

# SELF-EMPLOYMENT DYNAMICS AND THE RETURNS TO ENTREPRENEURSHIP

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# Introduction

- Hamilton (2000) spawned a literature on the returns to self-employment by documenting that the median entrepreneur earns less than the median paid worker.
  - ▶ Recent papers confirm this finding across datasets and in different contexts.
  - ▶ Hall and Woodward (2010) estimate the expected earnings of VC backed founders in a dynamic model but they don't observe the entrepreneur's outside option.
  - ▶ Manso (2016) and Daly (2015) match self-employed with paid workers and show that self-employed have higher earnings several years after entry.
- We estimate a structural dynamic model of lifecycle self-employment to a) quantify the value of resolving uncertainty and b) to explore allocation issues resulting from counterfactual policies that change entry patterns into self-employment.

# Understanding the Returns to Entrepreneurship

- Nearly half of all workers who enter self-employment return to paid work within five years.
- This (costly) churning between sectors points to the importance of considering self-employment in a dynamic context.
- Maintained Hypothesis: individuals cycle in and out of self-employment in part to resolve initial uncertainty about their potential earnings as entrepreneurs.

# Implications of Experimentation

- **Option value:** The expected value of entering entrepreneurship in the first period can exceed the expected value of choosing paid work, even if mean entrepreneurial earnings are below mean paid earnings.
- **Selection bias:** Long-term self-employed workers are more successful than average; those who leave self-employment are less successful. Which dominates determines bias in cross-sectional earnings estimates.
- **Efficient Sorting:** Barriers to entering self-employment may deter workers from learning about their abilities, slowing Roy-style sorting across sectors.

# Game Plan

- **Document** patterns of self-employment choices that are consistent with gradually resolved uncertainty about earnings.
- **Earnings distributions** in paid work and entrepreneurship.
- **Model** sector choice dynamics with worker heterogeneity and strategic experimentation.
- **Estimate** parameters and assess model fit
- **Simulate** expected and counterfactual lifetime earning streams
  - ▶ Value the option to experiment and return to paid work
  - ▶ Assess alternative tax policies

# Summary of Findings

- The option to experiment with entrepreneurship and return to the paid sector increases the expected lifetime earnings from entering self-employment for workers with no prior self-employment experience.
- Tastes for self-employment vary considerably across workers.
  - ▶ Most workers would require substantial compensation to overcome their dis-utility from self-employment, but 15% of workers prefer working for themselves.
- These strong preferences mute the effects of subsidies and tax policies on self-employment rates.
- Policies should target high-ability entrepreneurs due to the thick tail of earnings and the positive correlation between paid and self-employment.

# Self Employment in the PSID

- We use data from the 1976-2011 waves of the Panel Study of Income Dynamics.
  - ▶ Men age 22 to 55
  - ▶ Long panel, where we observe annual earnings and labor sector choice
- Define entrepreneurship as being self-employed in the main job.
  - ▶ Also people who start businesses and new jobs at the same time.
- Moves in and out of entrepreneurship are common.
  - ▶ A quarter of the sample enters entrepreneurship at some point.
  - ▶ Each year, only about 10% of the sample is an entrepreneur.

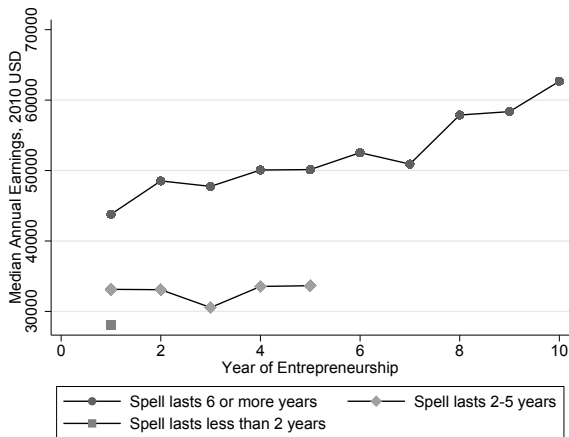
# Composition of Entrepreneurs



Source: PSID 1976-2011.

