Labor Market Search, Informality, and On-The-Job Human Capital Accumulation

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Motivation

- Most labor markets in developing countries are characterized by high levels of informality. Implications:
  - *Negative*: Low contributions and loss of benefits for a large portion of the labor force.
  - *Positive*: Lower negative employment effects induced by some labor market institutions.

- If informality is an optimal reaction to a given institutional context, then it is correlated with other labor market features that impact productivity.

- There is evidence on strong correlations between firm's productivity and formality status (Busso et al., 2012). An important channel is the *Distortions of firms' investment decisions* (Paula and Scheinkman, 2011; Ulyssea, 2015).

- The literature focusing on productivity and the worker side is scarce and rarely take into account workers' investment decisions.
  - Meghir et al. (2015) takes into account workers behavior and firms' productivity but it does not allow for workerss investment decision.
  - Bobba et al. (2017) focus on human capital accumulation decisions *before* entering the labor market.

This Paper

We analyze the dynamics of human capital accumulation that take place after entering the labor market when informality is high (human capital accumulation on-the-job).

Our Approach

- Develops a model where formality status and job search decisions are updated optimally when human capital levels change (upgrades or downgrades).
- Structurally estimates the model to match the Mexican labor market data.
- Performs policy experiments.

Preview of the Results

- Human capital accumulation on-the-job explains 1/3 of the overall production.
- Human capital upgrading is slower while working informally than formally (first entrants: 2 and 6 years to upgrade). Upgrading is harder the higher the level of human capital is.
- Labor market policies that encourage informality have negative effects on human capital accumulation.

Literature

This paper is related with various streams of literature.

1. *Informality*: Albrecht et.al. (2009); Bosch and Esteban-Pretel (2012); Busso et.al. (2012); Ulyssea (2015); Meghir et.al. (2015); Bobba et.al. (2017).

2. *Human Capital*: Bagger et.al. (2014); Flinn and Mullins (2015); Flinn et.al. (2017); Bobba et.al. (2017).

3. *Structural Estimation*: Flinn and Heckman (1982); Eckstein and Wolpin (1995); Flinn (2006), Dey and Flinn (2008); Bobba et.al. (2017).

Institutional Setting

- *Informality:* Non-compliance with labor market regulations, particularly the failure to contribute to the social system – IMSS (Kanbur, 2009; Levy, 2008).

- Dual social security system in Mexico
  - Formal workers contribute 33% of their labor income: contributory benefits (housing, day care, pensions) + non-contributory benefits (health).
  - Informal workers (since early 2000s): non-contributory benefits (housing, retirement, pensions).

- There is no unemployment insurance and self-employment is viewed as a "necessity" labor market state (also as another searching state).

- There is a monetary penalty for hiring informally (20-350 daily minimum wage per worker). The imperfect enforcement of this rule makes informality an attractive device for firms to save labor costs.

Data

Data source: Mexico's official labor force survey – *Encuesta Nacional de Ocupación y Empleo (ENOE)*

- Rotative panel: Households stay in the sample for 5 consecutive quarters.
- Due sample size issues, we stack two panels together (those starting in 2013q1 and in 2014q1).
- We have quarterly data on wages and labor market states that characterize the individual trajectories (job-to-job transitions).
- Sample restrictions:
  - non-agricultural, full-time, male, private-sector workers between the ages of 25 and 55 and with secondary schooling degree.
  - Outliers: earnings distributions trimmed at the top and bottom 1% in each labor market states.
- The final sample is a balanced panel dataset comprised of 3860 individual observed for 5 quarters.

Descriptive Statistics I

Descriptive Statistics, Cross-Section

Labor Market State	Proportions	Mean Hourly Wages	SD Hourly Wages
Formal Employees	0.613	24.178	10.714
Informal Employees	0.223	18.051	7.101
Self-employed	0.123	22.394	15.449
Unemployed	0.041	.	.

NOTE: Data extracted from the first quarters of 2013 and 2014 of the Mexican labor force survey (N=3,860). Wages for employees and incomes for self-employed individuals are reported in Mexican pesos (exchange rate: 1 US dollars $\approx$ 13.5 Mex. pesos in 2014). The Formal status of the job is defined according to whether or not workers report having access to health care through their employers.

Descriptive Statistics II

Yearly Transition Rates

LMK State Q5: / Job change:	Formal Empl. (No Yes)	Informal Empl. (No Yes)	Self-empl.	Unempl.
LMK State Q1:				
Formal Employee	88.34 (78.92 9.42)	7.73 (4.10 3.63)	1.27	2.66
Informal Employee	18.63 (11.76 6.87)	68.92 (49.01 19.91)	8.73	3.73
Self-employed	5.26	20.42	72.00	2.32
Unemployed	47.80	23.27	10.69	18.24

NOTE: Stacked panel of individuals who were followed for five quarters starting in the first quarters of 2013 and 2014 of the Mexican labor force survey (N=19,300).

