Graduate Public Finance: Social Security & Unemployment Insurance

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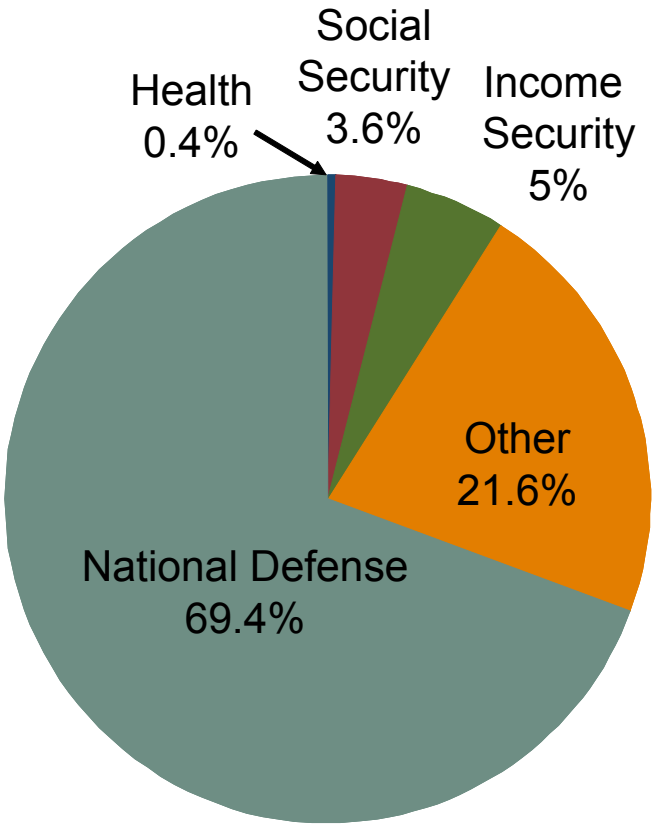
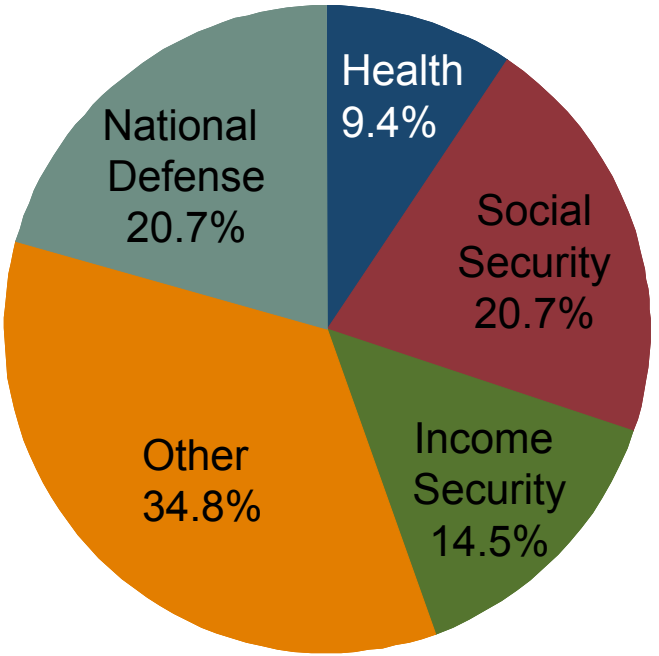
Definition of Social Insurance

- Transfers based on **events** such as unemployment, disability, or age
- Contrasts with welfare: **means-tested** transfers
- SI is the biggest and most rapidly growing part of government expenditure today

Growth of Social Insurance in the U.S.



1953



2008

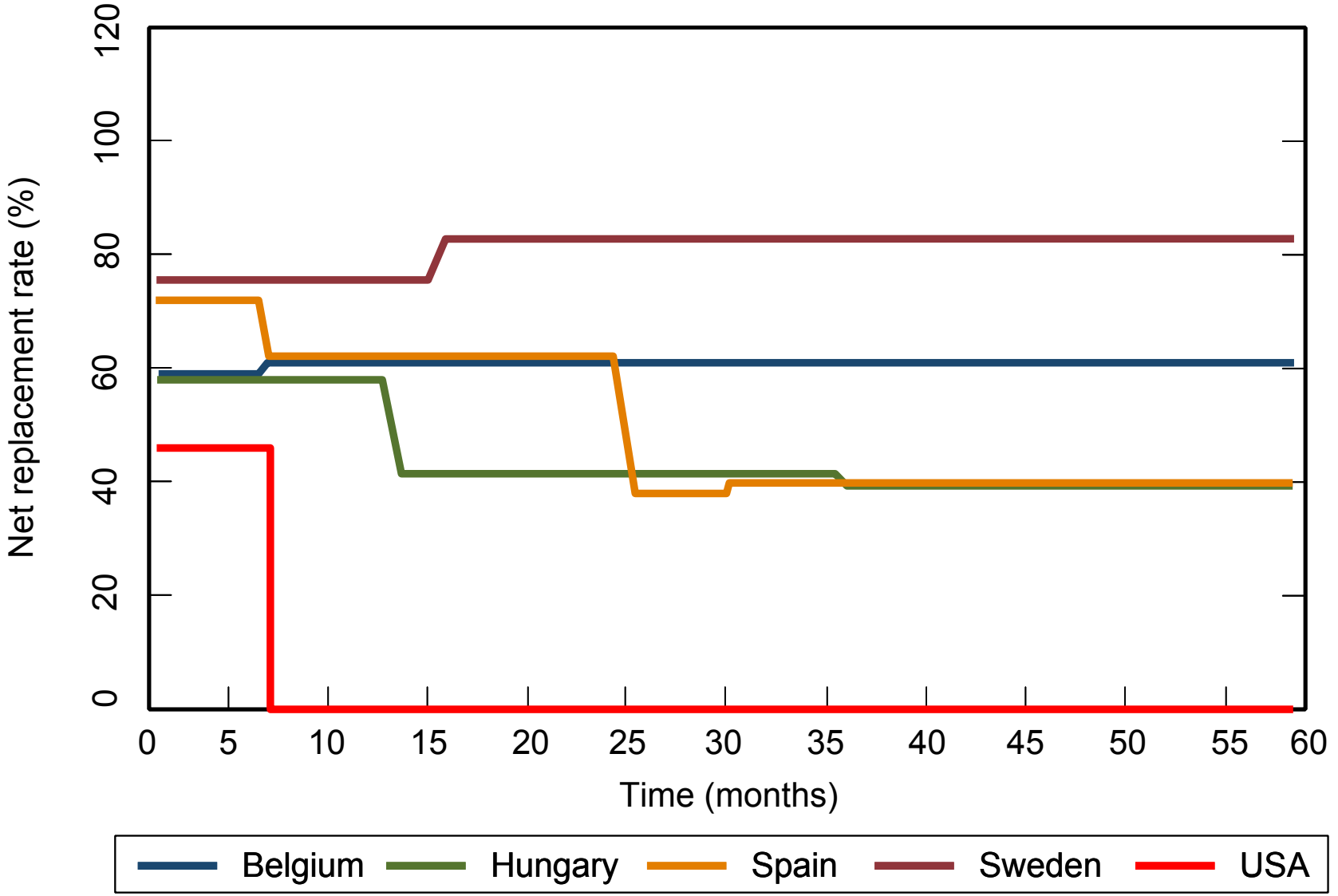
Source: Office of Management and Budget, historical tables, government outlays by function

