Working and Saving Informally

The Link between Labor Market Informality and Financial Exclusion

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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 the labor force is informal.
  - Informality:
    - may introduce some useful flexibility
    - but lowers workers' protections, increases employment risks, hinders productivity growth.

[Jessen and Kluve, 2021; La Porta and Shleifer, 2014; World Bank, 2013; Perry et al., 2007]

- 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;
    - make economies less resilient;
    - but they are not simply due to many individuals "too poor to save".

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

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 potentially worse outcomes.

- The informality status causes:
  - higher employment risk, which in turn increases the need for precautionary savings
  - significant financial exclusion, which in turn increases the cost of saving
- As a result, workers with a history of informality:
  - need savings the most, but they end up with relatively low saving levels
  - low savings do not support effective labor market search, so they are more likely to accept informal jobs.
- In conclusion:
  - low savings and high informality can reinforce each other, becoming persistent.

This Paper: How

Since these 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.
- Agents save through both formal and informal financial institutions.
- Informal workers face higher costs of accessing formal financial institutions (financial exclusion.)

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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 saving and labor market behavior (rare among developing countries).

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As a byproduct, we provide a methodological contributions in the search literature:

- We add two assets to search and saving literature.

  [Rendon (2006); Lentz (2009); Lise (2013); Garcia-Perez and Rendon (2020); Abrahams (2022); Krusell et al. (2010)]

- We add savings to search and informality literature.

  [Bobba et al. (2022, 2021); Megir et al. (2015); Bosch and Esteban-Pretel (2012); Charlot et al. (2013); Albrecht et al. (2009)]

Model: General Environment

- Stationary, continuous time.
- Individuals discount the future at ρ and face a death shock with Poisson rate θ
  $\implies$ effective discount rate $\tilde{\rho} = \rho + \theta$
- They consume, search for jobs and can save and borrow.
- Objective function:

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

  where c is consumption, $f = 1$ if formal, $\epsilon > 0$ is the additional utility of being hired formally.
- We assume risk aversion of the form: Constant Relative Risk Aversion (CRRA)

$$u(c) = \frac{c^\delta}{\delta}$$

Model: Labor Market Environment

- Three labor market states:
  1. Unemployed
     - Flow income b (social protection benefits, transfers, others)
     - Job offers at rate λ^u
  2. Employment in an informal job.
     - Flow income w
     - Job offers at rate $\lambda^e(0)$
     - Termination shock at rate $\eta(0)$
  3. Employment in a formal job.
     - Receive flow income $w(1-\tau)$
     - Receive job offers at rate $\lambda^e(1)$
     - Termination shock at rate $\eta(1)$
- Job offer is a pair $\{w, f\}$ where:
  - $f \in \{0, 1\}$, $f = 1$ if formal status
  - $w \sim F(w|f)$
  - $p(f) =$ proportion of f-status offers in the population

Model: Financial Market Environment

- Markets are incomplete:
  - individuals cannot fully insure against risk (but they can save and borrow.)
- There are two assets:
  1. Risk-less asset a_1 (formal asset):
     - Constant return r_1.
  2. Risky asset a_2 (informal asset):
     - Different returns $r_2 \sim R(r_2)$
     - Return updates following a Poisson process with rate κ
- Wealth: $a = a_1 + a_2$
  - Share of formal assets $\phi = \frac{a_1}{a}$.
  - Convex costs to maintain portfolio ϕ:
    - $\frac{\psi^e(f)}{2}\phi^2 \implies \psi^e(0) > \psi^e(1)$ captures financial exclusion.
  - Self-imposed borrowing limit [Lise 2013; Aiyagari 1994]: $\underline{a} = -\frac{b}{\bar{r}_2(1+\nu)}$

Model: Equilibrium

Definition

Given the primitive parameters $\{\rho, \theta, \lambda^u, \lambda^e(1), \lambda^e(0), \eta(1), \eta(0), \psi^u, \psi^e(1), \psi^e(0), b\}$, the instantaneous utility function $u(c)$, the distributions of wage offers $F(w|1)$, $F(w|0)$, $p(1)$ the *steady state equilibrium* is a set of values $U(a, r_2)$ and $W(a, r_2, w, f)$ that satisfy the value functions equations, together with the invariant distributions of individuals across labor market states and the invariant distributions of total assets $\Lambda(a)$.

- Endogenous:
  - hazard rates
  - accepted wages distributions
  - distribution over labor market states
  - assets distribution
- Exogenous
  - wage offers distributions
  - utility function and institutional parameters
  - Poisson rates (mobility parameters, risky asset)
  - effective discount rate

Data: Sources

We combine information from two data sources: GEIH and ELCA.

