Insurance and Opportunities: A Welfare Analysis of Labor Market Risk

1 Introduction

- Large rise in cross-sectional U.S. wage dispersion since 1970
- In the past decade, economists have investigated the *causes* of this phenomenon
- Next natural question: what are its *welfare implications*?
  - **Quantitatively big**: variance of growth rate of individual wages over 100 times larger than variance of growth rate of average wages
  - **Policy relevance**: welfare gains from redistributive policies may be much larger than gains from aggregate stabilization

2 Welfare effect of a rise in wage dispersion

- Focus on expected welfare "under the veil of ignorance", equivalently welfare for a utilitarian social planner
- Consider an increase in wage dispersion of $\Delta v = \Delta v_\alpha + \Delta v_\varepsilon$
- Compute the equivalent variation ω that solves

$$Eu\left(\left(1+\omega\right)c, h\right)|_{\begin{bmatrix} v_\alpha \\ v_\epsilon \end{bmatrix}} = Eu\left(\hat{c}, \hat{h}\right)|_{\begin{bmatrix} \hat{v_\alpha} = v_\alpha + \Delta v_\alpha \\ \hat{v_\epsilon} = v_\epsilon + \Delta v_\epsilon \end{bmatrix}}$$

3 Insurance and Opportunities

- With *exogenous* labor supply: increased wage dispersion $\Rightarrow$ increased consumption dispersion
- With *endogenous* labor supply, may also get changes in aggregate consumption and hours, and increased dispersion in labor supply
- Following Benabou (2002) and Floden (2001) we decompose welfare effects into a level effect and a volatility effect: $\omega = \omega^{lev} + \omega^{vol}$

  1. ω^{lev}: welfare effect from changes in *aggregate* consumption & hours

  $$u\left(\left(1+\omega^{lev}\right)C, H\right) = u\left(\hat{C}, \hat{H}\right)$$

  2. ω^{vol}: welfare effect from changes in cross-sectional dispersion

4 Welfare Gain from Completing Markets

- Compute the equivalent variation $\chi_{IM \to CM}$ that solves

$$Eu\left(\left(1+\chi_{IM \to CM}\right) c_{IM}, h_{IM}\right)|_{\begin{bmatrix} v_\alpha \\ v_\epsilon \end{bmatrix}} = Eu\left(c_{CM}, h_{CM}\right)|_{\begin{bmatrix} v_\alpha \\ v_\epsilon \end{bmatrix}}$$

for market structure IM = incomplete markets

5 Assume Separable Preferences

$$u(c,h) = \frac{c^{1-\gamma}}{1-\gamma} - \psi \frac{h^{1+\sigma}}{1+\sigma}$$

- $1/\gamma$ is the elasticity of intertemporal substitution (and γ is the risk aversion coefficient)
- $1/\sigma$ is the Frisch elasticity of labor supply
- ψ measures the taste for leisure, relative to consumption (turns out to be irrelevant for welfare)

6 Competitive Equilibrium: Autarky

- The autarky allocation is:

$$\begin{aligned} c(\alpha,\epsilon) &= \exp\left(\frac{1+\sigma}{\gamma+\sigma}\cdot(\alpha+\epsilon)\right) \\ h(\alpha,\epsilon) &= \exp\left(\frac{1-\gamma}{\gamma+\sigma}\cdot(\alpha+\epsilon)\right) \end{aligned}$$

- Hours are increasing in wages iff $\gamma < 1$
  - If $\gamma < 1$ labor flexibility used to make hay while the sun shines
  - If $\gamma > 1$ labor flexibility used to smooth earnings and consumption
- Consumption is always is increasing in wages

7 Competitive Equilibrium: Complete Markets

- CM allocation captures Marx's dictum :

  "From each according to his abilities, to each according to his needs"

$$
\begin{aligned}
c(\alpha,\epsilon) &= \bar{c} \equiv \exp\left(\frac{1+\sigma}{\sigma+\gamma}\cdot\frac{v_\alpha+v_\epsilon}{2\sigma}\right) \\
h(\alpha,\epsilon) &= \exp\left(-\frac{\gamma}{\sigma^2}\frac{1+\sigma}{\sigma+\gamma}\cdot\frac{v_\alpha+v_\epsilon}{2} + \frac{1}{\sigma}\cdot(\alpha+\epsilon)\right)
\end{aligned}
$$

- Hours are increasing in w
- Consumption is independent of w
- Average consumption is increasing in wage dispersion

  ▶ *Remark: From period 0 onwards, high fixed-effect agents hold constant debt, low fixed-effect agents hold constant positive wealth.*

8 Competitive Equilibrium: Incomplete Markets

- Under IM, there exists a competitive equilibrium with a safe rate of return $R_t = 1/\beta$ where all agents maintain zero financial wealth over time

