$, and the

gender wage gaps, $\frac{W^m}{W^f}$.

Table 6 summarizes the gender gaps in the steady state. The discount factor of both male and female entrepreneurs is lower than the households' who are the natural lenders in the economy. In India, there is substantial evidence that females' demand for credit is lower than males. This is mainly because of lower financial literacy amongst females and lack of trust in the banking system. Therefore, following the strategy in Babilla et al. (2016), female entrepreneurs are calibrated to be impatient with a discount factor of 0.97 in comparison to male entrepreneurs' discount factor at 0.98.

According to the IFC (2014), women enterprises collectively contribute 3.09 percent to India's industrial output and employ over 8 million people (close to 3 percent of total employment), and that over 90 percent rely on informal sources of finance. Calibration of the loan-to-value ratio and the hiring cost of workers for each type of entrepreneur is based on matching these statistics. Female entrepreneurs are assumed to be more financially constrained than male entrepreneurs, and hence we calibrate their loan-to-value ratio ratio in the formal sector, $LTV_{f,F,t}$, to be lower at 0.5 in comparision to male entrepreneurs, $LTV_{m,F,t}$ at 0.7. Based on a DSGE model for the Indian economy, Gabriel et al (2010) estimate financial frictions to be higher in the formal relative to the informal sector. Hence, we assign a higher value to the loan-to-value ratio in the informal sector, $LTV_{f,I,t} = LTV_{m,I,t} = 0.8$, and assume it to be the same for both male and female entrepreneurs. We also calibrate the hiring cost to wage ratio for male workers in the formal sector and in the informal sector at 1 and 0.2, and for female workers in the formal and informal sector at 2 and 0.5, respectively. We assume that these values are the same for both male and female entrepreneurs. This pins down the $\frac{Y_f}{Y}$ at 6 percent, the share of female entrepreneurs' formal finances, $\frac{Loan_{f,F}}{Loan_{f,F}+Loan_{f,I}}$, at 23 percent, and the share of labor employed by female entrepreneurs at 12 percent.

Plausible estimates for the substitution elasticity between female and male workers in production function of market goods, $\frac{1}{1-\rho_s}$, based on Acemoglu et al. (2004), range between 3.2 and 4.2. We assign this a value of 2.5 in the formal sector, $\frac{1}{1-\rho_F}$, with a higher substitution elasticity of 5 in the informal sector, $\frac{1}{1-\rho_I}$.[25] Standard estimates (e.g. Blundell and Macurdy (1999)) suggest that female's Frisch elasticity of labor supply, $-1/\nu_{le}^f$, is approximately three times that of males, $-1/\nu_{le}^m$. Assuming an 'average' elasticity of 2 in the economy which is a value frequently used in calibrated versions of small open economy models (see Mendoza (1991), Aguiar and Gopinath (2007)), and female share in total employment of 0.33 (NSSO, 2004-05), we can write:

$$0.33\frac{3}{\nu_{le}^f} + 0.67\frac{1}{\nu_{le}^m} = 2$$

This obtains $1/\nu_{le}^m = 1.20$ and $1/\nu_{le}^f = 3.61$.

[25] Calibration of substitution elasticity between males and females in home production is the same as the informal sector, i.e. $\rho_H = \rho_I$.

Table 5: Calibration of gender-related parameters, Baseline model for India

Parameter	Value	Description
$1/\nu_{le}^{m}$	1.2	male's Frisch elasticity of labor supply
$1/\nu_{le}^{f}$	3.61	female's Frisch elasticity of labor supply
β_m	0.98	male entrepreneur's discount factor
β_f	0.97	female entrepreneur's discount factor
$\frac{1}{(1-\rho_F)}$	2.5	substitutability btw male & female formal workers
$\frac{1}{(1-\rho_I)}, \frac{1}{(1-\rho_H)}$	5	substitutability btw male & female informal workers
$\frac{skill_F^m}{skill_F^f}$	1.7	male-to-female skill ratio in formal employment
$\frac{skill_I^m}{skill_I^f}$	1	male-to-female skill ratio in informal employment
λ_F^m	0.7	bargaining power of male formal worker
λ_I^m	0.3	bargaining power of male informal worker
λ_F^f	0.6	bargaining power of female formal worker
λ_I^f	0.01	bargaining power of female informal worker
$\omega_{m,F}, \omega_{m,I}$	0.62	male entrepreneur's relative preference for male worker
$\omega_{f,F}, \omega_{f,I}$	0.5	female entrepreneur's relative preference for male worker
$LTV_{m,F,t}$	0.7	loan-to-value ratio of formal male entrepreneur
$LTV_{f,F,t}$	0.5	loan-to-value ratio of formal female entrepreneur
$LTV_{m,I,t}, LTV_{f,I,t}$	0.8	loan-to-value ratio in the informal sector
φ_{le}^m	0.7	male utility weight on leisure
φ_{le}^f	0.1	female utility weight on leisure
ϕ^m	0.7	male utility weight on staying at home
ϕ^f	1	female utility weight on staying at home

