Working and Saving Informally

The Link between Labor Market Informality and Financial Exclusion

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Introduction

Motivation

Developing countries are characterized by high informal employment and by low saving rates.

- High Informal employment:
  - In the Latin America and the Caribbean region (LAC), about half of labor force is informal.
  - Informality:
    - may introduce some useful flexibility
    - but lowers workers' protections, increases employment risks, hinders productivity growth.

  [World Bank, 2013; Perry et al., 2007; La Porta and Shleifer, 2014]

- Low Saving rate:
  - In LAC, savings are 17% of GDP compared to 30% in High-Income regions.
  - Low savings:
    - make individuals more vulnerable to shocks
    - but they are not simply due to many individuals "too poor to save".

  [Cavallo et al., 2016; Karlan and Morduch, 2010; Dupas and Robinson 2013; Bond et al. 2015.]

This Paper: Why

If both high levels of informality and low levels of saving are problems in themselves, this paper studies how they feed each other to generate even worse outcomes.

- Informality increases the need for precautionary savings because of higher employment risk;
- but the informality status also cause financial exclusion and sub-optimal saving levels;
- which in turn may induce workers to accept informal jobs with higher frequency because they cannot finance an effective labor market search.

This Paper: How

Since the deep linkages prevents from studying each problem in isolation, we develop a model that integrates all the crucial elements giving rise to both phenomena:

- Agents search on- and off-the-job for both formal and informal work;
- save through both formal financial institutions and informal ones.
- But informal workers face higher costs of accessing formal financial institutions (financial exclusion.)

To provide a quantitative assessment and evaluate policy interventions, we estimate the model on Colombia:

- It belongs to a region where both issues are particularly acute (Colombia is the fourth economy in LAC).
- It collects good quality data on both savings and labor market behavior (rare among developing countries).

Preview of Results

1. The link labor market informality and financial exclusion is confirmed:
   - Our estimates confirm that informal workers face higher cost to access formal financial institutions.
   - Our equilibrium-based counterfactual show that granting full financial access to informal workers would increase savings by 3% a month and formal assets by 21%. It would also decrease inequality in assets and consumption.
2. Specific policy experiments for Colombia:
   - The recent fiscal reform that lowered the payroll contribution for formal workers may be responsible for increasing saving by 10% a year.
3. Methodological contributions:
   - First paper to successfully estimate a search model of the labor market with savings and borrowing where two assets are allowed.
     [Rendon (2006); Lentz (2009); Lise (2013); Garcia-Perez and Rendon (2020); Abrahams (2022]
   - First paper to successfully estimate a search model of the labor market with both informality and savings.
     [Bobba et al. 2022, 2021; Megir et al. 2015; Bosch and Esteban-Pretel (2012)]; Charlot et al. 2013; Albrecht et al 2009]

Model and Estimation

Workers' optimization problem

The model environment can be summarized in the following optimization problem:

$$\max_{c,\phi} E_0 \int_0^{\infty} e^{-(\rho+\theta)t} \left[u(c) + \epsilon f\right]$$

subject to

$$da = \begin{cases} \left[(r_1\phi + r_2(1-\phi))(1+\nu l_{a^-})a + i - c - \frac{\psi^u}{2}\phi^2\right] dt & \text{u} \\ \left[(r_1\phi + r_2(1-\phi))(1+\nu l_{a^-})a + i(1-\tau f) - c - \frac{\psi^e(f)}{2}\phi^2\right] dt & \text{f=1,0} \end{cases}$$

$$a \geq \underline{a}$$

$$dr_2 = \kappa(\bar{r}_2 - r_2)dt + \sigma dz \qquad r_2 \sim \mathcal{N}\left(\bar{r}_2, \frac{\sigma^2}{2\kappa}\right)$$

$$di = \begin{cases} dq_{\lambda_1^u} \mathbf{l}_1 w(1) + dq_{\lambda_0^u} \mathbf{l}_0 w(0) - b & u \\ dq_{\eta_1} b + dq_{\lambda_1^e} \mathbf{l}_1 w'(1) + dq_{\lambda_0^e} \mathbf{l}_0 w'(0) - w(1) & f = 1 \\ dq_{\eta_0} b + dq_{\lambda_1^e} \mathbf{l}_1 w'(1) + dq_{\lambda_0^e} \mathbf{l}_0 w'(0) - w(0) & f = 0 \end{cases}$$

where $w(f)$ are draws form $F(w|f)$ and f are a draws from a Bernoulli distribution with $p(f)$.