The Model

Environment

Environment of the Model

State	Decision	Value Function	Shocks	Flow Utility
Workers:				
Unemp.	$s=0$	$V_0(k,q)$	$\lambda_0, \gamma_{0,k}$	$\xi + \beta_0 B_0$
Self-emp.	$s=1$	$V_1(,k,q)$	$\lambda_1, \gamma_{1,k}$	$q + \beta_0 B_0$
Informal Emp.	Y/N	$E_0(x;k,q)$	$\eta_0, \tau_{0,k}$	$w_0(x;k,q) + \beta_0 B_0$
Formal Emp.	Y/N	$E_1(x;k,q)$	$\eta_1, \tau_{1,k}$	$w_1(x;k,q) + \beta_1 \phi t w_1(x;k,q) + b_1$
Firms:				
Informal Job	$f=0$	$F_0(x;k,q)$	η_0	$a_k x - w_0(x;k,q) - c a_k x$
Formal Job	$f=1$	$F_1(x;k,q)$	η_1	$a_k x - (1+t) w_1(x;k,q)$

Heterogeneity: $q \sim R(q)$, $x \sim G(x)$, and $1 = a_1 < ... < a_K < \infty$.

▸ Details of the Model

The Model

Value Functions

- The flow value of the searching state in recursive form is:

$$\begin{aligned}\tilde{\rho}V_s(k,q) &= (1-s)\xi + sq + \beta_0 B_0 \\ &+ \lambda_s \int_x \max\{(1-f)E_0(x;k,q) + fE_1(x;k,q) - V_s(k,q), 0\} dG(x) \\ &+ \gamma_{s,k} \max\{V_0(k-1,q) - V_s(k,q), V_1(k-1,q) - V_s(k,q)\}\end{aligned}$$

- The flow value of the employee state in recursive form is:

$$\begin{aligned}\tilde{\rho}E_f(x;k,q) &= w_f(x;k,q) + (1-f)\beta_0 B_0 + f[\beta_1 \phi t w_1(x;k,q) + b_1] \\ &+ \tau_{f,k}(\max\{(1-f)E_0(x;k+1,q) + fE_1(x;k+1,q), V_s(k+1,q)\} - E_f(x;k,q)) \\ &+ \eta_f[V_s(k,q) - E_f(x;k,q)]\end{aligned}$$

- The flow value of a filled job in recursive form is:

$$\begin{aligned}\tilde{\rho}F_f(x;k,q) &= (1-f)\pi_0(x;k,q) - f\pi_1(x;k,q) - \eta_f F_f(x;k,q) \\ &+ \tau_{f,k}(\max\{F_0(x;k+1,q), F_1(x;k+1,q), 0\} - F_f(x;k,q))\end{aligned}$$

▸ Equilibrium Details

Identification

- The model is characterized by: $\{\rho, \delta, \tau_{f,k}, \gamma_{s,k}, \lambda_s, \eta_f, \xi, \alpha\}$; $\{G(x), R(q)\}$; $\{a_k\}_{k=1}^K$; $\{\beta_0, B_0, \phi, t, \beta_1, b_1, c\}$

- Flinn and Heckman (1982): labor market parameters $\{\lambda_s, \eta_f, \xi\}$ and distributions $G(x)$ and $R(q)$.
  - Dynamics in the labor market + steady state conditions.
  - Recoverability condition: $G(x)$ and $R(q)$ are assumed Lognormal.

- Flinn et.al. (2017): Human capital dynamics $(\tau_{f,k}, \gamma_{s,k})$.
  - Wages growth within jobs, transitions between labor market states and changes in formality status within jobs.

$$\tau_{f,k} \equiv \begin{cases} \tau_{f,1} a_k^{\tau_{f,2}} & \text{if } 1 \leq k < K \\ 0 & \text{if } k = K \end{cases}$$

  - Limited information on searching process: (1) durations and transitions over the searching states and (2) wages before and after the searching state.

$$\gamma_{s,k} \equiv \begin{cases} \gamma_s & \text{if } 1 < k \leq K \\ 0 & \text{if } k = 1 \end{cases}$$

- Bobba et.al (2017): Informality parameters (c).
  - Overlapping between formal and informal wages distributions.

Estimation Method

- We estimate the parameters of the model using the Method of Simulated Moments (MSM).

$$\hat{\Theta} = \underset{\Theta}{\text{argmin}} \left[M_R(\Theta) - m_N\right]' W^{-1} \left[M_R(\Theta) - m_N\right],$$

where:

$$\Theta = \left\{\tau_{f,1},,\tau_{f,2},\gamma_{s,1},\gamma_{s,2},\lambda_s,\eta_f,\xi,\mu_x,\sigma_x,\mu_q,\sigma_q,c\right\}, \quad f=(0,1), s=(0,1)$$

- *62 moments m_N:* Labor market states, wages distributions (mean, variance and quintiles), overlapping of wages distributions, yearly transitions matrices, yearly wage growth within jobs (mean and quintiles), wage growth with a searching state in between.

- Given the size of the state space in the model we set a grid of 10 point between 1 and 3 for a_k.

- *Weighting Matrix W*: Matrix with a diagonal comprised by the bootstrapped variances of each moment.