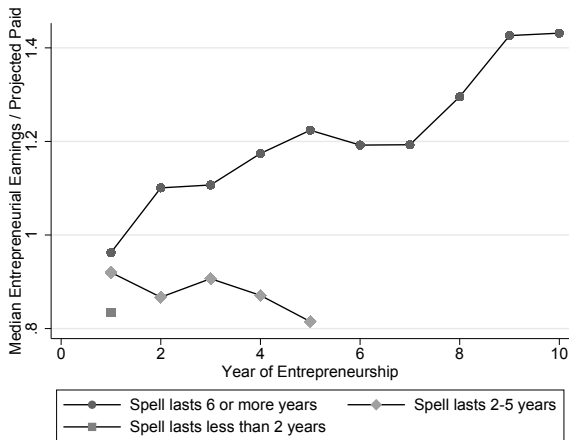


# Earning Profiles by Persistence in Entrepreneurship



Source: PSID 1976-2011. The gap between each of the two lower profiles and the top profile are statistically significant with 99% confidence.

# Relative Earnings by Persistence in Entrepreneurship



Source: PSID 1976-2011. Profiles are the ratio of average observed annual earnings for entrepreneurs to their projected earnings had they worked in the paid sector that year, constructed using the estimates described in the paper.

## A few stylized facts from the data to keep in mind

- Forming an incorporated business within a year of becoming self-employed and initial investments in businesses are only weakly correlated with entrepreneurial earnings after controlling for paid earnings.
  - ▶ Most workers earn less in the year they become self-employed than they did in their last year of paid work.
- Low entrepreneurial earnings are a strong predictor of exiting back to paid work.
- Not strong predictors of returning to paid work:
  - ▶ Having been “pushed in” to self-employment by a negative shock to paid earnings.
  - ▶ Lack of access to business credit.

## Some of the Prior Bullets in Table Form: Cox Exit Models

	(2)	(3)	(4)
Earn diff. q2	0.99 (0.94)	0.97 (0.79)	0.96 (0.82)
Earn diff. q3	0.65* (0.01)	0.58* (0.00)	0.61* (0.02)
Earn diff. q4	0.28* (0.00)	0.26* (0.00)	0.23* (0.00)
Pushed in		1.10 (0.56)	1.11 (0.54)
Pushed in* Earn diff. q2		1.08 (0.75)	1.05 (0.83)
Pushed in* Earn diff. q3		1.17 (0.60)	1.17 (0.60)
Pushed in* Earn diff. q4		1.83 (0.16)	1.89 (0.14)
Observations	6,191	6,191	6,191
Log likelihood	-3,332	-3,318	-3,294

Table reports hazard ratios with **p-values from z-tests in parentheses**. Earn diff. is the difference between projected entrepreneurial earnings for the coming year and projected paid earnings. Column 4 includes interactions for high-capital industries, those with an above-median

# Overview of model ingredients to signpost what's important

- Forward-looking risk-neutral individuals work for multiple periods.
  - ▶ Work from age 22 to 55. Then receive 10 more years of final earnings.
- Workers accumulate sector-specific experience, which may affect earnings in either sector.
- Workers know their paid ability, and gradually learn their entrepreneurial ability – conditional on paid ability – by working in self-employment.
- Workers get some non-monetary value from working in entrepreneurship and face utility costs to entering self-employment.

# Modeling Individual Sector-Specific Abilities and Earnings

- The log of paid ability,  $\alpha_i$ , known with certainty, and the log of entrepreneurial ability,  $\eta_i$ , have a bivariate normal distribution.
- With no entrepreneurial experience, workers' beliefs about  $\eta$  depend on  $\alpha_i$ :

$$\hat{\eta}_{i0} = \mu_{\eta} + \frac{\sigma_{\eta}}{\sigma_{\alpha}} \rho (\alpha_i - \mu_{\alpha})$$

with variance  $\sigma_{\eta 0}^2 = \sigma_{\eta}^2 (1 - \rho^2)$ .

- With entrepreneurial experience, beliefs evolve following Bayes' rule:

$$\hat{\eta}_{ix} = \frac{\sigma_{\xi}^2 \hat{\eta}_{i0} + x_{Rit} \sigma_{\eta 0}^2 \overline{\log(\tilde{R}_{ix-1})}}{x_{Rit} \sigma_{\eta 0}^2 + \sigma_{\xi}^2}$$

with variance  $\sigma_{\hat{\eta}_{ix}}^2 = \frac{\sigma_{\eta 0}^2 \times \sigma_{\xi}^2}{x_{Rit} \sigma_{\eta 0}^2 + \sigma_{\xi}^2}$ , where  $x_{Rit}$  denotes years of entrepreneurial experience,  $\overline{\log(\tilde{R}_{ix-1})}$  denotes mean previous log residual entrepreneurial earnings, and  $\sigma_{\xi}^2$  is the variance of the transitory earnings shock.

