1 Appendix

Access to Credit Products

In this subsection, I want to discuss how the borrower-lender distance influences access to credit products. Unfortunately, CAPS data does not contain information about business-related lending, and in a perfect situation, the influence of CMA on labor decisions should be estimated through the access to credit products. Using available data, I highlight two main groups of variables characterizing the access to credit: the access to different credit products and indicators of reduction in credit access. Variables describing the access to various products are a set of dummy variables: if the respondent applied for a new credit card in the last 12 months, if the respondent applied for a car loan in the previous 12 months, if the respondent opened a new charge card in the last 12 months, if the respondent refinanced a mortgage during the previous 12 months. Indicators of the reduction in credit access are a set of dummy variables: if the respondent's application for a new credit has been denied in the last 12 months, if the respondent's available limit for credit cards was reduced in the last 12 months, if the respondent was asked to pay off the remaining balance for a loan over the previous 12 months, if the respondent filed bankruptcy in the last 12 months.

To evaluate the effect of credit market accessibility on the access to credit, I estimate a random-effects probit model for each of the variables characterizing the access to credit. To avoid a problem of possible correlation of unobserved individual permanent heterogeneity with explanatory variables I include analogs with the Mundlak-Chamberlain device, $\overline{X_i^+} = \frac{1}{T-1}\sum_{t=2}^{T} X_{it}$ and $\overline{L_i^+} = \frac{1}{T-1}\sum_{t=2}^{T} L_{it}$.

$$Pr(C_{it} = 1) = \Phi(Z_{it-1}\beta_1 + X_{it}\beta_2 + L_{it}\beta_3 + \overline{X_i^+}\beta_4 + \overline{L_i^+}\beta_5 + \nu_i) \tag{1}$$

where ν_i are i.i.d., $\nu_i \in N(0, \sigma_\nu^2)$, and Φ is the standard normal cumulative distribution function. C_{it} is a dummy variable that equals 1 if the respondent applied for a new credit card in the last 12 months; if the respondent applied for a car loan in the last 12 months; if the respondent opened a new charge card in the last 12 months; if the respondent refinanced a mortgage in the last 12 months; if the respondent's application for new credit has been denied in the last 12 months; if the respondent's available limit for credit cards was reduced in the last 12 months; if respondent was asked to pay off remaining balance for loan in the last 12 months; if the respondent filed bankruptcy in the last 12 months.

The results of equation (1) are shown in Table 1. Results suggest that improvements in the CMA (smaller borrower-lender distance) increases the risk of receiving a new credit card, having a car loan, obtaining a charge card or refinancing a mortgage. These results support the evidence from the literature that shorter borrower-lender distance makes loans more affordable. The other part of the results suggests that improvements in the CMA decrease the risk of the reduction in access to credit. Shorter borrower-lender distance reduces the risk of denying the application for new credit, reduction in the available limit for credit cards, being asked to pay off the remaining balance, and filing for bankruptcy.

Table 1: Random-Effects Probit Model of Access to Credit

	Credit Products			
	Credit Card, t	**Car Loan, $t = 2003$**	**Charge Card, t**	**Refinance Mortgage, t**
	(1)	(2)	(3)	(4)
CMA, $t-1$	1.081***	1.047***	1.047*	1.050**
	(0.032)	(0.024)	(0.029)	(0.018)
Observations	17,279	3,003	19,097	5,547
	Reduction in Access to Credit			
	Application for new credit has been denied, t	**Reduction in the Available Limit for Credit Cards, t**	**Being Asked to Pay Off Remaining Balance, t**	**Filing Bankruptcy, t**
	(5)	(6)	(7)	(8)
CMA, $t-1$	0.991*	0.952*	0.862**	0.913*
	(0.036)	(0.025)	(0.059)	(0.048)
Observations	14,283	6,080	5,200	13,283

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes. Table presents the relative risk ratios from the random-effect probit model of access to credit market equation (1), where the random-effect term $\nu_i \in N(0, \sigma_\nu^2)$. The dependent variables are dummy variables that equal 1 if the respondent applied for a new credit card, applied for a car loan, opened a new charge card, refinanced a mortgaga, had an application for new credit denied, had available limit on a credit card reduced, was asked to pay off the remaining loan balance, or filed for bankruptcy in the last 12 months. Columns present the full estimates of eq.(1) with correlated random effects, using the Mundlak-Chamberlain devise to avoid a problem of possible correlation of unobserved individual permanent heterogeneity with explanatory variables. Other explanatory variables include the value of large durable assets, durable logarithm of differences in average wages of salary workers and unincorporated self-employed, individual characteristics such as age, gender, etc., local economic conditions, year dummies, four regional dummies, fixed effects for the first year of the stochastic process, and the Mundlack device.

Solution of the Theoretical Model

In this model, time is discrete. In contrast to **?** and **?**, I abstract to a stylized two-period model for the clarity of predictions, although the extension to the infinite horizon is straightforward. Agents live for two periods - the present (t) and the future ($t+1$)[1]. Each period the agent can be in one of three labor states: Type-1 self-employed ($j = SE_1$), Type-2 self-employed ($j = SE_2$) or paid employed worker ($j = PE$). The set of all possible choices for the agent:

$$\begin{aligned} J = &\{(PE_t, PE_{t+1}); (PE_t, SE_{1t+1}); (PE_t, SE_{2t+1}); (SE_{1t}, PE_{t+1}); (SE_{1t}, SE_{1t+1}); \\ &(SE_{1t}, SE_{2t+1}); (SE_{2t}, PE_{t+1}); (SE_{2t}, SE_{1t+1}); (SE_{2t}, SE_{2t+1})\} \end{aligned}$$

Each period employment type-specific uncertainty (ϵ_t^j and ϵ_{t+1}^j) realizes. For simplicity in describing the model, assume that the error terms are known at the beginning of the first period so that the optimization problem may be started in terms of individual making all decisions at the beginning of the first period, so at the begin of the period t, the agent makes the static labor decision $j \in J$ for both periods. If instead the random variable for period $t+1$ was not known until the beginning of that period, then the model could be extended with the decisions in period t based on the distribution of the error term in period $t+1$. Assuming that the error term for the second period is not realized until after the first period decisions are made complicates the notation but do not change the nature of the problem or solution.

Individuals select in which labor market sector to participate based on their productivity (ability), θ, and the amount of available assets, a_t. The agent is allowed to take a business loan only if her amount of assets exceeds the value a_b that is determined by the bank (see Fig.1). Individuals with access to financial markets ($a_t > a_b$) may borrow to finance some of their capital acquisitions; others must finance their purchases from their beginning-of-period assets. At the end of the period, individuals (a) receive revenue from any business operations, paid-employment, and financial investments, (b) repay any loans and accrued interest, (c) pay switching cost in period $t+1$ if they changed labor market sectors from period t, (d) receive interest on savings, and (e) purchase the consumption goods. The agent is permitted to borrow at the period t against the next period's revenues at the period $t+1$, and any assets remaining at the end of the period t, a_{t+1}, are carried forward to the next period, $t+1$.

The individual selects the labor market sectors, her borrowing to purchase capital, and her consumption to maximize her expected discounted utility subject to the given below constraints. The discounted utility for an individual who selects employment types j and who consumes c_t

[1]Period t is the beginning of the agent's life, and she did not participate in labor market at period $t-1$.

and c_{t+1} :

$$\max_{c_t \geq 0,\ c_{t+1} \geq 0} V = U^j(c_t) + \beta U^j(c_{t+1}) + \epsilon_t^j + +\epsilon_{t+1}^j$$

where ϵ^j is the choice-specific error term.

The decision rule $\delta(j)$:

$$\delta(j) = \arg\max_j \left(U^j(c_t) + \beta U^j(c_{t+1}) + \epsilon_t^j + \epsilon_{t+1}^j \right)$$

Given this set-up, the budget constraints for a two-period version of the model can be most easily derived by first determining the constraint involving the assets at the end of period t, as dependent upon the decisions in that period, and then determining the constraint involving consumption in period $t+1$, as dependent upon the assets carried forward to the period and the decisions made during the period. For any labor market choice, the assets at the end of the period t consist of any revenue from business operations, paid-employment, and interest on financial investments minus (a) consumption expenditures and (b) any repayment of business borrowings and the accrued interest, and the transaction costs of borrowing.

The budget constraint of self-employed worker (any type) at period t:

$$a_{t+1} + c_t = f(\theta, k_t) - r(k_t - a_t)\mathbb{1}((k_t - a_t) \geq 0) - (k_t - a_t)\mathbb{1}((k_t - a_t) < 0) - \psi_t \mathbb{1}((k_t - a_t) \geq 0)$$

where c_t is consumption in period t, $f(\theta, k_t)$- the production function, k_t - the amount of capital invested in the business at period t, a_{t+1} - savings in period t, r - the gross cost of capital (one plus the interest rate), θ - agent's productivity level. If $a_t \leq k_t$ the agent is a net-borrower, and $r(k_t - a_t)$ is the amount she repays at the end of the period; if $(a_t \geq k_t)$ she is a net-saver. The model also includes the non-interest cost of borrowing, ψ_t, that may contain not only the direct fees charged at closing such as origination and application fees but also the indirect cost to borrowers such as the value of time spent preparing application documents and traveling to the bank.

The paid-employed worker is allowed to take a one-period non-business loan (e.g., consumer loan, mortgage) at a gross interest rate r_b (one plus the interest rate). The budget constraint of the paid-employed worker at period t:

$$a_{t+1} + c_t = \theta w_t + a_t + b_t(1 - r) - \psi_t \mathbb{1}(b_t \neq 0)$$

where c_t is consumption in period t, a_t - initial wealth at period t, a_{t+1} - savings in period t, w_t is the wage at period t, θ - agent's productivity level, b_t - a one-period non-business loan, r - the gross cost of loan (one plus the interest rate), ψ_t - non-interest cost of borrowing.

In the second period, the individual has no incentive to carry assets forward to the next period, so consumption equals the revenue from all sources minus (a) any repayment of business borrowing, accrued interest, and the transaction cost of borrowing, and (b) any switching cost as a result of a change from the type of labor market from the first period. If at period t the agent was a paid-worker, she pays the switching cost π_t^{PE} to any type of self-employed at period $t+1$. If she worked as Type-2 self-employed at period t, she pays the switching cost $\pi_t^{SE_1}$ to Type-1 self-employed at period $t+1$.