We calibrate the ratio of skill level of male to female worker in each sector, $\frac{skill_F^m}{skill_F^f}$ and $\frac{skill_I^m}{skill_I^f}$, based on the data on education gaps between males and females in India. According to the 2004-05 NSSO survey, the average years of education of females is 4.5, as opposed to 6.8 for males, which implies a male-to-female ratio of 1.5. Matching this, we calibrate these ratios at 1.7 in the formal sector.[26]

According to the Global Gender Gap Report published by the World Economic Forum (2010, 2014a), females earn 62 percent of the male's salary for equal work, which implies a value of 1.62 for $\frac{W^m}{W^f}$. Setting bargaining values for male workers at $\lambda_F^m = 0.7$ and $\lambda_I^m = 0.3$, and for female workers at $\lambda_F^f = 0.6$ and $\lambda_I^f = 0.01$, pins down $\frac{W^m}{W^f}$ at 1.4. Lower bargaining power of female workers reflects the male domination of labor unions in India (see union membership data published by the ILO in 2011).

[26] Since the informal sector largely consists of unskilled jobs, we assume that relative to the formal sector, the skill level of workers in the informal sector are lower and that males and females are equally skilled, i.e. $\frac{skill_I^m}{skill_I^f} = 1$

This report also finds that 86 percent of female workers were employed in the informal sector, $\frac{L_I^f}{L_F^f+L_I^f}$, as opposed to 74 percent males, $\frac{L_I^m}{L_F^m+L_I^m}$. Gender discrimination at the firm level in formal employment is a key factor contributing to this disparity (Javeed and Manuhaar (2013)). This is captured in our model via firms' preference for male relative to female workers, $\omega_{h,F}$ and $\omega_{h,I}$. We assume no gender discrimination by female entrepreneurs, i.e. $\omega_{f,F} = \omega_{f,I} = 0.5$. By setting $\omega_{m,F} = \omega_{m,I}$ at 0.62, we obtain a value of 20 percent for female formality, $\frac{L_F^f}{L_F^f+L_I^f}$, as opposed to 30 percent for male formality, $\frac{L_F^m}{L_F^m+L_I^m}$.

Household care work, HP_t^m and HP_t^f, in particular, is widely regarded as especially feminine, and with the relative utility weight on leisure relative to home-work for males and females at, $\varphi_{le}^m = 0.7$ and $\varphi_{le}^f = 0.1$, the female to male ratio of home-work, $\frac{HP_t^f}{HP_t^m}$, is obtained at 14.19.[27]

According to the NSSO report, in 2015, female labor force participation rate, $\frac{P^f}{p^f}$, is close to 25 percent which is less than one-third of that of the male labor force participation rate, $\frac{P^m}{p^m}$, at approximately 80 percent. Combined with the above calibration, we obtain values of $\frac{P^f}{p^f}$ at 20.3, and $\frac{P^m}{p^m}$ at 85.4, by setting the male and female relative weight on utility from staying at home versus market-good consumption, ϕ^m and ϕ^f, at 0.7 and 1, respectively.

4 Policy Results

After obtaining the above steady state which matches the current state of the Indian economy, the next step is to assess the impact of changes in structural policies. Note that the changes in policy variables are permanent and are thus deterministic in nature. This allows us to see the ne steady state the economy moves to after the reform has been implemented.

4.1 Gender-Specific Policies

In this section, we study the long-run impact of the following:

- Increase in womens' financial access to formal credit in the baseline scenario: we start by studying the impact of financial inclusion policies that help lower financial constraints faced by female entrepreneurs' in access to formal finance, i.e. when there are no gender gaps in access to credit (female and male entrepreneurs are equally constrained). To obtain this, we set the same value for the discount factor and the same value for the LTV ratio for both male and female entrepreneurs.

