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Women's Empowerment: Aggregate Effects on Savings and Wealth

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Abstract: This article explores the aggregate effects of women's empowerment on intra- and inter-temporal household choices within a Bewley-style heterogeneous agent framework to aggregate household level decisions into macroeconomic variables. Emphasis is placed on the role of attitudes towards risk and subsistence consumption. In this context, we find that as women get more empowered, we assume that households show a higher risk aversion reflecting the more risk adverse women's preferences. Thus, households heighten self-insurance by increasing precautionary savings for smoothing consumption and, in turn, this higher level of savings tends to reduce wealth inequality. Also, regardless of income, women's preferences increase food intake in households as women get empowered. The model is calibrated with the 2014 National Survey of Household Income and Expenditures of Mexico.

Keywords: Women empowerment, wealth, savings, subsistence consumption

JEL Classification: O11, E21, D70

Resumen: Este artículo explora los efectos agregados del empoderamiento de las mujeres en las elecciones intra e intertemporales de los hogares en el marco de un modelo Bewley, de agentes heterogéneos, que agrega las decisiones de los hogares en variables macroeconómicas. En particular, se enfatiza el papel de las actitudes hacia el riesgo y el consumo de subsistencia. En este contexto, encontramos que a medida que las mujeres se empoderan y, como consecuencia de ello, suponemos que los hogares muestran una mayor aversión al riesgo, estos generan un aumento de sus ahorros precautorios para suavizar el consumo y, a su vez, este mayor nivel de ahorro tiende a disminuir la desigualdad de la riqueza. En adición, sin importar el nivel de ingreso, las preferencias de las mujeres aumentan la ingesta de alimentos en los hogares cuando las mujeres se empoderan. El modelo se calibra con base en datos de la Encuesta Nacional de Ingresos y Gastos de Hogares de México de 2014.

Palabras Clave: Empoderamiento de las mujeres, riqueza, ahorros, consumo de subsistencia

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1 Introduction

Women’s agency, the ability to exert power and influence over one’s life outcomes, has been identified with a series of positive societal effects, ranging from the daily allocation of resources to inter-generational effects on education. While in a broader sense, empowerment refers as well to women’s participation in society by joining formal political institutions and economic activity, say, by entering the labor market, the focus of this study concerns their influence in household decisions, and those, in turn, in the economy as a whole. As shown throughout the paper, changes in the distribution of power at the household level can have large aggregate repercussions. The effects are particularly noticeable for the poor, for whom credit constraints play an important role. The former Secretary General of the United Nations, Kofi Annan, in his report on progress towards Millennium Development Goals (MDGs) argued that achieving gender equality is a “prerequisite” to achieving some of these goals, including eradicating extreme poverty and hunger, achieving universal education, reducing infant mortality, and eliminating the gender gap in education (United Nations, 2005).

The gains associated to providing equal access to women to resources, economic opportunities, and society at large and within their households, have been largely documented. Among these are higher allocation of household resources towards food and shelter and the accumulation of human capital, which enhance overall well-being and foster growth. In the current study, we unveil previously unknown outcomes and revisit earlier findings based on differences between female and male members of the household in terms of their respective tolerance for risk and preferences for consumption. The main contribution of the paper consists on exploring these gender-based variations and studying the associated macroeconomic effects in terms of saving rates, and the implied consumption, income and wealth distribution.

The setup for the analysis is based on a Bewley-style heterogeneous agent model, where households are ex-ante identical but differ over time according to their (random)

endowment histories. In this endowment economy, households buy and sell bonds to smooth consumption and self-insure against idiosyncratic risk. The framework generates consumption-saving profiles according to income levels that allow us to compute long-term distributions of consumption and wealth, and thus track the impact of greater women's empowerment on the entire economy. We find that women's empowerment reduces wealth and consumption inequality as savings rise, *particularly at the bottom of the income distribution*.

The analysis is carried out by addressing each of the gender differences and then seeing how greater empowerment at the household level plays out in the (aggregate) equilibrium of the economy. In the model setup, risk aversion corresponds to the differences in consumption preferences between women and men, which are built in along with an initial distribution of power within the household. We allow for a subsistence related good, which can be thought of as food or clothing, and a numeraire good which can be consumed or carried to the next period by the purchase of an interest-bearing bond. The minimum consumption of food requirement allows to probe the role of poverty in the analysis.

In equilibrium, higher empowerment results in a higher share of the subsistence good in consumption (as expected), but also higher precautionary savings as the household's degree of risk aversion exogenously increases supposing that this reflects a higher bargaining power of women in households. This, in turn, changes the distribution of wealth and consumption at the aggregate level. To validate these findings, the model's predictions are contrasted against the 2014 National Household Income and Expenditure Survey of Mexico (NHIES). The survey contains information on income and expenditure, and on dwelling and socioeconomic characteristics at the household level. The NHIES also contains records on the gender of the head of the household. Such information is used to contrast the economic choices of household heads based on their gender.

The paper is organized as follows. Section 2 reviews the literature on which the paper

builds and shows where our paper fits. Section 3 presents an endowment economy model in which risk-free bonds are the only tradable asset and characterizes the households' inter-temporal decisions, where households maximize the present value of the collective utility given by a weighted average of individual members' utilities, the weights being the intra-household bargaining power of the respective members. Section 4 provides the survey-based perspective on the model's predictions; and Section 5 concludes.

2 Literature Review

In a household, consumption-saving decisions are not always taken by a single member of the household. All adult members of the household would typically participate in these decisions. Some members might have a greater say in this process compared to other members which can lead to a more favorable outcome for them. There exists a broad range of research on the gender difference in micro and macroeconomic decisions. Doepke and Tertilt (2016) provide a survey of literature in the context of intrahousehold bargaining between husband and wife, while Lauer and Yodanis (2014) provide a survey in the context of larger institutional (social and cultural) difference in the roots of these gender differences in the micro and macroeconomic outcomes.

There is a large body of literature (Thomas, 1990, 1993; Kanbur and Haddad, 1994; Lundberg et al., 1997; Hoddinott and Haddad, 1995; Quisumbing and Maluccio, 1999; and Duflo, 2003) that shows how the same amount of income allotted to either the female or male member of the household is spent differently, suggesting women's focus on nutrition, education and clothing, in particular. Due to the differences in preferences by men and women, redistribution of the household's power dynamics can lead to different outcomes in the household and hence the economy as a whole. It is thus important to understand the household's decision making process. The growing literature on collective models of household behavior (Bourguignon and Chiappori, 1992, 1994; Vermeulen, 2002; Lundberg, 2005; Basu, 2006; Atal, 2017) has not examined

the long-run aggregate effect of women’s empowerment on savings and wealth, which is the objective of this paper.

All our findings conform to the evidence on how social factors inside or outside households affect their short- and long-term decisions, including those regarding saving and the role of culture in shaping preferences (see Fehr and Hoff (2011), Mullainathan and Shafir (2009), and Brune et al. (2017)). In close relation to this study, Browning (2000), Nargis (2003) and Lee and Pocock (2007) find that wives’ savings increase with their bargaining power in the households; furthermore, this increase compensates the decline in the husbands’ savings so that overall the households save more. Along the same line, Lundberg and Ward-Batts (2000) find positive correlation between households’ net worth at the age of retirement and the wives’ education and bargaining power. These findings align to our model’s prediction of higher savings as an endogenous response to greater women’s empowerment.