1. **Gran Encuesta Integrada de Hogares (GEIH)**: Monthly household survey focusing on labor market outcomes.
   - Individual characteristics (gender, age, years of schooling)
   - Labor market status:
     - Formal employment: employed individuals who contribute to social security.
     - Informal employment: employed individuals who do not contribute to social security.
     - Unemployment: individuals who are not employed.
   - Durations:
     - On-going
     - In both unemployment and employment
   - Labor income:
     - Monthly wages and salaries
     - Weekly hours worked

Sources

2. **Encuesta Longitudinal Colombiana (ELCA)**: Longitudinal survey focusing on saving behavior.
   - Individual characteristics (gender, age, years of schooling)
   - Labor market outcomes similar to GEIH with the exception of durations.
   - Savings:
     - Average monthly savings.
     - Most assets in formal financial institutions such as as banks, employee funds, credit unions.
     - Most assets in informal financial institutions such as cash, informal group savings (RoSCA funds).

Estimation Sample:

- Unskilled urban men:
  - male, 25 and 55 years old, living in urban areas, at most secondary education.
- Observed in 2016:
  - most recent year for which both surveys are available
  - all monetary variables in December 2016 US Dollars

Descriptive statistics

Descriptive Statistics on Labor Market Outcomes

	Formal Employment	Informal Employment	Unemployment
	Labor Market States		
Proportion	0.395	0.527	0.077
	Wages (monthly, 100s of US$)		
Mean	3.284	2.429	–
Standard Deviation	1.395	1.126	–
	Ongoing Duration (months)		
Mean	67.535	89.507	4.034
Standard Deviation	78.689	100.191	6.858
	Sample		
Number Obs.	31,709	42,307	6,195

Descriptive statistics

Descriptive Statistics on Saving Behavior

	Formal Employment	Informal Employment	Unemployment
Proportion of Individuals who save			
At all	0.271	0.211	0.036
Mainly in formal institutions	0.493	0.185	0.333
Savings amount among savers (monthly, 100s of US$)			
Mean	0.601	0.508	0.443
Standard Deviation	0.721	0.748	0.480
Saving rate among savers (savings/labor income)			
Mean	0.133	0.151	-
Standard Deviation	0.123	0.122	-
Sample Size			
Number Obs.	517	589	83

Identification

1. Wage offers distributions: wages + distributional assumption: $\log(w)|f \sim \mathcal{N}(\mu(f), \sigma(f))$, with $f = 0, 1$.
2. Mobility parameters: durations and steady state proportions
3. Rate of returns:
   - Formal assets: $r_1 = 0.075$ (10-year Colombian Government Bond)
   - Informal assets: Eeckhout and Munshi (2010) + distributional assumption: $r_2 \sim \mathcal{N}(\mu_{r_2}, \sigma^2_{r_2})$
4. Portfolio cost functions: savings and portfolio allocations
5. Calibrated parameters:
   - $\rho = 0.120$: discount rate recommended for LAC by multilateral development banks;
   - $\theta = 0.013$: Colombia's life expectancy of 77 years.
   - $\delta = -0.5$: Relative risk aversion 1.5
   - $\tau = 0.16$: 2016 payroll contributions
   - $\nu = 1.14$: financial institutions markup from IMF *International Financial Statistics*

Method

We estimate the model's parameters using the following Method of Simulated Moments (MSM) estimator:

$$\hat{\Xi}_{N,T}(W) = \text{argmin}_{\Xi} \frac{1}{2} \left[M_N^D - M_T(\Xi) \right]' W_N \left[M_N^D - M_T(\Xi) \right]$$

where:

- Parameter set is: $\Xi \equiv \{b, \lambda^u, \psi^u, \kappa, p(1)\} \cup \{\lambda^e(f), \eta(f), \mu(f), \sigma(f), \psi^e(f)\}_{f \in \{0,1\}}$
- M_N^D denotes the set of appropriately chosen sample statistics
- $M_T(\Xi)$ denotes the corresponding simulated statistics at Ξ from sample of size T
- W is a symmetric, positive-definite weighting matrix

and we use 41 moments to estimate 15 parameters.

Results

Implied Values

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)

Estimated Parameters

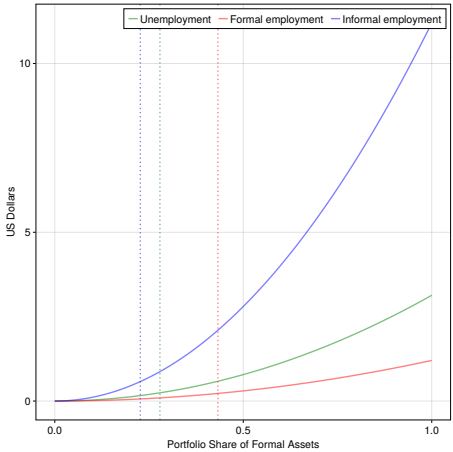
Results

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)
Unemployment income			
Flow	b	0.197	(0.0230)
Utility Value of Formal Jobs			
Value	ϵ	0.026	(0.0012)