- Fixed parameters: $\{\alpha, \beta_0, \beta_1, B_0, \phi, t, \rho, \delta\}$. ▸ Detailed Sources

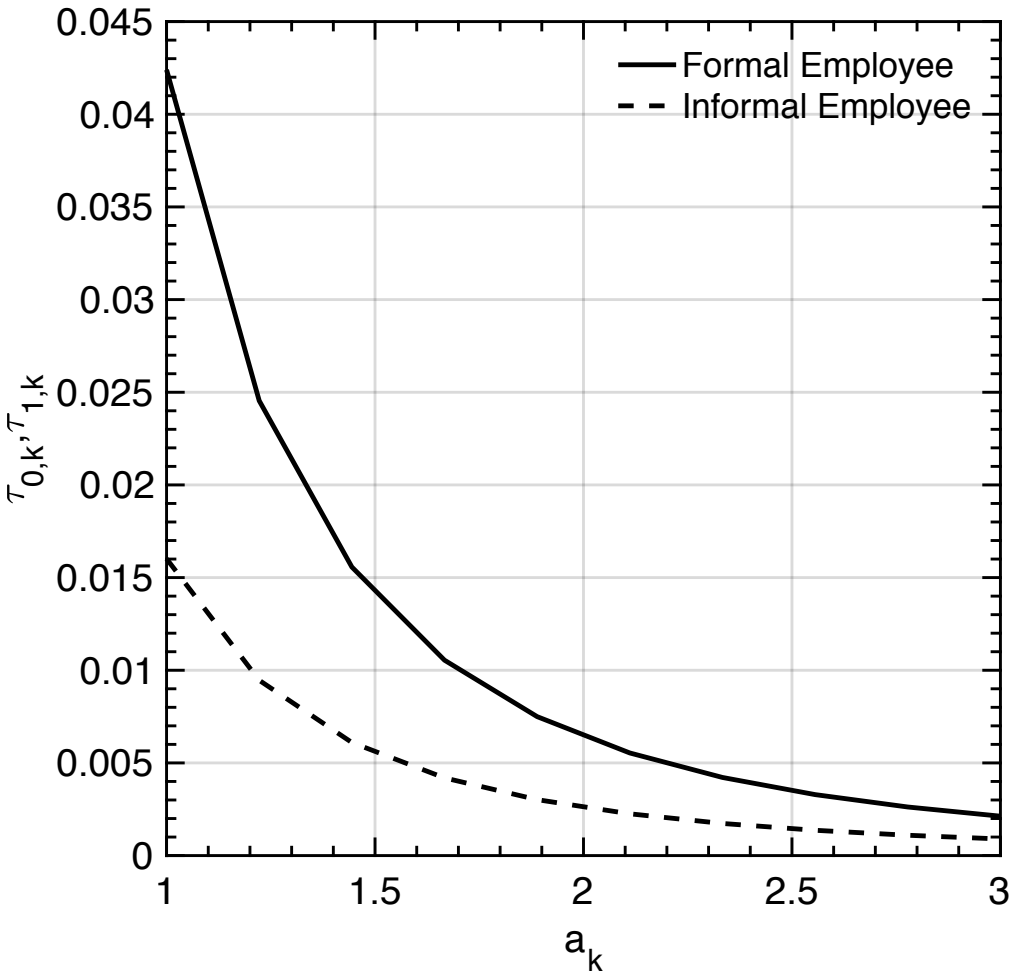
Results

Estimates of the Model Parameters

	Coefficient	Standard Error
$\lambda_{\{s=0\}}$	0.2995	0.01490
$\lambda_{\{s=1\}}$	0.0435	0.00098
$\eta_{\{f=0\}}$	0.0152	0.00017
$\eta_{\{f=1\}}$	0.0132	0.00006
$\gamma_{\{s=0\}}$	0.2027	0.00311
$\gamma_{\{s=1\}}$	0.0735	0.00294
$\tau_{\{f=0\},1}$	0.0160	0.00070
$\tau_{\{f=0\},2}$	-2.6241	0.02095
$\tau_{\{f=1\},1}$	0.0424	0.00229
$\tau_{\{f=1\},2}$	-2.7243	0.02391
c	0.1013	0.00113
ξ	-7.2292	0.10100
Predicted Values		
$E(x)$	15.59	
$SD(x)$	24.62	
$E(q)$	8.12	
$SD(q)$	5.69	
Number of Individuals	3860	

