Flexible Hours as a Motive for Entrepreneurship

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Motivation

- Literature mostly explains entrepreneurship via:
  - productivity (Lucas (1978))
  - productivity and wealth (Buera and Shin (2013))
- Issues in replicating income patterns of entrepreneurs
  - They earn less than comparable workers (Hamilton (2000)).
- No focus on entrepreneurs' hours, no comparison with workers
  - Different patterns in hours can be important in the occupational choice.
- Research questions:
  - What is missing in the models of entrepreneurship?
  - Why is it relevant?

What is missing in the models of entrepreneurship?

Definition: Flexibility in hours is the ability to choose the desired hours without sacrificing hourly income at a given occupation.

Hypothesis: Many people become entrepreneurs because they can work flexible hours.

- Hurst and Pugsley (2011) document that flexible hours is a major reason for starting a business.
- Data on hours is in line with this evidence.
  - Studies show the inflexibility for workers.
    (Dickens and Lundberg (1993); Aaronson and French (2004))
  - Patterns are different between workers and entrepreneurs.

Patterns of hours

Entrepreneurs' hours are more disperse.

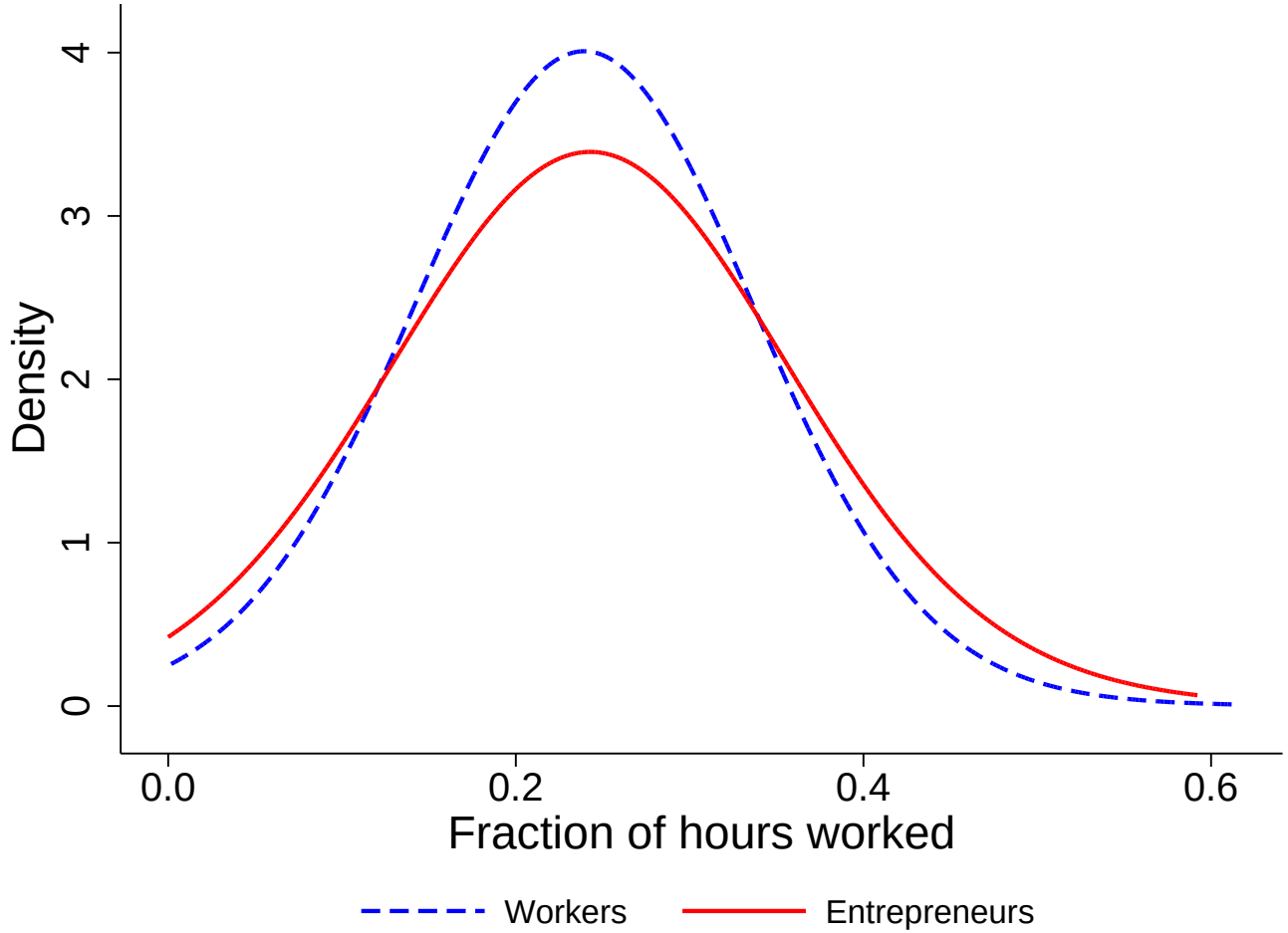

Figure: **Distribution of hours worked**

Patterns of hours

Entrepreneurs' hours move more.