Data Description

Gran Encuesta Integrada de Hogares (GEIH): Monthly household survey focused on labor market outcomes

- Individual characteristics (gender, age, years of schooling).
- Labor market states (non-employment, formal and informal employment).
- On going durations in unemployment and employment states (in months).
- Labor income and weekly hours worked.

Encuesta Longitudinal Colombiana (ELCA): Longitudinal survey that follows $\approx$ 10000 households every three years (2010, 2013, and 2016).

- Savings behavior (average monthly savings, formal savings and informal savings.

Sample: male, between 25 and 55 years old, living in urban areas, with only secondary education completed ("unskilled")

Descriptive Statistics

Descriptive Statistics

	Formal Emp.	Informal Emp.	Unemp.
Labor Market States - GEIH			
Proportion	0.395	0.527	0.077
Wages (hundred of US$ per month) - GEIH			
Mean	3.284	2.429	–
Standard Deviation	1.395	1.126	–
Ongoing Duration (months) - GEIH			
Mean	67.535	89.507	4.034
Proportion of Individuals who save - ELCA			
At all	0.271	0.211	0.036
Mainly in formal institutions	0.493	0.185	0.333
Savings amount among savers (hundred of US$) - ELCA			
Mean	0.601	0.508	0.443
Standard Deviation	0.721	0.748	0.480
Savings/Labor Income	0.133	0.151	-

Estimation and Identification

- We estimate the model using the Method of Simulated Moments (MSM).
- Identification (main points):
  - Interest rate in the informal financial system: We assume the 99% interval $[0, 0.075 \times 2.1]$, therefore $\mathcal{N}\left(0.079, \frac{\sigma^2}{2\kappa} = 0.0009\right)$ [Eeckhout and Munshi, 2010]
  - Labor market dynamics: durations + steady state distributions [Flinn and Heckman, 1982].
  - Wages distributions and unemployment income: Log-normality assumption + observed wages [Flinn and Heckman, 1982].
  - Portfolio costs: Observed savings + the behavior of individual in choosing financial assets to accumulate wealth.
- Estimation takeaways:
  - Informal workers face significantly higher portfolio costs of formal financial assets (9 times).
  - Formality state is not a permanent state. Job security in formality is reflected in higher on the job arrival rates.
  - Informal assets have considerable risk in their rate of return.

Counterfactual Experiments

Definitions

Counterfactual experiments:

1. **Financial inclusion**: Equal portfolio costs $\psi^e(0) = \psi^e(1) = 0.024$.
2. **Payroll tax policy** Increase of the payroll to from 16% to 29.5% (level set prior to the 2012 reform).

We evaluate the impact on labor market and financial outcomes and on wealth and consumption inequality taking into account the endogenous adjustment in individual's optimal behaviors.

Results

Counterfactual Experiments - Labor Market and Financial Outcomes

Statistic	Benchmark	$\psi^e(0) = \psi^e(1)$		$\tau = 0.295$	
	Value	Value	Ratio	Value	Ratio
Labor market states (proportion)					
$e(1)$	0.394	0.393	0.996	0.342	0.867
$e(0)$	0.566	0.565	0.997	0.615	1.086
u	0.039	0.043	1.077	0.043	1.097
Wages (hundred of US$ per month)					
$E[w\|e(1)]$	3.759	3.753	0.999	3.772	1.004
$E[w\|e(0)]$	2.854	2.871	1.006	2.861	1.003
Savings (hundred of US$ per month)					
$E[s\|s > 0]$	0.189	0.195	1.030	0.170	0.900
$E[s\|s > 0, e(1)]$	0.221	0.225	1.019	0.176	0.797
$E[s\|s > 0, e(0)]$	0.172	0.177	1.030	0.170	0.990

NOTE: Benchmark: $\psi^e(0) = 0.224$; $\psi^e(1) = 0.024$; $\tau = 0.160$.

Results

Counterfactual Experiments - Labor Market and Financial Outcomes

Statistic	Benchmark	$\psi^e(0) = \psi^e(1)$		$\tau = 0.295$	
	Value	Value	Ratio	Value	Ratio
Total Assets (hundred of US$)					
$E[a]$	6.149	6.365	1.035	5.519	0.898
$E[a\|e(1)]$	7.362	7.412	1.007	5.768	0.783
$E[a\|e(0)]$	5.495	5.862	1.067	5.557	1.011
Formal Assets (hundred of US$)					
$E[\phi a]$	2.241	2.705	1.207	1.921	0.857
$E[\phi a\|e(1)]$	3.264	3.223	0.987	2.404	0.736
$E[\phi a\|e(0)]$	1.598	2.461	1.540	1.704	1.066
Portfolio (proportion of total assets which is formal)					
$E[\phi]$	0.310	0.415	1.338	0.297	0.957
$E[\phi\|e(1)]$	0.433	0.430	0.994	0.401	0.926
$E[\phi\|e(0)]$	0.227	0.415	1.831	0.239	1.054

NOTE: Benchmark: $\psi^e(0) = 0.224$; $\psi^e(1) = 0.024$; $\tau = 0.160$.