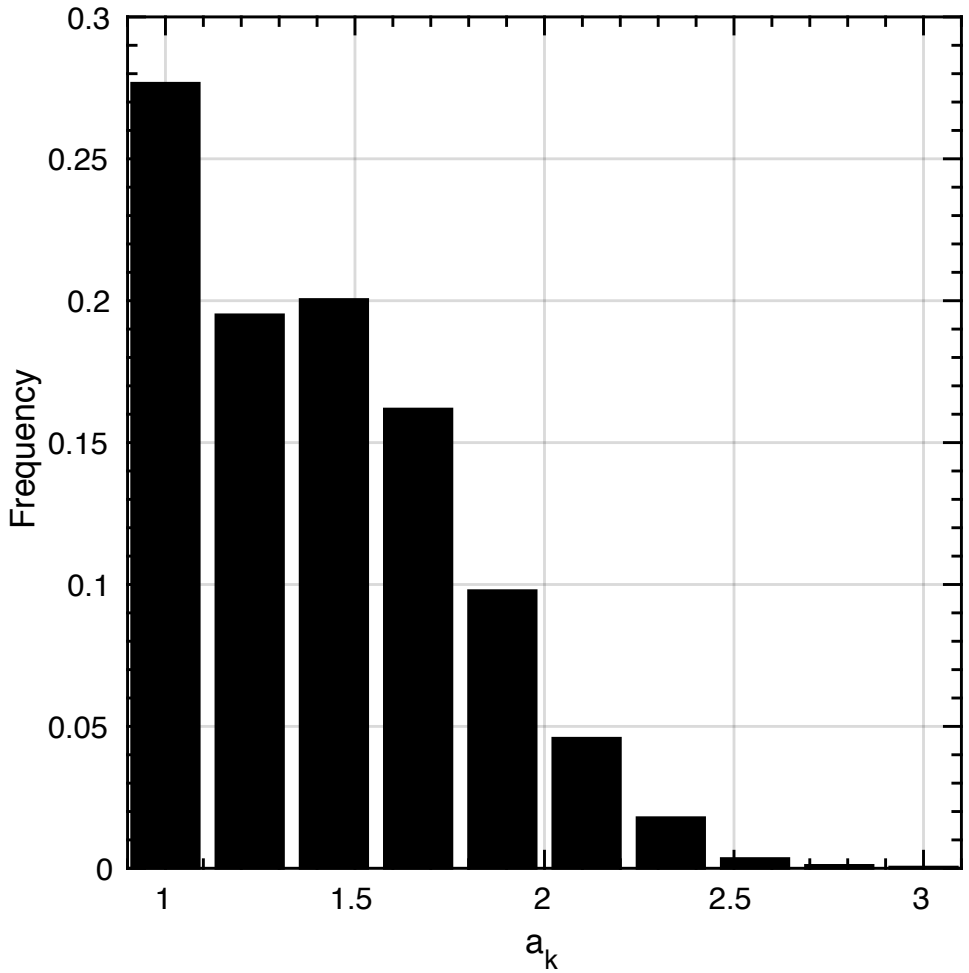
Results

Figure: Distribution of Arrival Rates of Human Capital Upgrading Shocks



Results

Figure: Distribution of On-The-Job Human Capital



Results

Output per Workers by Employment Status

	Proportion Over All Employees	Average Value of Production	Contribution of Human Capital
All Employees	1.0000	42.2084	0.3393
By Formality Status			
Formal Employees	0.7099	52.1555	0.3429
Informal Employees	0.2901	17.8710	0.3137
By Human Capital Level			
a_1	0.1391	24.6769	0.0000
a_2	0.2237	33.5628	0.1818
a_3	0.2359	39.5116	0.3077
a_4	0.1966	47.9012	0.4000
a_5	0.1204	56.6714	0.4706
a_6	0.0573	65.6566	0.5263
a_7	0.0217	70.5683	0.5714
a_8	0.0041	78.0250	0.6087
a_9	0.0010	51.1451	0.6400
a_{10}	0.0003	171.7176	0.6667

NOTE: Simulated samples of 5,000 worker-level observations for each quarter based on the estimated parameters.