Estimated Parameters

Financial Exclusion

Figure: Portfolio Costs ($ per month)



Experiments: Definitions

We perform the following counterfactual experiments by simulation:

1. **Financial inclusion**: Equal portfolio costs for formal and informal workers: $\psi^e(0) = \psi^e(1) = 0.024$.
2. **Drop in informal job offers**: Reduction that generates the same increase in savings obtained by the financial inclusion experiment: $p(0) = 0.486$ from the baseline 0.545.
3. **Increase in formal payroll contribution**: Back to the level before the influential 2012 tax reform: $\tau = 0.295$ from the baseline 0.160.

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

Results

	Benchmark	$\psi^e(0) = \psi^e(1)$		$p(0) = 0.486$		$\tau = 0.295$	
	Value	Value	Ratio	Value	Ratio	Value	Ratio
Savings (100s of $ per month)							
$E[s\|s > 0]$	0.189	0.195	1.030	0.195	1.030	0.170	0.900
$E[s\|s > 0, e(1)]$	0.221	0.225	1.019	0.226	1.020	0.176	0.797
$E[s\|s > 0, e(0)]$	0.172	0.177	1.030	0.172	1.004	0.170	0.990
Total Assets (100s of $ per month)							
$E[a]$	6.149	6.365	1.035	6.322	1.028	5.519	0.898
$E[a\|e(1)]$	7.362	7.412	1.007	7.573	1.029	5.768	0.783
$E[a\|e(0)]$	5.495	5.862	1.067	5.499	1.001	5.557	1.011
Formal Assets (100s of $ per month)							
$E[\phi a]$	2.241	2.705	1.207	2.305	1.028	1.921	0.857
$E[\phi a\|e(1)]$	3.264	3.223	0.987	3.283	1.006	2.404	0.736
$E[\phi a\|e(0)]$	1.598	2.461	1.540	1.566	0.980	1.704	1.066

Counterfactual Experiments - Labor Market and Financial Outcomes

Conclusion

- 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

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  1. High level of labor market informality
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- Our claim that working informally is linked to saving informally is confirmed:
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  - 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%

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- Colombia-specific policies:
  - A recent reform reducing formal payroll contribution had the potential to increase savings by 10% a month.
- 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 and portfolio allocation decisions 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)]

Appendix

Model: Value functions

The steady state value of unemployment is:

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

where ν is the markup over the savings rate that financial institutions charge and $I_{a^-}=1$ if $a<0$ (borrowing). Notice conditioning on both a and r_2.

Model: Value functions

The steady state value of employment is:

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

Model: Decisions rules

- Optimal decisions on job offers are derived by pairwise value function comparisons.
- Optimal decision rules on $\{c, \phi\}$ are derived from the first order conditions of the value functions:
  - Unemployment:

$$\begin{aligned} u'(c) &= \partial_a U(a, r_2) && \text{inter-temporal condition} \\ (r_1 - r_2)(1 + \nu I_{a^-})a &= \psi^u \phi && \text{optimal portfolio allocation} \end{aligned}$$

  - Employment:

$$\begin{aligned} u'(c) &= \partial_a W(a, r_2, w, f) && \text{inter-temporal condition} \\ (r_1 - r_2)(1 + \nu I_{a^-})a &= \psi^e(f)\phi && \text{optimal portfolio allocation} \end{aligned}$$

Note: Corner solutions at $\phi = 0, \phi = 1$ are possible.