The budget constraint of self-employed worker (any type) at period $t+1$:

$$c_{t+1} = f(\theta, k_{t+1}) - r(k_{t+1} - ra_{t+1})\mathbb{1}\left((k_{t+1} - ra_{t+1}) \geq 0\right) - (k_{t+1} - ra_{t+1})\mathbb{1}\left((k_{t+1} - ra_{t+1}) < 0\right) -$$
$$- \psi_{t+1}\mathbb{1}\left((k_{t+1} - ra_{t+1}) \geq 0\right) - \pi_{t+1}^{PE}\mathbb{1}\left(y_t = y^{PE}\right) - \pi_{t+1}^{SE_1}\mathbb{1}\left((y_t = y^{SE_2}) \ \& \ (y_{t+1} = y^{SE_1})\right)$$

where c_{t+1} - consumption in period $t+1$, $f(\theta, k_{t+1})$- the production function, k_{t+1} - the amount of capital invested in the business at period $t+1$, a_t - initial wealth at period t, a_{t+1} - savings in period t, r - the gross cost of capital (one plus the interest rate), ra_{t+1} - wealth in period $t+1$, θ - agent's productivity level. If $ra_{t+1} \leq k_{t+1}$, the agent is a net-borrower, and $r(k_{t+1} - ra_{t+1}))$ is the amount she repays at the end of the period; if $a_{t+1} \geq k_{t+1}$, she is a net-saver. If the agent decides to switch from paid-employment to other labor states, she has to pay the cost of switching from paid employment, π_{t+1}^{PE} that may include the cost of the license, security deposit for office, cost of time invested in new skills. Being a Type-1 self-employed requires higher entrepreneurial skills than Type-2 self-employed, it means if the agent switches to Type-1 self-employment, she has to pay the cost of switching, $\pi_{t+1}^{SE_1}$, that includes the cost of time invested in new skills.

The budget constraint of the paid-employed worker at period $t+1$:

$$c_{t+1} = \theta w_{t+1} + ra_{t+1} + b_{t+1}(1-r) - \psi_{t+1}\mathbb{1}(b_{t+1} \neq 0)$$

where c_{t+1} - consumption in period $t+1$, a_{t+1} - savings in period t, r - the gross cost of capital (one plus the interest rate), ra_{t+1} - wealth in period $t+1$, w_{t+1} - the wage at period $t+1$, θ - agent's productivity level, b_{t+1} - a one-period non-business loan, ψ_{t+1}-non-interest cost of borrowing.

Given the additive nature of the business revenue and any loan costs in the constraints, the optimal capital decisions can be made separately from the consumption decisions. In either period, a self-employed individual with access to the capital market selects the amount of capital that maximizes her business profit or:

$$\text{Period } t\text{:} \quad \max_{0 \le k_t \le \lambda a_t} \left[f(\theta, k_t) - r(k_t - a_t)\mathbb{1}\left((k_t - a_t) \ge 0\right) - (k_t - a_t)\mathbb{1}\left((k_t - a_t) < 0\right) \right]$$

$$\text{Period } t+1\text{:} \quad \max_{0 \le k_{t+1} \le \lambda r a_{t+1}} \left[f(\theta, k_{t+1}) - r(k_{t+1} - r a_{t+1})\mathbb{1}\left((k_{t+1} - r a_{t+1}) \ge 0\right) - \right.$$
$$\left. - (k_{t+1} - r a_{t+1})\mathbb{1}(k_{t+1} - r a_{t+1}) < 0) \right]$$

Assuming that the production function is strictly concave in the capital and making the Inada assumption that the marginal product of capital is infinity at zero, the optimal level of capital is positive and finite, and is denoted k^*. If a self-employed individual (Type-2) does not have access to the capital markets and cannot finance the optimal capital with her own assets, then she uses all of her assets to purchase capital. The resulting revenue is greater than if she had used only part of the assets to purchase capital and had put the remainder in a financial instrument earning a gross return r. As in ?, I assume that the agent can borrow an amount that is proportional to her wealth ($k_t \le \lambda a_t$ and $k_{t+1} \le \lambda r a_{t+1}$, where $\lambda \ge 1$). If the amount of wealth exceeds the amount required to finance ($\lambda a_t \ge k_t^*$ and $\lambda r a_{t+1} \ge k_{t+1}^*$), the remaining wealth is invested at the rate r, and it's "unconstrained case". If the optimal amount of capital is lower than the amount of wealth ($\lambda a_t \le k_t^*$ and $\lambda r a_{t+1} \le k_{t+1}^*$), the agent borrows the maximum available amount of loan, and it is "constrained case".

Agents sort into employment type j to maximize her utility:

$$V = U^j(c_t) + \beta U^j(c_{t+1}) + \epsilon_t^j + \epsilon_{t+1}^j$$

where ϵ^j is the choice-specific error term. All possible labor choices: $J = \{(PE_t, PE_{t+1});$ $(PE_t, SE_{1t+1}); (PE_t, SE_{2t+1}); (SE_{1t}, PE_{t+1}); (SE_{1t}, SE_{1t+1}); (SE_{1t}, SE_{2t+1}); (SE_{2t}, PE_{t+1});$ $(SE_{2t}, SE_{1t+1}); (SE_{2t}, SE_{2t+1})\}$

The decision rule $\delta(j)$:

$$\delta(j) = \arg\max_j \left(U^j(c_t) + \beta U^j(c_{t+1}) + \epsilon_t^j + \epsilon_{t+1}^j \right)$$

Assume that $U(c_t) = log(c_t)$ and $\epsilon^j \in N(0; 1)$ for simplicity.

If the agent works as a paid-employed worker, her budget constraints:

$$\text{Period } t\text{:} \quad a_{t+1} + c_t = \theta w_t + a_t + b_t(1 - r_b) - \psi_t$$

$$\text{Period } t+1\text{:} \quad c_{t+1} = \theta w_{t+1} + r a_{t+1} + b_{t+1}(1 - r_b) - \psi_{t+1}$$

where c_t is consumption in period t, c_{t+1} - consumption in period $t+1$, a_t - initial wealth at period t, a_{t+1} - savings in period t, r - the gross cost of capital (one plus the interest rate),

ra_{t+1} - wealth in period $t+1$, w_t is the wage at period t, w_{t+1} - the wage at period $t+1$, θ - agent's productivity level, b_t - a one-period non-business loan at period t, b_{t+1} - a one-period non-business loan at period $t+1$, r_b - an gross interest rate of non-business loan, ψ_t - non-interest cost of borrowing at period t, ψ_{t+1} - non-interest cost of borrowing at period $t+1$.

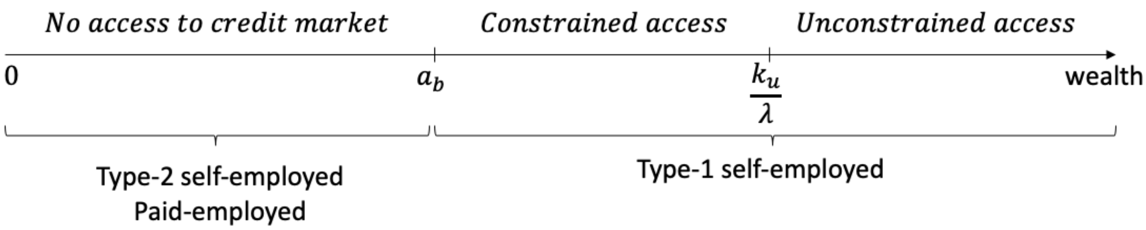


Figure 1: Wealth and The Access to Credit Market

If the agent works as a Type-1 self-employed worker (only if $a_t \geq a_b, a_{t+1} \geq a_b$), she can borrow money from the bank. In this case she maximizes her production function ($f(\theta, k_t) = \theta k_t^\alpha$, where $\alpha < 1$) making decision about amount of capital invested in the business, and she can use her wealth as a collateral. In this case agent's budget constraints:

$$\text{Period } t: \quad a_{t+1} + c_t = \max_{0 \leq k_t \leq \lambda a_t} [\theta(k_t)^\alpha - r(k_t - a_t)\mathbb{1}((k_t - a_t) \geq 0) - (k_t - a_t)\mathbb{1}((k_t - a_t) < 0) -$$

$$- \psi_t \mathbb{1}((k_t - a_t) \geq 0)]$$

$$\text{Period } t+1: \quad c_{t+1} = \max_{0 \leq k_{t+1} \leq \lambda r a_{t+1}} [\theta(k_{t+1})^\alpha - r(k_{t+1} - ra_{t+1})\mathbb{1}((k_{t+1} - ra_{t+1}) \geq 0) - (k_{t+1} - ra_{t+1}) \cdot$$

$$\cdot \mathbb{1}((k_{t+1} - ra_{t+1}) < 0) - \psi_{t+1}\mathbb{1}((k_{t+1} - ra_{t+1}) \geq 0) - \pi_{t+1}^{PE}\mathbb{1}(y_t = y^{PE}) - \pi_{t+1}^{SE_1}\mathbb{1}(y_t = y^{SE_2})]$$

where c_t is consumption in period t, c_{t+1} - consumption in period $t+1$, k_t - the amount of capital invested in the business at period t, k_{t+1} - the amount of capital invested in the business at period $t+1$, a_t - initial wealth at period t, a_{t+1} - savings in period t, r - the gross cost of capital (one plus the interest rate), ra_{t+1} - wealth in period $t+1$, θ - agent's productivity level. If $a_t \leq k_t$ or $ra_{t+1} \leq k_{t+1}$, the agent is a net-borrower, and $r(k_t - a_t)$ or $r(k_{t+1} - ra_{t+1}))$ is the amount she repays at the end of the period. If $(a_t \geq k_t)$ or $(a_{t+1} \geq k_{t+1})$, she is a net-saver, and $(k_t - ra_t)$ is the amount she has as wealth at the period $t+1$. If at period t the agent was a paid-worker, she pays switching cost π_t^{PE} at period $t+1$. If she worked as Type-2 self-employed at period t, she pays switching cost $\pi_t^{SE_1}$ at period $t+1$. As in **?**, I assume that the agent can borrow an amount that is proportional to her wealth ($k_t \leq \lambda a_t$ and $k_{t+1} \leq \lambda r a_{t+1}$, where $\lambda \geq 1$). If the amount of wealth exceeds the amount required to finance ($\lambda a_t \geq k_t^*$ and $\lambda r a_{t+1} \geq k_{t+1}^*$), the remaining wealth is invested at the rate r, and it's "unconstrained case". If the optimal amount of capital is lower than the amount of wealth ($\lambda a_t \leq k_t^*$ and $\lambda r a_{t+1} \leq k_{t+1}^*$), the agent borrows the maximum available amount of loan, and it is "constrained case".

In constrained case $k_t^* = \lambda a_t$ and $k_{t+1}^* = \lambda r a_{t+1}$. In unconstrained case the amount of capital invested in the business is higher than the amount of capital in constrained case: $k_t^* = (\frac{r}{\theta})^{\frac{\alpha}{\alpha-1}}$ and $k_{t+1}^* = (\frac{r}{\theta})^{\frac{\alpha}{\alpha-1}}$. And if the agent uses her personal savings $k_t \leq a_t$ and it is lower than the amount of capital in contained case, therefore the agent always prefers to borrow, instead of paying out of pocket.