Policy Experiments

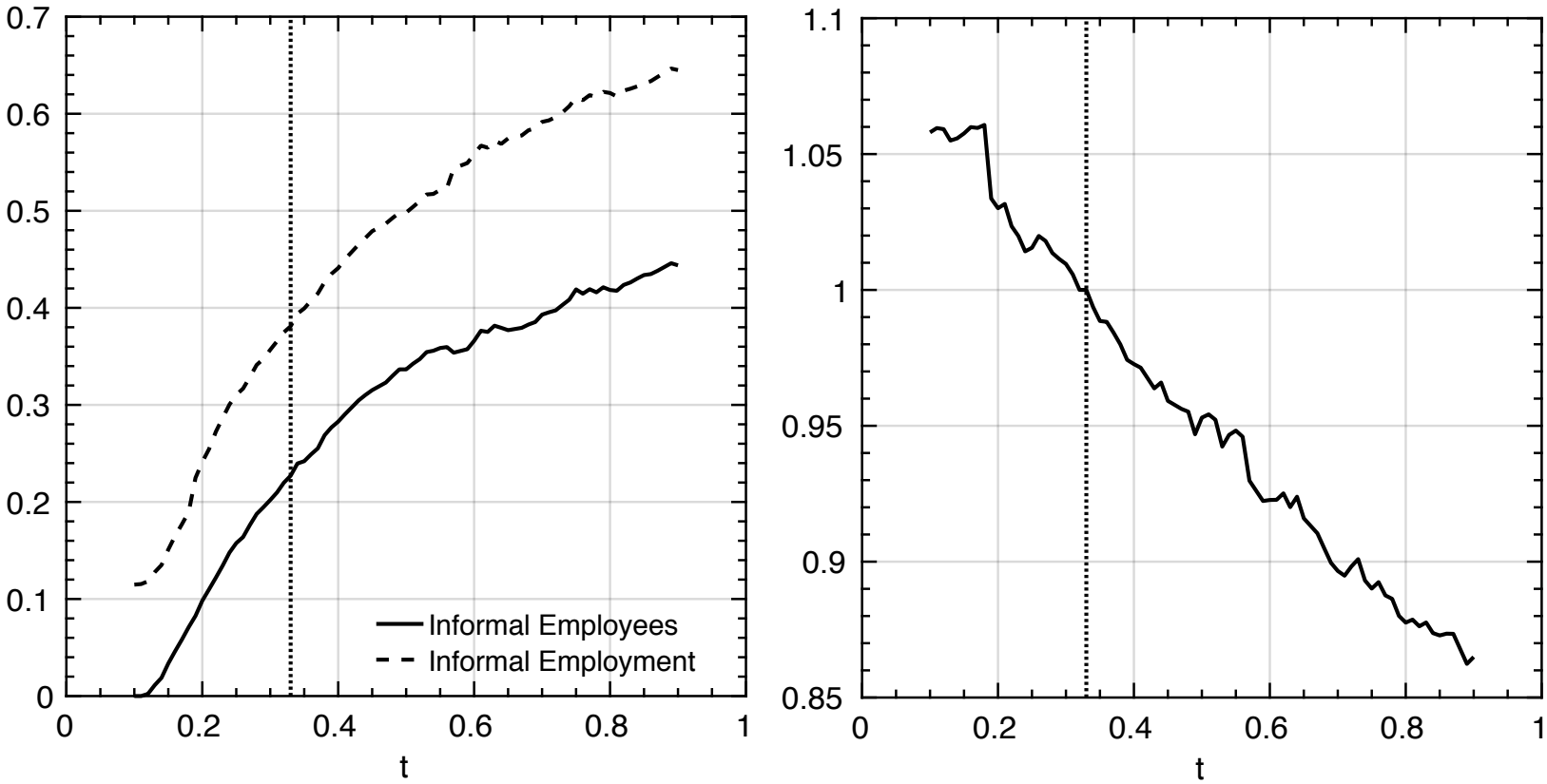
- Our model incorporates the *dual social security system*: contributory benefits and non-contributory benefits.

- We focus on changes in two policy parameters:
  - The payroll contribution rate in formal jobs $t \in [0.1, 0.9]$
  - The per-capita level of the non-contributory social benefits $B_0 \in [0, 8]$ pesos per hour.

- These two parameters are considered crucial in generating the high level of informality since they directly affect the differential benefits and cost of working formally.