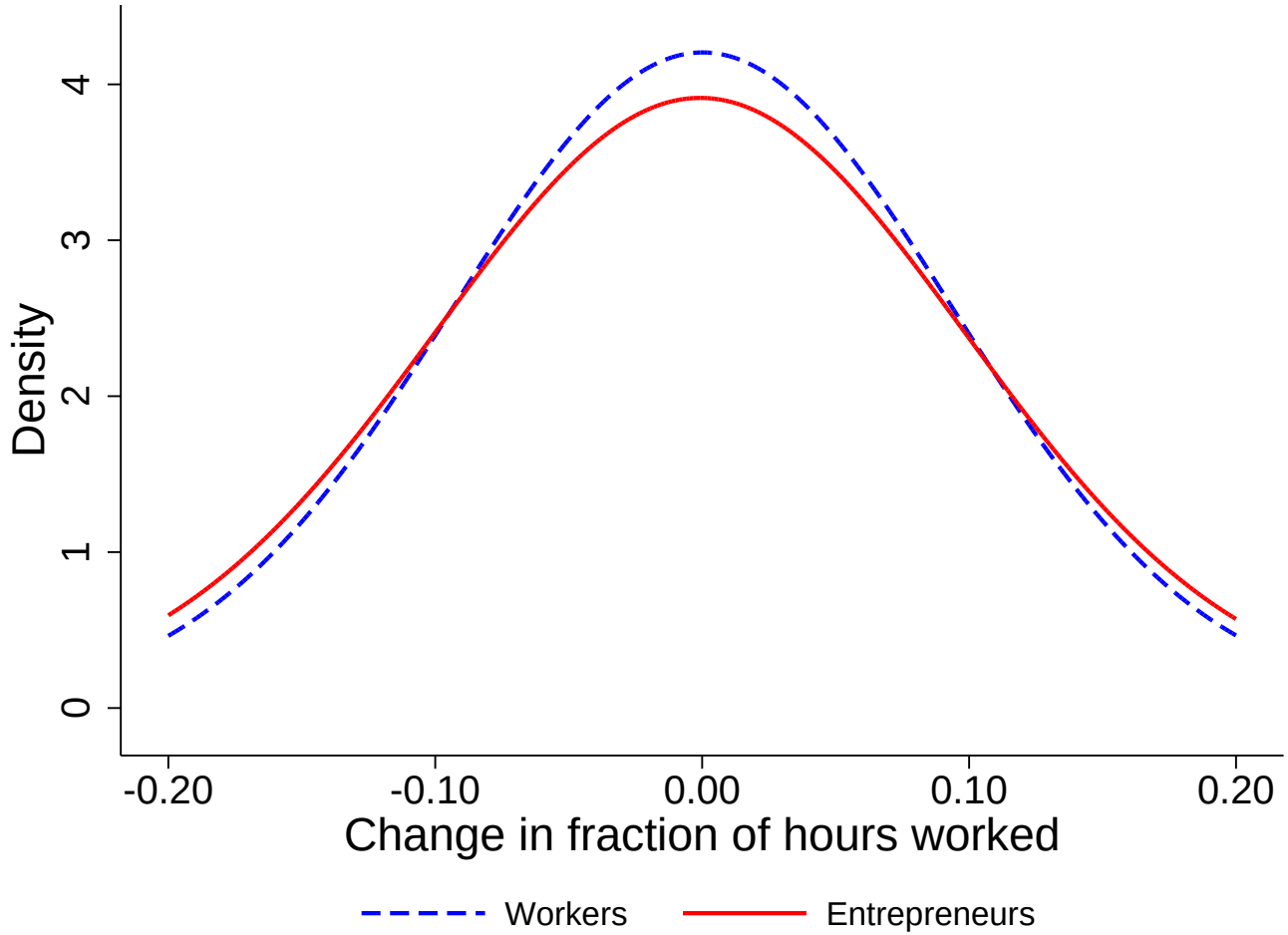

Figure: **Distribution of changes in hours worked**

In this paper

- I build a model with two main features:
  (1) volatile value of leisure
  $\rightarrow$ preference for flexibility
  (2) complementarities across workers' hours
  $\rightarrow$ hours' tied to each other, inflexibility
- This helps generate patterns observed in the data:
  - (1) is crucial for matching volatility and persistence in hours
    ... productivity shocks are not enough.
  - (2) is important to keep volatility in hours of workers low.
  - (1)+(2) give preference for entrepreneurship, low income for entrepreneurs.

Why is capturing the flexible hours motive relevant?

- Having a better model of entrepreneurship is key for
  - understanding the allocation of talents into occupations
  - studying the aggregate productivity.
- Relevance for policy implications: restrictions on hours
  (Japan in 1988, France in 2000, Chile in 2005)
  - negative effects due to the need for flexibility
  - additional channel due to complementarities

Model

Overview

- Firms:
  - Entrepreneurial and non-entrepreneurial firms
  - All firms use capital and labor
  - All firms aggregate hours of workers using:
    - Technology 1: Perfect substitutability
    - Technology 2: Complementarity
  - Factor markets are competitive, all firms face the same prices.
  - Entrepreneurial firms:
    - factor productivity depends on owner's (i) hours, (ii) ability
    - limited span-of-control
  - Non-entrepreneurial firms:
    - constant productivity
    - constant returns to scale
- Consumers:
  - Occupational choice: work for technology 1, technology 2 or be an entrepreneur.
  - Also choose labor supply and consumption.