Doepke and Tertilt (2018) study the effect of direct conditional cash transfers to women on households’ decisions. Based on a survey of recipients of the PROGRESA program in Mexico from 1998 and 1999, contrary to our findings, they find a decrease in savings associated to the program’s empowering of women. The intuition for this is that male-provided public goods are directly linked to savings objectives (buying physical assets), while women’s are not related to bequests or tangible goods. The highlight of our model is uncertainty, in which risk aversion plays a significant role in inter-temporal decisions: a higher weight on women’s preferences results in higher savings at the bottom of the income distribution; that is, for those households close to the subsistence bound. In light of our model, lower saving rates would also be observed if low endowment realizations were to shift away from the subsistence bound; or as noted, under the loosening of the credit constraint along the lines of the findings of Pitt and Khandker (1998), Khandker (2005). Based on the same data however, Rubalcava, Teruel and Duncan (2009) find that “among poor rural Mexicans, women have longer planning horizons, and so resources under their control, including PROGRESA income,

are likely to be spent on investments in children and in small-scale livestock.”

Gender difference affects other macroeconomic factors as well, among them are fertility, leading to demographic changes; and education, leading to changes in human capital and hence growth of the economy. Ashraf, Field and Lee (2014) find that women are less likely to choose contraceptives and more likely to give birth if their husbands are required to co-sign the contraceptive application. Doepke and Kindermann (2018) find that in programs aimed at fertility, fertility rises when the government implements policies to reduce the child-care burden from mothers. Dutta and Mallick (2018) demonstrate that although fertility has a negative impact on women’s entrepreneurship, the impact can be offset or even reversed by increased female-to-male labor force participation ratio or women’s access to informal loans.

Cooray, Mallick and Dutta (2014) find that openness of the economy, interacting with male and female human capital stock, has a differential impact on economic growth in South Asia; in particular, it is positive for female human capital with secondary enrollments. Hence secondary level education should be encouraged for females in order to encourage greater foreign direct investment and maximize its impact on economic growth. In a different article (Cooray, Dutta and Mallick, 2016), they find that high skilled female human capital remits more money and this remittance has a higher positive impact on the rise of per capita GDP and growth. Since mothers invest more on children’s education and health (Schultz, 2002), policies targeting women can have a larger impact on overall economic growth in the long run.

The increase in savings in our model is driven by differences in risk aversion by gender. Controlled experiments suggest that women are more risk averse than men (Jianakoplos and Bernasek, 1998; Nelson, 2012). Croson and Gneezy (2009) document a series of studies for which this is the case, along with evidence from experimental psychology. In the model, higher gender-weighted risk aversion is linked to greater precautionary savings at the household level, where these savings, in turn, have macroeconomic implications reflected on the interest rate and on the economy’s wealth and

consumption distributions. In this paper, we trace back gender-based stylized facts to intrinsic differences in consumption and risk preferences between female and male members of the household and study their effect on macroeconomic variables. At the theoretical level, the static model builds on Basu's (2006) collective utility model with intra-household bargaining power for women; the dynamic model adds uncertainty and generalizes the findings of Atal and San Vicente Portes (2012).

3 An Endowment Economy

With the aim of assessing the aggregate effects of women as empowered decision-makers in the household, the modelling approach is one in which one can introduce a gauge of women's capacity to weigh in the household's choices and at the same time allow for an ex-post view of the economy as a whole. For this, we use a Bewley-style heterogeneous agent model in which the economy consists of a set of households who are ex-ante identical but differ over time according to their endowment realizations, rendering them different from one another. Households face uncertainty due to their idiosyncratic endowment risk. The only form of insurance against low endowment realizations is through the buying and selling of one-period bonds; in the aggregate level, these bonds are issued in zero net-supply, following Huggett (1993). In any given period, high endowment households buy the bonds and low endowment ones sell them, each type of household has consumption smoothing in mind. This set up is a Huggett-type (1993) economy in which women's empowerment, following Basu (2006), is captured through the household's collective utility, where both the 'woman' the 'man' make joint choices about the mix of consumption goods and about savings. The intra-household bargaining power could be determined by several factors in the household dynamics. It could be increasing with the woman's contribution to the household income (Woolley, 2003; Basu, 2006; Atal, 2017); it could be increasing with their level of education; or it could be dependent on the desirable characteristics of a wife in the marriage market (Grossbard-Shechtman, 1993; Grossbard, 2015). To keep the model tractable and to

focus on the aggregate effects of women’s empowerment, we consider θ to be exogenous in our model, thus each member’s influence in the choice is parametrically given, as in Becker (1973); this, in turn, is run through the model to derive the aggregate effects of higher influence of women in the household’s decisions.

3.1 Household’s Utility Maximization Problem

The household’s problem is summarized as follows. Each household consumes two goods: a subsistence good called “food” (f) on which they need to satisfy a minimum subsistence level (s) (i.e., $f_t \geq s$ for every t) and a non-subsistence consumption good (x), which represents the numeraire good. The household’s collective utility is given by a weighted Cobb-Douglas utility functions in the form of a consumption aggregator C_t :

$$C_t \equiv \left\{ (f_t - s)^\alpha (x_t)^{(1-\alpha)} \right\}^\theta \left\{ (f_t - s)^\beta (x_t)^{(1-\beta)} \right\}^{(1-\theta)},$$

where α is the preference parameter for food for women, β represents the same for men, $0 < \beta < \alpha < 1$; and θ is the woman’s intra-household bargaining power, $\theta \in [0, 1]$.

Then, taking as given the interest rate (r), the relative price of food (p), initial asset holdings (a_0), endowment (e_0), relative risk aversion (σ), and the woman’s power (θ), the consumption basket enters the representative household’s collective lifetime utility maximization problem in the form of:

$$\max_{\{f_t, x_t, a_{t+1}\}} U(f_t, x_t; \theta, s) = E_0 \sum_{t=0}^{\infty} \delta^t \frac{C_t^{1-\sigma}}{1-\sigma}.$$

As noted before, households’ resources are comprised by their bond holdings (a_t) and the random endowment (e_t). These are recursively allocated between savings and consumption, where the latter involves food and the numeraire good. This yields period t budget constraint:

$$pf_t + x_t + a_{t+1} \leq (1+r)a_t + e_t \text{ for } t = 0, 1, 2, \dots \text{ and } a_t \geq -\phi,$$

where $\delta \in (0, 1)$ is the discount factor, ϕ is an *ad hoc* borrowing constraint, and U satisfies the Inada conditions.