Results

Counterfactual Experiments - Inequality

Inequality indexes	Benchmark	$\psi^e(0) = \psi^e(1)$		$\tau = 0.295$	
	Value	Value	Ratio	Value	Ratio
		Total Assets			
Mean log deviation	0.277	0.240	0.869	0.277	1.001
Theil index	0.224	0.196	0.878	0.223	0.997
Half coef of the variation	0.247	0.216	0.872	0.241	0.975
		Formal Assets			
Mean log deviation	0.794	0.359	0.453	0.799	1.007
Theil index	0.434	0.232	0.533	0.451	1.039
Half coef of the variation	1.625	1.135	0.699	1.678	1.033
		Consumption			
Mean log deviation	0.128	0.126	0.986	0.128	1.002
Theil index	0.110	0.107	0.971	0.109	0.990
Half coef of the variation	0.113	0.108	0.957	0.110	0.977

NOTE: Benchmark: $\psi^e(0) = 0.224$; $\psi^e(1) = 0.024$; $\tau = 0.160$.

Concluding Remarks

Concluding Remarks

- We develop and estimate a model able to replicate the crucial features of developing countries economies:
  1. High level of labor market informality
  2. Low level of savings
  3. High proportion of assets held in informal institutions
- Our claim that working informally is linked to saving informally is confirmed:
  - Informal workers face partial financial exclusion from formal financial institutions
  - If full financial access were guaranteed to them:
    - Savings would increase 3% a month and formal assets 21%
    - Asset inequality would decrease 13% and consumption inequality 4%
- Colombia-specific policies:
  - A recent reform reducing formal payroll contribution had the potential to increase savings by 10% a month.

Concluding Remarks

- We also provide two methodological contributions in the labor market search literature:
  1. We add saving and borrowing to search models with informality.
     [Bobba et al. 2022, 2021; Megir et al. 2015; Bosch and Esteban-Pretel (2012)]; Charlot et al. 2013; Albrecht et al 2009]
  2. We allow for two assets in search models with saving.
     [Rendon (2006); Lentz (2009); Lise (2013); Danforth (1979); Acemoglu and Shimer (1999); Krusell et al. (2010); Bils et al. (2011)]

Thank You!!

Additional slides

Our paper in Context

1. Large literature on savings in developing countries shows that low savings not only due to too poor to save individuals but also to institutions [Dupas and Robinson 2013; Batini et al. 2010; Ogbuabor et. 2013; Lorenzo and Osimani (2001); Granda and Hamann (2015)]
2. Growing literature using models with frictions to explain labor market informality, but ignores the link with saving behavior and financial access [Megir et al. 2015; Bobba et al. 2022, 2021; Bosch and Esteban-Pretel (2012); Albrecht et al 2009; Charlot et al. 2013]
3. Small but established literature analyzing saving with idiosyncratic risk in search models of the labor market [Danforth (1979); Acemoglu and Shimer (1999); Krusell et al. (2010); Bils et al. (2011); Ji (2021); Rendon (2006); Lentz (2009); Lise (2013)]
4. Tiny literature analyzing labor market informality and saving behavior, but cannot study financial exclusion because allows for only one asset [Esteban-Pretel and Kitao, 2021; Granda and Hamann, 2020]

Model environment

- Time is continuous and the environment is assumed to be stationary.
- Individuals discount the future at ρ and face common probability of death (with Poisson rate θ).
- Individuals are ex-ante homogeneous in every aspect.
- Individuals objective function:

$$E_0 \int_0^{\infty} e^{-\tilde{\rho} t} \left[u(c) + \epsilon f \right]$$

- The labor market is characterized by three states: unemployment, employment in a formal job, and employment in an informal job.
- Both off- and on-the-job is allowed.
- Unemployed workers receive a flow income b (unemployment benefits, transfers and subsidies).