[27] According to the Times User Survey conducted in 2010, female contribution towards unpaid domestic work in India is 10 times more than males. This unpaid work includes the inter-personal work for caring for other household members, and in countries like India with lack of sufficient infrastructure, the work of collecting water and fuel for household needs.

Table 6: Gender inequality in the steady state

Variable	Value	Description
U	0.13	unemployment rate
$\frac{L_I}{L_F+L_I}$	0.75	share of informal employment
$\frac{Y_I}{Y}$	0.49	share of informal output
$\frac{Y_f}{Y}$	0.06	share of female entrepreneurs' output
$\frac{Loan_{f,F}}{Loan_{f,F}+Loan_{f,I}}$	0.23	share of female entrepreneurs' formal finances
$\frac{L_f}{L}$	0.12	share of female entrepreneurs' employment
$\frac{W^m}{W^f}$	1.4	gender wage gap
$\frac{L_I^f}{L_F^f+L_I^f}$	0.80	share of females' informal employment
$\frac{L_I^m}{L_F^m+L_I^m}$	0.70	share of males' informal employment
$\frac{HP_t^f}{HP_t^m}$	14.19	gender gap in home-work
$\frac{P^f}{p^f}$	0.20	female labor force participation
$\frac{P^m}{p^m}$	0.85	male labor force participation

We then study the impact of such financial inclusion policies under the following three scenarios (see Table 7):

- Greater labor market flexibility: lower regulations in the formal labor market which is defined as lower hiring costs of labor in the formal sector, i.e. lower β_{HC_F}.
- Increase in education of females: higher skill level of female labor force, i.e. no gender gaps in skills.
- Increase in safety: lower females' relative disutility from working outside home, such that $\phi_t^f = \phi_t^m$ in the household utility function.

Table 8 summarizes the long run impact of reforms on aggregate economic activity (i.e. GDP,

Table 7: Permanent policy shock

	LTV ratio	Discount factor	Hiring cost	Skill	Disutility from working outside home
Benchmark	$LTV_{m,F,t} > LTV_{m,F,t}$	$\beta_f < \beta_m$	$\beta_{HC_F} > \beta_{HC_I}$	$skill_s^m > skill_s^f$	$\phi^f > \phi^m$
Financial access	$LTV_{m,F,t} = LTV_{m,F,t}$	$\beta_f = \beta_m$	$\beta_{HC_F} > \beta_{HC_I}$	$skill_s^m > skill_s^f$	$\phi^f > \phi^m$
+ Deregulation	$LTV_{m,F,t} = LTV_{m,F,t}$	$\beta_f = \beta_m$	$\beta_{HC_F} = \beta_{HC_I}$	$skill_s^m > skill_s^f$	$\phi^f > \phi^m$
+ Skill	$LTV_{m,F,t} = LTV_{m,F,t}$	$\beta_f = \beta_m$	$\beta_{HC_F} > \beta_{HC_I}$	$skill_s^m = skill_s^f$	$\phi^f > \phi^m$
+ Safety	$LTV_{m,F,t} = LTV_{m,F,t}$	$\beta_f = \beta_m$	$\beta_{HC_F} > \beta_{HC_I}$	$skill_s^m > skill_s^f$	$\phi^f = \phi^m$

formality in the labor market, and unemployment), and Table 9 on indicators of gender inequality.

Financial access

The scenario titled 'Financial Access' in Figure 3 shows the macroeconomic impact of lowering financial constraints faced by female entrepreneurs in access to formal finance, such that there are no gender gaps. This is obtained by setting $LTV_{f,F,t} = LTV_{m,F,t} = 0.7$ and $\beta_f = \beta_m = 0.98$. Results indicate that when female entrepreneurs face lower financial constraints it leads to: i) an increase in female entrepreneurship in the formal sector; ii) an increase in female labor force participation; and iii) an increase in GDP and lower unemployment. However, a large share of labor market participants get employed in informal sector jobs, leading to a: iv) decrease in the overall size of the formal economy with a v) limited impact on the gender wage gap. Below we provide a detailed analysis of the exact transmission channels involved.