The emphasis on the distribution of power within the household is captured by the weight θ of the women's greater preference for food ($\alpha > \beta$) in the composite good C_t and in the degree of risk-aversion σ . The effect of the preference for food can be solved analytically, and as expected, higher empowerment increases food consumption. Letting γ represent the household's utility weight on f so that $\gamma = \alpha\theta + \beta(1 - \theta)$ and \tilde{c}_t the available resources for consumption such that $\tilde{c}_t \equiv pf_t + x_t = (1+r)a_t + e_t - a_{t+1}$, we get the intra-temporal solution as:

$$f_t = \frac{\gamma}{p}\tilde{c}_t + (1 - \gamma)s, \quad (1)$$

$$x_t = (1 - \gamma)\tilde{c}_t - (1 - \gamma)ps. \quad (2)$$

All else equal, women's empowerment (higher $\theta \rightarrow$ higher γ) is associated with higher consumption of food (and less of the numeraire); the subsistence requirement shifts the allocation of resources towards food, as well. Note, however, that as far as subsistence concerns, the values of f_t and x_t tend to a no subsistence model (i.e. one with $s = 0$) as the available consumption resources (\tilde{c}) tend to infinity. The effect of women's empowerment on the household's consumption mix remains for any \tilde{c} . These properties suggests a push in favor of food consumption across income levels.

3.2 Recursive Formulation

To analyze the dynamics of the model and economy-wide effects of women's empowerment, we discretize the state-space and use numerical methods.¹ In addition, to make the solution tractable, this approach is without loss of generality and preserves the

¹The algorithm for the solution is described in the Appendix. Numerical methods are used to solve this type of dynamic stochastic problems because of several reasons. First, there are no analytical (closed form) solutions that characterize the equilibrium properties of the problem; second, binding boundary conditions are important in this set up with poor and credit constrained individuals, where nonlinearities are present; and third, it allows for an empirically based computation of the question

non-linearities in the consumption-saving decision, specially at low levels of income and wealth. To proceed, in every period t , we let each infinitely-lived household i receive an endowment $e_t \in E = [e_1 < e_2 < \dots < e_L]$ which evolves according to a L -state Markov chain with transition matrix P . At the beginning of time, $t = 0$, each household has to find the utility maximizing sequence $\{C_t, a_{t+1}\}_{t=0}^{\infty}$ for the given interest rate r and account for the *ad hoc* borrowing constraint ϕ , which is common to all households, and $a_{t+1} \in A = [-\phi < 0 < \dots < a_J]$, which comprises the state space for assets. The borrowing constraint gives rise to the incomplete markets setting, where there are no state-contingent assets, but a single risk-free bond that households can buy and sell up to that limit. Hence the state space is defined by $E \times A$. We use the static nature of the consumption basket to express the problem in terms of \tilde{c}_t to be recursively formulated in terms of the following Bellman equation:

$$v(a_j, e_l) = \max_{a'} \left\{ u[(1+r)a_j + e_l - a'] + \delta \sum_{n=1}^L P(l, j)v(a', e_n) \right\},$$

where $v(a, e)$ is the value function evaluated at the optimal $\{C_t, a_{t+1}\}_{t=0}^{\infty}$ sequence.

The solution to this problem yields a decision rule for asset holdings in the next period $a' = g(a, e)$, which also implies a stationary distribution $\lambda(a, e)$ across the state-space. Hence a stationary equilibrium for this economy is given by a borrowing limit ϕ , an interest rate r , a policy function $a' = g(a, e)$, and a stationary distribution $\lambda(a, e)$ such that:

1. The households' problem is solved.
2. The stationary distribution is induced by P and $g(a, e)$.
3. The market for loans clears, that is $\sum_{a,e} \lambda(a, e)g(a, e) = 0$.

being analyzed tied to clear quantitative predictions. The method employed in this paper is free of approximation errors and provides a full solution to the household's problem tied to equilibrium prices (interest rate) and wealth distribution that encompasses the entirety of the modeled economic system.

In other words, a stationary equilibrium is an invariant distribution over assets and endowments, consistent with the latter’s Markov process, such that households’ lifetime utility is maximized and bonds are in zero net-supply. The outline of the algorithm used to solve the model is provided in the Appendix.

To solve the model numerically, we calibrate the model with values observed in Mexico’s 2014 National Household Income and Expenditure Survey for the model’s counterpart parameter values, such as proportion of female household heads (θ); ² the men’s food share (β) corresponding to the national average; the women’s share of food (α) which corresponds to the observed in the bottom income decile food expenditure share by female led households. Given that the share of food in household expenditure is decreasing in income, this serves as an upper bound on the expected effects of increased women’s empowerment.

Although it is not reported in the survey, the minimum consumption requirement of food is used as a marker for subsistence consumption, a form of extreme poverty in the model. For the remaining parameters, we used standard values from the real business cycle literature, where each model period represents one year. The benchmark parametrization reported in Table 1 is given as follows.

Table 1. Model Calibration

Parameter	Symbol	Benchmark	Empowerment
Discount factor	δ	0.96	
Relative risk aversion	σ	3.00	4.00
Food share: women	α	0.36	
Food share: men	β	0.30	
Female household head	θ	0.26	0.50
Relative price of food	p	1.00	
Min. consumption of food	s	0.00	0.10
Borrowing constraint	ϕ	2.00	3.00

²Households are classified according to the gender of the person who makes the decisions.

In this setting, the shift towards greater women’s empowerment is captured by several of the model’s parameters. The woman’s voice within the household is represented by θ , which in the experiment rises from 26 percent that corresponds to female led household in the survey to 50 percent, this being interpreted as both the ‘woman’ and the ‘man’ having the same voice in decisionmaking. As a consequence, the parameter for risk aversion is exogenously also modified to reflect this different dimension of women’s preferences. Also, for exploratory purposes, structural features such as credit constraints, and the role of a floor on food consumption provide an alternative to the benchmark; both prove crucial in the model’s predictions.

For the endowment values and transition probabilities, we follow Sargent and Ljungqvist (2012) by using a 7-state Markov process where endowments are given by the set $E = [0.3012, 0.4493, 0.6703, 1.0000, 1.4918, 2.2255, 3.3201]$ with the invariant distribution $\underline{P} = [0.0063, 0.0608, 0.2417, 0.3823, 0.2417, 0.0608, 0.0063]$. These values reflect an order of magnitude between the lowest and the highest endowment realizations, and a symmetric stationary distribution centered around the median endowment value. By taking these values, we do not attempt to replicate Mexico’s wealth distribution, which would be a study in itself; the focus is rather on the aggregate effects of women’s empowerment.

3.3 Solution

Now we turn to illustrate the features of this stationary equilibrium. First we discuss the intra-temporal effects of women’s empowerment. Figure 1 shows the decision rule for food consumption across the asset space for the lowest and the highest endowment realizations for the benchmark economy and the one with higher empowerment.