Social Insurance Spending, 1996

	% of GDP	% of Central Government Expenditures	% of Total Government Expenditures
Sweden	32.47%	86.60%	49.58%
Germany	28.05%	82.91%	49.44%
Mexico	1.36%	8.82%	6.39%
Columbia	6.61%	43.33%	N/A
United Kingdom	17.53%	43.13%	33.77%
United States	12.22%	59.76%	30.02%
Japan	2.50%	19.44%	16%
Czech Republic	11.89%	38.90%	25.75%

Source: Krueger and Meyer 2002

Unemployment Benefit Systems in Developed Countries



Source: OECD Benefits and Wages 2002

Main Questions in Social Insurance

1. Why have social (as opposed to private, or any) insurance?
2. What type of SI system maximizes social welfare?

- Tradeoff between two forces:
  - **Benefits** – reducing risk (fluctuations in consumption)
  - **Distortion** – changes in incentives for workers and firms –> inefficient behavior and DWL
- Generate new distortions as you fix the problem you set out to solve –> second-best solution
- Identify optimal policy by combining theoretical models of social insurance with empirical evidence on program effects

Why have social insurance?

- Motivation for insurance: reduction in risk for risk-averse individuals
  - Unemp Ins: risk of involuntary unemployment
  - Workers' comp and DI: risk of injuries/disabilities
  - Social Security annuity: risk of living too long
- But why is **government** intervention needed to provide this insurance?
- Possible sources of market failure here:
  1. Informational problems (adverse selection)
  2. Individual optimization failures (myopia/improper planning)
  3. Macroeconomic shocks

Adverse Selection as a Motivation for SI

- Key paper: Rothschild and Stiglitz (1976); see MWG Ch. 13 for a good review
- More recent "sufficient statistic" version that can be connected to data: Einav, Finkelstein, and Cullen (QJE 2010)
- Consider an environment with asymmetric information, e.g. individuals know risk of losing job but insurer does not
- Main result: can lead to market failure where no equilibrium supports provision of insurance
- Government intervention through mandated insurance can increase welfare

Rothschild-Stiglitz model

- Economy with two types, low-risk (L) and high-risk (H)
- A fraction f of the individuals are high-risk
- Type L has a chance p_L of becoming unemployed in a given year
- Type H has a chance $p_H > p_L$ of becoming unemployed.
- In good state (state 1), income is E_1 for both types; in bad state, income is $E_2 < E_1$.

Rothschild-Stiglitz: Key Assumptions

1. **Static model**: individuals arrive in the period either employed or unemployed; no savings/dynamics.
2. **No moral hazard**: agents choose insurance contract but make no choices after signing a contract.
3. Insurance market is **perfectly competitive**, so firms earn zero profits in equilibrium.

Rothschild-Stiglitz: Contracts

- An insurance contract is described by a vector $\alpha = (\alpha_1, \alpha_2)$
  - Consumption in the two states: $(E_1 - \alpha_1, E_2 + \alpha_2)$
- Type i's expected utility is

$$V_i(\alpha) = (1 - p_i)u(E_1 - \alpha_1) + p_i u(E_2 + \alpha_2)$$

- Any contract that earns non-negative profits is feasible
  - Zero-profit condition $\Rightarrow$ firms price insurance s.t.

$$\alpha_2 = \frac{1-p}{p}\alpha_1$$

where p is risk rate of those who purchase contract.

Rothschild-Stiglitz: Equilibrium

Definition

An **equilibrium** is defined by a set of insurance contracts such that
(1) individuals optimize: both types cannot find a better contract than the ones they chose
(2) firms optimize: all firms earn zero profits

- Two types of equilibrium:

1. **Pooling**: both types are offered the same contract α.
2. **Separating**: high-risk types choose a contract α_H while low-risk types choose a different contract α_L.