With a higher LTV ratio, female entrepreneurs are now able to obtain greater access to formal credit which boosts investment and demand for capital. Price of capital increases resulting in higher value of collateral, which further eases access to credit. Owing to higher profits and investment, more number of female entrepreneurs now set up business in the formal sector. Demand for both male and female workers in the formal sector increases as both incumbents and new female entrepreneurs hire new workers. Higher likelihood of getting employed in the formal sector leads to an increase in overall labor force participation. Womens' share of formal employment is now higher as female entrepreneurs in the formal sector do not discriminate among workers, thus also leading to a larger increase in female labor force participation in comparison to males, and a fall in gender wage gaps. An increase in entrepreneurship and overall employment leads to an increase in GDP and consumption. Consumption demand for both formal and informal sector goods goes up, leading to an increase in demand for labor in the informal sector and an increase in informal entrepreneurship.

However, owing to the presence of labor market rigidities, increase in labor supply is not met with an equal increase in job creation and hiring in the formal sector, thus leading to a larger share of labor market participants getting employed in low paying informal jobs. Overall share of formal employment falls and fall in gender wage gaps remains small.

Deregulation

The scenario titled 'Deregulation' in Figure 3 shows the impact of the above financial inclusion policy (i.e. no gender gaps in financial access) in an economy where labor markets are more flexible, which is obtained by lowering hiring costs of workers in the formal sector, β_{HC_F}. We combine the changes in parameters under the financial inclusion policy scenario discussed above with a 10 percent permanent decrease in β_{HC_F}. Results indicate that when labor markets are more flexible, policies that enhance financial inclusion of females lead to a larger gain in GDP and unemployment reduction in comparison to when labor markets are rigid. Moreover,

Table 8: Long-run impact on the overall economy

Case	GDP	Unemp.	Formality		LFP	Entrepreneurship	
			Labor	Product		Formal	Informal
Financial access	1.6	-5	-2.1	0.9	0.6	1.8	0.07
+ Deregulation	4.7	-9.1	11.5	14.1	2.1	4.5	-1.5
+ Skills	6.8	-6.8	10	19.7	1.1	4.9	-2.7
+ Safety	0.9	-8	0.5	0.5	1.1	-0.2	-0.4

Note: All values are percentage deviations from steady state. Unemp. is unemployment, LFP is labor force participation, formality is the share of formal sector in each market.

Table 9: Long-run impact on gender gaps

Case	Entrepreneurship				LFP		Formal share of employment		Wage gap
	Formal		Informal						
	M	F	M	F	M	F	M	F	
Financial access	-0.8	4	1.5	-1.5	0.4	1.4	-3	1.2	-0.8
+ Deregulation	6.6	2.7	-1.7	-1.2	5.3	4.5	12.1	9.3	-6.4
+ Skills	3.3	6.3	-3.7	-1.6	0.4	4.3	-2.5	26	-18.7
+ Safety	-1.4	0.8	-0.7	-0.1	3.3	0.6	1.4	-2.2	-0.9

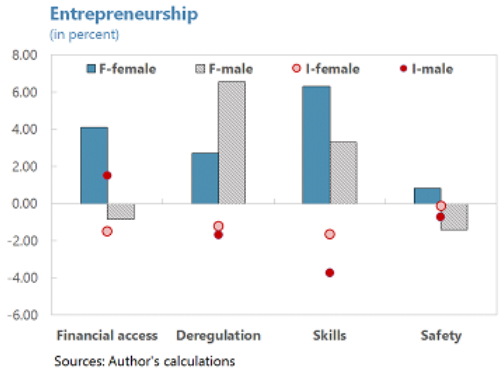
Note: All values are percentage deviations from steady state. LFP is labor force participation. M and F correspond to male and female. Wage gap is male-to-female wage ratio.

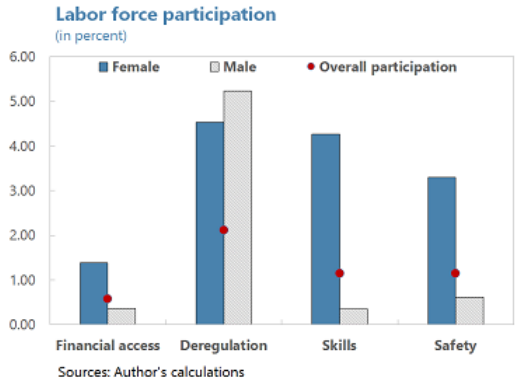
the size of the informal sector shrinks as both males and females get employed in higher paying formal jobs resulting from higher job creation in the formal sector. However, due to gender-related constraints (i.e. lower skills and gender discrimination), male workers gain more, leading to a larger increase in formal employment of male versus female workers. Below we provide a detailed analysis of the exact transmission channels involved.