In the top panels one can see that for both low and high endowment realizations, higher empowerment is associated to higher levels of food consumption. This finding is expected given that compared to men a bias towards food is built into women’s

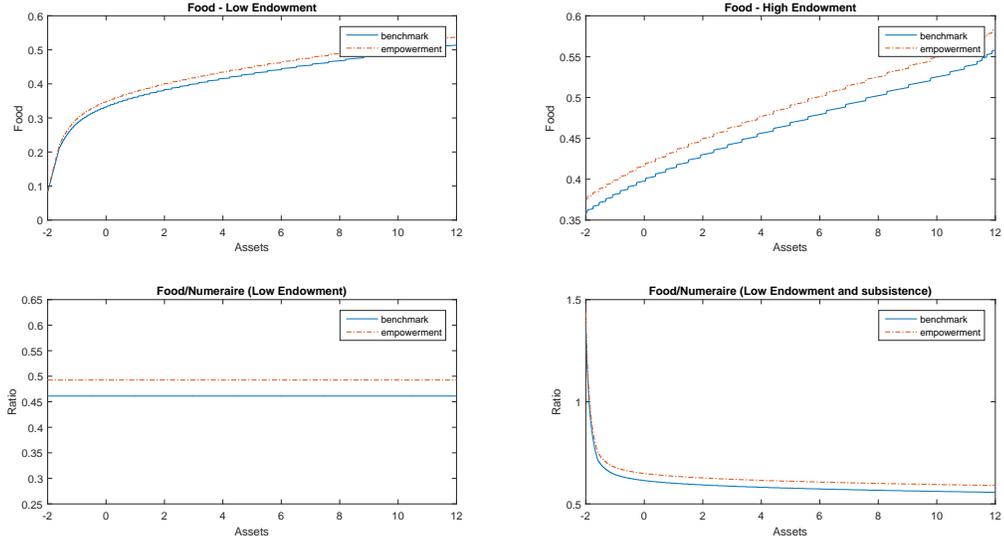


Figure 1. The top-left (top-right) panel shows a household’s choice of food consumption when subject to the lowest (highest) endowment shock. The bottom-left (bottom-right) panel presents a household’s consumption mix of food relative to the numeraire good without (with) a minimum subsistence requirement of food.

preferences. The lower-left panel shows the predicted consumption mix of food and the numeraire good in the absence of a lower bound on food consumption. Again, higher empowerment leads to more food in the consumption basket. The lower-right panel highlights the interaction of poverty and empowerment. For this chart, there is a minimum consumption requirement of food that the household has to meet. A realistic prediction from this set up is that the share of food in households’ expenditure is decreasing in wealth. In line with the other panels, food consumption is increasing in empowerment. In regard to the role of poverty, subsistence consumption implies that in equilibrium, across the state space, the highest consumption share of food to numeraire good is realized in households with low endowment and low assets; that is, in the poorest segment of the population.

At the macroeconomic level, which is the focus of the current study, higher women’s empowerment is analyzed through the household’s consumption-saving decision. The change in the household’s inter-temporal choice associated to higher women’s empower-

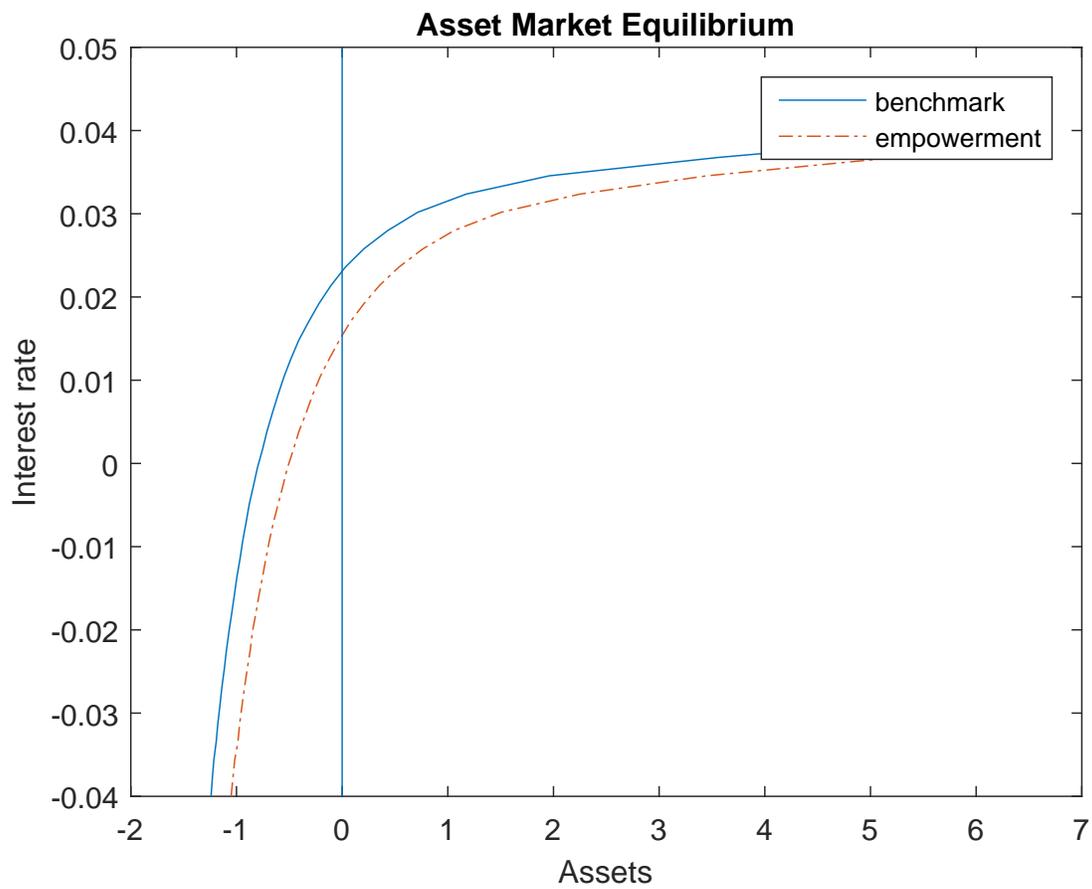


Figure 2. Higher risk aversion in women's preferences leads to larger precautionary savings, and thus to a lower interest rate.

ment works through the market for savings, and the economy-wide impact is reflected in the equilibrium interest rate. In this dimension, women differ from men in the model by the former exhibiting a higher degree of risk aversion, which is built into the curvature of the utility function. A higher coefficient of risk aversion delineates another dimension in which women and men differ in this economy. Figure 2 presents the steady state equilibrium interest rate in this framework. All else equal, a larger weight of women's preferences in the household's collective utility function leads to higher precautionary savings. The additional flow of savings into the market for loans leads to a lower equilibrium interest rate when bonds are issued in zero net-supply.³ In this case, the aggregate effect of greater empowerment is a reduction in the equilibrium interest rate.⁴

3.4 Applications

By easing the borrowing constraints that women had faced in terms of lack of credit for entrepreneurial purposes, microfinance institutions have boomed with the flourishing of mostly women-run businesses. In the realm of the model, this directly translates into a less restrictive borrowing limit that in turn leads to a new asset market equilibrium. Figure 3 shows that greater credit availability is associated with a higher interest rate triggered by lower precautionary savings — as households can tap the credit market to smooth consumption. This is a step closer to the complete market solution which would exhibit an even higher equilibrium interest rate, where state-contingent securities are available thus eliminating the need for self-insurance.