Model

Firms

A firm m operates with:

$$Y_m = Z_m(K_m^{\alpha} L_m^{1-\alpha})^{\tilde{\eta}_m}$$

Effective labor of a firm is:

$$L_m = \underbrace{\left(\int_0^{\infty} y L_{m1}(y) dy \right)^{\kappa}}_{\text{Technology 1}} \underbrace{\left(\int_0^{\infty} y L_{m2}(y) dy \right)^{1-\kappa}}_{\text{Technology 2}}$$

Model

Firms

$$L_m = \left(\underbrace{\int_0^\infty y L_{m1}(y)dy}_{\text{Technology 1}} \right)^{\kappa} \left(\underbrace{\int_0^\infty y L_{m2}(y)dy}_{\text{Technology 2}} \right)^{1-\kappa}$$

Technologies differ in complementarity:

$$L_{m1}(y) = \int_0^1 \underbrace{x_{m1}(l,y)}_{\substack{\text{Measure with} \\ (l,y) \text{ in } m1}} l dl$$

$$L_{m2}(y) = \left(\int_0^1 x_{m2}(l,y) l^{\rho} dl \right)^{\frac{1}{\rho}} \left(\int_0^1 x_{m2}(l,y) dl \right)^{1-\frac{1}{\rho}}$$

Remark

Technology 2

Contribution of a worker with hours l and skill y:

$$\frac{dL_{m2}(y)}{dx_{m2}(l,y)} = E_{x_{m2,y}}(l^\rho)^{\frac{1}{\rho}} \left(\frac{1}{\rho} \frac{l^\rho}{E_{x_{m2,y}}(l^\rho)} + 1 - \frac{1}{\rho} \right)$$

Contribution per hour is maximized at:

$$l_m^*(y) \equiv E_{x_{m2,y}}(l^\rho)^{\frac{1}{\rho}}$$

Model

Firms

Reminder:

$$Y_m = Z_m(K_m^{\alpha} L_m^{1-\alpha})^{\tilde{\eta}_m}$$

- There are two types firms (Cagetti and De Nardi (2006)):
  - Entrepreneurial $Z_n = A_n h_n^{\omega}, \tilde{\eta}_n = \eta < 1$
  - Non-entrepreneurial: $Z_b = B, \tilde{\eta}_b = 1$
- Factor prices for all firms are: r, $w_1(l, y)$ and $w_2(l, y)$.

Model

Consumers

A continuum of consumers with preferences given by:

$$\sum_{t=0}^{\infty} \beta^t [\frac{c_{it}^{1-\gamma}}{1-\gamma} - v_{it} \frac{l_{it}^{1+\phi}}{1+\phi}]$$

Two types:

- Stable (S):

$$v_{it} = v_0$$

- Unstable (U):

$$logv_{it} = (1-\pi_v) logv_0 + \pi_v logv_{it-1} + \xi_{it}, \qquad \xi_{it} \sim N(0, \sigma_v)$$

Model

Consumers

- An individual can be either
  - a worker for technology 1
  - a worker for technology 2
  - an entrepreneur.
- Switch between occupations:
  - Individuals can become workers at any technology, anytime.
  - Becoming an entrepreneur requires the opportunity, which arrives at rate s.

Model

Consumers

- Entrepreneurial productivity follows:

$$\log A_{it} = (1-\pi_A) logA_0 + \pi_A logA_{it-1} + \zeta_{it}, \qquad \zeta_{it} \sim N(0, \sigma_A)$$

- Worker productivity follows:

$$\log y_{it} = \pi_y \log y_{it-1} + \epsilon_{it}, \qquad \epsilon_{it} \sim N(0, \sigma_y)$$

where ξ_{it}, ν_{it} and ϵ_{it} are independent from each other.

- Remark: ζ_{it} and ϵ_{it} serve as "demand shocks" in hours.
  ξ_{it} is a "supply shock".

Value functions

Equilibrium

A stationary equilibrium of this economy is an allocation K_b, $x_{bj}(l, y)$, $K_n(a, A, y, v)$, $x_{nj}(l, y; a, A, y, v)$, $c_i(a, A, y, v)$, $a_i(a, A, y, v)$, $l_i(a, A, y, v)$ for $i \in \{N, O\}$, $S(a, A, y, v)$, $Q(a, A, y, v)$, prices r, $w_j(l, y)$ for $j \in \{1, 2\}$, and time-invariant distribution $\varphi(a, A, v, J)$ over wealth (a), entrepreneurial productivity (A), worker skill (y), value of leisure (v) and occupation (J) such that:

- Policy functions solve the problems of consumers.
- K_b and x_{bj} for $j \in \{1, 2\}$ solve the problem of the non-entrepreneurial sector.
- Asset markets clear. Total capital used by the non-entrepreneurial sector and the entrepreneurial sector is equal to total wealth in the economy.
- Labor markets clear. Total measure of workers demanded by entrepreneurial and non-entrepreneurial firms for each level of labor productivity y and each level of working hours $l \in [0, 1]$ in each technology $j \in \{1, 2\}$ is equal to the corresponding labor supply.

Wages in equilibrium

- Wages in technology 1 do not depend on a worker's hours:

$$w_1(l, y) = \tilde{w}_1(y) \equiv \kappa(1-\alpha)\left(\frac{\alpha}{r+\delta}\right)^{-\frac{\alpha}{1-\alpha}} y \left(\frac{\bar{\bar{L}}_1}{\bar{L}}\right)^{-1}$$

- Wages in technology 2 do:

$$\begin{aligned} w_2(l, y) &= (1-\kappa)(1-\alpha)\left(\frac{\alpha}{r+\delta}\right)^{-\frac{\alpha}{1-\alpha}} y \left(\frac{\bar{\bar{L}}_2}{\bar{L}}\right)^{-1} E_{\bar{x}_2, y}(l^\rho)^{\frac{1}{\rho}} \\ &\quad \times \left[\frac{1}{\rho}\frac{l^{\rho-1}}{E_{\bar{x}_2, y}(l^\rho)} + (1-\frac{1}{\rho})l^{-1}\right] \end{aligned}$$

For given y, $w_2(l, y)$ is maximized at:

$$l^*(y) = E_{\bar{x}_2, y}(l^\rho)^{\frac{1}{\rho}}.$$

Notation

Data

- I use SIPP panels 1998, 2001, 2004 and 2008.
- Each panel has $9 - 12$ waves repeated every 4 months.
- Exclude:
  - unemployed
  - owners of big businesses (+100) Sample comparison
- Use residual hourly income and hours:
  - control for potential experience, marital status, sex, race, disability, retirement, education and year dummies
  - adjust the residuals to have the (i) minimum equal to 0 (ii) mean equal to the unconditional mean.