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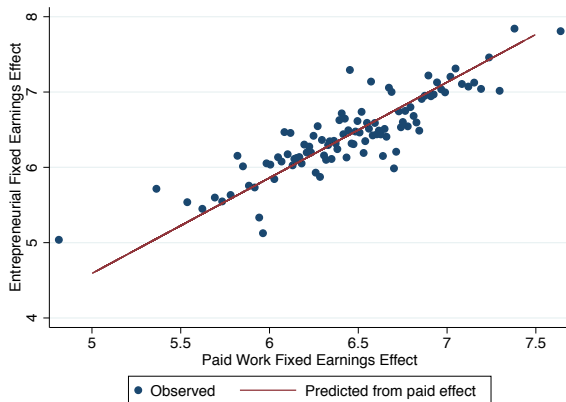
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# Assessing Bivariate Normality: Predicted Entrepreneurial Earnings Ability



Source: PSID 1976-2011. Plots average earnings residuals in paid work and self-employment for the subset of workers who we observe in both sectors.

# Workers' Objectives

- Worker  $i$  chooses to work in the sector that maximizes the present value of expected utility.
- The lifetime maximization problem can be rewritten as a sequences of single-period choices using the Bellman equation,

$$V(S_t, \beta_{0i}, \varepsilon_t) = \max_{d_t \in \{0,1\}} \{u(d_t, S_t, \beta_{0i}, \varepsilon_t) + \delta E[V(S_{t+1}, \beta_{0i}, \varepsilon_{t+1}) \mid d_t, S_t, \beta_{0i}]\}$$

where  $\delta$  is the discount rate.

# Choice-Specific Flow Payoffs

- The expected flow utility from choosing the paid sector is

$$u(d_{it} = 0, S_{it}, \varepsilon_{it}^0) = \beta_1 E[W_{it} | S_{it}] + \varepsilon_{it}^0,$$

where

- ▶  $W_{it}$  is paid earnings
  - ▶  $S_{it}$  summarizes the individual's employment history, and beliefs about entrepreneurial ability at time  $t$
  - ▶  $\varepsilon_{it}^0$  is a transitory taste shock for choosing paid work that is unobserved to the econometrician.
- $\beta_1$  scales the value of money relative to the variance of the taste shocks.

# Choice-Specific Flow Payoffs

- The expected flow utility from choosing entrepreneurship is

$$u(d_{it} = 1, S_{it}, \beta_{0i}, \varepsilon_{it}^1) = \beta_{0i} + \beta_1 E[R_{it}|S_{it}] + \beta_2 (d_{it-1} = 0) E[\tilde{W}_{it}|S_{it}] \\ + \beta_3 (x_{Rit} = 0) E[\tilde{W}_{it}|S_{it}] + \varepsilon_{it}^1.$$

- $\beta_{0i}$  is a random parameter that describes an individual's non-pecuniary benefit of being an entrepreneur.
- $\beta_2$  is a utility cost of entering entrepreneurship, proportional to residual earnings in the paid sector.
- $\beta_3$  captures any differences in entry costs for first-time entrepreneurs relative to former entrepreneurs.

# Overview of Sequential Estimation

## 1 Step 1

- ▶ Estimate paid and self-employment earnings processes in a first stage, with appropriate controls for selection.

## 2 Step 2

- ▶ Use estimates from step 1 in the full model to get preference parameters.

## 3 Step 3

- ▶ Simulate mobility patterns from step 2, then calculate discounted earnings using step 1.

Alternative approach (in progress): treat  $\alpha$  as a random effect and integrate over the joint distribution of earnings and choices.

# Effect of Sectoral Experience on Earnings

On earnings in	Effect of experience in			
	Paid		Entrepreneurship	
Paid	Cubic		None	
	1 year	0.051 (0.005)		
	10 years	0.421 (0.385)		
Entrepreneurship	Quadratic		Cubic	
	1 year	0.028 (0.036)	1 year	0.031 (0.012)
	10 years	0.202 (0.440)	10 years	0.229 (0.147)

Estimated from log weekly earnings equation, instrumenting same-sector experience with deviations from eventual spell duration. Bootstrapped standard errors in parentheses.