Model environment

- A job offer is a pair wage and type of job: (w, f). Jobs arrive at rate λ^u and $\lambda^e(f)$.
- Wages are draws form $F(w|f)$ and f is a draw from $p(f)$ with $f = \{0, 1\}$.
- Jobs are terminated at exogenous rate $\eta(f)$.
- Two assets: a_1 risk-less *formal asset* with return r_1 and a_2 risky *informal asset* with return r_2.
- r_2 follows a Ornstein-Uhlenbeck process:

$$dr_2 = \kappa(\bar{r}_2 - r_2)dt + \sigma dz$$

  z is a standard Brownian motion and in steady state $r_2 \sim \mathcal{N}\left(\bar{r}_2, \frac{\sigma^2}{2\kappa}\right)$
- Total wealth $a = a_1 + a_2$ and the share of formal assets $\phi = \frac{a_1}{a}$. There is a convex cost of portfolio ϕ: $\frac{\psi^u}{2}\phi^2$ and $\frac{\psi^e(f)}{2}\phi^2$.

Model environment

- Budget constraint:

$$da = \begin{cases} \left[(r_1\phi + r_2(1-\phi))(1+\nu l_{a^-})a + b - c - \frac{\psi^u}{2}\phi^2\right] dt & \text{u} \\ \left[(r_1\phi + r_2(1-\phi))(1+\nu l_{a^-})a + w(f)(1-\tau f) - c - \frac{\psi^e(f)}{2}\phi^2\right] dt & \text{f=1,0} \end{cases}$$

- Individuals can borrow, however markets are incomplete. Self-imposed borrowing limit for a permanent state of unemployment:

$$\underline{a} = -\frac{b}{\bar{\bar{r}}_2(1+\nu)}$$

where $\bar{\bar{r}}_2$ is the upper bound of the C.I. that contains 99% of the r_2 draws, and the interest rate spreads are νr_i, $i = 1, 2$.

Value functions: Steady state value of unemployment

$$
\begin{aligned}
\tilde{\rho} U(a, r_2) &= \max_{0 \leq c \leq \bar{c}, 0 \leq \phi \leq 1} \{u(c) \\
&+ \lambda^u \sum_{f=0}^{1} \int_w \max\{W(a, r_2, w, f) - U(a, r_2), 0\} dF(w|f) p(f)\} \\
&+ \partial_a U(a, r_2) \left[(r_1 \phi + r_2(1-\phi))(1 + \nu I_{a^-}) a + b - c - \frac{\psi^u}{2} \phi^2 \right] \\
&+ \partial_{r_2} U(a, r_2) \kappa(\bar{r}_2 - r_2) + \frac{1}{2} \partial_{r_2}^2 U(a, r_2) \sigma_z^2 \}
\end{aligned}
$$

where $(1 + \nu)$ is the markup over the savings rate that financial institutions charge and $I_{a^-} = 1$ if $a < 0$ (borrowing).

Value functions: Steady state value of employment

$$
\begin{aligned}
\tilde{\rho} W(a, r_2, w, f) &= \max_{0 \leq c \leq \bar{c}, 0 \leq \phi \leq 1} \{ u(c) + \epsilon f \\
&+ \lambda^e(f) \sum_{f=0}^{1} \int_{w'} \max\{ W(a, r_2, w', f') - W(a, r_2, w, f), 0 \} dF(w'|f') \\
&+ \eta(f) \left[U(a, r_2) - W(a, r_2, w, f) \right] \\
&+ \partial_a W(a, r_2, w, f) \Big[(r_1 \phi + r_2(1-\phi))(1 + \nu I_{a^-}) a + w(1 - \tau f) - c \\
&+ \partial_{r_2} W(a, r_2, w, f) \kappa(\bar{r}_2 - r_2) + \frac{1}{2} \partial^2_{r_2} W(a, r_2, w, f) \sigma_z^2 \}
\end{aligned}
$$

Decisions rules

- Let $U(a, r_2)$ and $W(a, r_2, w, f)$ be the value of being unemployed and employed, respectively. The optimal consumption and portfolio decision rules are derived from the first order conditions of the value functions:

$$\begin{aligned} u'(c) &= \partial_a U(a, r_2) \\ (r_1 - r_2)(1 + \nu I_{a^-})a &= \psi^u \phi \\ u'(c) &= \partial_a W(a, r_2, w, f) \\ (r_1 - r_2)(1 + \nu I_{a^-})a &= \psi^e(f)\phi \end{aligned}$$

- The optimal labor market decision rules concern accepting or rejecting job offers:

$$\begin{cases} \text{accept an offer } \{w, f\} \text{ if } W(a, r_2, w, f) \geq U(a, r_2) & \text{u} \\ \text{accept an offer } \{w', f'\} \text{ if } W(a, r_2, w', f') \geq W(a, r_2, w, f) & \text{f=1,0} \end{cases}$$