Parameters

Parameter	Value	Basis
η	0.504	SIPP Getting η
ρ	-10	High complementarity
λ	0.6	ISSP
ϕ	2	Inverse of labor supply elasticity
α	0.330	Cagetti and De Nardi (2006)
δ	0.020	''
β	0.983	''
γ	1.5	''
B	1	''
π_y	0.983	''

Table: **Parameters from data and literature**

Parameters

Parameter	Value	Moment
A_0	2.461	Fraction of entr
π_A	0.718	Autocorr of log-inc (entr)
σ_A	0.147	Sd of log-inc (entr)
σ_y	0.037	Sd of log-inc (worker)
v_0	96	Hours (worker, mean)
π_v	0.605	Autocorr of log-hours (entr)
σ_v	0.556	Sd of log-hours (worker)
κ	0.103	Sd of log-hours (worker)
ω	0.517	Hours (entr, mean)
s	0.016	Population switching to worker

Table: **Calibrated parameters**

Results

Moment	Data	Model
Fraction of entr	0.088	0.088
Hours (entr, mean)	0.244	0.244
Hours (worker, mean)	0.239	0.239
Sd of log-inc (entr)	0.636	0.635
Sd of log-inc (worker)	0.327	0.327
Sd of log-hours (entr)	0.395	0.396
Sd of log-hours (worker)	0.229	0.229
Autocorr of log-inc (entr)	0.743	0.740
Autocorr of log-hours (entr)	0.690	0.693
Population switching to worker	0.005	0.005

Table: **Targeted moments in the data and the model**

Results

Moment	Data	Model
Ratio of mean income (entr/worker)	0.936	0.912
Ratio of median income (entr/worker)	0.861	0.718
Ratio of mean hourly income (entr/worker)	0.950	0.840
Autocorr of log-inc (worker)	0.807	0.723
Autocorr of log-hours (worker)	0.655	0.612
Population switching to entr	0.004	0.005
Earning more than median worker (entr)	0.364	0.381
Earning more than median worker (entr, hourly)	0.298	0.238
Absolute change in hours (entr)	0.036	0.044
Absolute change in hours (entr, res)	0.036	0.042
Absolute change in hours (worker)	0.018	0.015
Absolute change in hours (worker, res)	0.018	0.015