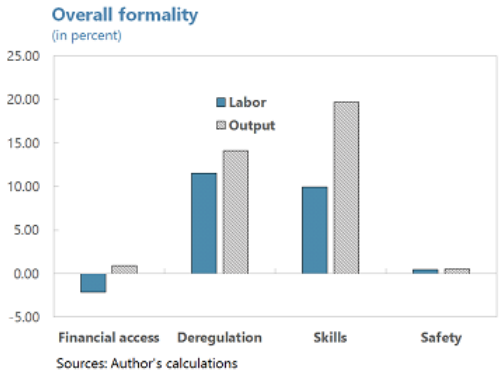
Combined with the transmission channels of the impact of higher financial access described above, we now have an additional impact of lower labor market regulations in the economy. Formal firms hire more workers when the costs of hiring are lower, increasing overall formal employment, L_F. Lower labor costs increase profits, and more number of firms choose to operate in the formal sector, leading to an increase in both male and female entrepreneurship in the formal sector. This leads to lower formal price mark-ups, $\frac{\varepsilon_F}{\varepsilon_{F-1}}$ falls, and boosts the external competitiveness of the economy, leading to a larger increase in exports (lower imports), investment, and GDP.

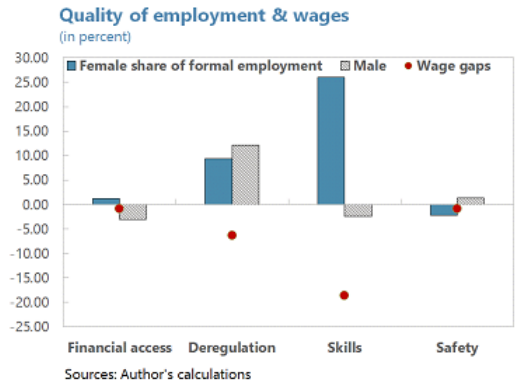
There are two opposing impacts on male and female participation rates, P^m and P^f: (i) substitution effect: increase in job-finding rate in the formal sector produces higher returns to job search, increasing P^f and P^m, and (ii) household income effect: as more household members are employed in higher paying formal jobs, this increases total household income, which decreases P^f and P^m. For both males and females, substitution effect outweighs the income effect, increasing P^m and P^f. However, gender gaps in participation rates widen, $\frac{P^f}{P^m}$ falls – gender-related constraints (including education gaps and discrimination by firms) results in a smaller increase in female's job-finding rate in the formal sector relative to males. Similarly, increase in male entrepreneurship in the formal sector is higher than an increase in female entrepreneurship.

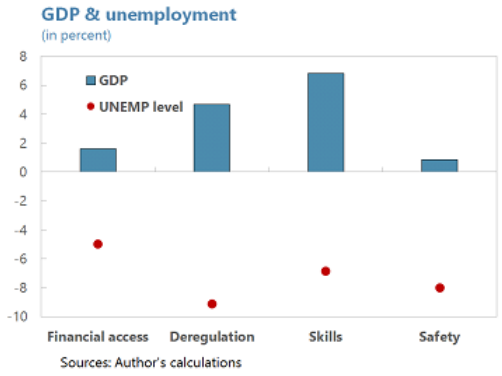
Figure 3: Results - Impact of an increase in female entrepreneurs' access to formal finance











Source: Author's calculations

Note: Financial access in the figure refers to an increase in access to formal finance for female entrepreneurs (i.e. no gender gaps in access to formal finance); Deregulation refers to lower hiring costs in the formal labor market along with no gender gaps in financial access; Skills refers to an increase in females' average years of schooling (i.e. no gender gaps) along with no gender gaps in access to finance. Safety refers to an increase in females' safety outside home along wit no gender gaps in access to finance.

Gender-related labor market reforms

Skills (Gender-related labor demand side policy)

The above scenario of 'Deregulation' highlights the importance of gender-related labor market constraints in limiting the positive impact of financial inclusion and other policies on womens'

economic opportunities. Hence, we now analyze the impact of higher financial inclusion of females in combination with policies that lower constraints on female labor demand which is defined as an increase in their skill (i.e. higher education). The scenario titled 'Skills' in Figure 3 summarizes its impact on the Indian economy, where this scenario is obtained by a permanent increase in the skill level of female workers such that there are no gender gaps $\frac{skill_F^m}{skill_F^f} = 1$ along with no gender gaps in access to formal finance. Results indicate that when females have higher access to both formal jobs in the labor market and formal finance in the financial markets, it not only leads to lower gender inequality in labor force participation, formal employment share, wages, and entrepreneurship, but it also leads to larger gains in GDP, employment and formality.