Budget constraints of unconstrained Type-1 self-employed worker, where $\gamma = \left(\frac{r}{\theta}\right)^{\frac{1}{\alpha-1}}$:

$$\text{Period } t\text{:} \quad a_{t+1} + c_t = \theta\gamma^\alpha - r\left(\gamma - a_t\right) - \psi_t$$
$$\text{Period } t+1\text{:} \quad c_{t+1} = \theta\gamma^\alpha - r\left(\gamma - r a_{t+1}\right) - \psi_{t+1} - \pi_{t+1}^{PE}\mathbb{1}(y_t = y^{PE}) - \pi_{t+1}^{SE_1}\mathbb{1}(y_t = y^{SE_2})$$

Budget constraints of constrained Type-1 self-employed worker:

$$\text{Period } t\text{:} \quad a_{t+1} + c_t = \theta(\lambda a_t)^\alpha - r a_t(\lambda - 1) - \psi_t$$
$$\text{Period } t+1\text{:} \quad c_{t+1} = \theta(\lambda r a_{t+1})^\alpha - r a_{t+1}(\lambda - 1) - \psi_{t+1} - \pi_{t+1}^{PE}\mathbb{1}(y_t = y^{PE}) - \pi_{t+1}^{SE_1}\mathbb{1}(y_t = y^{SE_2})$$

Further analysis will investigate the role of the non-interest costs of borrowing in labor market choices, and for the clarity of predictions I will consider only unconstrained case, but although the extension to the constrained case is straightforward.

If the agent works as a Type-2 self-employed worker (if $a_t \leq a_b, a_{t+1} \leq a_b$), she does not have access to credit market. In this case she maximizes her production function making decision about amount of capital invested in the business, but she uses assets as a capital. In this case agent's budget constraints:

$$\text{Period } t\text{:} \quad a_{t+1} + c_t = \max_{k_t \leq a_t}[\theta(k_t)^\alpha]$$
$$\text{Period } t+1\text{:} \quad c_{t+1} = \max_{k_{t+1} \leq r a_{t+1}}[\theta(k_t)^\alpha] - \pi_{t+1}^{PE}\mathbb{1}(y_t = y^{PE})]$$

Budget constraints of Type-2 self-employed worker:

$$\text{Period } t\text{:} \quad a_{t+1} + c_t = \theta(a_t)^\alpha$$
$$\text{Period } t+1\text{:} \quad c_{t+1} = \theta(r a_{t+1})^\alpha - \pi_{t+1}^{PE}\mathbb{1}(y_t = y^{PE})$$

Utility Functions for All Possible Labor Choices

- $\{SE_{1t}, SE_{1t+1}\}$

$$U^{(SE_{1t},SE_{1t+1})} - \epsilon^{(SE_{1t},SE_{1t+1})} = (1+\beta)log\left(\frac{(r^2+1)(\theta\gamma^{\alpha} - r\gamma) + r^3 a_t - \psi_{t+1} - r^2\psi_t}{r^2+r}\right) + \beta log(r)$$

- $\{SE_{1t}, PE_{t+1}\}$

$$U^{(SE_{1t},PE_{t+1})} - \epsilon^{(SE_{1t},PE_{t+1})} = (1+\beta)log\left(\frac{r\theta\gamma^{\alpha} - r^2(\gamma - a_t) - r\psi_t + \theta w_{t+1} + b_{t+1}(1-r_b) + \psi_{t+1}}{(r+1)}\right)$$

- $\{SE_{1t}, SE_{2t+1}\}$

$$U^{(SE_{1t},SE_{2t+1})} - \epsilon^{(SE_{1t},SE_{2t+1})} = (\alpha+\beta)log\frac{(\theta\gamma^{\alpha} - r(\gamma - a_t) - \psi_t)}{r+\alpha} + (\alpha+\beta)log(r) + log(\alpha^{\alpha}\theta)$$

- $\{PE_t, PE_{t+1}\}$

$$U^{(PE_t,PE_{t+1})} - \epsilon^{(PE_t,PE_{t+1})} = (1+\beta)log\left(\frac{r\theta w_t + ra_t + rb_t(1-r_b) + \theta w_{t+1} + b_{t+1}(1-r_b)}{r+1}\right)$$

- $\{PE_t, SE_{1t+1}\}$

$$U^{(PE_t,SE_{1t+1})} - \epsilon^{(PE_t,SE_{1t+1})} = (1+\beta)log\left(\frac{r^2\theta w_t + r^2 a_t + r^2(b_t(1-r_b) - \psi_t) + \theta\gamma^{\alpha} - r\gamma - \psi_{t+1} - \pi^{PE}_{t+1}}{(r^2+r)}\right) + \beta log(r)$$

- $\{PE_t, SE_{2t+1}\}$ (under assumption $\pi^{PE}_{t+1} = 0$[2])

$$U^{(PE_t,SE_{2t+1})} - \epsilon^{(PE_t,SE_{21t+1})} = (1+\beta)log(\theta w_t + a_t + b_t(1-r_b)) + log\frac{r}{r+\alpha} + \beta log\frac{r^{\alpha}\theta\alpha}{r+\alpha}$$

- $\{SE_{2t}, SE_{2t+1}\}$

$$U^{(SE_{2t},SE_{2t+1})} - \epsilon^{(SE_{2t},SE_{2t+1})} = (1+\beta)log(a_t^{\alpha}) + log\frac{r\theta}{r+\alpha} + \beta log\frac{r^{\alpha+1}\theta^2}{r+\alpha}$$

- $\{SE_{2t}, SE_{1t+1}\}$

$$U^{(SE_{2t},SE_{1t+1})} - \epsilon^{(SE_{2t},SE_{1t+1})} = (1+\beta)log\left(\frac{r\theta(a_t)^{\alpha} + \theta\gamma^{\alpha} - r\gamma - \pi^{SE_1}_{t+1} - \psi_{t+1}}{(r^2+r)}\right) + \beta log(r)$$

- $\{SE_{2t}, PE_{t+1}\}$

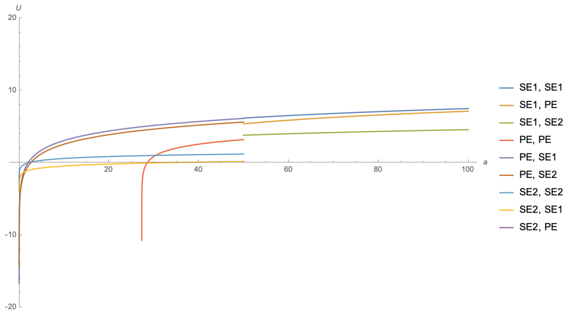
$$U^{(SE_{2t},PE_{t+1})} - \epsilon^{(SE_{2t},PE_{t+1})} = (1+\beta)log\left(\frac{r\theta(a_t)^{\alpha} + \theta w_{t+1} + b_{t+1}(1-r_b) - \psi_{t+1}}{(r+1)}\right)$$

[2] If $\pi^{PE}_{t+1} \neq 0$ it's impossible to find implicit functional form for $U^{(PE_t,SE_{2t+1})}$.

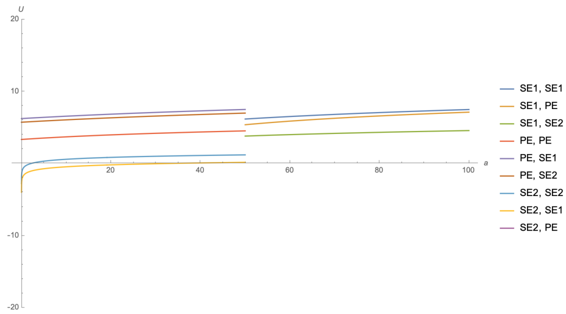
Relative Positions of Utility Functions

Let's consider an economy where $\beta = 0.9$, $\theta = 1.03$[3], $r = 1 + 0.025$[4], and assume that the production function θk^α has an decreasing returns to scale, $\alpha = 0.2$. In this economy $\gamma = 1.04$.

Fig. (a) shows the initial position of all utilities function ($a_b = 50$, $\gamma = 1.04$, $\alpha = 0.2$, $\theta = 1.03$, $r = 1 + 0.025 = 1.025$, $\beta = 0.9$, $r_b = 1.04$, $\psi_t = 0$, $\psi_{t+1} = 0$, $w_t = 0$, $w_{t+1} = 0$, $\pi^{PE}_{t+1} = 0.5$, $\pi^{SE1}_{t+1} = 0.5$). Under these assumptions about coefficients, the agent chooses $\{PE_t, SE_{t+1}\}$ if $a_t \leq a_b$ and $\{SE_{1t}, SE_{1t+1}\}$ if $a_t > a_b$.



a)



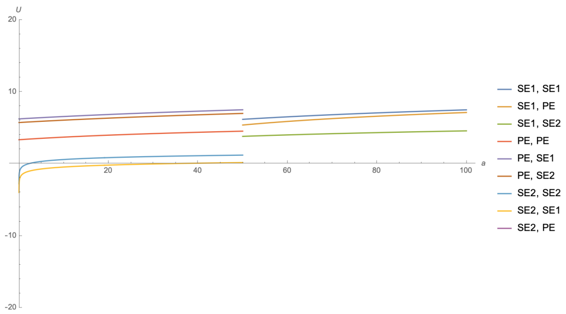
b)

Fig. (b) and (c) show positions of all utilities function if wages (for paid-employed worker) increase keeping all other parameters at the minimal level. Fig. (b) $w_t \uparrow$, Fig.(c) $w_{t+1} \uparrow$. ($a_b = 50$, $\gamma = 1.04$, $\alpha = 0.2$, $\theta = 1.03$, $r = 1 + 0.025 = 1.025$, $\beta = 0.9$, $r_b = 1.04$, $\psi_t = 0$, $\psi_{t+1} = 0$, $w_t \geq 0$ (Fig.(b)), $w_{t+1} \geq 0$ (Fig.(c)), $\pi^{PE}_{t+1} = 0.5$, $\pi^{SE1}_{t+1} = 0.5$). If wages increase in the first period, $w_t \uparrow$, the agent chooses $\{PE_t, SE_{1t+1}\}$ if $a_t \leq a_b$, and $\{SE_{1t}, SE_{1t+1}\}$ if $a_t > a_b$. Fig.(b) also shows such increase in $w_t \uparrow$ that the position of $U^{(PE_t, SE_{1t+1})}$ is above $U^{(SE_{1t}, SE_{1t+1})}$. It's possible that the agent prefers to be paid-employed worker in period t and Type-1 self-employed in period $t+1$ regardless the amount of initial wealth, a_t. If wages increase in the second period, $w_{t+1} \uparrow$, the agent chooses $\{SE_{2t}, PE_{t+1}\}$ if $a_t \leq a_b$, and $\{SE_{1t}, SE_{1t+1}\}$ if $a_t > a_b$. Fig.(c) shows the situation when the agent prefers to work as Type-2 self-employed at period t and paid-employed worker at period $t + 1$ regardless the amount of initial wealth, a_t.