3.5 Distributional Effects

The macroeconomic effects outlined above result in a new positioning of households over the state space of assets and endowments as households revise their savings decisions

³This is relative to the complete markets solution, in which a lower supply of loanable funds due to the absence of need for precautionary savings exhibits a higher interest rate.

⁴In a production economy, the equivalent outcome (higher savings) would exhibit richer macroeconomic effects in terms of investment, productivity, output, and growth.

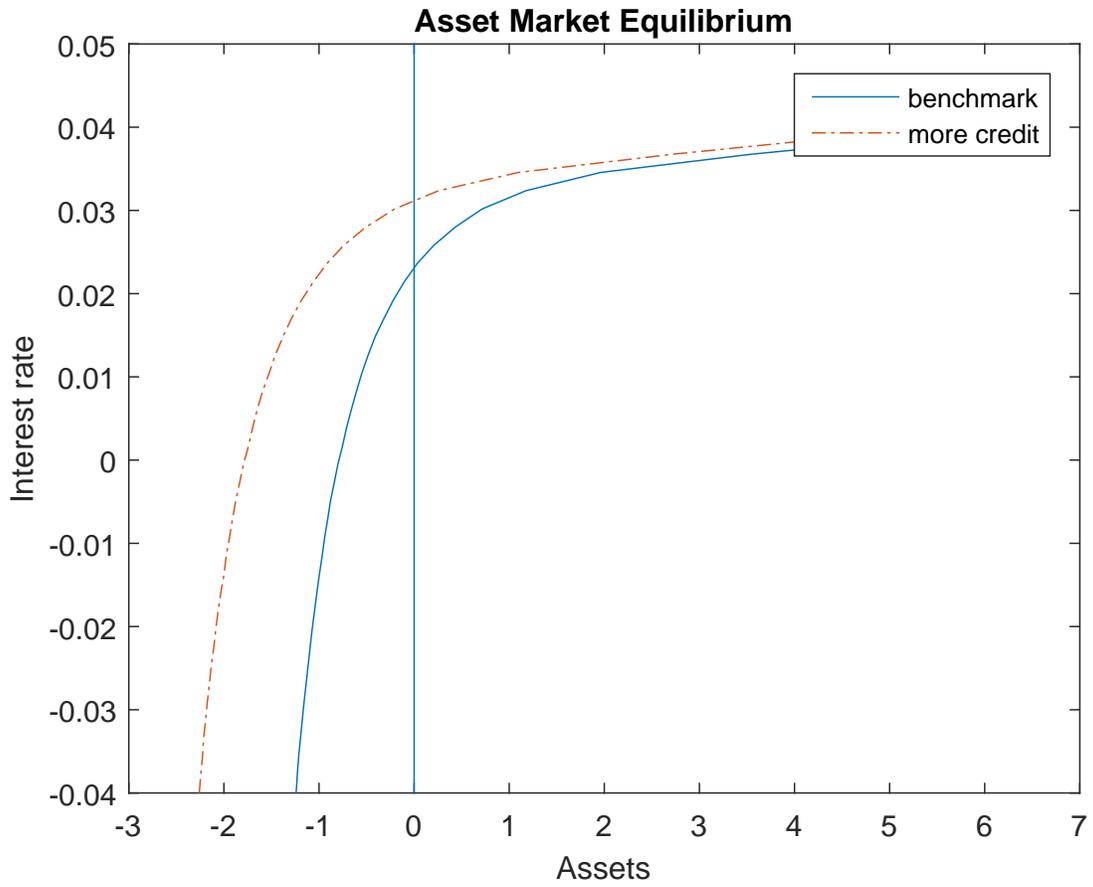


Figure 3. A loosening of the borrowing constraint (e.g. microfinance-style lending), brings the economy closer to a complete markets allocation which would feature a higher interest rate in the absence of precautionary savings.

due to the increase in women’s empowerment. That is, there is a shift in the distribution of wealth and on the distribution of consumption in the economy. The distributional effects of such shift in power within the household are captured by a new stationary equilibrium defined by a new probability distribution of households over assets and endowments; hence we can calculate the implied measures of wealth and consumption inequality before and after the change in empowerment.

From the household’s budget constraint, recall that income at time t is given by the endowment and by the return on the household’s asset holdings; and income, in turn, determines the level of consumption. Then, to calculate the economy-wide effect of greater women’s empowerment on inequality, we compare the variance across variables relative to the benchmark calibration. Table 2 reports the ratio of the variance of the model with empowerment compared to the original calibration, a value of 1 represents no change in the dispersion of households across the endowment and asset space between models.

Table 2. Distributional Effects (variance relative to benchmark model)

Parameter	Symbol	Empowerment	
		Wealth	Consumption
Relative risk aversion	$\sigma \uparrow$	0.93	0.94
Women’s say in consumption decisions	$\theta \uparrow$	1.00	1.00
Access to credit	$\phi \uparrow$	1.35	1.01

The distributional effects of women’s empowerment stem from the increase in precautionary savings against idiosyncratic risk. Given the nature of the credit market (one period bond, with a limit on credit) more risk-averse households would increase their savings for a “rainy day”, particularly those that are poor. As women lean towards more self-insurance, the extra savings, particularly at the bottom of the wealth distribution, reduces inequality as the (capital) income of poorer households rises in a

higher proportion than in the remainder of the distribution, in which the households' incentive for self-insurance is smaller.

In the contra factual exercises, we assume an increase in σ . Inequality, measured by the variance of the equilibrium distributions of wealth and consumption, falls relative to the benchmark scenario. In this case, since consumption is a function of income, and income a function of wealth, the drop in the latter, reduces consumption inequality, as well. Hence, in contrast to Schmidt and Sevak (2006), we find that there would be a drop in both measures of inequality as women become more empowered, as this affects dynamic decisions.

However, the exercise suggests that greater access to credit ϕ could counteract such decrease in inequality. Larger availability of formal credit reduces the need for self-insurance, particularly at the bottom of the distribution; hence, wealth and consumption inequality rise as precautionary savings fall. Despite both wealth and income inequality rising compared to the benchmark scenario, greater credit availability is a step closer to the complete markets solution, and thus must be welfare enhancing as the credit constraint becomes less binding. In this endowment setting with no production, a looser credit constraint improves welfare; however, Doepke and Tertilt (2018) argue that transfers targeting women may not necessarily be beneficial to growth if the production in the economy is more land or physical capital intensive, then they find an adverse effect of these transfers on the economic growth.

The remaining results concern the parameter linked to food consumption and women's say in the household's decisions θ . Women's preference for food relative to men does not affect the aggregate distribution of wealth in the model, since the impact of women's empowerment on this dimension narrows down to the within period composition of the consumption basket; the higher preference for food is neutral on savings, unlike the degree of risk aversion. It is only the allocation of expenditure resources that is affected once savings out of current income have been determined.

4 Empirical Validation

To verify the model's predictions, we matched the model's variables counterparts to those in the 2014 National Household Income and Expenditure Survey of Mexico. A key feature of this survey is that household profiles can be built based on the gender of the head of the household. With this in mind, we calculated food, clothing, and savings to income ratios of the national sample by income deciles. The gender dimension of these measures are compared to those generated by the model.