Rothschild-Stiglitz: First Best Solution

- In first best, insurer can distinguish types (perfect information)
  - In this case, equilibrium is separating
- Plugging in $\alpha_2 = \frac{1-p_i}{p_i}\alpha_1$, each type solves

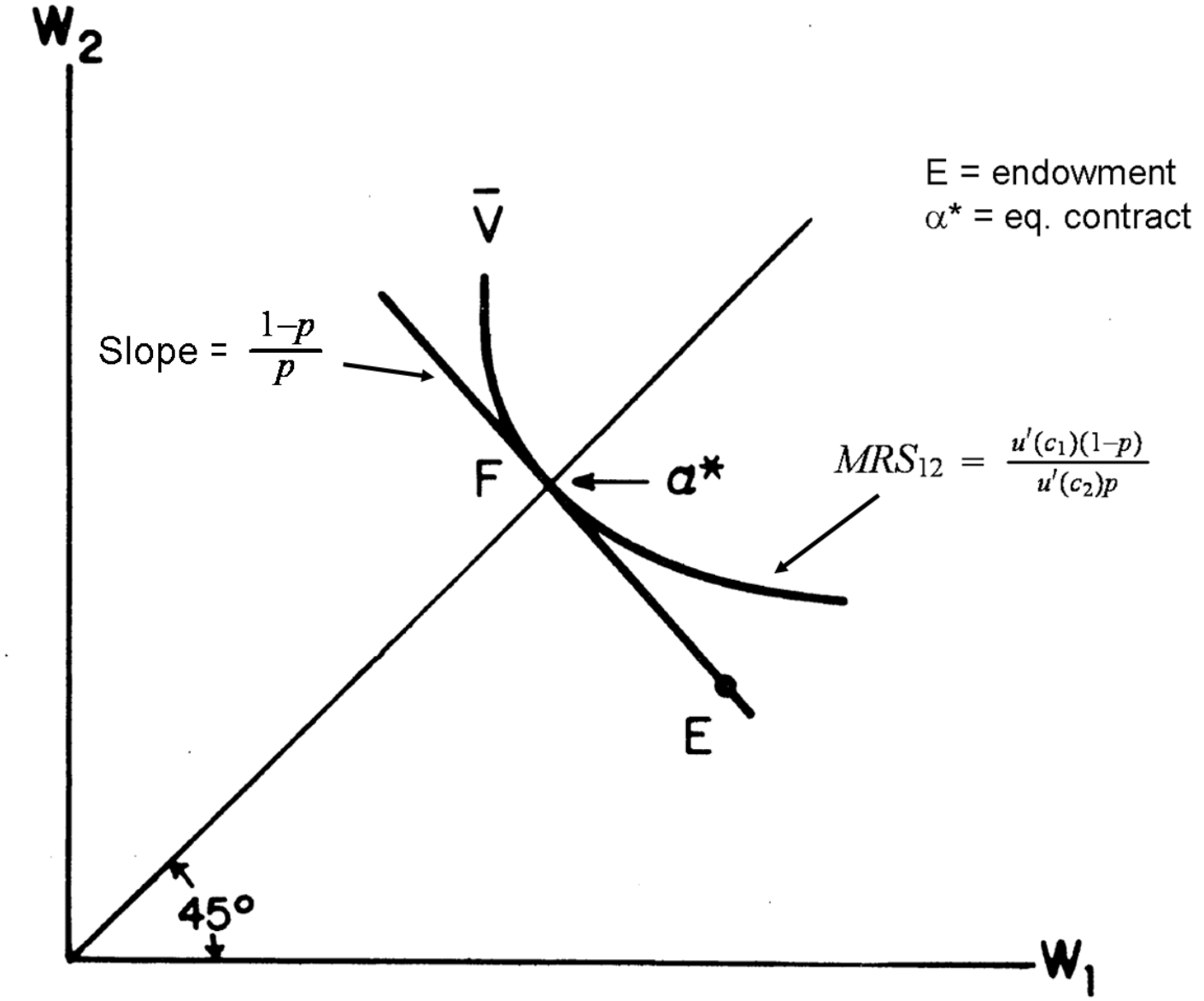
$$\max_{\alpha_1}(1-p_i)u(w-\alpha_1)+p_i u(w+\frac{1-p_i}{p_i}\alpha_1).$$

Solution

Set $MRS_{12} = \frac{1-p_i}{p_i}$, i.e. $u'(c_1) = u'(c_2)$, i.e. full insurance

- Both types are perfectly insured: earn their expected income $(1-p_i)w$ regardless of the state.