Increase in females' skill level improves their productivity in the labor market, leading to entrepreneurs substituting out male workers for more productive female workers in both sectors. More females are hired in the formal relative to the informal sector, thus increasing female formality in labor employment, $\frac{L_F^f}{L_F^f+L_I^f}$, in the long run. Higher job-finding rate increases females' return from job search, which increases female labor supply, P^f. The positive impact of higher productivity of female workers on wages outweighs the negative impact of higher female labor supply in the long run, leading to an increase in female wages, W_F^f and W_I^f, in both sectors and lower gender gaps. Increase in male participation rate is lower due to two reinforcing effects - (i) household income effect: higher female wage incomes increase total household income, and (ii) substitution effect: fall in male job-finding rate reduces their return from job search.[28] Higher aggregate formality and lower unemployment boosts GDP in the long run. The effect of higher skills of female workers combined with the positive gains in formal entrepreneurship leads to a much higher increase in GDP, employment and formality.

Safety (Gender-related labor supply side policy)

The scenario titled 'Safety' analyzes the impact of higher financial inclusion of females in combination with policies that lower constraints on female labor supply which in our model is modeled as an increase in safety of females outside home (i.e. better provisions of safe transportation, infrastructure etc.). This is obtained by setting $\phi_t^f = \phi_t^m$ in the females' household utility function, along with no gender gaps in access to formal finance. Results indicate that in comparison to the 'Financial access' scenario, increase in female labor force participation is now higher, resulting in lower wages, increased hiring and increase in employment. However, in comparison to all other scenarios (discussed above), gains in GDP are small as increase in overall and female entrepreneurship is the lowest. Moreover, even though gender inequality in labor force participation is lower, females tend to get employed in informal sector jobs, thus worsening the gender divide in quality of jobs. Under our theroetical framework, safety only has implications for female workers' decision to participate in the labor market, and is not linked to their entrepreneurship decision. If the latter is allowed, these results could vary significantly leading to much larger gains.

[28] Fall in male informal employment is higher relative to their fall in formal employment, thus increasing overall male formality, $\frac{L_F^m}{L_F^m+L_I^m}$.

5 Conclusion and Policy Implications

In this paper, we investigate the impact of an increase in female entrepreneurs' access to formal finance (i.e. closing gender gaps in financial access) on gender gaps in the labor market, and on overall macroeconomic outcomes (GDP, unemployment, and informality). To achieve this goal, we build a small open economy DSGE model by incorporating three features of a developing economy relevant to this study: a) gender inequality in the labor market and in entrepreneurial activities; b) financial frictions; and c) existence of two sectors – formal and informal. The model is then applied and calibrated to Indian data.

We were motivated by the fact that while the existing literature on female labor force participation is vast, the effect of gender-based resource restrictions on women's labor market outcomes has been less explored. Integrating three strands of the literature – on financial frictions, gender inequality, and on informality – within a unified framework allows us to capture the impact of gender gaps in access to finance on women's entrepreneurial activities as well as on their labor market outcomes. The inclusion of informality is a particularly important feature when examining the case of India. This is the main contribution of our study.

In our model, we have two sectors, formal and informal sector, where informality results from significantly higher labor rigidities in the formal sector. There are two types of entrepreneurs, males and females, and while both are financially constrained, female entrepreneurs are more constrained than male entrepreneurs. Financial frictions are modeled in the form of a collateral constraint. Households consist of males and females, who either participate in the labor market or work at home, and are owners of these firms. Gender inequality in the labor market is modeled as various frictions on their labor supply and demand, which are higher for females relative to males. Using this framework, we investigate the macroeconomic impact of financial inclusion policies that are aimed towards closing gender gaps in access to formal finance. In addition, we analyze the impact of higher financial inclusion of females under two scenarios: a) greater labor market flexibility (i.e. deregulation in the formal sector labor market); and b) no gender gaps in skills (i.e. education).

Our findings can be summarized as follows. First, the Indian economy gains 1.6 percent in GDP and unemployment falls by 5 percent when females are less financially constrained such that there are no gender gaps in access to finance. It also leads to greater female entrepreneurial activity in the formal sector and greater job creation, which boosts female labor force participation and employment. On the other hand, due to labor market rigidities, firms prefer to hire workers informally and hence the share of informality in the economy increases. This limits the gains from enhanced financial inclusion.