Estimation results

Estimated Parameters

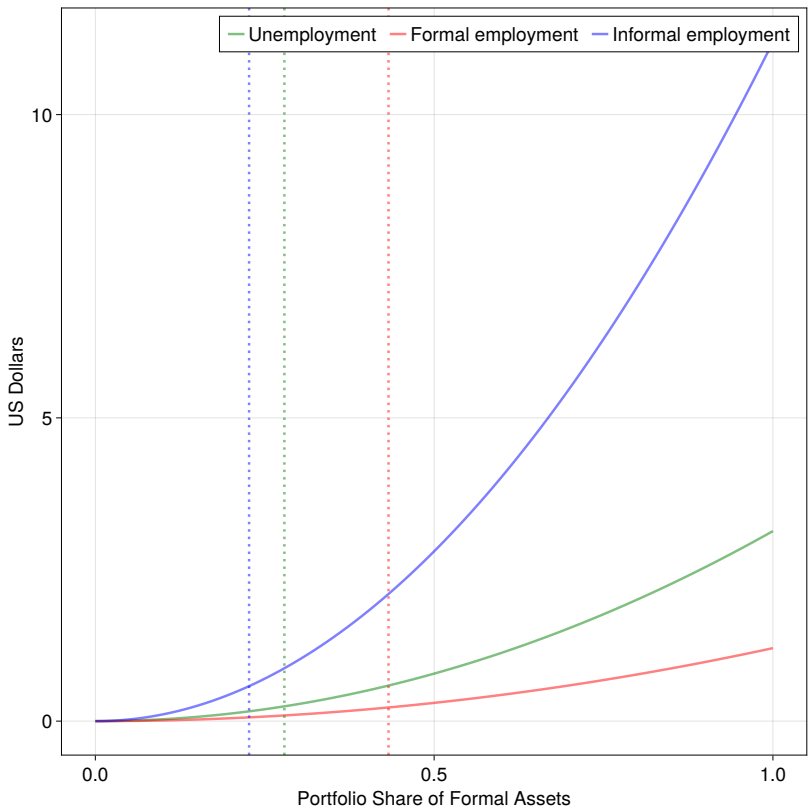
Definition	Parameter	Est. Value	Std. Error
Mobility Shocks			
Job offer rate - unemployment	λ^u	0.178	(0.0072)
Job offer rate - formal employment	$\lambda^e(1)$	0.034	(0.0054)
Job offer rate - informal employment	$\lambda^e(0)$	0.015	(0.0040)
Job separation rate - formal employment	$\eta(1)$	0.017	(0.0039)
Job separation rate - informal employment	$\eta(0)$	0.014	(0.0027)
Job offers			
Proportion formal job offers	$p(1)$	0.455	(0.0038)
Location wages distribution - formal employment	$\mu(1)$	1.056	(0.0519)
Scale wages distribution - formal employment	$\sigma(1)$	0.394	(0.0147)
Location wages distribution - informal employment	$\mu(0)$	0.800	(0.0369)
Scale wages distribution - informal employment	$\sigma(0)$	0.408	(0.0205)

Estimation results

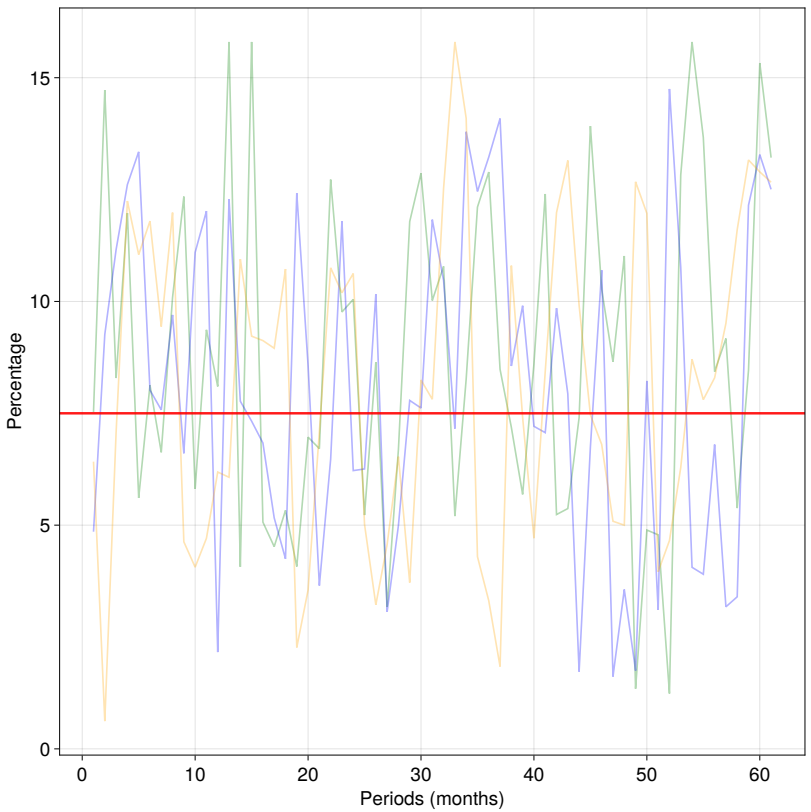
Estimated Parameters (cont...)