Equilibrium with Perfect Information



Source: Rothschild and Stiglitz 1976

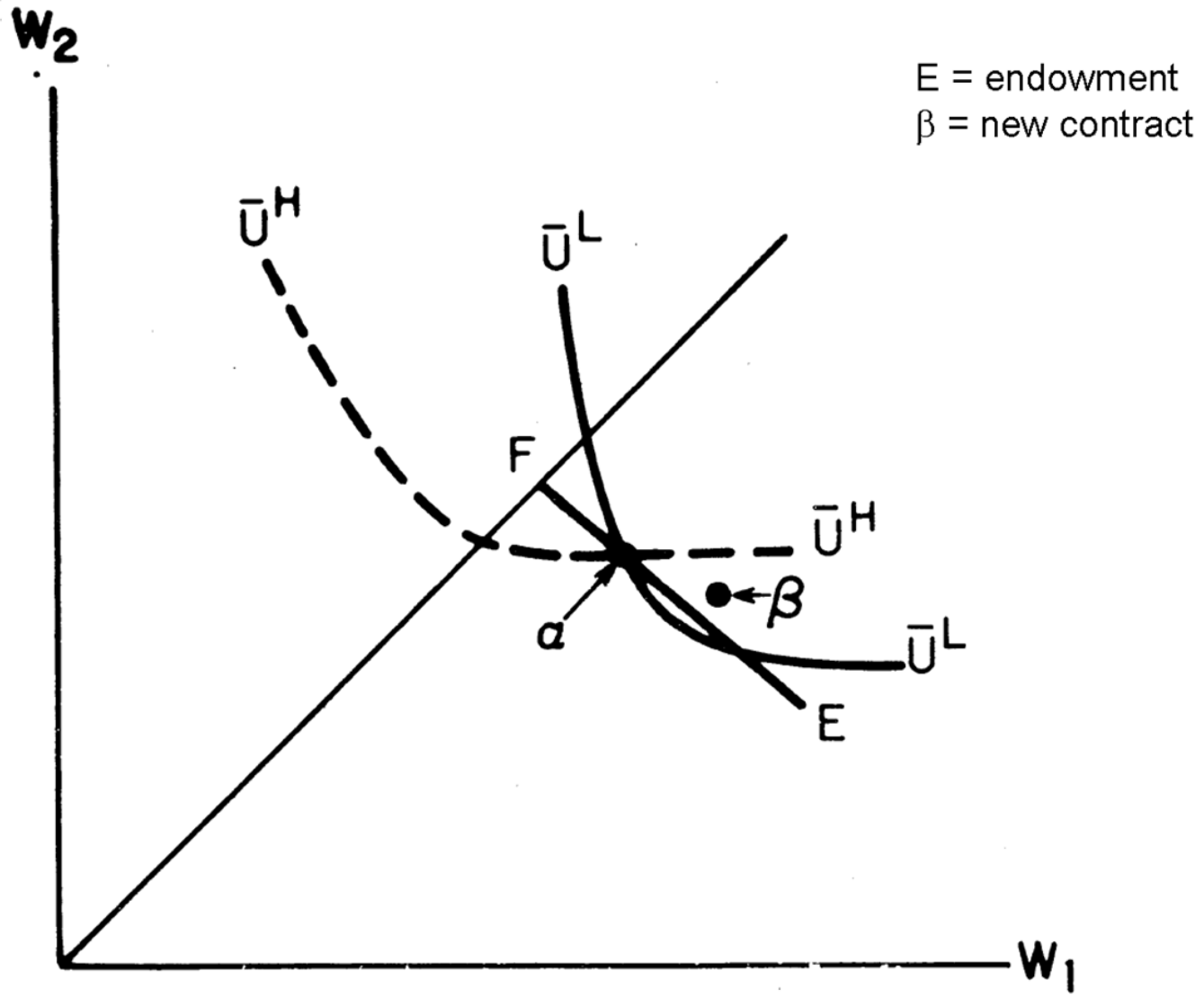
Rothschild-Stiglitz: Second Best Problem

- Firms cannot distinguish types in practice, because they cannot determine true layoff risks, illness history, etc.
- With contracts above, all the high risk types buy the low risk's contract and insurer goes out of business
- Hence optimal contracts differ when information is asymmetric

Rothschild-Stiglitz: Second Best Solution

- **Result #1:** no pooling equilibrium exists
- If H and L types are pooled in a contract α,low-risk types lose money in expectation.
- Zero-profit condition requires $\alpha_2 = \frac{1-\overline{p}}{\overline{p}}\alpha_1$ but $\overline{p} > p_L$.
  - Low-risk type gets fewer dollars in state 2 than he should if the insurance were fair for him.
- Creates an opportunity for a new insurer to enter and "pick off" low risk types by offering slightly less insurance at a better price: higher c_1, lower c_2
  - Only low risk types switch, because they value c_1 more.

No Pooling Equilibrium with Asymmetric Information



Source: Rothschild and Stiglitz 1976

Rothschild-Stiglitz: Second Best Solution

- **Result #2:** in a separating eq, Type H obtains full insurance and Type L is under-insured
- **Intuition:** in any sep. eq., both types are getting actuarially fair insurance because of the zero-profits condition
  - For H, no cost to firm in providing full ins. (worst that can happen is that L will join the pool, raising profits)
  - But for L, full ins. would create an incentive for H to buy this (cheaper) policy, forcing firm into negative profits
- Incentive constraints always bind downward – "no distortion at the top" result in standard asymmetric info. models
- In eq., L gets as much ins as possible without inducing H to deviate and pretend to be low-risk

Rothschild-Stiglitz: Gains from Government Mandate

- There can be gains from government intervention through mandated insurance
- Consider an example where

$$\begin{aligned} E_1 &= 100, E_2 = 0 \\ u(c) &= \sqrt{c}, p_L = \frac{1}{4}, p_H = \frac{3}{4}, f = 10\% \end{aligned}$$

- In candidate separating eq., type H gets perfect insurance:

$$EU_H = u(100(1 - p_H)) = \sqrt{100 \cdot \frac{1}{4}} = 5$$

Rothschild-Stiglitz: Second Best Solution

- Type L gets as much ins. as possible without making H want to deviate at actuarially fair rate for L:

$$5 = \frac{1}{4}\sqrt{100 - \alpha_1^L} + \frac{3}{4}\sqrt{\frac{1 - p_L}{p_L}\alpha_1^L}$$

- Solving gives $\alpha_1^L = \$3.85, \alpha_2^L = \$11.55$ – nowhere near full insurance for low risk type.

- Note that expected utility for low risk type is

$$EU_L = \frac{3}{4}\sqrt{100 - 3.85} + \frac{1}{4}\sqrt{3 \cdot 3.85} = 8.2.$$

Rothschild-Stiglitz: Second Best Solution

- Now suppose govt. comes in and mandates pooled insurance at actuarial rate. Everyone gets an income of

$$(\frac{9}{10}\frac{3}{4}+\frac{1}{10}\frac{1}{4})100=\frac{7}{10}100=70.$$

- H benefits from this: now pooling with less risky people
- But L benefits too! Expected utility is $\sqrt{70}>8.2$

Rothschild-Stiglitz: Second Best Solution

- Because there are relatively few high risk types, L types benefit from pooling with them and getting full insurance coverage.
- Note: pooled contract of 70 could be offered by a private firm, destroying separating eq. proposed above
    - Hence there is actually no equilibrium in this example

Adverse Selection as a Motivation for SI

- More generally, consider an economy in which people differ in their risks of becoming unemployed
- Adverse selection can destabilize the market:
  - Firm provides UI but lowest-risk (tenured people) drop out $\Rightarrow$ rates have to rise
  - But then even moderate-risk types opt out $\Rightarrow$ rates rise further, more drop out, ...
  - Could cause unraveling to the point where virtually no one is insured by private market
  - UI program that pools everyone can lead to (ex-ante) welfare improvements
- What tool does the govt. have that private sector does not? Ability to mandate

Adverse Selection: Empirical Evidence

- Empirical evidence shows that adverse selection is a real source of market failures in practice
- Standard test: "positive correlation" property in equilibrium (Chiappori and Salanie 2000)
  - Are those who buy more insurance more likely to file claims?
  - Could be driven by both moral hazard + AS but not in certain contexts such as death
- Example: Finkelstein and Poterba (2004): adverse selection in U.K. annuity market.
  - Annuities = ins. against the risk of living too long.