Second, closing gender gaps in financial access when formal labor markets are more flexible amplifies the gains from the former as it leads to an increase in the size of the formal economy. There is a 4.7 percent increase in GDP, a 9 percent fall in unemployment, and an 11.5 percent increase in the share of formal employment of both males and females when hiring costs in the formal labor market are lowered by 10 percent. However, male workers gain more, as constraints on female labor supply (modeled as lower safety and mobility and cultural constraints) and demand (modeled as lower skills and gender-based discrimination in employment) lead

to a smaller increase in female labor force participation and formality in comparison with males.This further worsens gender gaps in the labor market.

Third, the macroeconomic gains from simultaneously lowering demand-side constraints faced by females in the labor market (calibrated as an increase in females' skills), along with lowering their constraints in financial market access, helps in fully utilizing the gains from such reforms. When females have higher skills (such that there are no gender gaps), it increases their efficiency at work and leads to an increase in formal employment of females. In addition, this increase in female efficiency, leads to an expansion of formal sector, leading to an increase in both female and male formal employment. In the case of India, this combined with the gains from greater financial inclusion could increase India's output by 6 percent.

From a policy perspective it may be argued that before selecting the policy strategy, governments should have a clear idea what they want to accomplish: do they want to stimulate the number of female entrepreneurs or the female share in formal entrepreneurship (i.e. gender gaps in entrepreneurship)? Similarly, do they want to stimulate the number of female labor force participants or the share of females in the labor force? A higher female employment or a higher share of female employment in the formal sector? The analyses in this study points out that there may be different factors involved. Considering that gender gaps and size of formality are important from an economic perspective for India - it may be important for the Indian government to focus on stimulating the share of females and formality in economic activities. To this end, the Indian government policy should aim at influencing those factors that have a relatively stronger impact on females rather than on males in the economy and implement them simultaneously with policies that that aim at lowering informality.

References

[1] Acemoglu, D., Autor, D. H. and Lyle, D.S. (2004). Women, War, and Wages: The Effect of Female Labor Supply on the Wage Structure at Mid-Century. *Journal of Political Economy,* 112 (3), 497–551, June 2004.

[2] Aguiar, M. and Gopinath, G. (2007). Emerging Market Business Cycles: The cycle is the trend. *Journal of Political Economy,* 115, 69–112.

[3] Babilla, T.M., Kendo,S., Elondou, M.J.K., and A.N. Bilong (2016). Macroeconomic Implications of Female Entrepreneurs Facinfg Financial Frictions to Access to Credit: A DSGE Model Approach in Cameroon. *Partnership for Economic Policy (PEP) Working Paper*, 2016-02.

[4] Blanchard, O. and Gali, J. (2006). A New Keynesian Model with Unemployment. *National Bank of Belgium Working Paper,* No. 92, October 2006.

[5] Blundell, R. and MaCurdy, T. (1999). Labour Supply: A Review of Alternative Approaches. Handbook of Labor Economics Vol. 3A, 1999, 1560-1695.

[6] Campolmi, A. and Gnochhi, S. (2014). Labor Market Participation, Unemployment, and Monetary Policy. *Bank of Canada Working Paper*, European Central Bank.

[7] Chatterjee U., R. Murgai, and M. Rama (2015). Job Opportunities along the Rural-Urban Gradation and Female Labor Force Participation in India, *Policy Research Working Paper* 7412. World Bank.

[8] Christiano, L.J, Eichenbaum, M.S. and Trabandt, M. (2014). Understanding the Great Recession. *NBER Working Paper,* 20040.

[9] Cuberes, D. and Teigner, M. (2016). Aggregate Effects of Gender Gaps in the Labor Market: A Quantitative Estimate. *Journal of Human Capital*, 2016, vol. 10, no. 1.

[10] Cuberes, D. and Teigner, M. (2018). Macroeconomic costs of gender gaps in a model with entrepreneurship and household production. *The B.E. Journal of Macroeconomics*, 2018; 20170031.

[11] Das, S., S. Jain-Chandra, K. Kochhar, and N. Kumar (2015). Women Workers in India: Why So Few Among So Many? *IMF Working Paper* WP/15/55 (International Monetary Fund: Washington).

[12] Dixit, A.K. and Stiglitz, J. (1977). Monopolistic Competition and Optimum Product Diversity. *The American Economic Review*, 67, 297-308.