- The IM allocation ("α-island trading") is:

$$\begin{aligned} c(\alpha,\epsilon) &= \exp\left(\frac{1+\sigma}{\sigma+\gamma}\cdot\left(\alpha+\frac{v_\epsilon}{2\sigma}\right)\right) \\ h(\alpha,\epsilon) &= \exp\left(-\frac{\gamma}{2\sigma^2}\frac{1+\sigma}{\sigma+\gamma}\cdot v_\epsilon \;+\; \frac{1-\gamma}{\sigma+\gamma}\cdot\alpha \;+\; \frac{\epsilon}{\sigma}\right). \end{aligned}$$

- Consumption is increasing in v_ϵ and α

- Differential effect of permanent and transitory shocks on labor supply

9 Welfare Effect of Rise in Labor Market Risk

$$\omega_{CM} \simeq \frac{1}{\sigma}\frac{\Delta v}{2}$$

$$\omega_{IM} \simeq \frac{1}{\sigma}\frac{\Delta v_{\epsilon}}{2} + \left[\frac{1-\gamma}{\sigma+\gamma} - \gamma\left(\frac{1+\sigma}{\sigma+\gamma}\right)\right]\frac{\Delta v_{\alpha}}{2}$$

10 Complete Markets

$$\omega_{CM} \simeq \frac{1}{\sigma}\frac{\Delta v}{2}$$

$$\omega^{lev} = \frac{1}{\sigma}\Delta v \qquad \omega^{vol} = -\frac{1}{\sigma}\frac{\Delta v}{2}$$

- Source of welfare gains is increase in aggregate productivity
- Planner takes advantage of flexible labor supply to impose "positive assortative matching"
- Related to consumer theory result that indirect utility function is quasi-convex in prices
- Magnitude of the welfare gain proportional to the Frisch labor supply elasticity
- The "price" paid for assortative matching is increased dispersion in leisure

11 Autarky

$$\omega_{AUT} \simeq \left[\frac{1-\gamma}{\sigma+\gamma} - \gamma\frac{1+\sigma}{\sigma+\gamma}\right]\frac{\Delta v}{2}$$

$$\omega^{lev} = \frac{1-\gamma}{\gamma+\sigma}\Delta v \qquad \omega^{vol} = -\left[\frac{1-\gamma}{\gamma+\sigma} + \gamma\left(\frac{1+\sigma}{\sigma+\gamma}\right)\right]\frac{\Delta v}{2}$$

- As $\sigma \to \infty$, $\omega^{AUT} \to \; - \; \gamma\frac{\Delta v}{2} < 0$ (Lucas, 1987)
- $\gamma \in [0, 1/(2+\sigma)] \;\Rightarrow\; \omega^{AUT} > 0$
  - When $\gamma < 1$, hours and wages are positively correlated and greater productivity dispersion increases average labor productivity
  - When γ is low, consumption fluctuations not too costly
  - For $\gamma = 0$, $\omega_{AUT} = \omega_{CM} > 0$

12 Incomplete markets

- Under incomplete markets, the welfare gain of increased inequality is a weighted average of gain under complete markets and autarky:

$$\omega_{IM} = \omega_{CM} \cdot \frac{\Delta v_\epsilon}{\Delta v} + \omega_{AUT} \cdot \frac{\Delta v_\alpha}{\Delta v}$$

13 Welfare Gain from Completing Markets

- With separable preferences, the welfare gain from completing markets when the variance of uninsurable risk is v_α is

$$\chi_{IM \to CM} \simeq \left[\frac{1}{\sigma} + \frac{\gamma - 1}{\sigma + \gamma} + \gamma \left(\frac{1 + \sigma}{\sigma + \gamma} \right) \right] \frac{v_\alpha}{2}$$

- This is equal to the welfare effect of a change in the variance of wages, ω_{IM} where

$$\Delta v_\alpha = -v_\alpha$$
$$\Delta v_\epsilon = +v_\alpha$$

14 Observables-Based Representation for Welfare Effects

- Using expressions for equilibrium allocations, the welfare effect from a change in the process for wages can be expressed in terms of observables as follows:

$$\omega \simeq \Delta cov\left(\log h, \log w\right) - \frac{\gamma}{2} \cdot \Delta var\left(\log c\right) - \frac{\sigma}{2} \cdot \Delta var\left(\log h\right)$$

$$\begin{aligned} \omega^{lev} &= \Delta cov\left(\log h, \log w\right) \\ \omega^{vol} &= -\frac{\gamma}{2} \cdot \Delta var\left(\log c\right) - \frac{\sigma}{2} \cdot \Delta var\left(\log h\right) \end{aligned}$$

- These expressions apply irrespective of market structure

- One can also show that

$$\omega^{lev} \simeq \Delta \log\left(\frac{Y}{H}\right),$$

  the percentage change in aggregate labor productivity.