Table: **Other moments in the data and the model**

Patterns of hours

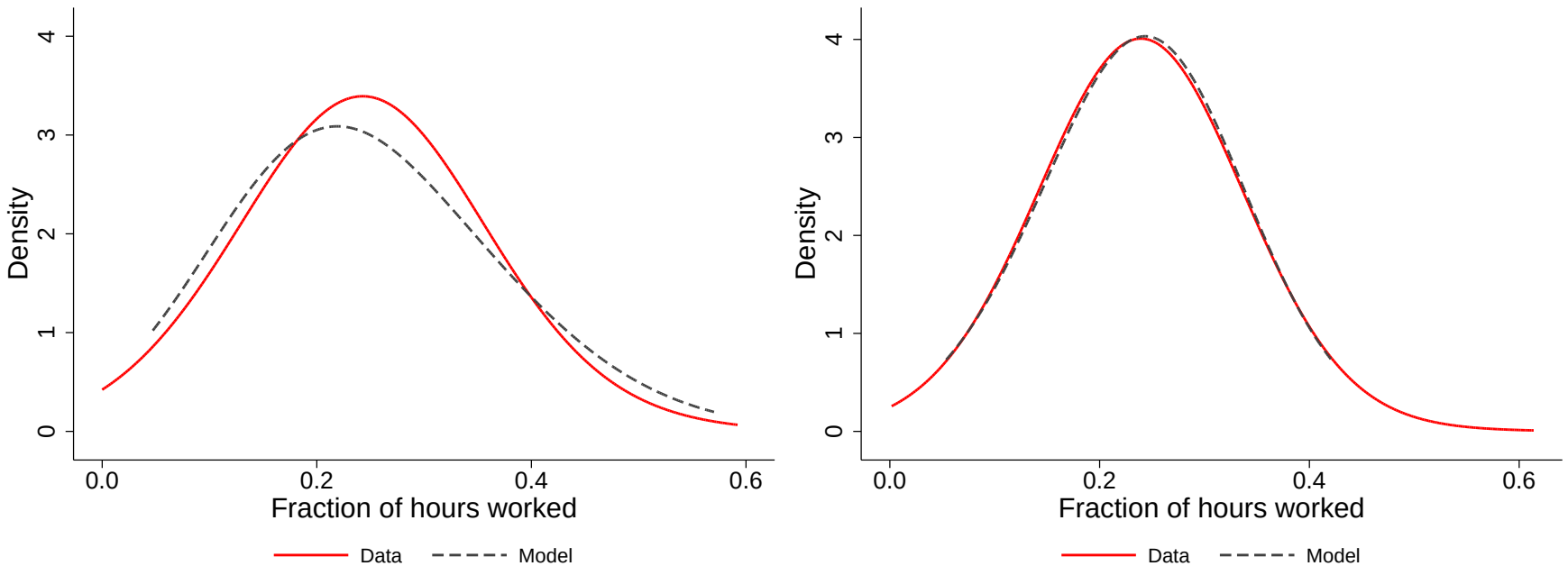

Figure: **Distribution of hours worked, entrepreneurs (left) and workers**

Changes in hours

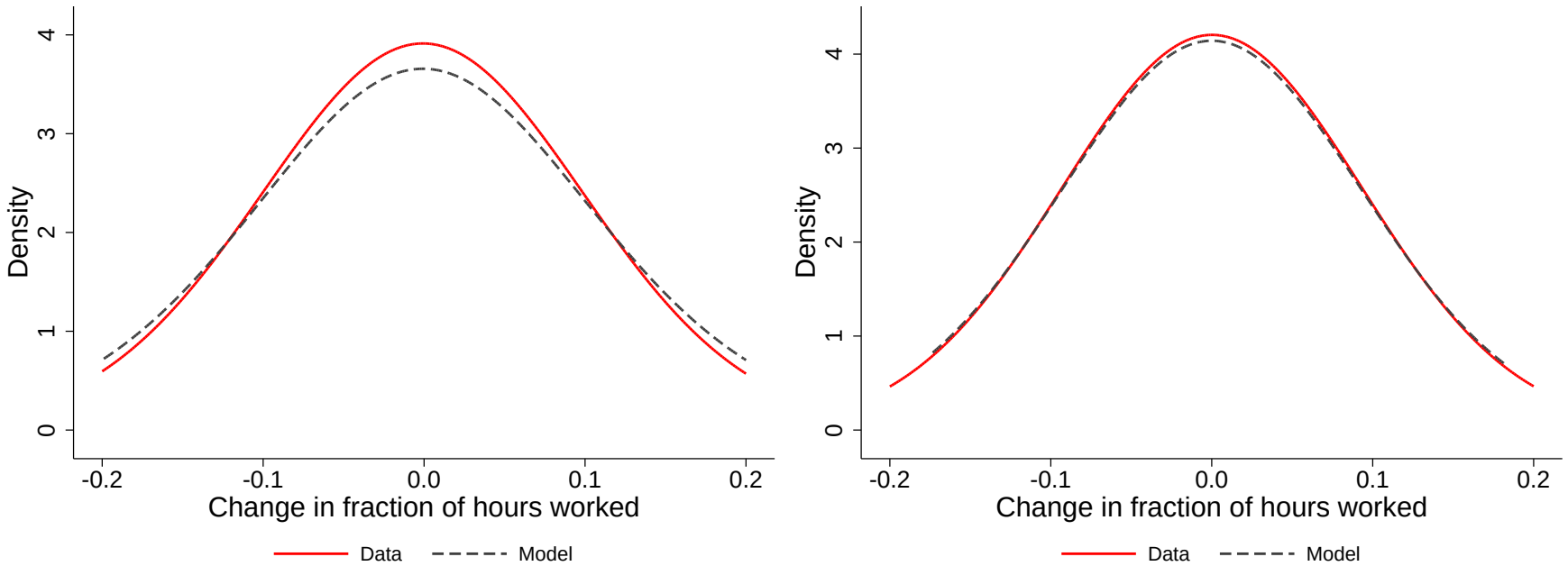

Figure: **Distribution of changes in hours worked, entrepreneurs (left) and workers**

Changes in residual hours

Hours conditional on hourly income

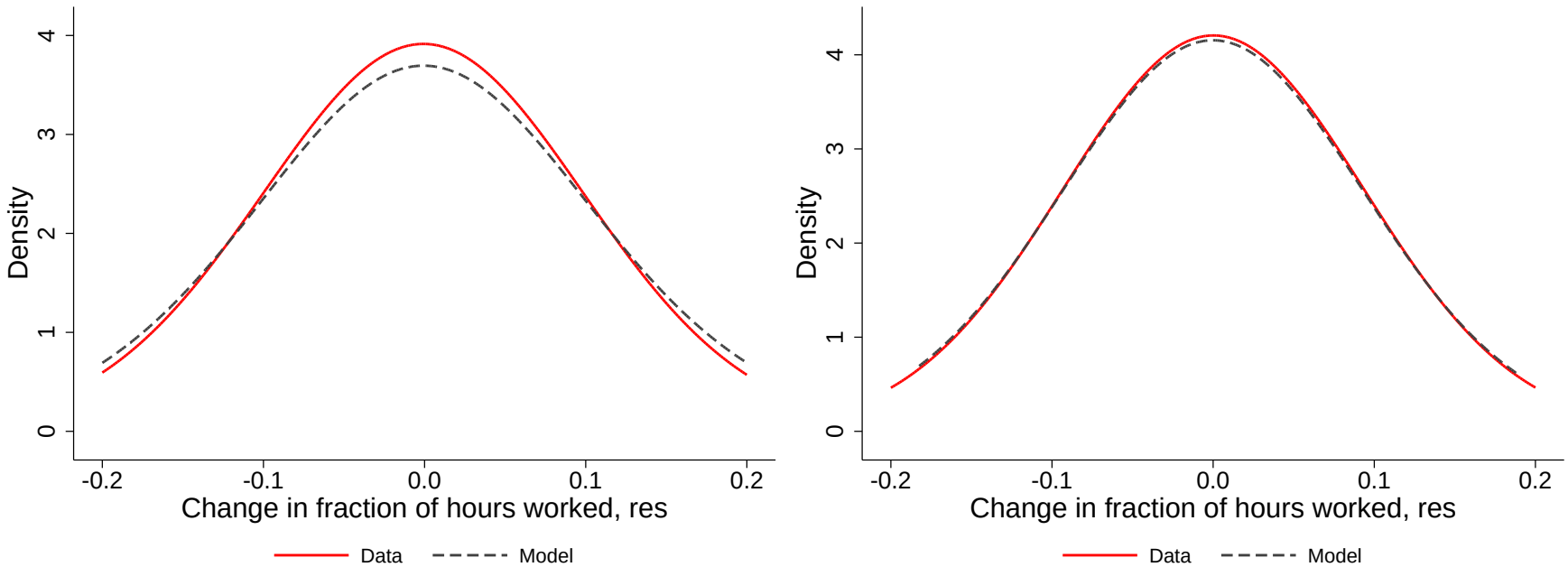

Figure: **Distribution of changes in residual hours worked, entrepreneurs (left) and workers**