Moments and Fit

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Moments Fit

Statistic	Data	Model	Statistic	Data	Model	Statistic	Data	Model
$e(1)$	0.395	0.394	$E[I_{s>0} \times s \vert e(1)]$	0.163	0.097	$\Pr[\phi > 0.5 \vert e(1)]$	0.493	0.434
$e(2)$	0.527	0.566	$SD[I_{s>0} \times s \vert e(1)]$	0.460	0.223	$\Pr[\phi > 0.5 \vert e(1)]$	0.493	0.434
u	0.077	0.039	$E[I_{s>0} \times s \vert e(0)]$	0.107	0.080	$\Pr[\phi > 0.5 \vert e(0)]$	0.185	0.208
$E[w(1)]$	3.284	3.759	$SD[I_{s>0} \times s \vert e(0)]$	0.400	0.183	$\Pr[\phi > 0.5 \vert u]$	0.333	0.314
$SD[w(1)]$	1.395	1.465	$E[I_{s>0} \times s \vert u]$	0.016	0.001	$\Pr[\phi > 0.5 \vert e(1), Q_1]$	0.312	0.397
$E[w(0)]$	2.429	2.854	$SD[I_{s>0} \times s \vert u]$	0.112	0.003	$\Pr[\phi > 0.5 \vert e(1), Q_2]$	0.458	0.436
$SD[w(0)]$	1.126	1.153	$E[I_{s>0} \times s \vert e(1), Q_1]$	0.061	0.029	$\Pr[\phi > 0.5 \vert e(1), Q_3]$	0.368	0.450
$P5[w(1)]$	2.289	1.790	$E[I_{s>0} \times s \vert e(1), Q_2]$	0.065	0.067	$\Pr[\phi > 0.5 \vert e(1), Q_4]$	0.623	0.454
$P5[w(0)]$	0.867	1.348	$E[I_{s>0} \times s \vert e(1), Q_3]$	0.145	0.106	$\Pr[\phi > 0.5 \vert e(0), Q_1]$	0.000	0.047
$E[t \vert e(1)]$	5.628	5.950	$E[I_{s>0} \times s \vert e(1), Q_4]$	0.393	0.187	$\Pr[\phi > 0.5 \vert e(0), Q_2]$	0.107	0.176
$SD[t \vert e(1)]$	6.557	6.316	$E[I_{s>0} \times s \vert e(0), Q_1]$	0.026	0.029	$\Pr[\phi > 0.5 \vert e(0), Q_3]$	0.194	0.257
$E[t \vert e(0)]$	7.459	7.653	$E[I_{s>0} \times s \vert e(0), Q_2]$	0.056	0.051	$\Pr[\phi > 0.5 \vert e(0), Q_4]$	0.353	0.353
$SD[t \vert e(0)]$	8.349	8.107	$E[I_{s>0} \times s \vert e(0), Q_3]$	0.096	0.087			
$E[t \vert u]$	4.034	4.954	$E[I_{s>0} \times s \vert e(0), Q_4]$	0.310	0.152			
$SD[t \vert u]$	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 individual

Implied Paramters

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Table: Implied Parameters

Definition	Parameter	Est. Value
Job offers		
Mean of wages distribution - formal employment	$E[w(1)]$	3.106
Std.Dev. of wages distribution - formal employment	$SD[w(1)]$	1.274
Mean of wages distribution - informal employment	$E[w(0)]$	2.418
Std. Dev. of wages distribution - informal employment	$SD[w(0)]$	1.030
Distribution of the rate of return for informal assets		
Mean rate of return of informal assets	$\bar{r}_2$	0.079
Std. Dev. of the rate of return of informal assets	s_{r_2}	0.031

Informal Asset

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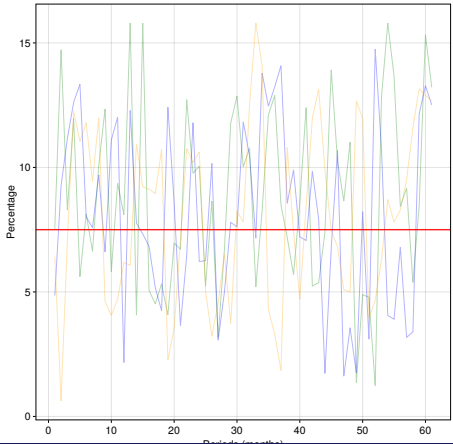
Figure: Returns of Informal Asset r_2



Results: Inequality

General Entropy Indexes	Benchmark Value	$\psi^e(0) = \psi^e(1)$ Value	Ratio	$p(0) = 0.325$ Value	Ratio	$\tau = 0.295$ Value	Ratio
Total Assets							
$GE(0)$ Mean log deviation	0.277	0.240	0.869	0.270	0.975	0.277	1.001
$GE(1)$ Theil index	0.224	0.196	0.878	0.220	0.982	0.223	0.997
$GE(2)$ Coefficient of variation/2	0.247	0.216	0.872	0.242	0.979	0.241	0.975
Formal Assets							
$GE(0)$ Mean log deviation	0.794	0.359	0.453	0.760	0.956	0.799	1.007
$GE(1)$ Theil index	0.434	0.232	0.533	0.415	0.955	0.451	1.039
$GE(2)$ Coefficient of variation/2	1.625	1.135	0.699	1.556	0.958	1.678	1.033
Consumption							
$GE(0)$ Mean log deviation	0.128	0.126	0.986	0.130	1.016	0.128	1.002
$GE(1)$ Theil index	0.110	0.107	0.971	0.111	1.007	0.109	0.990
$GE(2)$ Coefficient of variation/2	0.113	0.108	0.957	0.113	1.002	0.110	0.977

Counterfactual Experiments - Inequality

NOTE: Benchmark's values are: $\psi^e(0) = 0.224; \psi^e(1) = 0.024; p(0) = 0.545; \tau = 0.160$.