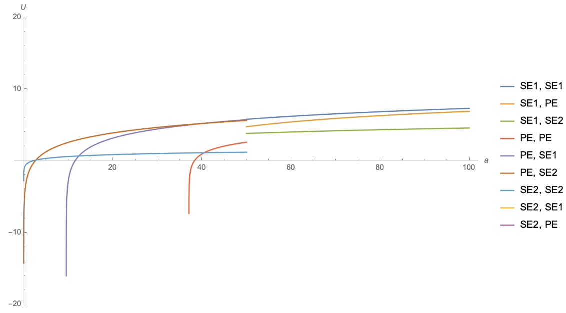
Fig. (d) and (e) show positions of all utilities function if the non-interest cost of borrowing increases keeping all other parameters at the minimal level. Fig. (d) $\psi_t \uparrow$, Fig.(e) $\psi_{t+1} \uparrow$. ($a_b = 50$, $\gamma = 1.04$, $\alpha = 0.2$, $\theta = 1.03$, $r = 1 + 0.025 = 1.025$, $\beta = 0.9$, $r_b = 1.04$, $\psi_t \uparrow$ (Fig.(d)), $\psi_{t+1} \uparrow$ (Fig.(e)), $w_t = 0$, $w_{t+1} = 0$, $\pi^{PE}_{t+1} = 0$, $\pi^{SE1}_{t+1} = 0$). If the non-interest cost of

[3] University of Groningen and University of California, Davis, Total Factor Productivity at Constant National Prices for United States, retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/RTFPNAUSA632NRUG, August 8, 2019.

[4] The Federal Reserve Interest Rate Decision on June, 2019

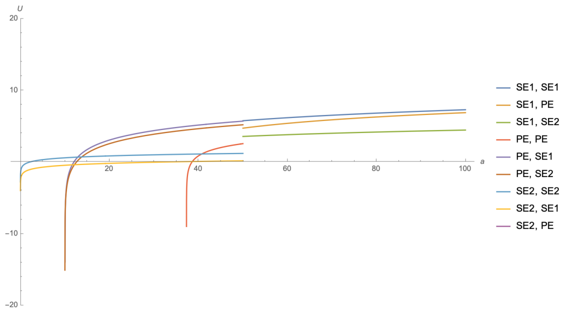


c)

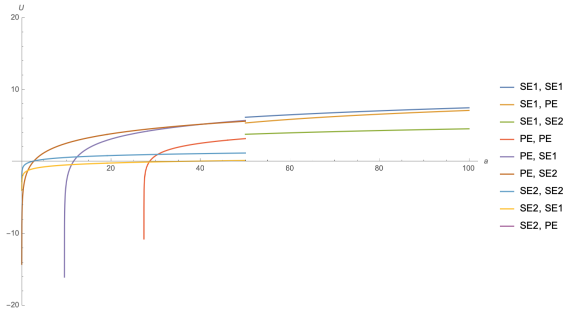


d)

borrowing increases in the first period, $\psi_t \uparrow$, the agent chooses $\{SE_{2t}, SE_{2t+1}\}$ if $a_t \leq a_1 \leq a_b$, $\{PE_t, SE_{2t+1}\}$ if $a_1 \leq a_t \leq a_2 \leq a_b$, $\{PE_t, SE_{1t+1}\}$ if $a_2 \leq a_b$ (where a_1 and a_2 are intersections of utility functions), and $\{SE_{1t}, SE_{1t+1}\}$ if $a_t > a_b$. If the non-interest cost of borrowing increases in the second period, $\psi_{t+1} \uparrow$, the agent chooses $\{SE_{2t}, SE_{2t+1}\}$ if $a_t \leq a_1 \leq a_b$, $\{PE_t, SE_{1t+1}\}$ if $a_1 \leq a_t \leq a_b$, and $\{SE_{1t}, SE_{1t+1}\}$ if $a_t > a_b$.



e)



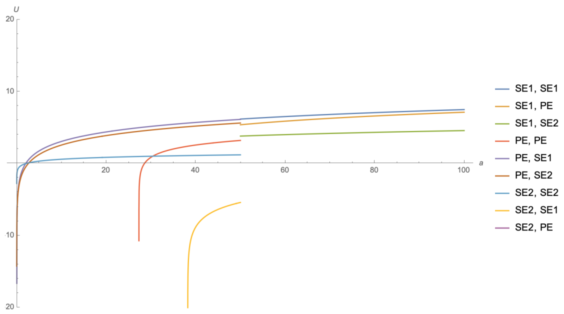
f)

Fig. (f) shows positions of all utilities function if the cost of switching from paid-employment, π_{t+1}^{PE} increases keeping all other parameters at the minimal level. ($a_b = 50$, $\gamma = 1.04$, $\alpha = 0.2$, $\theta = 1.03$, $r = 1 + 0.025 = 1.025$, $\beta = 0.9$, $r_b = 1.04$, $\psi_t = 0$, $\psi_{t+1} = 0$, $w_t = 0$, $w_{t+1} = 0$, $\pi_{t+1}^{PE} \uparrow$, $\pi_{t+1}^{SE1} = 0$). If the cost of switching from paid-employment increases, $\pi_{t+1}^{PE} \uparrow$, the agent chooses $\{SE_{2t}, SE_{2t+1}\}$ if $a_t \leq a_1 \leq a_b$, $\{PE_t, SE_{2t+1}\}$ if $a_1 \leq a_t \leq a_b$, and $\{SE_{1t}, SE_{1t+1}\}$ if $a_t > a_b$.

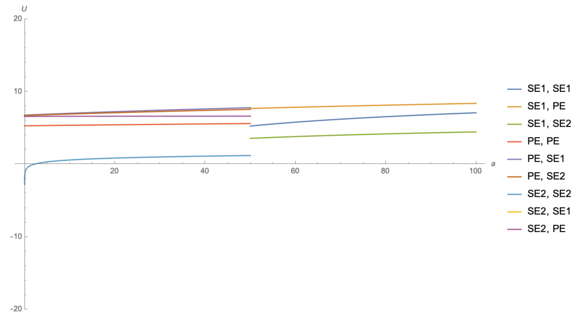
Fig. (g) shows positions of all utilities function if the cost of switching to Type-1 self-employment, π_{t+1}^{SE1}, increases keeping all other parameters at the minimal level. ($a_b = 50$, $\gamma = 1.04$, $\alpha = 0.2$, $\theta = 1.03$, $r = 1 + 0.025 = 1.025$, $\beta = 0.9$, $r_b = 1.04$, $\psi_t = 0$, $\psi_{t+1} = 0$, $w_t = 0$, $w_{t+1} = 0$, $\pi_{t+1}^{PE} = 0$, $\pi_{t+1}^{SE1} \uparrow$). If the cost of switching to Type-1 self-employment increases, $\pi_{t+1}^{SE1} \uparrow$, the agent chooses $\{SE_{2t}, SE_{2t+1}\}$ if $a_t \leq a_1 \leq a_b$, $\{PE_t, SE_{1t+1}\}$ if $a_1 \leq a_t \leq a_b$, and $\{SE_{1t}, SE_{1t+1}\}$ if $a_t > a_b$.

Fig. (h) shows positions of all utilities function if all costs increase ($a_b = 50$, $\gamma = 1.04$,

$\alpha = 0.2$, $\theta = 1.03$, $r = 1 + 0.025 = 1.025$, $\beta = 0.9$, $r_b = 1.04$, $\psi_t \uparrow$, $\psi_{t+1} \uparrow$, $w_t \uparrow$, $w_{t+1} \uparrow$, $\pi^{PE}_{t+1} \uparrow$, $\pi^{SE1}_{t+1} \uparrow$). In this case the agent chooses $\{PE_t, SE_{2t+1}\}$ if $a_t \leq a_1 \leq a_b$, $\{PE_t, SE_{1t+1}\}$ if $a_1 \leq a_t \leq a_b$, and $\{SE_{1t}, PE_{t+1}\}$ if $a_t > a_b$.



g)



h)

The Role of Non-Interest Cost of Borrowing ψ_t in the Decision of Being Type-1 Self-Employed at Period t

The agent prefers to being as Type-1 self-employed at period t and $t+1$ if she receives the highest utility function:

$$U^{(SE_{1t},SE_{1t+1})} \geq \max\{U^{(PE_t,SE_{1t+1})}, U^{(SE_{2t},SE_{1t+1})}, U^{(PE_t,SE_{2t+1})}, U^{(SE_{2t},SE_{2t+1})}, U^{(PE_t,PE_{t+1})}, \\ U^{(SE_{2t},SE_{2t+1})}, U^{(SE_{1t},PE_{t+1})}, U^{(SE_{1t},SE_{2t+1})}\}$$

To investigate the role of non-interest cost of borrowing ψ_t in the decision of being Type-1 self-employed at period t, I fix a labor choice at the period $(t+1)$ as Type-1 self-employed for simplicity to avoid an estimation of all nine possible labor choices. The extension of the model for other labor choices PE_{t+1} and SE_{2t+1} is straightforward.

The agent prefers to works as Type-1 self-employed at period t if she receives the highest utility function:

$$U^{(SE_{1t},SE_{1t+1})} \geq \max\{U^{(PE_t,SE_{1t+1})}, U^{(SE_{2t},SE_{1t+1})}\}$$

In this subsection I show that the probability of being Type-1 self-employed at period t declines if non-interest cost of borrowing at period t increases.

$$\frac{\partial Pr\left(U^{(SE_{1t},SE_{1t+1})} \geq \max\{U^{(PE_t,SE_{1t+1})}, U^{(SE_{2t},SE_{1t+1})}\}\right)}{\partial \psi_t} \leq 0$$

The agent's task if she works as Type-1 self-employed at period t and $t+1$:

$$\max_{c_t \geq 0, c_{t+1} \geq 0} \mathbb{E}U^{(SE_{1t},SE_{1t+1})} = U(c_t) + \beta U(c_{t+1})$$

Agent's budget constraints ($a_t \geq a_b$ and $a_{t+1} \geq a_b$):

$$\text{Period } t\text{:} \quad a_{t+1} + c_t = \theta\gamma^\alpha - r\left(\gamma - a_t\right) - \psi_t \tag{2}$$

$$\text{Period } t+1\text{:} \quad c_{t+1} = \theta\gamma^\alpha - r\left(\gamma - ra_{t+1}\right) - \psi_{t+1} \tag{3}$$

where $\gamma = \left(\frac{r}{\lambda\theta}\right)^{\frac{1}{\alpha-1}}$, and $a_t \geq a_b$.