15 Data on Cross-Sectional U.S. Inequality

- **PSID**: Wages, hours and earnings, 1967-1996:
  - data for heads of households (males and females)
  - approximately 2,400 observation/year
  - hourly wage defined as annual earnings / annual hours worked
  - *sample averages*– age: 37.5, years of education: 12.1, hourly wage: 14.8, annual hours worked: 2,100
- **CEX**: Consumption
  - Krueger-Perri data on household consumption
  - nondurables + imputation for durables

16 Calibration

- Preference parameters
  - Risk aversion coefficient $\gamma = 2$
  - Inverse of labor supply elasticity $\sigma = 2$, Frisch elasticity $= 0.5$ (Frisch $= 1$ in the Cobb-Douglas case)
- Process for wages
  - Estimate exactly the simple permanent/transitory process adopted in the economic model
  - Wage dispersion increases from 0.25 to 0.35
  - Transitory component accounts for approx. 1/3 of total dispersion
  - Two components equally important in accounting for rise in wage dispersion

Quantitative Welfare Analysis: Wage Process Approach

Welfare change of rise in wage dispersion (%)						Welfare gain from completing markets	
Separable Preferences							
ω_{CM}		ω_{AUT}		ω_{IM}		$\chi_{IM \to CM}$	
+2.54 (+2.50)		-8.29 (-8.75)		-3.06 (-3.13)		+29.2 (+24.8)	
Volat.	Level	Volat.	Level	Volat.	Level	Volat.	Level
-2.50	5.00	-6.25	-2.50	-4.38	+1.25	+8.3	+16.5

17 Comments on Welfare Numbers

- Substantial losses from rise in wage inequality in incomplete-markets economy

  - Large gains with complete markets due to increases in productivity
  - Larger losses in autarky $\Rightarrow$ welfare losses with incomplete markets
  - Positive level effect is larger under Cobb-Douglas specification because of larger Frisch elasticity
  - Overall welfare effects are similar under both preference specifications

- Welfare gains from completing markets are huge

  - Under both preference specifications 2/3 of these potential gains come from increased productivity

18 Quantitative Welfare Analysis: Observables Approach

- Assume $\gamma = \sigma = 2$
- From the PSID sample:

$$\Delta cov\left(\log h, \log w\right) \approx 0.012$$

$$\Delta var\left(\log h\right) \approx 0.01$$

- From the CEX:
  - Krueger and Perri (2003): $\Delta var\left(\log c\right) \approx 0.01$
  - Attanasio, Battistin, Ichimura (2003): $\Delta var\left(\log c\right) \approx 0.05$

18.1 Results from Observables Approach

$$\omega \simeq \Delta cov\left(\log h, \log w\right) - \frac{\gamma}{2} \cdot \Delta var\left(\log c\right) - \frac{\sigma}{2} \cdot \Delta var\left(\log h\right) \in \left[-4.8\%, -0.8\%\right]$$

- Midpoint is -2.8% compared to -3.1% using the wage-based approach
- Two approaches give similar answers because positive predictions of the model for evolution of cross-sectional dispersion are broadly consistent with the data

19 The Role of Improved Assortative Matching in TFP Growth

- In our PSID sample, labor productivity – ratio of aggregate earnings to aggregate hours – increased by 13% from 1975 to 1995
- Covariance between hours and wages increased by 1.2%
- Thus more efficient allocation of time can account for about 1/10th of the increase in labor productivity over the period

► *Remark: There has been a large rise in non-employment for workers at the bottom of the wage distribution over this period (eg Juhn 1992, Murphy and Topel 1997, JMP 2002)*

By excluding non-workers, we may underestimate the rise in allocative efficiency - we are currently investigating this using aggregate data

20 A Simple Policy Example: Complete Wage Compression

- Welfare costs of incomplete insurance markets are huge
- Is wage compression a sensible policy response?
- Complete wage compression can be implemented with a revenue-neutral system of wage taxes and subsidies s.t. $w_{i,t} = 1 \ \forall i, t$
- The associated welfare change can be computed using the formula for ω_{IM}, setting $\Delta v_\epsilon = -v_\epsilon$ and $\Delta v_\alpha = -v_\alpha$
- When $v_\alpha = 0.22$ and $v_\epsilon = 0.13$ the implied welfare gains are worth 16% of consumption

21 Conclusions

- Presented a rich model of consumption and labor supply that can be solved analytically
- Analyzed welfare effects of increased inequality
  - More risk means more need for insurance, but also better productive opportunities (endogenous labor supply is key)
  - Increase in insurable risk is always good, and better the more flexible is labor supply
  - Increase in uninsurable (permanent) risk is worse the larger is risk aversion and the lower is labor elasticity
- Big numbers: our welfare estimates are *2-3 orders of magnitude bigger* than commonly-estimated welfare costs of business-cycles