Alternative specifications

Changing:

- complementarity in technology 2: $\rho \in \{0.1, 1\}$
- size of the unstable group: $\lambda \in \{0, 1\}$

Alternative specifications

Moment / Parameter	**Data**	**Substitutability, ρ**		
		-10	0.1	1
κ (weight of tech 1)		0.103	0.020	NA
Sd of log-hours (worker)	0.229	0.229	0.228	0.283
Ratio of mean income (entr/worker)	0.936	0.912	0.904	0.993
Ratio of median income (entr/worker)	0.861	0.718	0.614	0.686
Ratio of mean hourly income (entr/worker)	0.950	0.840	0.828	0.901
Earning more than median worker (entr)	0.364	0.381	0.310	0.429

Table: **Moments across calibrations, changing ρ**

No complementarities ($\rho = 1$)

$\rightarrow$ too much dispersion for workers

$\rightarrow$ too much income for entrepreneurs

Alternative specifications

Moment / Parameter	Data	Size of unstable group, λ		
		0	0.6	1
σ_v (volatility of v)		NA	0.556	0.503
π_v (persistence of v)		NA	0.605	0.507
κ (weight of tech 1)		1	0.103	0.062
Sd of log-hours (entr)	0.395	0.181	0.396	0.393
Sd of log-hours (worker)	0.229	0.107	0.229	0.226
Autocorr of log-hours (entr)	0.690	0.694	0.693	0.683
Autocorr of log-inc (worker)	0.807	0.984	0.723	0.591
Autocorr of log-hours (worker)	0.655	0.997	0.612	0.566
Absolute change in hours (entr)	0.036	0.013	0.044	0.048
Absolute change in hours (entr, res)	0.036	0.013	0.042	0.043
Absolute change in hours (worker)	0.018	0.000	0.015	0.018
Absolute change in hours (worker, res)	0.018	0.000	0.015	0.015

Table: **Moments across calibrations, changing λ**

No volatility in leisure $\rightarrow$ too little dispersion and volatility in hours

Imposing restrictions on workers' hours

- Limits on the workweek is a frequently implemented policy (Lee, McCann, and Messenger (2007))
- The benchmark has two key features to capture the effects:
  - complementarity across hours of workers
  - volatility in the value of leisure.

Policy: Introduce upper bound equal to mean hours of workers in the baseline

- What are the effects for the benchmark?
  - Initial responses
  - Steady state differences
- How are they different in the alternatives?
  - Perfect substitutability: $\rho = 1$
  - No volatility in leisure: $\lambda = 0$

Policy: Maximum hours for workers

	BM		$\rho = 1$		$\lambda = 0$	
	Initial	SS	Initial	SS	Initial	SS
Fraction of entr	-12.69	47.41	0.87	119.54	-47.73	37.68
Hours (worker)	-6.08	-5.99	-8.43	-6.92	-4.63	-4.52
Sd of log-inc (worker)	-17.08	-15.72	-20.74	-26.36	4.79	5.69
Sd of log-hours (worker)	-24.15	-23.28	-31.61	-37.36	-38.08	-41.56
Consumption	-1.99	-4.22	-1.99	-6.20	-1.99	-1.62
Welfare (CE)	-0.59	-1.37	-1.66	-3.30	-0.57	-0.68

Table: **Effects of maximum hours, % change from baseline**

- In all models:
  - $\rightarrow$ less consumption, lower welfare
  - $\rightarrow$ more entrepreneurs in steady state
- Stronger effects with volatile preferences

Conclusion

- This paper studies a model that allows for
  - volatile value of leisure
  - complementarity across hours of workers.
- These create need for flexibility and preference for entrepreneurship.
- Jointly, they help explain why:
  - entrepreneurs earn less and work more than workers
  - entrepreneurs' hours are more disperse and volatile than workers
  - hourly income does not explain well the movements in hours.
- Unique features of this model provide a good environment to study the effects of hours restrictions.

Future research

- Deeper study of how to incorporate hours of entrepreneurs in production to
  - disentangle entrepreneurs' contribution from factor productivity
  - better measure firm-level uncertainty.
- Policies related to complementarities and inflexibility:
  - income tax
  - minimum wage
- Cross-country analysis, effects of (i) complementarities and (ii) policy reforms on
  - number of entrepreneurs
  - firm size
  - firm productivity

Appendix

Data

- I use SIPP panels 1998, 2001, 2004 and 2008.
- Each panel has $9 - 12$ waves repeated every 4 months.
- Exclude:
  - unemployed
  - owners of big businesses (+100) Sample comparison
- Use residual hourly income and hours:
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  - adjust the residuals to have the (i) minimum equal to 0 (ii) mean equal to the unconditional mean.