Policy Experiment 1: Contribution Rate

Figure: Impacts of Policy 1: Changes in the Contribution Rate t



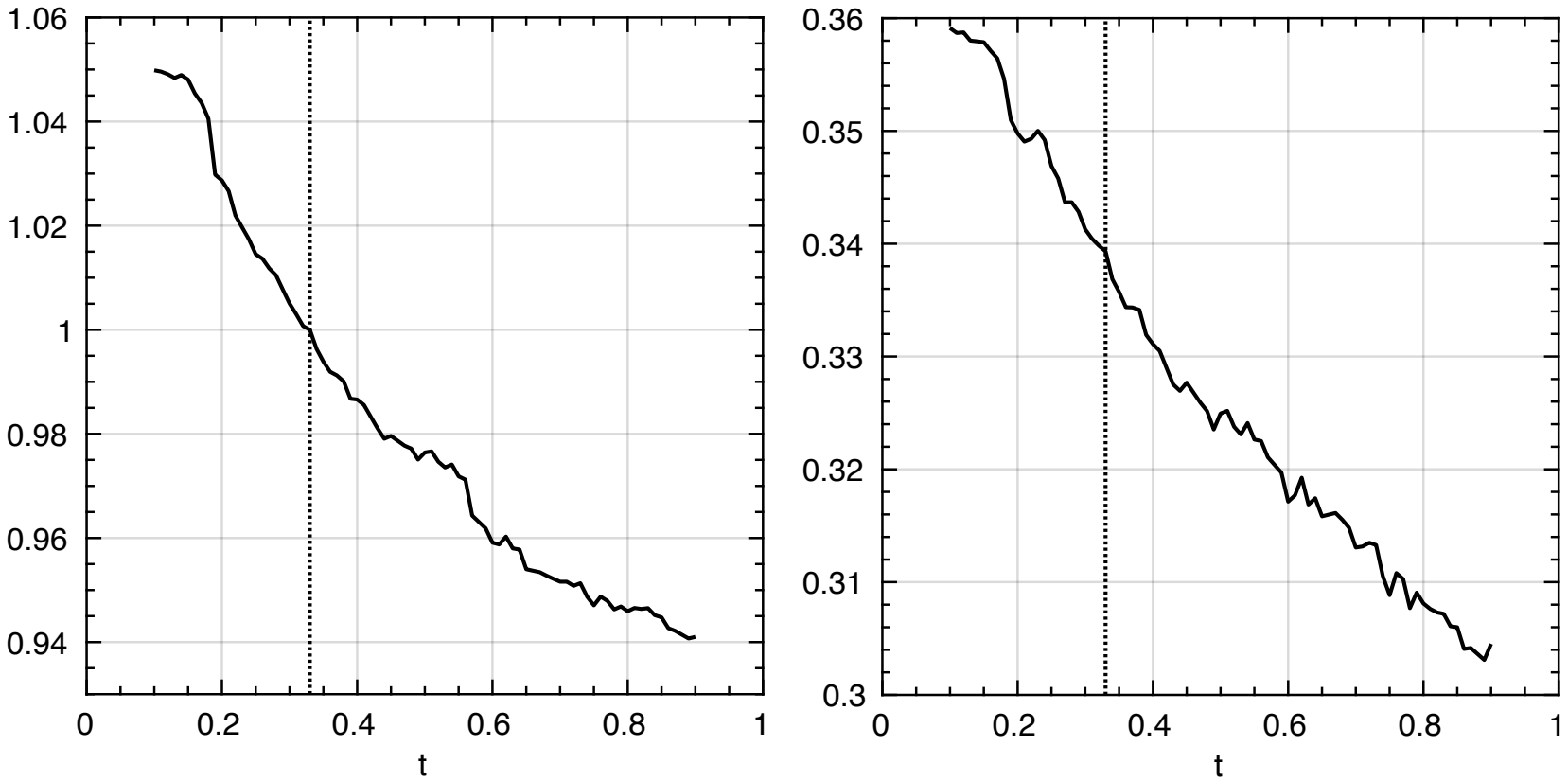
(a) Informality Rates

(b) Value of Production (Benchmark = 1)

NOTE: Vertical lines are set at the institutional values for the Mexican labor market (2013-2014)

Policy Experiment 1: Contribution Rate

Figure: Impacts of Policy 1: Changes in the Contribution Rate t (cont...)



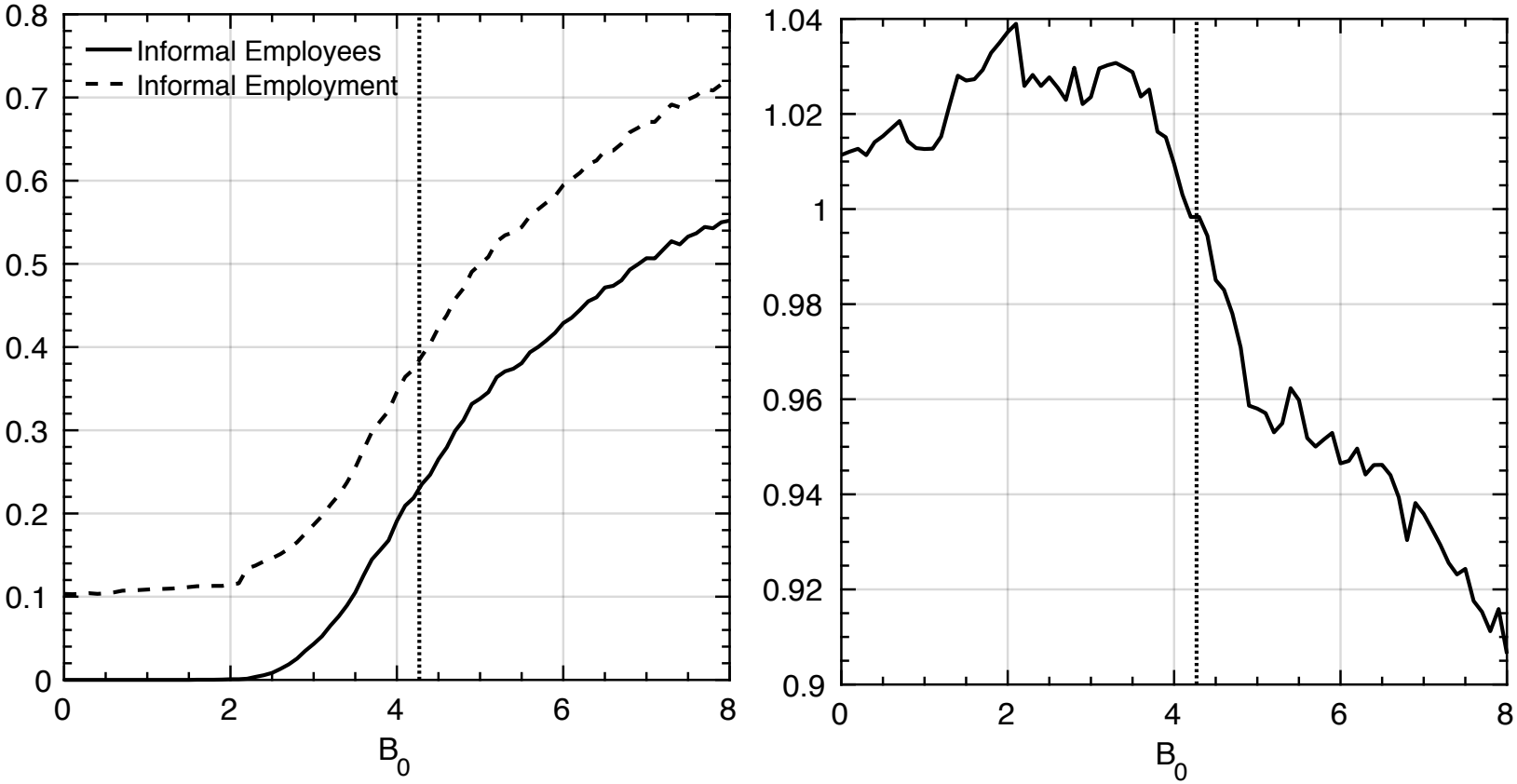
(a) Aggregate Human Capital (Benchmark = 1)