Finkelstein and Poterba 2004

- Study two types of annuity markets: compulsory vs. voluntary.
- Examine two features of annuity contracts
  - degree of **backloading** (inflation indexing and escalation of payments over time)
  - **payments to estate** in event of death (guarantees and capital protection).
- Test for positive correlation in two ways
  1. In eq., those who purchase backloaded annuities have lower mortality rates
  2. In eq., those who purchase annuities with payment to estate have higher mortality rates
  - Both effects should be stronger in voluntary markets

TABLE 2

SELECTION EFFECTS AND ANNUITY PRODUCT CHARACTERISTICS

	ESTIMATES FROM HAZARD MODEL OF MORTALITY AFTER PURCHASING AN ANNUITY		ESTIMATES FROM LINEAR PROBABILITY MODEL OF PROBABILITY OF DYING WITHIN FIVE YEARS	
EXPLANATORY VARIABLE	Compulsory Market (1)	Voluntary Market (2)	Compulsory Market (3)	Voluntary Market (4)
Index-linked	−.839***	−.894**	−.053***	−.185***
	(.217)	(.358)	(.019)	(.050)
Escalating	−1.085***	−1.497***	−.072***	−.152***
	(.113)	(.253)	(.010)	(.030)
Guaranteed	.019	.216***	.007*	.046***
	(.029)	(.060)	(.004)	(.016)
Capital-protected	…	.056	…	.064***
		(.051)		(.016)
Payment (£100s)	−.003***	.001**	−.0003***	.0003***
	(.0006)	(.0004)	(.0001)	(.0001)
Male Annuitant	.640***	.252***	.044***	.044***
	(.039)	(.051)	(.005)	(.014)
Observations	38,362	3,692	24,481	3,575
Number of deaths in sample	6,311	1,944	2,693	822

Source: Finkelstein and Poterba 2004

Limitations of Positive Correlation Test

1. Does not account for other dimensions of heterogeneity that may confound the correlation
    - Literature on "advantageous selection" (e.g., Finkelstein and McGarry 2006)
2. Correlation does not clearly map into parameters that control welfare costs of selection
    - Einav, Finkelstein, and Cullen (2010) develop "cost curve" tests that map to measures of welfare costs
3. Only applicable in markets that exist, i.e. those that have not totally unravelled
    - Hendren (2012) uses subjective expectations data to bound welfare costs in markets that have unraveled

Individual Optimization Failures as a Motivation for SI

- Given adverse selection, expect individuals to "self-insure" against temp. shocks by building up savings
- With such buffer stocks, still no need for large social safety nets to insure against temporary shocks such as unemployment
- In practice, individuals appear to be very liquidity constrained when hit by shocks: median job loser has $<$\$200 in assets
- Suggests 1st Welfare thm also does not hold due to *individual* failures to optimize
  - Individuals may misperceive the probability of a layoff
  - Firms may not be able to debias people in equilibrium, leading to role for govt. (Spinnewijn 2009)

Aggregate Shocks as a Motivation for SI

- Private ins. (cross-sectional pooling) relies on idiosyncratic risks so those who are well off can pay those who are poor
- Government is the only entity able to coordinate risk-sharing across different groups that are all affected by negative shocks
    - Inter-generational risk sharing required if everyone is poor at the same time
- Particularly relevant for UI and maybe social security
- Less so for health-related shocks

Optimal Social Insurance

- Now turn to question of optimal design of SI policies
- Take as given that market provides no insurance for some reason
- In the simple Rothschild-Stiglitz model, perfect insurance is optimal
  - But this abstracts from moral hazard
  - Individuals will not work if they have perfect unemp insurance
  - Must take this distortion into account to find optimal level of social insurance

Unemployment Insurance

- **Potential benefits**
  1. Smoother path of consumption
  2. Better job matches
- **Potential distortions**
  1. Less job search, higher unemployment rate
  2. Workers' preferences distorted toward unstable jobs
  3. Shirking on the job

Optimal UI: Outline

1. Optimal level of UI benefits ignoring firm responses [Baily-Chetty model]
    - Theory applies to all income security programs discussed later
2. Distortions to firms' layoff decisions due to imperfect exp rating [Feldstein model]
3. Other issues: Post-unemployment outcomes, general equilibrium effects

Replacement Rate

- Common measure of program's size is its "replacement rate"