The first order condition for an internal solution of the agent's problem leads to the following Euler equation:

$$U^{'}(c_t) = \beta r^2 U^{'}(c_{t+1})$$

Assume that $\beta r = 1$ and $U(c_t) = log(c_t)$.

$$rc_t = c_{t+1} \tag{4}$$

Substitute the eq.4 in budget constraints eq.3 and eq.2:

$$r(\theta\gamma^\alpha - r(\gamma - a_t) - \psi_t - a_{t+1}) = \theta\gamma^\alpha - r(\gamma - ra_{t+1}) - \psi_{t+1} \Rightarrow$$
$$a_{t+1} = \frac{\theta\gamma^\alpha(r-1) + r\gamma + \psi_{t+1} - r^2(\gamma - a_t) - r\psi_t}{r^2 + r}$$

The agent's total utility function:

$$U^{(SE_{1t}, SE_{1t+1})} - \epsilon^{(SE_{1t}, SE_{1t+1})} = log(c_t) + \beta log(c_{t+1}) = log(c_t)(1+\beta) + \beta log(r) =$$
$$= log(\theta\gamma^\alpha - r(\gamma - a_t) - \psi_t - \frac{\theta\gamma^\alpha(r-1) + r\gamma + \psi_{t+1} - r^2(\gamma - a_t) - r\psi_t}{r^2 + r})(1+\beta) + \beta log(r) =$$
$$= log(A - \frac{\psi_{t+1}}{r^2 + r} - \frac{r^2\psi_t}{r^2 + r})(1+\beta) + \beta log(r) \Rightarrow$$
$$\frac{\partial U^{(SE_{1t}, SE_{1t+1})}}{\partial \psi_t} = \frac{(1+\beta)\frac{-r}{r+1}}{A - \frac{\psi_{t+1}}{r^2+r} - \frac{r^2\psi_t}{r^2+r}} \leq 0, \quad \frac{\partial U^{(SE_{1t}, SE_{1t+1})}}{\partial \psi_{t+1}} = \frac{(1+\beta)\frac{-1}{r^2+r}}{A - \frac{\psi_{t+1}}{r^2+r} - \frac{r^2\psi_t}{r^2+r}} \leq 0$$

where $A = \theta\gamma^\alpha - r(\gamma - a_t) - \frac{\theta\gamma^\alpha(r-1) + r\gamma - r^2(\gamma - a_t)}{r^2+r} = \frac{r^2(\theta\gamma^\alpha - r\gamma) + r^2 a_t(r-1) - (\theta\gamma^\alpha + r\gamma)}{r^2+r}$.

The increasing in the non-interest cost of borrowing in the period t or period $t+1$ decreases the total utility function.

The agent's task if she works as paid-employed at period t and as Type-1 self-employed worker at period $t+1$:

$$\max_{c_t \geq 0, c_{t+1} \geq 0} \mathbb{E}U^{(PE_t, SE_{1t+1})} = U(c_t) + \beta U(c_{t+1})$$

Agent's budget constraints ($a_t \leq a_b$ and $a_{t+1} \geq a_b$):

$$\text{Period } t: \quad a_{t+1} + c_t = \theta w_t + a_t + b_t(1 - r_b) - \psi_t \tag{5}$$

$$\text{Period } t+1: \quad c_{t+1} = \theta\gamma^\alpha - r(\gamma - ra_{t+1}) - \psi_{t+1} - \pi^{PE}_{t+1} \tag{6}$$

The first order condition for an internal solution of the agent's problem leads to Euler equation:

$$U^{'}(c_t) = \beta r^2 U^{'}(c_{t+1})$$

Assume $\beta r = 1$, and $U(c_t) = log(c_t)$.

$$rc_t = c_{t+1} \tag{7}$$

Substitute the eq.7 in budget constraints eq.6 and eq.5 :

$$r(\theta w_t + b_t(1-r_b) - \psi_t + a_t - a_{t+1}) = \theta\gamma^\alpha - r\left(\gamma - ra_{t+1}\right) - \psi_{t+1} - \pi_{t+1}^{PE} \Rightarrow$$
$$a_{t+1} = \frac{r\theta w_t + rb_t(1-r_b) - r\psi_t + ra_t - \theta\gamma^\alpha + r\gamma + \psi_{t+1} + \pi_{t+1}^{PE}}{(r^2+r)}$$

The agent's total utility function:

$$U^{(PE_t,SE_{1t+1})} - \epsilon^{(PE_t,SE_{1t+1})} = log(c_t) + \beta log(c_{t+1}) = (1+\beta)log(c_t) + \beta log(r) = (1+\beta)\cdot$$
$$\cdot\, log\left(\theta w_t + b_t(1-r_b) - \psi_t + a_t - \frac{r\theta w_t + rb_t(1-r_b) - r\psi_t + ra_t - \theta\gamma^\alpha + r\gamma + \psi_{t+1} + \pi_{t+1}^{PE}}{(r^2+r)}\right)$$
$$+\beta log(r) =$$
$$= (1+\beta)log\left(\frac{r^2\theta w_t + r^2 a_t + r^2(b_t(1-r_b) - \psi_t) + \theta\gamma^\alpha - r\gamma - \psi_{t+1} - \pi_{t+1}^{PE}}{(r^2+r)}\right) + \beta log(r) =$$
$$= (1+\beta)log\left(G - \frac{r^2\psi_t}{(r^2+r)} - \frac{\psi_{t+1}}{(r^2+r)}\right) + \beta log(r) \Rightarrow$$
$$\frac{\partial U^{(PE_t,SE_{1t+1})}}{\partial \psi_{t+1}} = \frac{(1+\beta)\frac{-r}{r+1}}{G - \frac{\psi_{t+1}}{r^2+r} - \frac{r^2\psi_t}{r^2+r}} \leq 0; \quad \frac{\partial U^{(PE_t,SE_{1t+1})}}{\partial \psi_t} = \frac{(1+\beta)\frac{-1}{r^2+r}}{G - \frac{\psi_{t+1}}{r^2+r} - \frac{r^2\psi_t}{r^2+r}} \leq 0$$

where $G = \frac{r^2\theta w_t + r^2 a_t + r^2 b_t(1-r_b) + \theta\gamma^\alpha - r\gamma - \pi_{t+1}^{PE}}{(r^2+r)}$.

The agent's task if she worked as Type-2 self-employed at period t and as Type-1 self-employed worker at period $t+1$:

$$\max_{c_t \geq 0, c_{t+1} \geq 0} U(c_t) + \beta U(c_{t+1})$$

Agent's budget constraints ($a_t \leq a_b$ and $a_{t+1} \geq a_b$):

$$\text{Period } t\text{:} \quad \text{s.t } a_{t+1} + c_t = \theta(a_t)^\alpha \tag{8}$$

$$\text{Period } t+1\text{:} \quad c_{t+1} = \theta\gamma^\alpha - r\left(\gamma - ra_{t+1}\right) - \psi_{t+1} - \pi_{t+1}^{SE_1} \tag{9}$$

The first order condition for an internal solution of the agent's problem leads to Euler equation:

$$U^{'}(c_t) = \beta r^2 U^{'}(c_{t+1})$$

Under the assumption $\beta r = 1$, and $U(c_t) = log(c_t)$.

$$rc_t = c_{t+1} \tag{10}$$

Substitute the eq.10 in budget constraints eq.8 and eq.9:

$$r(\theta(a_t)^\alpha - a_{t+1}) = \theta\gamma^\alpha - r\left(\gamma - ra_{t+1}\right) - \psi_{t+1} - \pi_{t+1}^{SE_1} \Rightarrow$$
$$a_{t+1} = \frac{r\theta(a_t)^\alpha - \theta\gamma^\alpha + r\gamma + \psi_{t+1} + \pi_{t+1}^{SE_1}}{(r^2+r)}$$

The agent's total utility function:

$$U^{(SE_{2t},SE_{1t+1})} - \epsilon^{(SE_{2t},SE_{1t+1})} = log(c_t) + \beta log(c_{t+1}) = (1+\beta)log(c_t) + \beta log(r) =$$
$$= (1+\beta)log\left(\theta(a_t)^\alpha - \frac{r\theta(a_t)^\alpha - \theta\gamma^\alpha + r\gamma + \psi_{t+1} + \pi_{t+1}^{SE_1}}{(r^2+r)}\right) + \beta log(r) =$$
$$= (1+\beta)log\left(\frac{r\theta(a_t)^\alpha + \theta\gamma^\alpha - r\gamma - \psi_{t+1} - \pi_{t+1}^{SE_1}}{(r^2+r)}\right) + \beta log(r) =$$
$$= (1+\beta)log\left(H - \frac{\psi_{t+1}}{(r^2+r)}\right) + \beta log(r)$$

where $H = \frac{r\theta(a_t)^\alpha + \theta\gamma^\alpha - r\gamma - \pi_{t+1}^{SE_1}}{(r^2+r)}$.

Assume that $\epsilon^j \in N(0;1)$, the probability of Type-1 self-employment at period t:

$$Pr\left(U^{(SE_{1t},SE_{1t+1})} \geq \max\{U^{(PE_t,SE_{1t+1})}, U^{(SE_{2t},SE_{1t+1})}\}\right) =$$

$$= Pr\left(U^{(SE_{1t},SE_{1t+1})} \geq U^{(PE_t,SE_{1t+1})}\right) \cdot Pr\left(U^{(SE_{1t},SE_{1t+1})} \geq U^{(SE_{2t},SE_{1t+1})}\right) =$$

$$= Pr((1+\beta)log\left(A - \frac{\psi_{t+1}}{(r^2+r)} - \frac{r^2\psi_t}{(r^2+r)}\right) + \beta log(r) + \epsilon^{(SE_{1t},SE_{1t+1})} \geq$$

$$\geq (1+\beta)log\left(G - \frac{r^2\psi_t}{(r^2+r)} - \frac{\psi_{t+1}}{(r^2+r)}\right) + \beta log(r) + \epsilon^{(PE_t,SE_{1t+1})}) \cdot$$

$$\cdot Pr((1+\beta)log\left(A - \frac{\psi_{t+1}}{(r^2+r)} - \frac{r^2\psi_t}{(r^2+r)}\right) + \beta log(r) + \epsilon^{(SE_{1t},SE_{1t+1})} \geq$$

$$\geq (1+\beta)log\left(H - \frac{\psi_{t+1}}{(r^2+r)}\right) + \beta log(r) + \epsilon^{(PE_t,SE_{1t+1})}) =$$

$$= \Phi\left(\frac{1}{\sqrt{2}}\left(\underbrace{(1+\beta)log\left(A - \frac{\psi_{t+1}}{(r^2+r)} - \frac{r^2\psi_t}{(r^2+r)}\right) - (1+\beta)log\left(G - \frac{r^2\psi_t}{(r^2+r)} - \frac{\psi_{t+1}}{(r^2+r)}\right)}_{=J}\right)\right) \cdot$$

$$\cdot \Phi\left(\frac{1}{\sqrt{2}}\left(\underbrace{(1+\beta)log\left(A - \frac{\psi_{t+1}}{(r^2+r)} - \frac{r^2\psi_t}{(r^2+r)}\right) - (1+\beta)log\left(H - \frac{\psi_{t+1}}{(r^2+r)}\right)}_{=K}\right)\right)$$

$$\frac{\partial Pr\left(U^{(SE_{1t},SE_{1t+1})} \geq \max\{U^{(PE_t,SE_{1t+1})}, U^{(SE_{2t},SE_{1t+1})}\}\right)}{\partial\psi_t} = \Phi'(J) \cdot (1+\beta)\frac{1}{\sqrt{2}}(\frac{\left(-\frac{r}{r+1}\right)}{A - \frac{\psi_{t+1}}{(r^2+r)} - \frac{r^2\psi_t}{(r^2+r)}} -$$

$$- \frac{-\frac{r}{r+1}}{G - \frac{r^2\psi_t}{(r^2+r)} - \frac{\psi_{t+1}}{(r^2+r)}}) \cdot \Phi(K) + \Phi'(K) \cdot (1+\beta)\frac{1}{\sqrt{2}}\frac{\left(-\frac{r}{r+1}\right)}{A - \frac{\psi_{t+1}}{(r^2+r)} - \frac{r^2\psi_t}{(r^2+r)}} \cdot \Phi(J) =$$

$$= \underbrace{\Phi'(J) \cdot (1+\beta)\frac{1}{\sqrt{2}}\left(-\frac{r}{r+1}\right)\frac{G-A}{(A - \frac{\psi_{t+1}}{(r^2+r)} - \frac{r^2\psi_t}{(r^2+r)})(G - \frac{r^2\psi_t}{(r^2+r)} - \frac{\psi_{t+1}}{(r^2+r)})}\Phi(K)}_{\leq ?\geq 0} +$$

$$+ \underbrace{\Phi'(K) \cdot (1+\beta)\frac{1}{\sqrt{2}}\frac{\left(-\frac{r}{r+1}\right)}{A - \frac{\psi_{t+1}}{(r^2+r)} - \frac{r^2\psi_t}{(r^2+r)}} \cdot \Phi(J)}_{\leq 0}$$