(b) Contribution of HC to Production

NOTE: Vertical lines are set at the institutional values for the Mexican labor market (2013-2014)

Policy Experiment 2: Non-contributory Benefit

Figure: Impacts of Policy 2: Changes in the Non-Contributory Benefit B_0



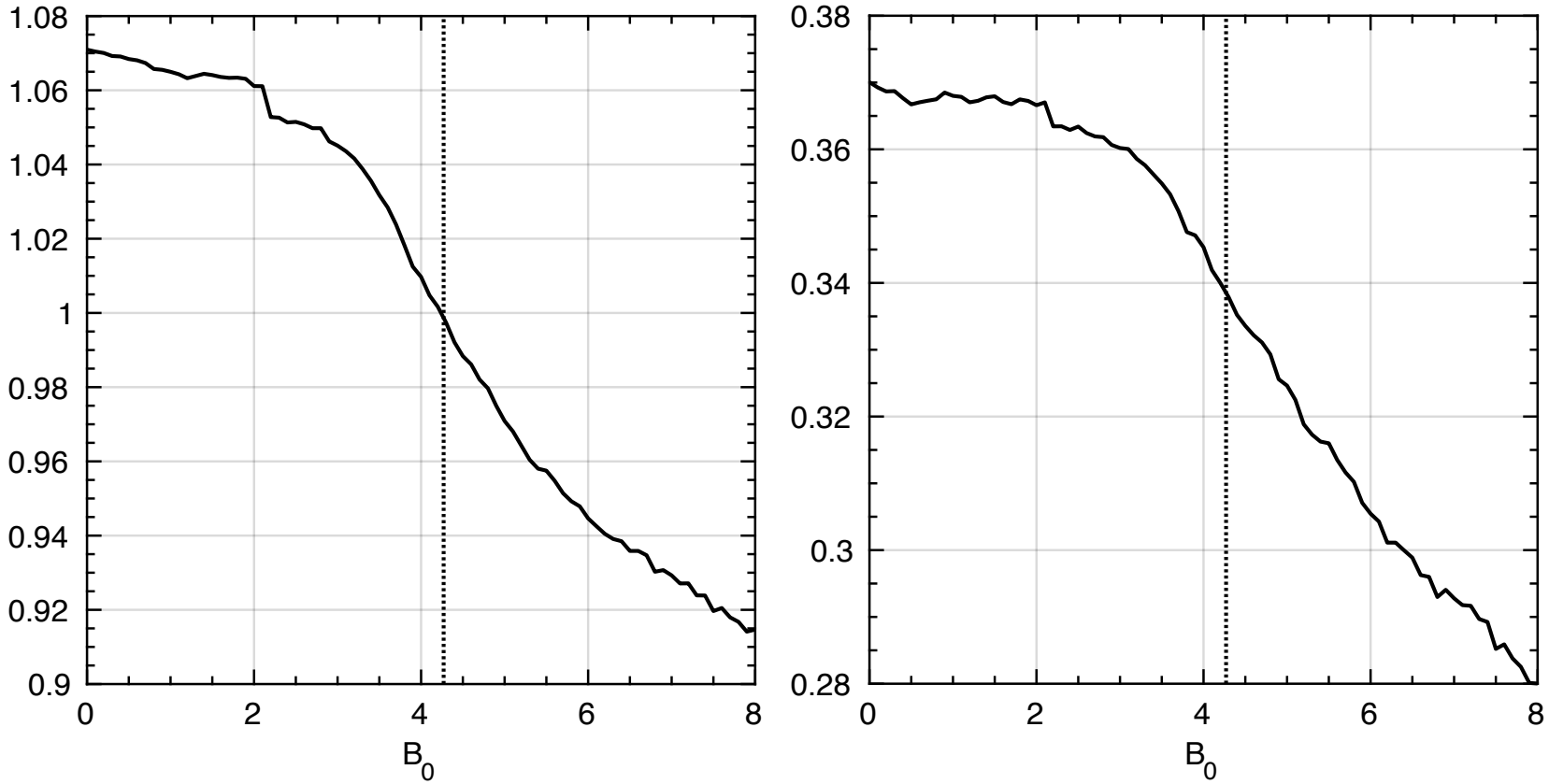
(a) Informality Rates

(b) Value of Production (Benchmark = 1)

NOTE: Vertical lines are set at the institutional values for the Mexican labor market (2013-2014)

Policy Experiment 2: Non-contributory Benefit

Figure: Impacts of Policy 2: Changes in the Non-Contributory Benefit B_0 (cont...)