$$r = \frac{\text{net benefit}}{\text{net wage}}$$

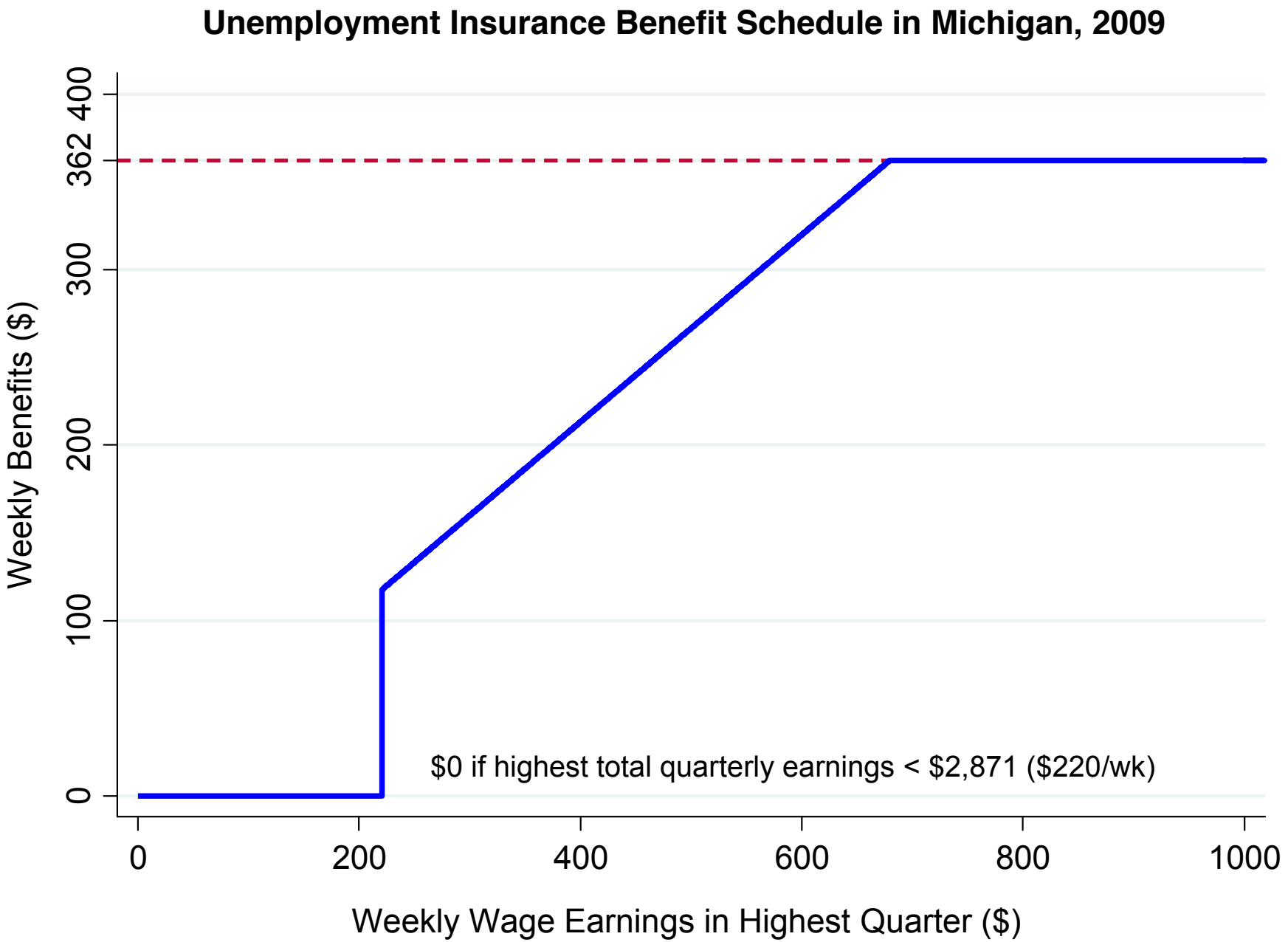
- UI reduces agents' effective wage rate from finding a new job to $w(1-r)$

- Feldstein (1978): UI makes effective wages very low because of interaction with tax system:

  - 1970: No tax $\Rightarrow r = \frac{(0.5)w}{(1-.18-.05-.07)w} = 72\%$

  - Incentives worse for some subgroups: secondary income earner faces MTR of 50% $\Rightarrow r = 1.3$

- Today, federal income taxes paid on UI benefits, so rep. rate is 50-60%



Source: Michigan Department of Energy, Labor, and Economic Growth 2009

Baily-Chetty model

- Canonical analysis of optimal level of UI benefits: Baily (1978)
- Shows that the optimal benefit level can be expressed as a fn of a small set of parameters in a static model.
- Once viewed as being of limited practical relevance because of strong assumptions
- Chetty (2006) shows formula actually applies with arbitrary choice variables and constraints.
- Parameters identified by Baily are sufficient statistics for welfare analysis $\Rightarrow$ robust yet simple guide for optimal policy.

Baily-Chetty model: Assumptions

1. Fixed wages – no GE effects
2. No distortions to firm behavior (temporary layoffs); implicitly assume perfect experience rating
3. No externalities such as spillovers to search

Baily-Chetty model: Setup

- Static model with two states: high (employed) and low (unemployed)
- Let w_h denote the individual's income in the high state and $w_l < w_h$ income in the low state
- Let A denote wealth, c_h consumption in the high state, and c_l consumption in the low state
- Agent is initially unemployed. Controls probability of being in the bad state by exerting search effort e at a cost $\psi(e)$
- Choose units of e so that the probability of being in the high state is given by $p(e) = e$

Baily-Chetty model: Setup

- UI system that pays constant benefit b to unemployed agents
- Benefits financed by lump sum tax $t(b)$ in the high state
- Govt's balanced-budget constraint:

$$e \cdot t(b) = (1 - e) \cdot b$$

- Let $u(c)$ denote utility over consumption (strictly concave)
- Agent's expected utility is

$$eu(A + w_h - t(b)) + (1 - e)u(A + w_l + b) - \psi(e)$$

First Best Problem

- In first best, there is no moral hazard problem
- To solve for FB, suppose government chooses b and e jointly to maximize agent's welfare:

$$\max_{b,e} e(A + w_h - t) + (1 - e)u(A + w_l + b) - \psi(e)$$
$$\text{s.t. } t = \frac{1 - e}{e} b$$

- Solution to this problem is $u'(c_e) = u'(c_u) \Rightarrow$ full insurance

Second Best Problem

- In second best, cannot eliminate moral hazard problem because effort is unobserved by govt.
- Problem: Agents only consider *private* marginal costs and benefits when choosing e
  - Social marginal product of work is $w_h - w_l$
  - Private marginal product is $w_h - w_l - b - t$
  - Agents therefore search too little from a social perspective, leading to efficiency losses