Patterns of hours

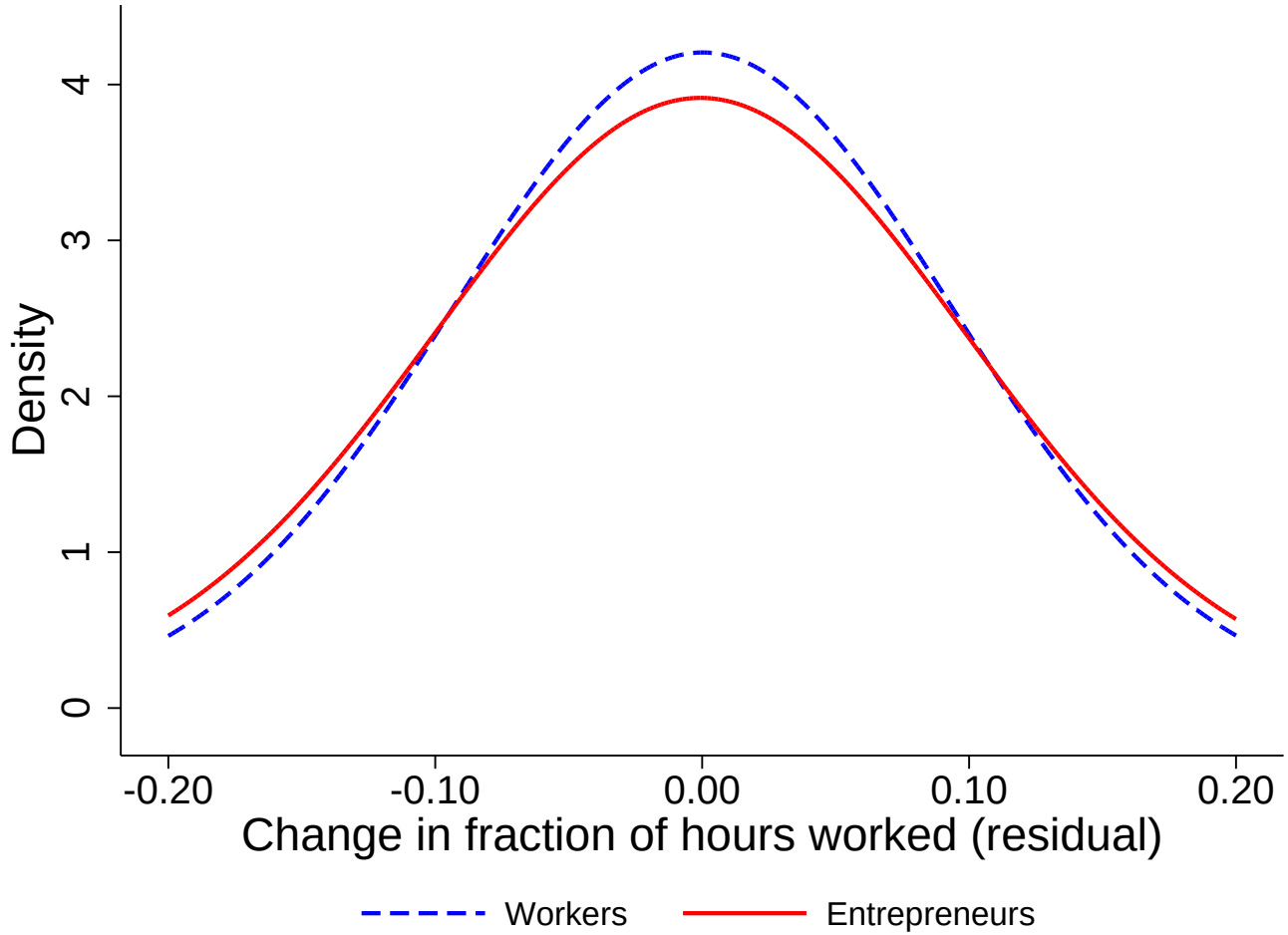

Figure: **Distribution of changes in residual hours worked**

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Absolute change in the share of hours worked

Variables	Absolute change in fraction of hours worked			
	(1)	(2)	(3)	(4)
Entrepreneur	0.0188***	0.0184***	0.0176***	0.0174***
	(158.0)	(153.0)	(150.4)	(146.6)
Hourly income change			0.000397***	0.000391***
			(168.7)	(167.0)
Constant	0.0176***	-0.00538	0.0169***	-0.00297
	(504.5)	(-0.313)	(488.2)	(-0.175)
Characteristics	No	Yes	No	Yes
Observations	1,008,003	1,008,003	1,008,003	1,008,003
R-squared	0.024	0.038	0.051	0.064

t-statistics in parentheses

Table: **Estimation of absolute changes in hours worked**

Wages in equilibrium

$$w_1(l,y) = \tilde{w}_1(y) \equiv \kappa(1-\alpha)\left(\frac{\alpha}{r+\delta}\right)^{-\frac{\alpha}{1-\alpha}} y\left(\frac{\bar{\bar{L}}_1}{\bar{L}}\right)^{-1}$$

$$\begin{aligned} w_2(l,y) &= (1-\kappa)(1-\alpha)\left(\frac{\alpha}{r+\delta}\right)^{-\frac{\alpha}{1-\alpha}} y\left(\frac{\bar{\bar{L}}_2}{\bar{L}}\right)^{-1} E_{\bar{x}_2,y}(l^\rho)^{\frac{1}{\rho}} \\ &\quad \times \left[\frac{1}{\rho}\frac{l^{\rho-1}}{E_{\bar{x}_2,y}(l^\rho)} + (1-\frac{1}{\rho})l^{-1}\right] \end{aligned}$$

where

$$\bar{\bar{L}}_j \equiv \int_{n\in\mathbf{M}} \int_0^\infty y L_{nj}(y)\,dy\,dn, \qquad \bar{L} \equiv \int_{n\in\mathbf{M}} L_n\,dn$$

$$E_{\bar{x}_j,y}(l^\rho) = \frac{\int_0^1 \bar{x}_j(l,y) l^\rho\,dl}{\int_0^1 \bar{x}_j(l,y)\,dl}, \qquad \bar{x}_j(l,y) \equiv \int_{n\in\mathbf{M}} x_{nj}(l,y)\,dn, \quad j \in \{1,2\}$$