Let's consider $(G - A)$ separately:

$$G - A = \frac{r^2\theta w_t + r^2 a_t + r^2 b_t(1-r_b) + \theta\gamma^\alpha - r\gamma - \pi^{PE}_{t+1}}{(r^2+r)} - \frac{r^2(\theta\gamma^\alpha - r\gamma) + r^2 a_t(r-1) - (\theta\gamma^\alpha + r\gamma)}{r^2+r} =$$

$$= \frac{r^2\theta w_t + a_t r^2(2-r) + r^2 b_t(1-r_b) + \theta\gamma^\alpha(2-r^2) + r^2\gamma - \pi^{PE}_{t+1}}{r^2+r}$$

It can be assumed that $r \leq 1.4 \leq \sqrt{2}$, because r is one plus the interest rate, and probably the interest rate will not exceed 40%. Also it can be assumed that $\pi^{PE}_{t+1} \leq r^2\theta w_t + a_t r^2(2-r) + r^2 b_t(1-r_b) + \theta$
So $G - A \geq 0 \Rightarrow G \geq A$.

If $G \geq A$, then $|\frac{\partial U^{(SE_{1t},SE_{1t+1})}}{\partial\psi_{t+1}}| \geq |\frac{\partial U^{(PE_t,SE_{1t+1})}}{\partial\psi_{t+1}}|$, and

$$\frac{\partial Pr\left(U^{(SE_{1t},SE_{1t+1})} \geq \max\{U^{(PE_t,SE_{1t+1})}, U^{(SE_{2t},SE_{1t+1})}\}\right)}{\partial \psi_t} \leq 0.$$

The probability of being Type-1 self-employment at period t declines if non-interest cost of borrowing ψ_t increases.

The Role of Non-Interest Cost of Borrowing ψ_{t+1} in the Decision of Being Type-1 Self-Employed at Period $t+1$

To investigate the role of non-interest cost of borrowing ψ_{t+1} in the decision of being Type-1 self-employed at period $t+1$, I fix a labor choice at the period t as Type-1 self-employed for simplicity to avoid an estimation of all nine possible labor choices.. The extension of the model for other labor choices PE_t and SE_{2t} is straightforward.

The agent prefers to works as Type-1 self-employed at period $t+1$ if she receives the highest utility function:

$$U^{(SE_{1t},SE_{1t+1})} \geq \max\{U^{(SE_{1t},PE_{t+1})}, U^{(SE_{1t},SE_{2t+1})}\}$$

In this subsection I show that the probability of being Type-1 self-employed at period $t+1$ declines if non-interest cost of borrowing at period $t+1$ increases.

$$\frac{\partial Pr\left(U^{(SE_{1t},SE_{1t+1})} \geq \max\{U^{(SE_{1t},PE_{t+1})}, U^{(SE_{1t},SE_{2t+1})}\}\right)}{\partial \psi_{t+1}} \leq 0$$

The total utility of being Type-1 self-employed at period t and $t+1$ is described in the previous subsection.

The agent's task if she works as Type-1 self-employed at period t and as paid-employed worker at period $t+1$:

$$\max_{c_t \geq 0, c_{t+1} \geq 0} U(c_t) + \beta U(c_{t+1})$$

Agent's budget constraints ($a_t \geq a_b$ and $a_{t+1} \leq a_b$):

$$\text{Period } t: \quad a_{t+1} + c_t = \theta\gamma^{\alpha} - r\left(\gamma - a_t\right) - \psi_t \tag{11}$$

$$\text{Period } t+1: \quad c_{t+1} = \theta w_{t+1} + r a_{t+1} + b_{t+1}(1 - r_b) - \psi_{t+1} \tag{12}$$

The first order condition for an internal solution of the agent's problem leads to Euler equation:

$$U^{'}(c_t) = \beta r U^{'}(c_{t+1})$$

Under the assumption $\beta r = 1$, and $U(c_t) = log(c_t)$.

$$c_t = c_{t+1} \tag{13}$$

Substitute the eq.13 in budget constraints eq.11 and eq.12:

$$\theta\gamma^{\alpha} - r(\gamma - a_t) - \psi_t - a_{t+1} = \theta w_{t+1} + ra_{t+1} + b_{t+1}(1 - r_b) - \psi_{t+1} \Rightarrow$$
$$a_{t+1} = \frac{\theta\gamma^{\alpha} - r(\gamma - a_t) - \psi_t - \theta w_{t+1} - b_{t+1}(1 - r_b) + \psi_{t+1}}{(r+1)}$$

The agent's total utility function:

$$U^{(SE_{1t},PE_{t+1})} - \epsilon^{(SE_{1t},PE_{t+1})} = log(c_t) + \beta log(c_{t+1}) = (1+\beta)log(c_t) =$$
$$= (1+\beta)log\left(\theta\gamma^{\alpha} - r(\gamma - a_t) - \psi_t - \frac{\theta\gamma^{\alpha} - r(\gamma - a_t) - \psi_t - \theta w_{t+1} - b_{t+1}(1 - r_b) + \psi_{t+1}}{(r+1)}\right) =$$
$$= (1+\beta)log(L - \frac{\psi_{t+1}}{r+1} - \frac{r\psi_t}{r+1}) \Rightarrow \frac{\partial U^{(SE_{1t},PE_{t+1})}}{\partial\psi_t} \leq 0; \; \frac{\partial U^{(SE_{1t},PE_{t+1})}}{\partial\psi_{t+1}} \leq 0$$

where $L = \theta\gamma^{\alpha} - r(\gamma - a_t) - \frac{\theta\gamma^{\alpha} - r(\gamma - a_t) - \theta w_{t+1} - b_{t+1}(1-r_b)}{(r+1)} = \frac{r(\theta\gamma^{\alpha} - r\gamma) + r^2 a_t + \theta w_{t+1} + b_{t+1}(1-r_b)}{(r+1)} = \frac{r^2(\theta\gamma^{\alpha} - r\gamma) + r^3 a_t + r\theta w_{t+1} + r b_{t+1}(1-r_b)}{(r^2+r)} = A - \frac{r^3 a_t - (\theta\gamma^{\alpha} - r\gamma) - r\theta w_{t+1} - r b_{t+1}(1-r_b)}{(r^2+r)}$

The agent's task if she works as Type-1 self-employed at period t and as Type-2 self-employed worker at period $t+1$:

$$\max_{c_t \geq 0, c_{t+1} \geq 0} U(c_t) + \beta U(c_{t+1})$$

Agent's budget constraints ($a_t \geq a_b$ and $a_{t+1} \leq a_b$):

$$\text{Period } t: \quad a_{t+1} + c_t = \theta\gamma^{\alpha} - r(\gamma - a_t) - \psi_t \tag{14}$$

$$\text{Period } t+1: \quad c_{t+1} = \theta(ra_{t+1})^{\alpha} \tag{15}$$

The first order condition for an internal solution of the consumer's problem leads to Euler equation:

$$U'(c_t) = \beta r U'(c_{t+1})(r^{\alpha-1}\theta\alpha(\theta\gamma^{\alpha} - r(\gamma - a_t) - \psi_t - c_t)^{\alpha-1})$$

Under the assumption $\beta r = 1$, $M = [\theta\gamma^{\alpha} - r(\gamma - a_t) - \psi_t]$ and $U(c_t) = log(c_t)$.

$$r^{\alpha-1}\theta_2\alpha(M - c_t)^{\alpha-1}c_t = c_{t+1} \tag{16}$$

Substitute the eq.16 in budget constraints eq.14 and eq.15:

$$\theta(ra_{t+1})^{\alpha} = r^{\alpha-1}\theta\alpha(a_{t+1})^{\alpha-1}(M - a_{t+1}) \Rightarrow a_{t+1} = \frac{\alpha M}{\alpha + r}$$

The agent's total utility function:

$$U^{(SE_{1t},SE_{2t+1})} - \epsilon^{(SE_{1t},SE_{2t+1})} = log(c_t) + \beta log(c_{t+1}) = (1+\beta)log(c_t) + log(r^{\alpha-1}\theta\alpha(M-c_t)^{\alpha-1}) =$$

$$= \underbrace{(1+\beta)log\frac{rM}{r+\alpha} + (\alpha-1)log\frac{\alpha M}{r+\alpha} + log(r^{\alpha-1}\theta\alpha)}_{=N\geq 0} \Rightarrow \frac{\partial U^{(SE_{1t},SE_{2t+1})}}{\partial \psi_t} \leq 0$$