# Ability and Earnings Shock Parameter Estimates

Distribution of abilities		
Mean log ability in paid sector	$\mu_{\alpha}$	6.450
Variance of log ability in paid sector	$\sigma_{\alpha}^2$	0.193
Mean log ability in entrepreneurship	$\mu_{\eta}$	6.432
Variance of log ability in entrepreneurship	$\sigma_{\eta}^2$	0.631
Correlation of abilities across sectors	$\rho$	0.702
Paid sector earnings shocks		
Variance of AR(1) innovation	$\sigma_{\zeta}^2$	0.024
Annual persistence of AR(1)	$\phi$	0.831
Variance of transitory shock	$\sigma_m^2$	0.022
Entrepreneurship earnings shock		
Variance of transitory shock	$\sigma_{\epsilon}^2$	0.096

Estimated from residual log weekly earnings using method of moments.  
 Bootstrapped standard errors reported in text.

# Startup Costs and Non-pecuniary Benefits

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## Dollar equivalent interpretations

Mean cost to enter self-emp.	-325,289
Mean add'l cost of first entry	-21,243
Std. dev. of transitory preference shock	89,877
Mean non-pecuniary benefit	-76,377
Std. dev. of non-pecuniary benefit	73,083
% of workers with $\beta_{0i} > 0$	15

## Posterior Distributions of Non-pecuniary Benefit

Mean $\mu_{\beta_{0i}}$ , never entrepreneurs	-95,085
Mean $\sigma_{\beta_{0i}}^2$ , never entrepreneurs	62,273
Mean $\mu_{\beta_{0i}}$ , sometime entrepreneurs	1,600
Mean $\sigma_{\beta_{0i}}^2$ , sometime entrepreneurs	31,002

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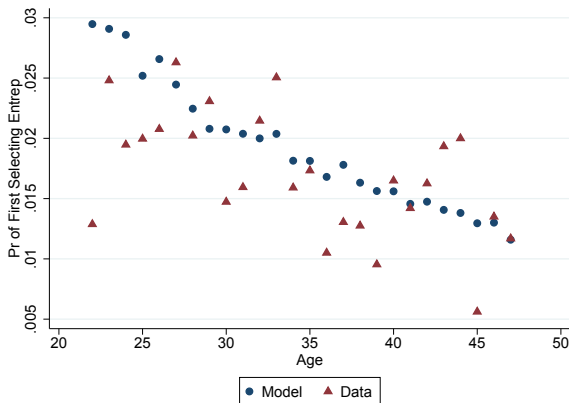
Entry costs are defined as a share of expected residual annual paid earnings,  $\exp(\alpha_i + \zeta_{it})$ .



# Estimated Probability of Choosing Entrepreneurship

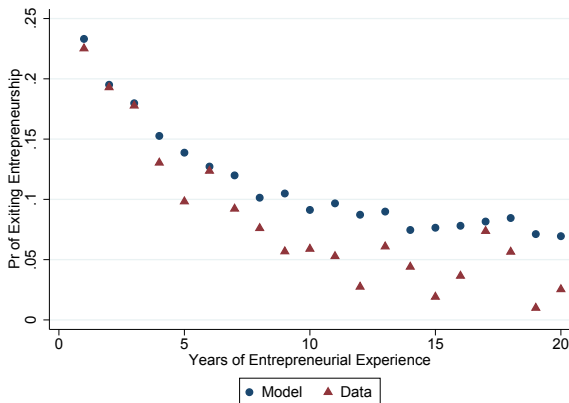
Sector Last Year:	Observed Choice this Year	
	Paid Sector	Entrepreneurship
Paid sector		
Income maximizing	54.5%	58.7%
Full model, homogeneous tastes	2.4%	3.7%
Full model, heterogeneous tastes	2.1%	12.3%
Share of prior paid workers	98.1%	1.9%
Self-Employment		
Income maximizing	48.6%	72.2%
Full model, homogeneous tastes	76.1%	83.8%
Full model, heterogeneous tastes	66.0%	88.5%
Share of prior entrepreneurs	7.8%	92.2%

# Model Fit: Entrepreneurship by Age



Source: PSID 1976-2011 and predicted likelihood of choosing self-employment from model. Both series describe the average probability of choosing to enter self-employment for individuals with no prior self-employment experience.

# Model Fit: Persistence in Entrepreneurship



Source: PSID 1976-2011 and predicted likelihood of choosing paid work from the model. Both series describe the probability of selecting paid work for individuals who worked as entrepreneurs in the previous year.