(a) Aggregate Human Capital (Benchmark = 1) (b) Contribution of HC to Production

NOTE: Vertical lines are set at the institutional values for the Mexican labor market (2013-2014)

Concluding Remarks

- We study how human capital accumulation in formal and informal jobs may impact labor market outcomes.
- We develop a search and matching model with endogenous formality and searching status that interact with the human capital dynamic on the job.
- We propose and implement an identification strategy for the structural parameters of the model using standard and representative labor market data for Mexico.
- The estimation results show that:
  - Human capital on the job accumulates at a lower rate when working informally.
  - The contribution of the accumulated human capital is about a third of the overall production.
- We perform policy experiments changing two crucial parameters of the social security system.
  - Higher payroll taxes reduce productivity by imposing a tax on more productive matches and also by reducing human capital upgrading on the job.
  - Higher contributions incentivize informality and reduces overall production by reducing human capital accumulation and generating lower productivity matches.

Thank you!!

The Model

Environment

- Time is continuous and the environment is stationary. Agents discount the future at rate ρ and die at Poisson rate δ.
- Four labor market states: unemployment, self-employment, informal employment and formal employment.
- Only unemployed and self-employed individuals search for a job. Endogenous searching status: $s \in \{0, 1\}$, with 1 indicating self-employment.
- Labor income as self-employed is $q \sim R(q)$. The flow utility while searching as unemployed is ξ.
- Agents meet employers at the Poisson rate λ_s and a match-specific productivity $x \sim G(x)$ is realized upon a meeting.
- Endogenous formality status: $f \in \{0, 1\}$, with 1 indicating a formal labor contract.
- Wages are bargained bilaterally and matches are terminated at the Poisson rate η_f

The Model

Environment

- The human capital distribution is discrete $1 = a_1 < ... < a_K < \infty$ and the total productivity of a match is $y(x, k) = a_k x$
- While working as employee, a worker receives human capital upgrading shocks at the Poisson rate $\tau_{f,k}$.
- A searcher receives human capital downgrading shocks at the Poisson rate $\gamma_{s,k}$
- Individuals are risk neutral. Given the social security system the flow utilities are:

$$\begin{aligned} \xi &+ \beta_0 B_0 \\ q &+ \beta_0 B_0 \\ w_0(x; k, q) &+ \beta_0 B_0 \\ w_1(x; k, q) &+ \beta_1 \phi t w_1(x; k, q) + b_1 \end{aligned}$$

- Firms post vacancies at no cost and receive a flow profit:

$$\begin{aligned} \pi_1(x; k, q) &= y(x, k) - (1 + t) w_1(x; k, q) \\ \pi_0(x; k, q) &= y(x, k) - w_0(x; k, q) - c y(x, k) \end{aligned}$$

Return

The Model

Wages and Equilibrium

- Wages are set by bargaining. We use the axiomatic Nash-bargaining solution:

$$w_f(x;k,q) \quad = \quad \arg\max_w \left[E_f(x;k,q) - V_s(k,q)\right]^{\alpha} \left[F_f(x;k,q)\right]^{(1-\alpha)}$$

- Formality status is decided by the firms:

$$f \equiv f(x;k,q) = \begin{cases} 1 & \text{if } F_1(x;k,q) \geq F_0(x;k,q) \\ 0 & \text{otherwise} \end{cases} \rightarrow \tilde{x}(k,q) : F_1(\tilde{x};k,q) = F_0(\tilde{x};k,q)$$

- Individual decide to search as unemployed or self-employed solving:

$$\max_s \{V_0(k,q), V_1(k,q)\} \rightarrow q^*(k) : V_0(k,q^*(k)) = V_1(k,q^*(k))$$

- Acceptable matches for workers and firms:

$$x_f^*(k,q) : F_f(x_f^*;k,q) = 0 \quad \Longleftrightarrow \quad E_f(x_f^*;k,q) = V_s(k,q)$$

▸ Return

The Model

Estimation Method

Fixed Parameters

Parameter	Value	Source
α	0.5000	Symmetric Bargaining case (Binmore et.al., 2006)
β_0	0.9082	Bobba et.al. (2017)
β_1	0.6705	Bobba et.al. (2017)
B_0	4.2700	Updated from Bobba et.al. (2017)
ϕ	0.5500	Levy (2008)
t	0.3300	Anton et.al. (2012)
b_1	4.5470	Based on average observed wages
ρ	0.0500	Previous literature (Eckstein and van den Berg, 2007)
δ	0.0013	Based on average life of 65 years

▸ Return