Back

The problem of the consumer

$$V(a, A, y, v) = \max\{V^e(a, A, y, v), V^w(a, A, y, v)\}$$

$$V^e(a, A, y, v) = \max_{c,h,a',K,\{x_j(l,y)\}_{j\in\{1,2\}}} \frac{c^{1-\gamma}}{1-\gamma} - v\frac{h^{1+\phi}}{1+\phi} + \beta E[V(a', A', y', v')|A, y, v]$$

$$s.t.\ c + a' = Y - K(r + \delta) - \sum_{j=1}^{2} \int_0^\infty \int_0^1 w_j(l, y)x_j(l, y)l dl dy + a(1 + r)$$

$$Y = Ah^\omega \left(K^\alpha \left[\left(\int_0^\infty yL_1(y)dy \right)^\kappa \left(\int_0^\infty yL_2(y)dy \right)^{1-\kappa} \right]^{1-\alpha} \right)^\eta$$

$$L_1(y) = \int_0^1 x_1(l, y)l dl, \quad L_2(y) = \left(\int_0^1 x_2(l, y)l^\rho dl \right)^{\frac{1}{\rho}} \left(\int_0^1 x_2(l, y)dl \right)^{1-\frac{1}{\rho}}$$

$$c \geq 0, h \in [0, 1], a' \geq 0, K \geq 0, x_j(l, y) \geq 0\ \forall\ l \in [0, 1], j \in \{1, 2\}$$

Back

The problem of the consumer

$$V^w(a, A, y, v) = \max\{V^{w,1}(a, A, y, v), V^{w,2}(a, A, y, v)\}$$

$$\begin{aligned} V^{w,j}(a, A, y, v) \quad = \quad & \max_{c,l,a'} \frac{c^{1-\gamma}}{1-\gamma} - v\frac{l^{1+\phi}}{1+\phi} \\ & +\beta E[sV(a', A', y', v') + (1-s)V^w(a', A', y', v')|A, y, v] \end{aligned}$$

$$\begin{aligned} s.t. \quad & c + a' = w_j(l, y)l + a(1+r) \\ & c \geq 0, l \in [0, 1], a' \geq 0 \end{aligned}$$

for $j \in \{1, 2\}$.

The problem of the non-entrepreneurial sector

$$\max_{K,\{x_j(l,y)\}_{j\in\{1,2\}}} Y-(r+\delta)K-\sum_{j=1}^{2}\int_0^\infty\int_0^1 w_j(l,y)x_j(l,y)\,l\,dl\,dy$$

$$s.t.\quad Y=BK^\alpha\left[\left(\int_0^\infty yL_1(y)dy\right)^\kappa\left(\int_0^\infty yL_2(y)dy\right)^{1-\kappa}\right]^{1-\alpha}$$

$$L_1(y)=\int_0^1 x_1(l,y)\,l\,dl,\quad L_2(y)=\left(\int_0^1 x_2(l,y)\,l^\rho\,dl\right)^{\frac{1}{\rho}}\left(\int_0^1 x_2(l,y)\,dl\right)^{1-\frac{1}{\rho}}$$

Moment	Excluding ≥ 100	Excluding < 100	All
Fraction of entr	0.088	0.001	0.089
Ratio of mean income (entr/worker)	0.936	1.774	0.947
Ratio of median income (entr/worker)	0.861	1.279	0.863
Ratio of mean hourly income (entr/worker)	0.950	1.897	0.962
Hours (entr, mean)	0.244	0.260	0.244
Hours (worker, mean)	0.239	0.239	0.239
Sd of log-inc (entr)	0.636	0.798	0.641
Sd of log-inc (worker)	0.327	0.327	0.327
Sd of log-hours (entr)	0.395	0.371	0.395
Sd of log-hours (worker)	0.229	0.229	0.229
Autocorr of log-inc (entr)	0.743	0.668	0.744
Autocorr of log-inc (worker)	0.807	0.807	0.807
Autocorr of log-hours (entr)	0.690	0.766	0.692
Autocorr of log-hours (worker)	0.655	0.655	0.655
Population switching to entr	0.004	0.000	0.004
Population switching to worker	0.005	0.005	0.005
Earn more than med worker (entr)	0.364	0.636	0.368
Earn more than med worker (e, hourly)	0.298	0.587	0.302
Abs change in hours (entr)	0.036	0.031	0.036
Abs change in hours (e, unexp)	0.036	0.032	0.036
Abs change in hours (worker)	0.018	0.018	0.018
Abs change in hours (w, unexp)	0.018	0.018	0.018
Sample size	1,400,196	1,278,477	1,401,653

Calibration

Estimating η

- Using the indicator of working for a firm with less than 100 employees:

$$\frac{(1-\alpha)\eta}{1-\eta} = \frac{\textit{Total income by small business workers}}{\textit{Total income by entrepreneurs}}$$

Parameters

Income distribution

Subsample	Data	Model
Top 1%	0.048	0.038
Top 5%	0.162	0.164
Top 10%	0.247	0.276
Top 20%	0.387	0.455

Table: **Distribution of entrepreneurial income across top percentiles**

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Wealth distribution

Subsample	Data	Model
Entire population		
Top 1%	0.066	0.076
Top 5%	0.217	0.236
Top 10%	0.347	0.363
Top 20%	0.535	0.548
Within entrepreneurs		
Top 1%	0.051	0.080
Top 5%	0.237	0.263
Top 10%	0.425	0.415
Top 20%	0.673	0.627

Table: **Distribution of wealth across top percentiles**

Back

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