Second Best Problem

- Agents maximize expected utility, taking b and $t(b)$ as given

$$\max_e eu(A + w_h - t) + (1 - e)u(A + w_l + b) - \psi(e)$$

- Let indirect expected utility be denoted by $V(b, t)$

- Government's problem is to maximize agent's expected utility, taking into account agent's behavioral responses:

$$\max_{b,t} V(b, t)$$
$$\text{s.t. } e(b)t = (1 - e(b))b$$

Second Best Problem

Problem

Optimal Social Insurance

$$\begin{aligned} & \max_b V(b, t(b)) \\ & s.t.\ \ e(b)t(b) = (1 - e(b))b \\ e(b) \quad = \quad & \arg\max_e e \cdot u(A + w_h - t) + (1 - e) \cdot u(A + w_l + b) - \psi(e) \end{aligned}$$

- Formally equivalent to an optimal Ramsey tax problem with state-contingent taxes

Two Approaches to Optimal Social Insurance

1. **Structural**: specify complete models of economic behavior and estimate the primitives
    - Identify b^* as a fn. of discount rates, nature of borrowing constraints, informal ins. arrangements.
2. **Sufficient Statistic:** derive formulas for b^* as a fn. of reduced-form elasticities
    - Baily-Chetty formula is one example

Chetty (2006) Sufficient Statistic Formula

- At an interior optimum, the optimal benefit rate must satisfy

$$dV/db(b^*) = 0$$

- To calculate this derivative, write $V(b)$ as

$$V(b) = \max_e eu(A + w_h - t(b)) + (1-e)u(A + w_l + b) - \psi(e)$$

- Since fn has been optimized over e, Envelope Thm. implies:

$$\frac{dV(b)}{db} = (1-e)u'(c_l) - \frac{dt}{db}eu'(c_h)$$

- Can ignore $\frac{\partial e}{\partial b}$ terms because of agent optimization

Kaplan 2009

- Exploiting f.o.c.'s from agent optimization particularly useful in more complex models
- Kaplan (2009): unemployed youth move back in with their parents.
  - How does this affect optimal UI?
- Kaplan takes a structural approach and estimates a dynamic model of the decision to move back home

Sufficient Statistic Approach to Kaplan 2009

- Suppose moving home raises consumption by H and has a cost $g(H)$:

$$\begin{aligned} V(b) &= \max_{e,H} eu(A + w_h - t(b)) \\ &\quad + (1-e)[u(A + w_l + b + H) - g(H)] - \psi(e) \end{aligned}$$

- Variable H drops out, as did e, because of agent optimization

- Formula derived for $\frac{dV(b)}{db}$ is unaffected by ability to move home:

$$\frac{dV(b)}{db} = (1-e)u'(c_l) - \frac{dt}{db} eu'(c_h)$$

where c_l is measured in the data as including home consumption (H)

Chetty (2006) Sufficient Statistic Formula

- The government's UI budget constraint implies

$$\frac{dt}{db} = \frac{1-e}{e} - \frac{b}{e^2}\frac{de}{db} = \frac{1-e}{e}(1+\frac{\varepsilon_{1-e,b}}{e})$$

$$\Longrightarrow \quad \frac{dV(b)}{db} = (1-e)\{u'(c_l) - (1+\frac{\varepsilon_{1-e,b}}{e})u'(c_h)\}$$

- Setting $dV(b)/db = 0$ yields the optimality condition

$$\frac{u'(c_l) - u'(c_h)}{u'(c_h)} = \frac{\varepsilon_{1-e,b}}{e}$$

- LHS: benefit of transferring \$1 from high to low state

- RHS: cost of transferring \$1 due to behavioral responses

Baily-Chetty Formula

$$\frac{u'(c_l) - u'(c_h)}{u'(c_h)} = \frac{\varepsilon_{1-e,b}}{e}$$

- This equation provides an exact formula for the optimal benefit rate
- Implementation requires identification of $\frac{u'(c_l)-u'(c_h)}{u'(c_h)}$
- Three ways to identify $\frac{u'(c_l)-u'(c_h)}{u'(c_h)}$ empirically
  1. Baily (1978), Gruber (1997), Chetty (2006): cons-based approach
  2. Shimer and Werning (2007): reservation wages
  3. Chetty (2008): moral hazard vs liquidity

Consumption-Based Formula

- Write marginal utility gap using a Taylor expansion

$$u'(c_l) - u'(c_h) \approx u''(c_h)(c_l - c_h)$$

- Defining coefficient of relative risk aversion $\gamma = \frac{-u''(c)c}{u'(c)}$, we can write

$$\begin{aligned} \frac{u'(c_l) - u'(c_h)}{u'(c_h)} &\approx -\frac{u''}{u'} c_h \frac{\Delta c}{c} \\ &= \gamma \frac{\Delta c}{c} \end{aligned} \tag{1}$$

- Gap in marginal utilities is a function of curvature of utility (risk aversion) and consumption drop from high to low states

Consumption-Based Formula

Theorem

The optimal unemployment benefit level b^* satisfies

$$\gamma \frac{\Delta c}{c}(b^*) \approx \frac{\varepsilon_{1-e,b}}{e}$$

where

$$\begin{aligned}
\frac{\Delta c}{c} &= \frac{c_h - c_l}{c_h} = \textit{consumption drop during unemployment} \\
\gamma &= -\frac{u''(c_h)}{u'(c_h)} c_h = \textit{coefficient of relative risk aversion} \\
\varepsilon_{1-e,b} &= \frac{d \log 1 - e}{d \log b} = \textit{elast. of probability of unemp. w.r.t. benefits}
\end{aligned}$$