Definition	Parameter	Est. Value	Std. Error
Portfolio costs			
Cost function parameter - unemployment	ψ^u	0.063	(0.0045)
Cost function parameter - formal employment	$\psi^e(1)$	0.024	(0.0027)
Cost function parameter - informal employment	$\psi^e(0)$	0.224	(0.0314)
Rate of return informal assets			
Persistence	κ	0.701	(0.0218)
Std. Dev. of shock	σ_z	0.037	(0.0006)
Unemployment income			
Flow	b	0.197	(0.0230)
Utility Value of Formal Jobs			
Value	ϵ	0.026	(0.0012)

Estimation and identification



(a) Portfolio Cost Function



(b) Assets Returns

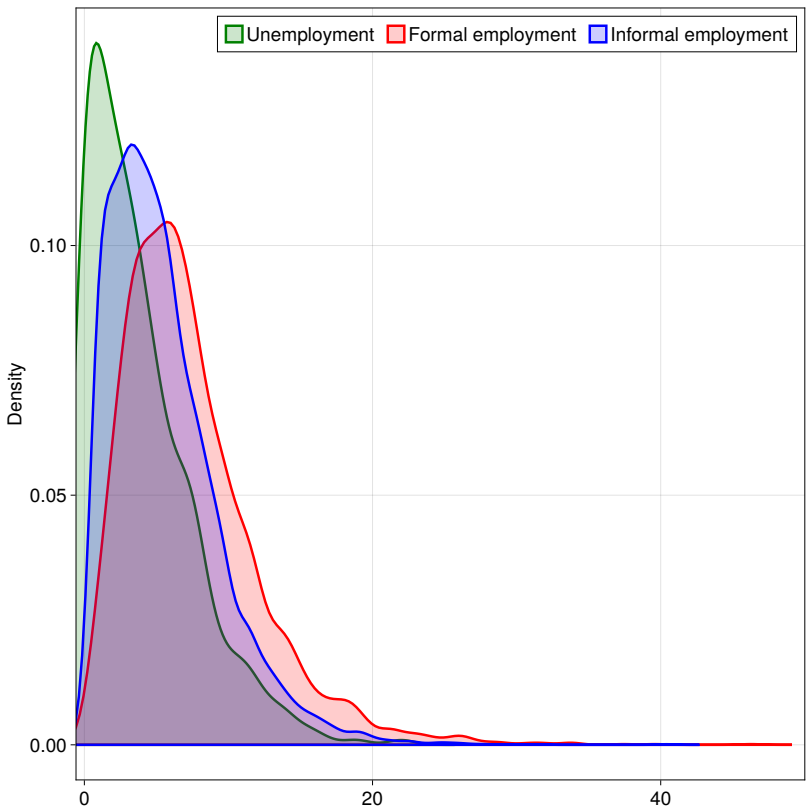
Fit of the model

Moments Fit

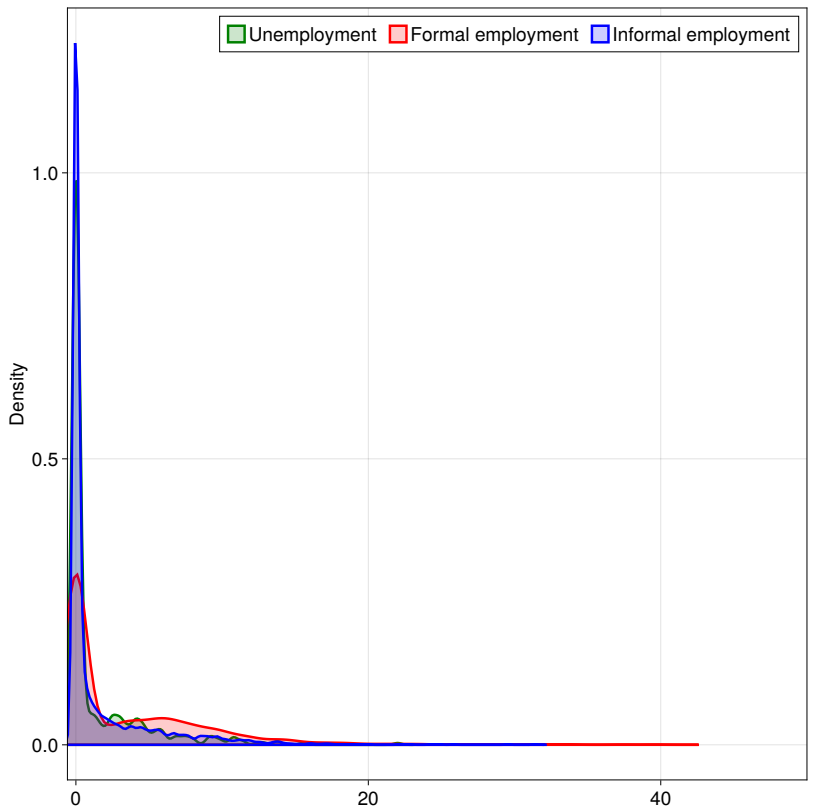
Statistic	Data	Model	Statistic	Data	Model	Statistic	Data	Mod
$e(1)$	0.395	0.394	$E[I_{s>0} \times s \mid e(1)]$	0.163	0.097	$\Pr[\phi > 0.5 \mid e(1)]$	0.493	0.43
$e(2)$	0.527	0.566	$SD[I_{s>0} \times s \mid e(1)]$	0.460	0.223	$\Pr[\phi > 0.5 \mid e(1)]$	0.493	0.43
u	0.077	0.039	$E[I_{s>0} \times s \mid e(0)]$	0.107	0.080	$\Pr[\phi > 0.5 \mid e(0)]$	0.185	0.20
$E[w(1)]$	3.284	3.759	$SD[I_{s>0} \times s \mid e(0)]$	0.400	0.183	$\Pr[\phi > 0.5 \mid u]$	0.333	0.31
$SD[w(1)]$	1.395	1.465	$E[I_{s>0} \times s \mid u]$	0.016	0.001	$\Pr[\phi > 0.5 \mid e(1), Q_1]$	0.312	0.39