Assume that $\epsilon^j \in N(0;1)$, the probability of being Type-1 self-employment at period $t+1$:

$$Pr\left(U^{(SE_{1t},SE_{1t+1})} \geq \max\{U^{(SE_{1t},PE_{t+1})}, U^{(SE_{1t},SE_{2t+1})}\}\right) =$$

$$Pr\left(U^{(SE_{1t},SE_{1t+1})} \geq U^{(SE_{1t},PE_{t+1})}\right) \cdot Pr\left(U^{(SE_{1t},SE_{1t+1})} \geq U^{(SE_{1t},SE_{2t+1})}\right) =$$

$$= Pr((1+\beta)log\left(A - \frac{\psi_{t+1}}{(r^2+r)} - \frac{r^2\psi_t}{(r^2+r)}\right) + \beta log(r) + \epsilon^{(SE_{1t},SE_{1t+1})} \geq$$

$$\geq (1+\beta)log\left(L - \frac{\psi_{t+1}}{r+1} - \frac{r\psi_t}{r+1}\right) + \epsilon^{(SE_{1t},PE_{t+1})}) \cdot$$

$$\cdot Pr((1+\beta)log\left(A - \frac{\psi_{t+1}}{(r^2+r)} - \frac{r^2\psi_t}{(r^2+r)}\right) + \beta log(r) + \epsilon^{(SE_{1t},SE_{1t+1})} \geq$$

$$\geq N + \epsilon^{(SE_{1t},SE_{2t+1})}) =$$

$$= \Phi\left(\frac{1}{\sqrt{2}}\left(\underbrace{(1+\beta)log\left(A - \frac{\psi_{t+1}}{(r^2+r)} - \frac{r^2\psi_t}{(r^2+r)}\right) + \beta log(r) - (1+\beta)log\left(L - \frac{\psi_{t+1}}{r+1} - \frac{r\psi_t}{r+1}\right)}_{=O}\right)\right) \cdot$$

$$\cdot \Phi\left(\frac{1}{\sqrt{2}}\left(\underbrace{(1+\beta)log\left(A - \frac{\psi_{t+1}}{(r^2+r)} - \frac{r^2\psi_t}{(r^2+r)}\right) + \beta log(r) - N}_{=P}\right)\right)$$

$$\frac{\partial Pr\left(U^{(SE_{1t},SE_{1t+1})} \geq \max\{U^{(SE_{1t},PE_{t+1})}, U^{(SE_{1t},SE_{2t+1})}\}\right)}{\partial \psi_{t+1}} = \Phi^{'}(O) \cdot (1+\beta)\frac{1}{\sqrt{2}}(\frac{\left(-\frac{1}{r^2+r}\right)}{A - \frac{\psi_{t+1}}{(r^2+r)} - \frac{r^2\psi_t}{(r^2+r)}} -$$

$$- \frac{\left(-\frac{1}{r+1}\right)}{L - \frac{\psi_{t+1}}{r+1} - \frac{r\psi_t}{r+1}}) \cdot \Phi(P) + \Phi^{'}(P) \cdot (1+\beta)\frac{1}{\sqrt{2}}\frac{\left(-\frac{1}{r^2+1}\right)}{A - \frac{\psi_{t+1}}{(r^2+r)} - \frac{r^2\psi_t}{(r^2+r)}} \cdot \Phi(O) =$$

$$= \Phi^{'}(O) \cdot (1+\beta)\frac{1}{\sqrt{2}}\left(\frac{-1}{r^2+r}\right)\left(\frac{(L - \frac{\psi_{t+1}}{r+1} - \frac{r\psi_t}{r+1}) - r(A - \frac{\psi_{t+1}}{(r^2+r)} - \frac{r^2\psi_t}{(r^2+r)})}{(A - \frac{\psi_{t+1}}{(r^2+r)} - \frac{r^2\psi_t}{(r^2+r)})(L - \frac{\psi_{t+1}}{r+1} - \frac{r\psi_t}{r+1})}\right) \cdot \Phi(P) +$$

$$+ \Phi^{'}(P) \cdot (1+\beta)\frac{1}{\sqrt{2}}\frac{\left(-\frac{1}{r^2+1}\right)}{A - \frac{\psi_{t+1}}{(r^2+r)} - \frac{r^2\psi_t}{(r^2+r)}} \cdot \Phi(O) =$$

$$= \underbrace{\Phi^{'}(O) \cdot (1+\beta)\frac{1}{\sqrt{2}}(\frac{L - rA}{(A - \frac{\psi_{t+1}}{(r^2+r)} - \frac{r^2\psi_t}{(r^2+r)})(L - \frac{\psi_{t+1}}{r+1} - \frac{r\psi_t}{r+1})}) \cdot \Phi(P)}_{\leq ? \geq 0} +$$

$$\underbrace{+ \Phi^{'}(P) \cdot (1+\beta)\frac{1}{\sqrt{2}}\frac{\left(-\frac{1}{r^2+1}\right)}{A - \frac{\psi_{t+1}}{(r^2+r)} - \frac{r^2\psi_t}{(r^2+r)}} \cdot \Phi(O)}_{\leq 0}$$

Let's consider $(L - rA)$ separately:

$$\begin{aligned} L - rA = & \frac{r^2(\theta\gamma^\alpha - r\gamma) + r^3 a_t + r\theta w_{t+1} + rb_{t+1}(1 - r_b)}{(r^2 + r)} - \\ & - r\frac{r^2(\theta\gamma^\alpha - r\gamma) + r^2 a_t(r-1) - (\theta\gamma^\alpha + r\gamma)}{r^2 + r} = \\ & = \frac{r^2(\theta\gamma^\alpha - r\gamma)(r-1) + r^4 a_t + r\theta w_{t+1} + rb_{t+1}(1 - r_b)}{(r^2 + r)} \geq 0 \end{aligned}$$

It means:

$$\frac{\partial Pr\left(U^{(SE_{1t}, SE_{1t+1})} \geq \max\{U^{(SE_{1t}, PE_{t+1})}, U^{(SE_{1t}, SE_{2t+1})}\}\right)}{\partial \psi_{t+1}} \leq 0$$

The probability of being Type-1 self-employment at period $t+1$ declines if non-interest cost of borrowing ψ_{t+1} increases.

The Role of Non-Interest Cost of Borrowing ψ_{t+1} in the Decision of Being Paid-Employed at Period $t+1$

In this subsection I want to show that if the agent is Type-2 self-employed worker (which means she does not have access to credit market), she may prefer to switch to paid-employment to be able to use credit products (e.g., mortgage) if non-interest cost of borrowing declines. To show it I complicate the model by allowing for paid-employed to take a one period loan in the bank. Paid-employed worker budget constraints:

$$\text{Period } t: \quad a_{t+1} + c_t = \theta w_t + a_t + b_t(1 - r_b) - \psi_t$$
$$\text{Period } t+1: \quad c_{t+1} = \theta w_{t+1} + r a_{t+1} + b_{t+1}(1 - r_b) - \psi_{t+1}$$

To investigate the role of non-interest cost of borrowing ψ_{t+1} in the decision of Type-2 self-employed at period t to switch to paid-employment at period $t+1$ - $SE_{2t} \to PE_{t+1}$, I consider all possible labor choices that the agent has at period $t+1$ if she was Type-2 self-employed at period t -it's SE_{1t+1} and SE_{2t+1}:

$$Pr(SE_{2t} \to PE_{t+1}) = Pr(U^{(SE_{2t}, PE_{t+1})} \geq \max\{U^{(SE_{2t}, SE_{2t+1})}, U^{(SE_{2t}, SE_{1t+1})}\}$$

In this subsection I show that the probability of switching $SE_{2t} \to PE_{t+1}$ declines if non-interest cost of borrowing at period $t+1$ increases.

$$\frac{\partial Pr(SE_{2t} \to PE_{t+1})}{\partial \psi_{t+1}} \leq 0$$

The agent's utility function if she works as Type-2 self-employed worker at period t and paid-employed worker at period $t+1$:

$$U^{(SE_{2t}, PE_{t+1})} - \epsilon^{(SE_{2t}, PE_{t+1})} = (1+\beta)log\left(\frac{r\theta(a_t)^\alpha + \theta w_{t+1} + b_{t+1}(1 - r_b) - \psi_{t+1}}{(r+1)}\right) =$$
$$= (1+\beta)log\left(Q - \frac{\psi_{t+1}}{(r+1)}\right)$$

where $Q = \frac{r\theta(a_t)^\alpha + \theta w_{t+1} + b_{t+1}(1 - r_b)}{(r+1)}$

The agent's utility function if she works as Type-2 self-employed worker at period t and $t+1$:

$$U^{(SE_{2t}, SE_{2t+1})} - \epsilon^{(SE_{2t}, SE_{2t+1})} = (1+\beta)log(a_t^\alpha) + log\frac{r\theta}{r+\alpha} + \beta log\frac{r^{\alpha+1}\theta^2}{r+\alpha} = R$$

where $R = (1+\beta)log(a_t^\alpha) + log\frac{r\theta}{r+\alpha} + \beta log\frac{r^{\alpha+1}\theta^2}{r+\alpha}$

The agent's utility function if she works as Type-2 self-employed worker at period t and Type-1 self-employed worker at period $t+1$:

$$U^{(SE_{2t},SE_{1t+1})} - \epsilon^{(SE_{2t},SE_{1t+1})} = (1+\beta)log\left(\frac{r\theta(a_t)^{\alpha} + \theta\gamma^{\alpha} - r\gamma - \pi_{t+1}^{SE_1} - \psi_{t+1}}{(r^2+r)}\right) + log(r) =$$

$$= (1+\beta)log\left(S - \frac{\psi_{t+1}}{(r^2+r)}\right) + log(r)$$

where $S = \frac{r\theta(a_t)^{\alpha}+\theta\gamma^{\alpha}-r\gamma-\pi_{t+1}^{SE_1}}{(r^2+r)}$

Assume that $\epsilon^j \in N(0;1)$, the probability of being Type-2 self-employment at period t and paid-employed worker at period $t+1$:

$$Pr\left(U^{(SE_{2t},PE_{t+1})} \geq \max\{U^{(SE_{2t},SE_{2t+1})}, U^{(SE_{2t},SE_{1t+1})}\}\right) =$$

$$Pr\left(U^{(SE_{2t},PE_{t+1})} \geq U^{(SE_{2t},SE_{2t+1})}\right) \cdot Pr\left(U^{(SE_{2t},PE_{t+1})} \geq U^{(SE_{2t},SE_{1t+1})}\right) =$$

$$= Pr((1+\beta)log\left(Q - \frac{\psi_{t+1}}{(r+1)}\right) + \epsilon^{(SE_{2t},PE_{t+1})} \geq R + \epsilon^{(SE_{2t},SE_{2t+1})}.$$

$$\cdot Pr((1+\beta)log\left(Q - \frac{\psi_{t+1}}{(r+1)}\right) + \epsilon^{(SE_{2t},PE_{t+1})} \geq (1+\beta)log\left(S - \frac{\psi_{t+1}}{(r^2+r)}\right) + log(r) + \epsilon^{(SE_{2t},SE_{1t+1})}) =$$

$$= \Phi\underbrace{\left(\frac{1}{\sqrt{2}}\left((1+\beta)log\left(Q - \frac{\psi_{t+1}}{(r+1)}\right) - R\right)\right)}_{T\geq 0}\cdot$$

$$\cdot\,\Phi\underbrace{\left(\frac{1}{\sqrt{2}}\left((1+\beta)log\left(Q - \frac{\psi_{t+1}}{(r+1)}\right) - (1+\beta)log\left(S - \frac{\psi_{t+1}}{(r^2+r)}\right) + log(r)\right)\right)}_{U\geq 0}$$

$$\frac{\partial Pr\left(U^{(SE_{2t},PE_{t+1})} \geq \max\{U^{(SE_{2t},SE_{2t+1})}, U^{(SE_{2t},SE_{1t+1})}\}\right)}{\partial\psi_{t+1}} = \underbrace{\Phi'(T)\cdot(1+\beta)\frac{1}{\sqrt{2}}\left(\frac{-\frac{1}{r+1}}{Q - \frac{\psi_{t+1}}{(r+1)}}\right)\cdot\Phi(U) +}_{\leq 0}$$

$$\underbrace{+\,\Phi'(U)\cdot(1+\beta)\frac{1}{\sqrt{2}}\left(\frac{-\frac{1}{r+1}}{Q - \frac{\psi_{t+1}}{(r+1)}} - \frac{\left(-\frac{1}{r^2+r}\right)}{S - \frac{\psi_{t+1}}{(r^2+r)}}\right)\cdot\Phi(T)}_{\leq ?\geq 0}$$