## Value of Entering Self-Employment at 30: Selection

	Value of Paid	Value of Entrep.	Difference	As % of Paid Value
Annual observed earnings in chosen sector				
Mean	41,119	39,093	-2,026	-4.9%
Median	39,743	30,823	-8,920	-22.4%
Projected annual earnings for all workers				
Mean	41,636	38,585	-3,051	-7.3%
Median	40,176	35,035	-5,141	-12.8%

The first panel of this table summarizes observed annual earnings for 32 year old paid workers and entrepreneurs (N=2,781). In the remaining panels, earnings are projected for all 32 year old workers conditional on choosing each sector.

## Value of Entering Self-Employment at 30: Option Value

	Value of Paid	Value of Entrep.	Difference	As % of Paid Value
Annual observed earnings in chosen sector				
Mean	41,119	39,093	-2,026	-4.9%
Median	39,743	30,823	-8,920	-22.4%
Projected annual earnings for all workers				
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Median	40,176	35,035	-5,141	-12.8%
Projected lifetime earnings, static model				
Mean	47,551	44,412	-3,139	-6.6%
Median	45,282	39,817	-5,464	-12.1%
Projected lifetime earnings, dynamic model				
Mean	47,146	47,537	391	0.8%
Median	44,447	43,567	-880	-2.0%

The third panel assumes that workers choose each sector this year and remain there for all future years. The last panel assumes workers choose each sector this year and then behave optimally according to the full model in each subsequent year. Projected lifetime earnings are converted to constant-annual-income equivalents,  $\bar{C}$  such that  $\sum_{s=t}^T \left(\frac{1}{1+r}\right)^s Y_s = \bar{C} \sum_{s=t}^T \left(\frac{1}{1+r}\right)^s$ .

# Annualized Option Value for 30 Year Olds

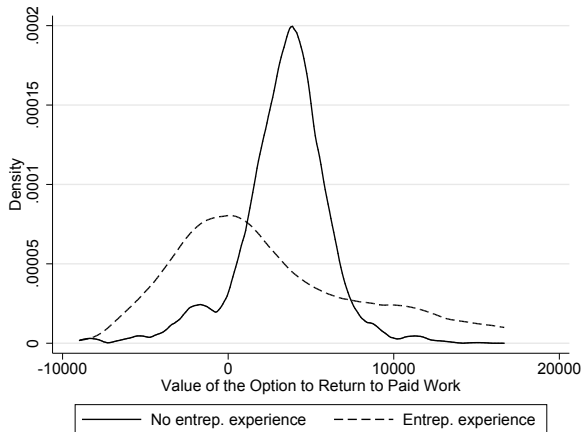
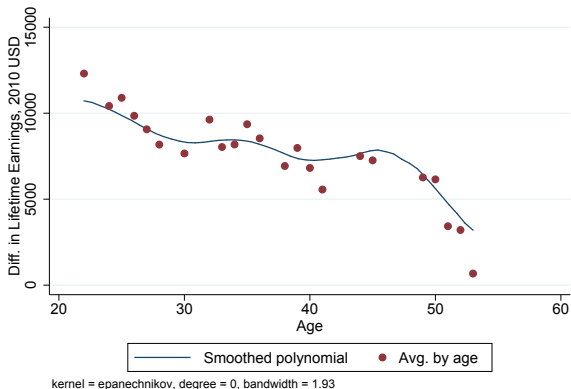


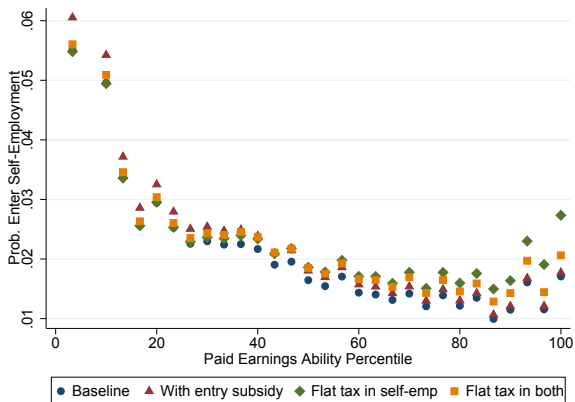
Figure plots the annualized expected lifetime earnings conditional on choosing entrepreneurship this year and behaving optimally in future years less the annualized expected lifetime earnings conditional on choosing entrepreneurship in all future years.