$E[w(0)]$	2.429	2.854	$SD[I_{s>0} \times s \mid u]$	0.112	0.003	$\Pr[\phi > 0.5 \mid e(1), Q_2]$	0.458	0.43
$SD[w(0)]$	1.126	1.153	$E[I_{s>0} \times s \mid e(1), Q_1]$	0.061	0.029	$\Pr[\phi > 0.5 \mid e(1), Q_3]$	0.368	0.45
$P5[w(1)]$	2.289	1.790	$E[I_{s>0} \times s \mid e(1), Q_2]$	0.065	0.067	$\Pr[\phi > 0.5 \mid e(1), Q_4]$	0.623	0.45
$P5[w(0)]$	0.867	1.348	$E[I_{s>0} \times s \mid e(1), Q_3]$	0.145	0.106	$\Pr[\phi > 0.5 \mid e(0), Q_1]$	0.000	0.04
$E[t \mid e(1)]$	5.628	5.950	$E[I_{s>0} \times s \mid e(1), Q_4]$	0.393	0.187	$\Pr[\phi > 0.5 \mid e(0), Q_2]$	0.107	0.17
$SD[t \mid e(1)]$	6.557	6.316	$E[I_{s>0} \times s \mid e(0), Q_1]$	0.026	0.029	$\Pr[\phi > 0.5 \mid e(0), Q_3]$	0.194	0.25
$E[t \mid e(0)]$	7.459	7.653	$E[I_{s>0} \times s \mid e(0), Q_2]$	0.056	0.051	$\Pr[\phi > 0.5 \mid e(0), Q_4]$	0.353	0.35
$SD[t \mid e(0)]$	8.349	8.107	$E[I_{s>0} \times s \mid e(0), Q_3]$	0.096	0.087			
$E[t \mid u]$	4.034	4.954	$E[I_{s>0} \times s \mid e(0), Q_4]$	0.310	0.152			
$SD[t \mid u]$	6.859	5.922						

NOTE: $s = da/dt$ is the amount saved, $I_{s>0}$ is an indicator variable that takes the value of 1 if the indivic saves a positive amount and zero otherwise, and Q_i represents the quartile i in the observed wages distributi