[13] Elborgh-Woytek, K., M. Newiak, K. Kochhar, S. Fabrizio, K. Kpodar, P. Wingender, B. Clements, and G. Schwartz (2013). "Women, Work, and the Economy: Macroeconomic Gains from Gender Equity." IMF Staff Discussion Note SDN/13/10. Washington, D.C.: International Monetary Fund.

[14] Mendoza, E.G. (1991). Real Business Cycles in a Small Open Economy. *The American Economic Review*, Vol. 81, No. 4 (Sep., 1991), 797-818.

[15] Gabriel, V.J., Levine, P., Pearlman, J. and Yang, B. (2010). An Estimated DSGE Model of the Indian Economy. *Discussion Paper in Economics*, DP 12/10, University of Surrey.

[16] Gonzales, C., S. Jain-Chandra, K. Kochhar, and M. Newiak (2015). Fair Play: More Equal Laws Boost Female Labor Force Participation. *IMF Staff Discussion Note* SDN/15/02. Washington, D.C.: International Monetary Fund.

[17] India (2016). Staff Report for the 2016 Article IV Consultation, *IMF Country Report No*. 16/75, February 2017 (International Monetary Fund: Washington).

[18] India (2017). Staff Report for the 2017 Article IV Consultation, *IMF Country Report* No. 17/54, February 2017 (International Monetary Fund: Washington).

[19] ILO (2011). Trade Union Membership Statistics. ILO Department of Statistics.

[20] Javeed, S. and Manuhaar, A. (2013). Women and Wage Discrimination in India: A Critical Analysis. *International Journal of Humanities and Social Science Invention*, Vol. 2, Issue 4, April 2013, pp. 06-12.

[21] Khera, P. (2016), Macroeconomic Impacts of Gender Inequality and Informality in India, *IMF Working Paper* WP/16/16. (Washington: International Monetary Fund).

[22] Khera, P. and Anand, R. (2016), Macroeconomic Impact of Product and Labor Market Reforms on Informality and Unemployment in India, *IMF Working Paper* WP/16/47. (Washington: International Monetary Fund).

[23] Khera, P. (2016a), India: 2016 Selected Issues, Macroeconomic Impacts of Gender Inequality and Informality in India, Chapter 7 of IMF Country Report No. 16/76 (Washington: International Monetary Fund).

[24] Khera, P. (2016b), Macroeconomic Impacts of Gender Inequality and Informality in India, *IMF Working Paper* WP/16/16. (Washington: International Monetary Fund).

[25] Kiyotaki, N. and Moore, J. (1997). Credit Cycles. J*ournal of Political Economy*, 1997, vol. 105, no. 2.

[26] Kochhar, K., S. Jain-Chandra, and M. Newiak, 2017. Women, Work, and Economic Growth: Leveling the Playing Field (Washington: International Monetary Fund).

[27] Mitra, A. and Verick, S. (2013). Youth Employment and Unemployment: An Indian Perspective. *ILO Asia Working Paper Series,* ISSN 2227-4491, International Labour Organization (ILO).

[28] Pal, R. and Rathore, U. (2013). Estimating Workers' Bargaining Power and Firms' Markup in India: Implications of Reforms and Labour Regulation, Indira Gandhi Institute of Development Research, *IGIDR Working Paper,* WP-2014-037.

[29] Rotemberg, J. (1982). Sticky prices in the Unites States. *Journal of Political Economy*, Vol. 90, No. 6, Dec. 1982, pp. 1187-1211.

[30] Sahoo, A. and Raa, T.T. (2009). The Relative Performance of Formal and Informal Sectors in India. *Economic Systems Research*, 21:2, 151-162.

[31] Sinha, P. (2013). Combating Youth Unemployment in India. *Mimeo*, Berlin, Friedrich-Ebert-Stiftung.

[32] Tobin, J. (1969). A General Equilibrium Approach to Monetary Theory. *Journal of Money, Credit and Banking*, 1(1): 15-29.

[33] World Economic Forum (2010). *The Global Gender Gap Report* 2010. Basel, World Economic Forum (WEF).

[34] World Economic Forum (2014a). *The Global Gender Gap Report* 2014. Basel, World Economic Forum (WEF).

[35] Woytek, K.E., Newiak, M., Kochhar K., Fabrizio, S., Kpodar, K., Wigender P., Clements B., and Schwartz, G. (2013). Women, Work, and the Economy: Macroeconomic Gains from Gender Equity. *IMF Staff Discussion Note 13/10*, Washington, International Monetary Fund.