Let's consider the last term separately:

$$\left(\frac{-\frac{1}{r+1}}{Q - \frac{\psi_{t+1}}{(r+1)}} - \frac{\left(-\frac{1}{r^2+r}\right)}{S - \frac{\psi_{t+1}}{(r^2+r)}}\right) = \frac{-\frac{1}{r+1}\cdot\left(S - \frac{\psi_{t+1}}{(r^2+r)}\right) + \frac{1}{r^2+r}\cdot\left(Q - \frac{\psi_{t+1}}{(r+1)}\right)}{\left(Q - \frac{\psi_{t+1}}{(r+1)}\right)\left(S - \frac{\psi_{t+1}}{(r^2+r)}\right)} =$$

$$= \frac{r\theta(a_t)^{\alpha} + \theta w_{t+1} + b_{t+1}(1-r_b) - \psi_{t+1} - r\theta(a_t)^{\alpha} - \theta\gamma^{\alpha} + r\gamma + \pi_{t+1}^{SE_1} + \psi_{t+1}}{(r+1)(r^2+r)\left(Q - \frac{\psi_{t+1}}{(r+1)}\right)\left(S - \frac{\psi_{t+1}}{(r^2+r)}\right)} =$$

$$= \frac{\theta w_{t+1} + b_{t+1}(1-r_b) - \theta\gamma^{\alpha} + r\gamma + \pi_{t+1}^{SE_1}}{(r+1)(r^2+r)\left(Q - \frac{\psi_{t+1}}{(r+1)}\right)\left(S - \frac{\psi_{t+1}}{(r^2+r)}\right)} = \frac{(c_{PE_{t+1}} - ra_{t+1} - \psi_{t+1}) - (c_{SE_{1t+1}} - ra_{t+1} - \psi_{t+1})}{(r+1)(r^2+r)\left(Q - \frac{\psi_{t+1}}{(r+1)}\right)\left(S - \frac{\psi_{t+1}}{(r^2+r)}\right)} =$$

$$\frac{c_{PE_{t+1}} - c_{SE_{1t+1}}}{(r+1)(r^2+r)\left(Q - \frac{\psi_{t+1}}{(r+1)}\right)\left(S - \frac{\psi_{t+1}}{(r^2+r)}\right)} = \frac{exp(U_{PE_{t+1}}) - exp(U_{SE_{1t+1}})}{(r+1)(r^2+r)\left(Q - \frac{\psi_{t+1}}{(r+1)}\right)\left(S - \frac{\psi_{t+1}}{(r^2+r)}\right)} \leq 0$$

The nominator is negative, because the agent receives higher utility being Type-1 self-employed that being paid-employed worker $U_{SE_{1t+1}} \geq U_{PE_{t+1}}$ if all else being equal.

The probability of switching form Type-1 self-employment at period t to paid-employed at period $t+1$ declines if non-interest cost of borrowing ψ_{t+1} increases.

$$\frac{\partial Pr\left(U^{(SE_{2t}, PE_{t+1})} \geq \max\{U^{(SE_{2t}, SE_{2t+1})}, U^{(SE_{2t}, SE_{1t+1})}\}\right)}{\partial \psi_{t+1}} \leq 0$$

Variables Description

Self-employed workers are self-defined category by respondents. Self-employment is their primary job.

Paid-employed workers are self-defined category and comprised of (a) employees in private business, (b) employees in government.

Age, female, year of survey. Self-explanatory.

Household income. It's a gross income, the sum of all HH members income during the last year.

Race. A binary indicator for following categories: White, Black, Hispanic and other (Asian, Native American and etc).

Education. A categorical variable indicating the highest level of schooling completed by a respondent: [1] "Less than High School diploma", [2] "High School diploma", [3] "College graduate ", and [4] "Doctoral or professional degree. The first category is the base category.

Married. = 1 for legally married individuals (including those not living together) and 0 for other categories including single, widowed, divorced, and living together without marriage.

Number of household members. Counts the number of household members who are presently living in the same household.

Number of kids per household. Counts the number of children under the age of 18 currently residing in the same household.

State population. Number of people living in the state, in thousands. Population is taken from the 2010 Census.

Regions. Set of dummies for living in one of the four regions at the time of interview. The regions are Midwest, Northeast, South and West.

First wave fixed effects. Set of dummies for the starting year of the stochastic sequence or the year of entry to the estimation sample.

Distance to the nearest bank, miles. The distance to the nearest bank is the Euclidean distance between the location of the respondent's home and the bank's address. Source: the FDIC Summary of Deposits (SOD) data, various years.

Average distance to the 10 nearest banks, miles. All distances between banks withing state and the location of respondent's home were sorted, and 10 nearest banks were chosen. The sum of all distances is divided by 10.

Number of banks within 10 miles. Total number of banks withing 10 miles from the location of respondent.

Number of bank offices per 1,000 state population. The number of bank offices includes bank headquarters, credit organizations, branches, supplementary offices, and operational offices, but excludes cash offices, cash desks, and mobile cash units. Source: the FDIC Summary of Deposits (SOD) data, 2010 Census.

Total assets. The amount of non-housing and housing assets adjusted for inflation at the moment of interview.

Average house value. The average house value within zip-code zone of the location of respondent's home. Source: Zillow.

Sample Design

The Community Advantage Panel Survey (CAPS)[5] was funded by the Ford Foundation and overseen by the UNC Center for Community Capital at the University of North Carolina at Chapel Hill (UNC). The survey sample comprises two subsamples (the owners sample and the renters sample), and the survey was designed to collect information about the economic and social experiences of low-to-moderate-income homeowners and renters.

The owners sample comprises a subset of the low-to-moderate-income homeowners whose loans were purchased by Self-Help, a community development financial institution with headquarters in Durham, North Carolina, as part of the Community Advantage Program (CAP). The panel survey for the owners sample was originally planned for a period of six years. After the initial year of owners sample data collection, a matched panel of low-to- moderate-income renters was selected to be interviewed during the remaining five-year period. The owners sample survey was originally planned to include six telephone interviews and two in-home interviews. In 2008, the decision was made to continue the survey beyond its original end date. The Survey Research Unit at UNC conducted the first four years of telephone interviews (2003 to 2006), and RTI International conducted all subsequent telephone data collection activities and three years of in-home interviews (2005, 2008, and 2012) for the owners sample.

For the renters sample survey, a panel of low-to-moderate-income renters was matched to a subset of owners sample members who were living in the same Metropolitan Statistical Areas (MSAs) in 2004. Data collection for the renters sample began one year after the start of data collection for the owners sample and was originally planned as a five-year survey, which was similarly extended in 2008. RTI conducted all in-home and telephone interviews for the renters sample.

Sample construction was carried out over the course of several years between 2001 and 2004. The owners sample is a convenience sample selected from Self-Help's CAP loan portfolio at the beginning of the survey period, and the renters sample is a random sample drawn one year later from neighborhoods near those in which urban owners sample members were living at the time of the baseline survey.

Owners sample. A total of 7,223 CAP loans were purchased by Self-Help before or during the baseline CAPS interview period of 2001-2003. These loans were originated during the period of 1999-2003. All of the borrowers whose loans had been purchased were put into

[5]Full description of the Community Advantage Panel Survey can be found `https://communitycapital.unc.edu/files/2017/10/Paper_22929_extendedabstract_1348_0.pdf`

calling, screened (efforts were made to exclude retirees and full-time students, and to include only those borrowers who still lived in their CAP properties and retained their CAP mortgages at the time of the baseline survey), and given the opportunity to participate in the baseline survey if they met the screening criteria. A total of 3,743 CAP borrowers completed the baseline survey.

Renters sample. A total of 15,934 potential renters sample members were selected via random digit dialing from the 30 metropolitan statistical areas (MSAs) with the greatest representation of owners sample members. The dialing zones were initially restricted to the census block groups in which owners sample members were located but were each subsequently expanded to encompass a four-mile radius for those cases in which a more localized match with an owners sample member could not be obtained. Potential renters sample members were screened for tenure status and a household income ceiling. The income ceiling for each potential renters sample member was based on the area median income (AMI) of the matched owners sample member's MSA and the percentage minority representation of the matched owners sample member's census tract. The income threshold was set equal to 80% of the AMI if minority representation was less than 30%, or equal to 115% of the AMI if minority representation was 30% or greater. Calling and screening continued until the target baseline sample size had been achieved. The baseline renters sample comprises 1,529 cases.

Demographic Characteristics. The owners sample members were, on average, 35 years old with an annual household income of about $32,000 at the time of the baseline survey. Slightly more than half of the owners sample respondents (54%) were male, and about 46% were married at baseline. About half of the owners sample respondents also reported children in the household at baseline. Whites make up about 62% of the sample, followed by Blacks (19%) and Hispanics (16%). Approximately 51% of owners sample members had completed a high-school education as of baseline, while an additional 14%, 18%, and 6% had completed an associate's degree, bachelor's degree, or graduate degree, respectively. The labor force participation rate of the owners sample was about 96%, and approximately 92% of owners sample members were employed at baseline. In comparison, the renters sample members at baseline were slightly older (40) on average, had a somewhat lower average income ($20,200), and were more likely to be female (70%). Blacks (33%) and Hispanics (19%) have greater representation in the renters sample, and Whites (44%) have lower representation. The renters sample members were less likely to be married (27%) at baseline and were less likely to report children in the household (43%). The renters sample members also exhibited a lower rate of postsecondary degree completion (25%), labor force participation (75%), and employment (63%) at baseline.

Geographic Coverage. A majority of owners (62%) and renters (74%) sample members were located in the South at baseline. An additional 26% of the owners sample and 14% of the renters sample members were located in the Midwest, while 10% of the owners sample members and 12% of the renters sample members were located in the West. Only about 3% of the owners sample members and none of the renters sample members were located in the Northeast. At the state level, North Carolina accounts for 27% of the owners sample and 33% of the renters sample. Ohio accounts for an additional 12% of the owners sample and 6% of the renters sample, while Oklahoma contributes an additional 11% of the owners sample and 22% of the renters sample. Each of the other states represents less than 10% of both samples.