The NHIES that we use took place between August and November of 2014, and was designed with the aim of learning about the level, distribution, and structure of income and expenditure in Mexico, in addition to the households' dwelling characteristics, such as equipment and infrastructure. The survey represents 120 million people (31.7 million households) and spans income and expenditure entries at a high level of disaggregation such as a classification for different monetary and non-monetary sources of income, and narrowly defined expenditure categories as well.

This section contrasts the model's predictions to what is observed in the data based on the head of the household's gender. Specifically, the research question centers on observable choices associated to greater women's empowerment within the household. The first variable concerns food and clothing expenditures. Figure 4 shows the ratio of women's to men's expenditure on food per household member from the national survey. As predicted by the model, higher women empowerment would lead to a shift towards more consumption of these goods at the household level. In the case of food, this is more prevalent at the bottom of the distribution.

Another prediction from the model concerns the inclusion of women in credit markets. Greater access to credit in the model facilitates consumption smoothing, and reduces precautionary savings as more households are able to buy and sell greater amounts of the one period bond. The counterpart in the survey corresponds to the degree to which women are credit constrained in relation to men. Though credit con-

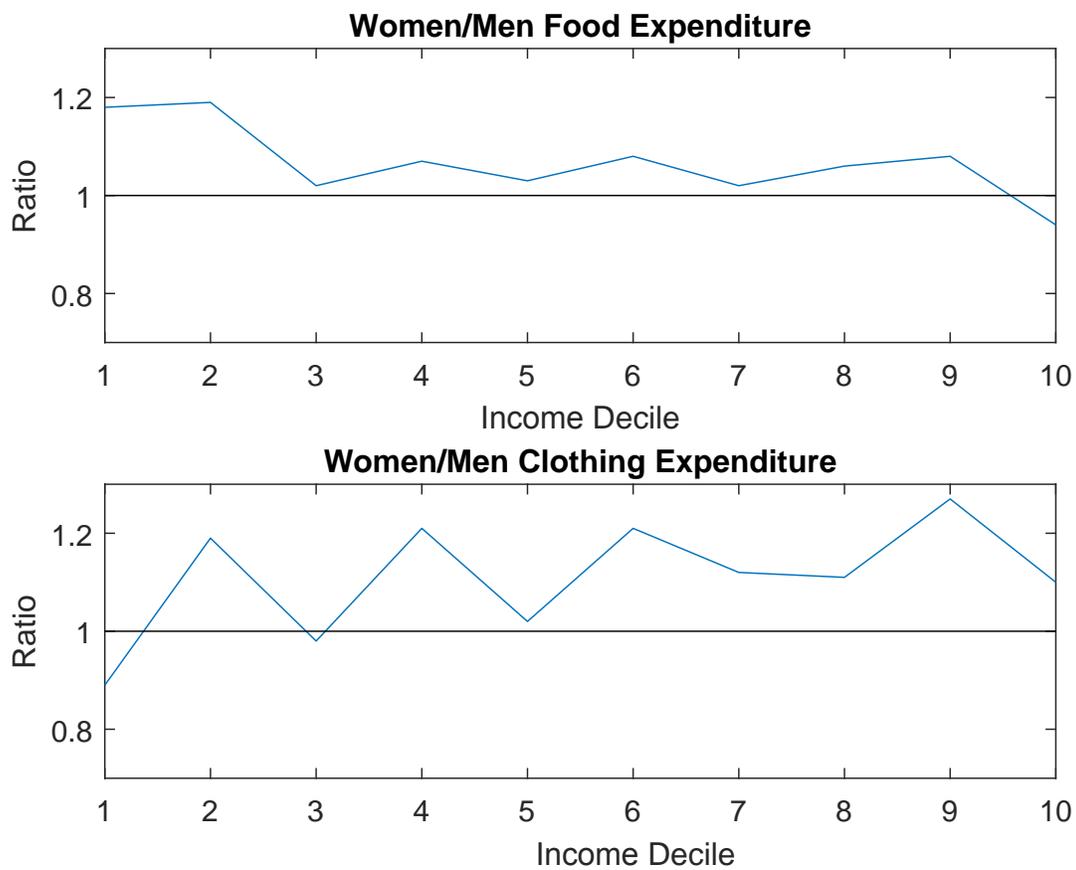


Figure 4. The top panel shows the ratio of women's to men's food expenditure, and the bottom does the same for clothing. This is at the national level. Source: National Household Income and Expenditure Survey, 2014 (Mexico).

straints are not reported as such, we constructed a proxy based on the absence of outstanding credit or loans reported by households. We note that this assumes that absence of outstanding credit means lack of access to credit, which may not be the case always. Figure 5 shows the ratio of credit constrained women to men by income decile. The figure shows that in 7 out of 10 deciles, women-led households appear to be more credit constrained than male-led ones.

These results corroborate the model's predictions in what is observed at the national level. Female-led households exhibit higher spending in human capital related goods compared to those with a male household head. Furthermore, easing credit constraints (such as microfinance programs) would lead to a more efficient economy-wide allocation of resources, and transition from self-insurance to formal market based arrangements that allow households to share risk and transfer wealth across time.

5 Conclusion

This paper explores and quantifies some of the dimensions that are influenced by increasing women's empowerment within the household. However, the main contribution concerns the macroeconomic effects of such empowering; these range from increase in savings, food consumption to other measures of inequality. Greater influence of women in households' decisions lead to changes in the economy as a whole.

Through the lens of an endowment economy, we analyze the inter-temporal and the intra-temporal effects of larger female empowerment. In terms of the household's inter-temporal problem, when increased women's empowerment is characterized by higher household relative risk aversion, there is an increase in economy-wide savings, precautionary in nature. This is reflected, in turn, in a lower interest rate, which is necessary to clear the bond market. Higher savings, particularly of the poor, lead to lower wealth and consumption inequality. The intra-temporal effect is reflected in the increase in spending in the subsistence/human capital related good. Once again, this effect proved