Steady state distributions

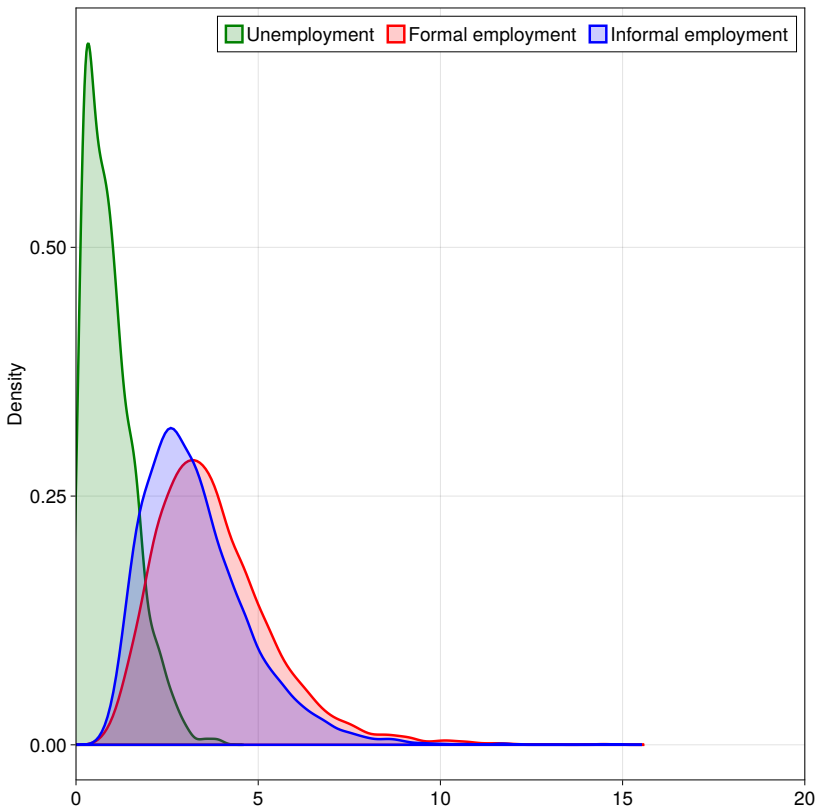


(c) Total Assets

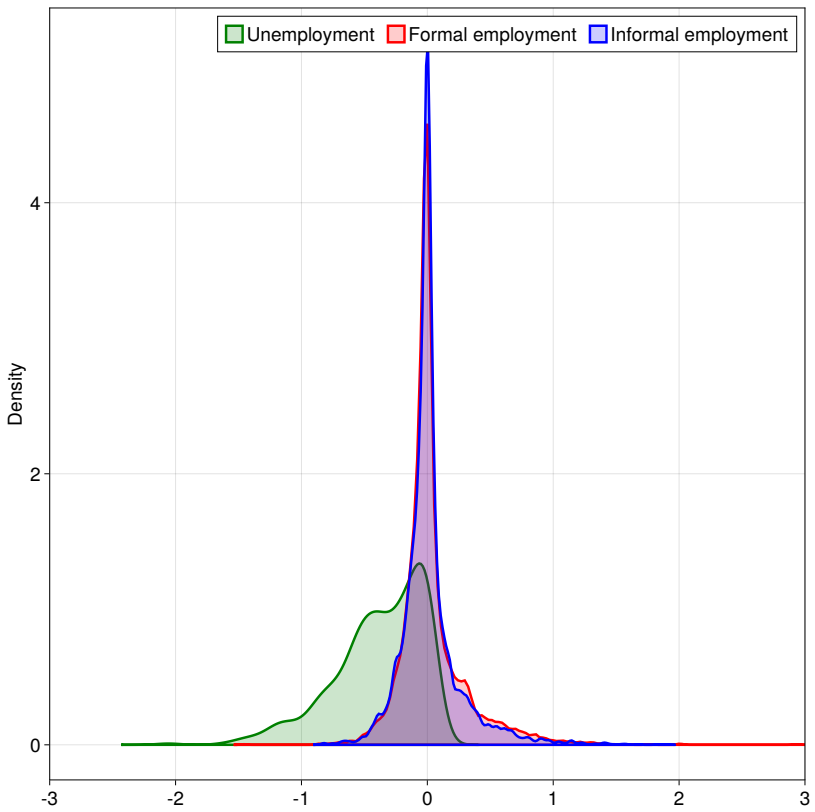


(d) Financial Assets

Steady State Distributions



(e) Consumption



(f) Savings