# Expected Post-tax Lifetime Earnings Gains from Entering Self-Employment by Age



Average PV of lifetime earnings gains given entrepreneurship this year and behaving optimally in future years for those without entrepreneurial experience. To adjust for composition differences over the lifecycle, the distribution of the paid earnings ability that forecasts entrepreneurial earnings is held constant

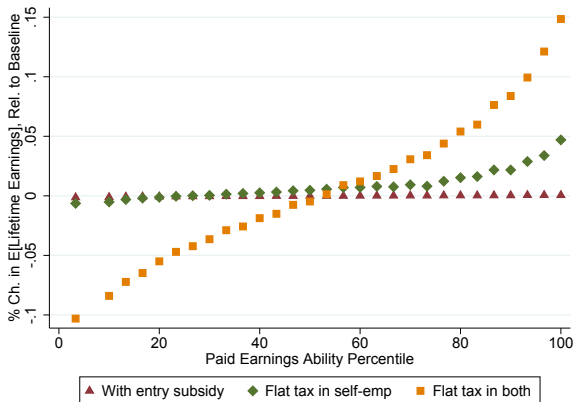
# Entry into Self-Employment Under Counterfactual Policies



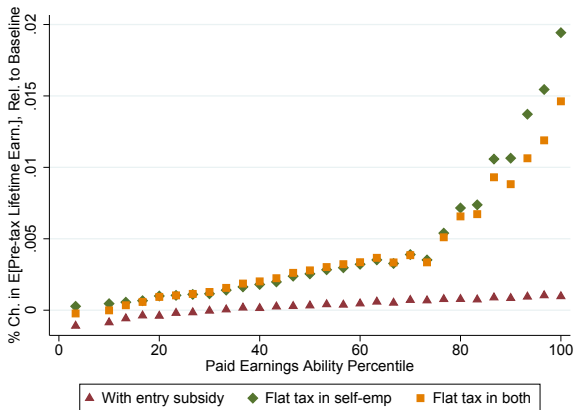
Figures plot the average predicted probability of selecting self-employment each period, conditional on having no prior entrepreneurial experience.



# Counterfactual After-Tax Expected Earnings (Private Return)



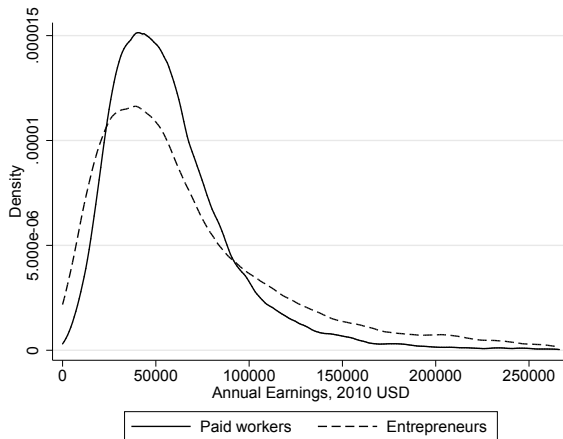
# Counterfactual Pre-Tax Expected Earnings (Social Return)



# Conclusions

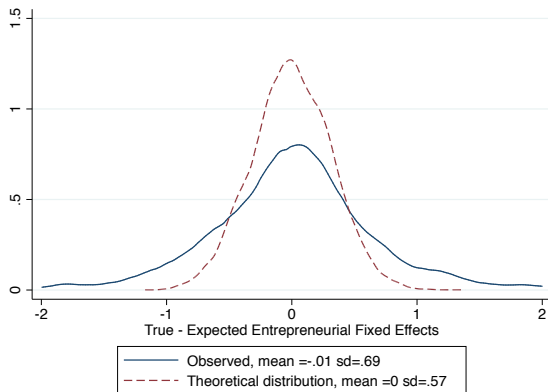
- Workers gradually learn their relative entrepreneurial ability through entrepreneurial experience.
- The option value of experimentation raises the expected lifetime earnings from entering entrepreneurship by 10%.
- Policy to increase experimentation in entrepreneurship is most effective if targeted toward the highly able.

# Earnings in Paid Work and Entrepreneurship



Source: PSID 1976-2011. Distribution of real weekly earnings in 2010 dollars. Truncated at \$4,000 per week, which excludes the top 2% of earnings.

# Assessing Bivariate Normality: Prediction Error for Entrepreneurial Ability



Observed is the difference between the average observed residual entrep earnings and the residual predicted by average paid earnings for workers observed in both sectors. The theoretical distribution of this prediction error is based on the assumption of bivariate normality.