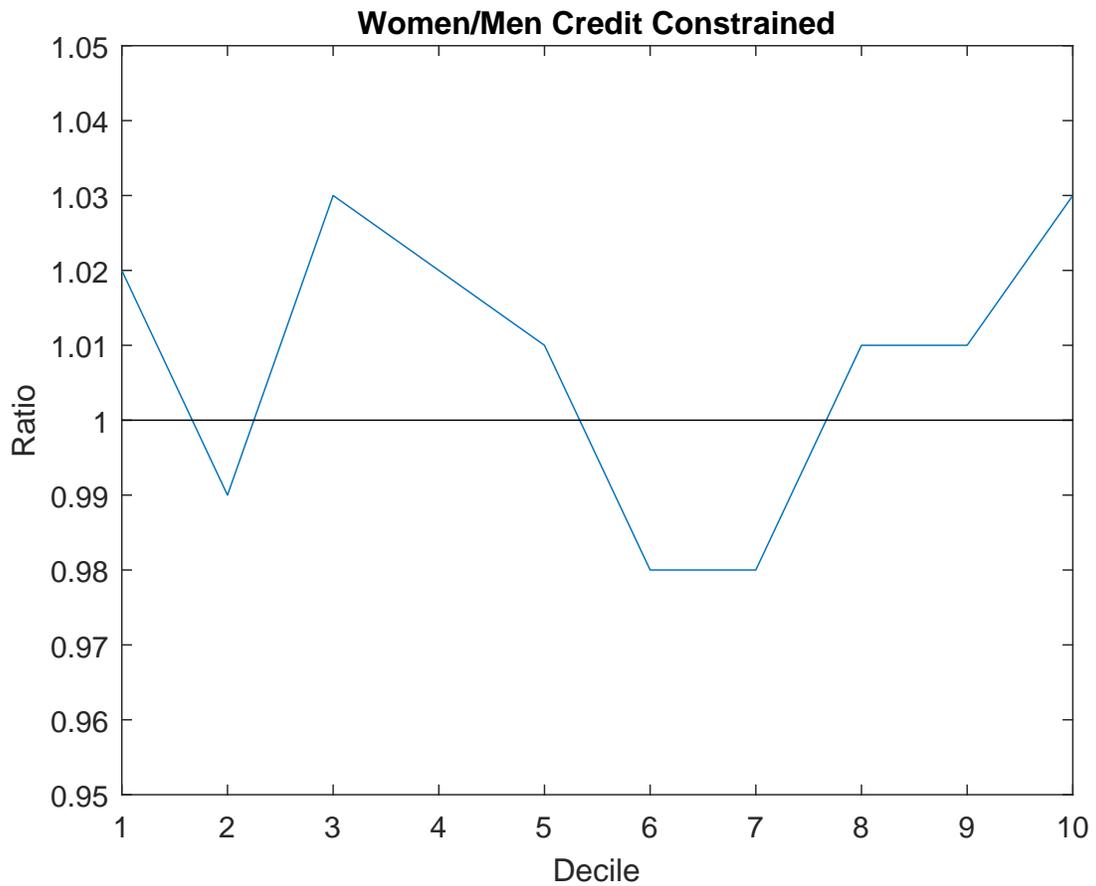


Figure 5. This figure shows the ratio of women to men who are credit constrained. Expanding access to credit would reduce self-insurance (precautionary savings) in favor of a market based mechanism for consumption smoothing. The data for this figure is at the national level and was constructed based on the absence of outstanding credit or loans from the National Household Income and Expenditure Survey, 2014 (Mexico).

to be stronger among low-income households.

Overall, these theoretical findings echo those from empirical studies and are corroborated by Mexico's National Household Income and Expenditure Survey; but most importantly, this paper shows how women's empowerment results in economy-wide changes. Future research could look at production decisions within the same realm in the style of Aiyagari (1994). We conjecture that greater women's empowerment would lead to higher human and physical capital accumulation, with the associated effects on output, growth, and wages.

As a final note, in the entire analysis above, we measured poverty and inequality in terms of wealth only. However, as Case and Deaton (2002) stress, poverty and inequality should be measured in multiple dimensions—education, health, wealth, etc. because these indicators are correlated with one's well-being. This also suggests an endogenously determined bargaining power in the household because with increased power women can influence the household's choice of higher education for them, which in turn can give them more bargaining power (Basu, 2006; Atal, 2017). Ignoring this endogeneity gives us a lower bound of the aggregate effects of women's empowerment in the event of feedback mechanisms of this sort. And also, we find that empowering women can increase savings and thus promote growth in the economy. However, we do not comment on the reverse effects of growth itself on the balance of power. Research in this area so far has not given clear results (Duflo, 2012; Kabeer and Luisa, 2013; Kabeer, 2016). Doepke and Tertilt (2009) demonstrate that increased demand for human capital as a result of technological change and economic development incentivizes men to voluntarily extend women's rights (and improve women's empowerment) because that can improve children's education. A different specification of our model that includes physical and human capital accumulation could shed some light onto the effect of economic growth on women's empowerment, which is left for future work.

References

- [1] Aiyagari, S. R. (1994). Uninsured Idiosyncratic Risk and Aggregate Saving. *Quarterly Journal of Economics*, 109: 659-684.
- [2] Ashraf, N., Field, E. and Lee, J. (2014). Household bargaining and excess fertility: An experimental study in Zambia. *American Economic Review*, 104(7): 2210–2237.
- [3] Atal, V. (2017). Say at home, or stay at home? Policy implications on female labor supply and empowerment. *Review of Economics of the Household*, 15(4): 1081-1103.
- [4] Atal, V. and San Vicente Portes, L. (2012). Women’s empowerment and households’ consumption-savings decisions. In Lownes-Jackson, M. and Guy, R. (Eds.), *Economic Empowerment for Women: A Global Perspective*. The World Institute for Sustainable Education and Research (WISER Group). Informing Science Press.
- [5] Basu, K. (2006). Gender and say: A model of household behavior with endogenously-determined balance of power. *The Economic Journal*, 116: 558-580.
- [6] Becker, G. (1973). A theory of marriage: Part I. *Journal of Political Economy*, 81(4): 813-846.
- [7] Bourguignon, F. and Chiappori, P. (1992). Collective models of household behavior: An introduction. *European Economic Review*, 36: 355-364.
- [8] Bourguignon, F. and Chiappori, P. (1994). The collective approach to household behavior. In Blundell, R., Preston, I. and Walker, I. (Eds.), *The Measurement of Household Welfare*, Cambridge University Press, New York.
- [9] Browning, M. (2000). The saving behavior of a two-person household. *Scandinavian Journal of Economics*, 102(2): 235–251.

- [10] Brune, L., Giné, X., Goldberg, J. and Yang, D. (2017). Savings defaults and payment delays for cash transfers: Field experimental evidence from Malawi. *Journal of Development Economics*, 129: 1-13.
- [11] Case, A. and Deaton, A. (2002). Consumption, health, gender and poverty. Mimeo, Research Program in Development Studies, Princeton University.
- [12] Cooray, A., Dutta, N. and Mallick, S. (2016). Does female human capital formation matter for the income effect of remittances? Evidence from developing countries. *Oxford Development Studies*, 44(4): 458-478.
- [13] Cooray, A., Mallick, S. and Dutta, N. (2014). Gender-specific human capital, openness and growth: Exploring the linkages for South Asia. *Review of Development Economics*, 18(1): 107–122.
- [14] Croson, R. and Gneezy, U. (2009). Gender differences in preferences. *Journal of Economic Literature*, 47(2): 448-474.
- [15] deMel, S., McKenzie, D. and Woodruff, C. (2009). Are women more credit constrained? Experimental evidence on gender and microenterprise returns. *American Economic Journal: Applied Economics*, 1(3): 1–32.
- [16] Doepke, M. and Kindermann, F. (2018). Bargaining over babies: Theory, evidence, and policy implications. Working Paper, available at: http://faculty.wcas.northwestern.edu/~mdo738/research/Doepke_Kindermann.1118.pdf
- [17] Doepke, M. and Tertilt, M. (2016). Families in Macroeconomics. In Chapter 23 of Taylor, J. and Uhlig, H. (eds.), *Handbook of Macroeconomics*, Vol. 2B. Elsevier, North Holland.
- [18] Doepke, M. and Tertilt, M. (2018). Does female empowerment promote economic development? Working Paper, available at: http://faculty.wcas.northwestern.edu/~mdo738/research/Doepke_Tertilt.0818.pdf

- [19] Doepke, M. and Tertilt, M. (2009). Women’s liberation: What’s in it for men? *The Quarterly Journal of Economics*, 124(4): 1541–1591.
- [20] Duflo, E. (2003). Grandmothers and granddaughters: Old-age pensions and intra-household allocations in South Africa. *The World Bank Economic Review*, 17(1): 1-25.
- [21] Duflo, E. (2012). Women empowerment and economic development. *Journal of Economic Literature*, 50(4): 1051–79.
- [22] Dutta, N., and Mallick, S. (2018). Enabling women entrepreneurs: Exploring the mitigating factors for the negative effect of fertility rates on female entrepreneurship. *Kyklos*, 71(3): 402-432.
- [23] Fehr, E. and Hoff, K. (2011). Introduction: Tastes, castes, and culture: the influence of society on preferences. *The Economic Journal*, 121(556): F396-F412.
- [24] Grossbard, S. (2015). *The Marriage Motive: A Price Theory of Marriage. How Marriage Markets Affect Employment, Consumption and Savings*, Springer, New York.
- [25] Grossbard-Shechtman, S. (1993). *On the Economics of Marriage: A Theory of Marriage Labor and Divorce*. Westview Press, Boulder, Colorado.
- [26] Hoddinott, J. and Haddad, L. (1995). Does female income share influence household expenditures? Evidence from Cote D’Ivoire. *Oxford Bulletin of Economics and Statistics*, 57: 77-95.
- [27] Huggett, M. (1993). The risk-free rate in heterogeneous-agent incomplete-insurance economies. *Journal of Economic Dynamics and Control*, Vol. 17, 953-969.
- [28] Jianakoplos, N. and Bernasek, A. (1998). Are women more risk averse. *Economic Inquiry*, 36(4): 620–630.

- [29] Kabeer, N. (2016). Gender equality, economic growth, and women’s agency: the “endless variety” and “monotonous similarity” of patriarchal constraints. *Feminist Economics*, 22(1): 295-321.
- [30] Kanbur, R. and Haddad, L. (1994). Are better-off households more equal or less equal? *Oxford Economic Papers*, 46: 445-58.
- [31] Khandker, S. (2005). Microfinance and poverty: Evidence using panel data from Bangladesh.” *World Bank Economic Review*, 19(2): 263–286.
- [32] Lauer, S. and Yodanis, C. (2014). Money Management, Gender and Households. In Treas, J., Scott, J. and Richards M. (eds.), *The Wiley Blackwell Companion of the Sociology of Families*, 344–360. John Wiley & Sons Ltd.
- [33] Lee, J. and Pocock, M. (2007). Intrahousehold allocation of financial resources: evidence from South Korean individual bank accounts. *Review of Economics of the Household*, 5: 41-58.
- [34] Lundberg, S. (2005). Gender and household decision-making. In Bettio, F. and Verashchagina A. (Eds.), *Frontiers in Gender Economics*, Routledge, New York.
- [35] Lundberg, S., Pollak, R. and Wales, T. (1997). Do husbands and wives pool their resources? Evidence from the United Kingdom Child Benefit. *Journal of Human Resources*, 32: 463-80.
- [36] Lundberg, S. and Ward-Batts, J. (2000). Saving for retirement: household bargaining and household net worth. Mimeo, Department of Economics, University of Washington.
- [37] Mullainathan, S. and Shafir, E. (2009). Savings Policy & Decision-making in Low Income Households. In B. Michael and B. Rebecca (Eds.), *Insufficient Funds: Savings, Assets, Credit and Banking Among Low-Income Households*. Russell Sage Foundation Press.

- [38] Nargis, N. (2003). The life-cycle saving behavior of two-person households: Evidence from the U.S. panel study of income dynamics. Mimeo: Department of Economics, Cornell University.
- [39] Nelson, J. (2012). Are women really more risk-averse than men? A re-analysis of the literature using expanded methods. *Journal of Economic Surveys*, 29(3): 566–585.
- [40] Pitt, M. and Khandker, S. (1998). The impact of group-based credit programs on poor households in Bangladesh: Does the gender of participants matter? *Journal of Political Economy*, 106 (5): 958–996.
- [41] Quisumbing, A. and Maluccio, J. (1999). Intra-household allocation and gender relations: New empirical evidence. Mimeo: IFPRI, Washington, D.C.
- [42] Rubalcava, L., Graciela, T. and Duncan, T. (2009). Investments, time preferences, and public transfers paid to women. *Economic Development and Cultural Change*, 57(3): 507–538.
- [43] Sargent, T. and Ljungqvist, L. (2012). *Recursive Macroeconomic Theory*, MIT Press.
- [44] Schmidt, L. and Sevak, P. (2006). Gender, marriage, and asset accumulation in the United States. *Feminist Economics*, 12(1-2): 139 – 166.
- [45] Schultz, T. (2002). Why governments should invest more to educate girls. *World Development*, 30(2): 207–225.
- [46] Thomas, D. (1990). Intra-household resource allocation: An inferential approach. *Journal of Human Resources* 25 (4): 635–64.
- [47] Thomas, D. (1993). The distribution of income and expenditure within the household. *Annales d’Economie et de Statistique*, 29: 109–35.

- [48] Vermeulen, F. (2002). Collective household models: principles and main results. *Journal of Economic Surveys*, 16: 533-564.
- [49] Woolley, F. (2003). Control over money in marriage. In Grossbard-Shechtman S. A. (Ed.), *Marriage and the Economy: Theory and Evidence from Advanced Industrial Societies*, Cambridge University Press.

A Appendix: The Algorithm

Here we describe the algorithm that solves the model numerically. To compute the equilibrium of the calibrated economy for a given level of bargaining power for women (θ), relative price of food (p), and subsistence level of consumption (s), there are three steps.

1. Solving the Household's Problem (intra-temporal)

Given the endowment (E) and the interest rate (r), the household's problem is to allocate consumption resources between food (f) and the numeraire good (x). Such allocation is solved analytically (see equations 1 and 2) and the solution is built into the dynamic household's problem.

2. Solving the Households' Problem (inter-temporal)

We exploit the recursive form of the households' problem to numerically solve it by iterating on the value function. The method requires a grid on the state space (endowment and wealth combinations), and an initial guess of the value function at every grid point. Then one finds a decision rule that leads to higher utility levels given current wealth and endowment, and the initial guess of the value function is updated. This step is repeated until the value function approximately converges. We adapted the model to the source code found in Sargent and Ljungqvist (2012) for Bewley-style models.

3. Computing the Stationary Distribution

The algorithm to compute the stationary distribution is also borrowed from Sargent and Ljungqvist (2012) and consists of two steps: (1) initializing the distribution functions (one for each productivity state), and (2) iterating the distribution functions until they approximately converge. The distribution functions are updated by identifying the source of the current mass on a given grid point based on the transition probabilities and the decision rules from step 2.