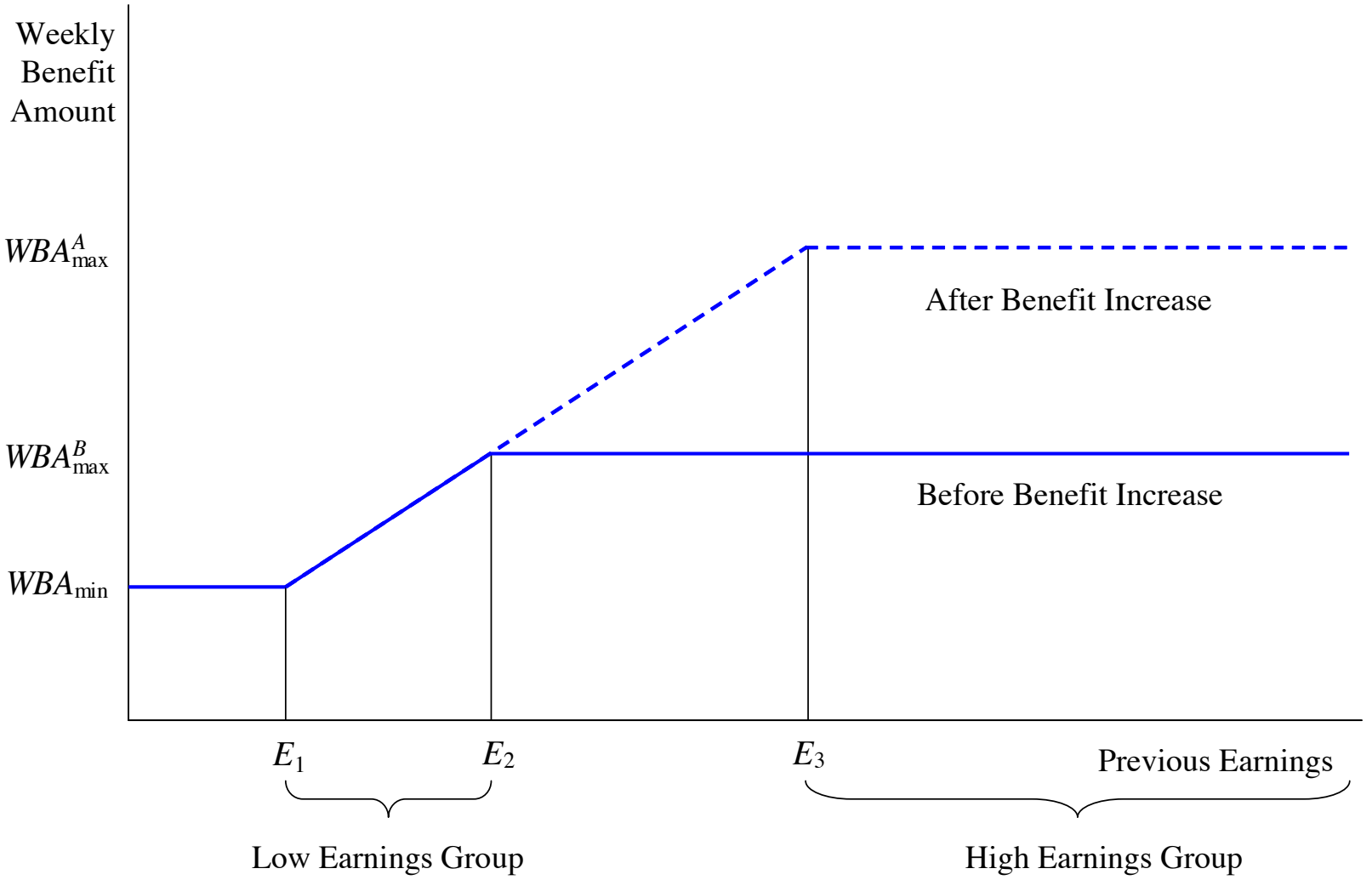
Consumption-Based Formula

$$\gamma \frac{\Delta c}{c}(b^*) \approx \frac{\varepsilon_{1-e,b}}{e}$$

- Intuition for formula: LHS is marginal social benefit of UI, RHS is marginal social cost of UI
- Extends to model where agent chooses N other behaviors and faces M other constraints, subject to some regularity conditions (Chetty 2006).
  - Envelope conditions used above still hold
- Empirical work on UI provides estimates of the three key parameters $(\gamma, \frac{\Delta c}{c}, \varepsilon)$.

Empirical Estimates: Duration Elasticity

- Early literature used cross-sectional variation in replacement rates
- Problem: comparisons of high and low wage earners confounded by other factors.
- Modern studies use exogenous variation from policy changes (e.g. Meyer 1990)



Source: Krueger and Meyer 2002

Hazard Models

- Define hazard rate h_t = number that find a job at time t divided by number unemployed at time t
  - This is an estimate of the probability of finding a job at time t conditional on being unemployed for at least t weeks
- Standard specification of hazard model: Cox "proportional hazards"

$$h_t = \alpha_t \exp(\beta X)$$

- Here α_t is the non-parametric "baseline" hazard rate in each period t and X is a set of covariates
- Semi-parametric specification – allow hazards to vary freely across weeks and only identify coefficients off of variation across spells

Hazard Models

- Useful to rewrite expression as:

$$\log h_t = \log \alpha_t + \beta X$$

- Key assumption: effect of covariates proportional across all weeks

$$\frac{d \log h_t}{dX} = \beta = \frac{d \log h_s}{dX} \forall t, s$$

- If a change in a covariate doubles hazard in week 1, it is forced to double hazard in week 2 as well

- Restrictive but a good starting point; can be relaxed by allowing for time varying covariates X_t

Meyer 1990

- Meyer includes log UI benefit level as a covariate:

$$\log h_t = \log \alpha_t + \beta_1 \log b + \beta_2 X$$

- In this specification,

$$\frac{d \log h_t}{d \log b} = \beta_1 = \varepsilon_{h_t,b}$$

- Note: in exponential survival (constant-hazard) models, $\varepsilon_{h_t,b} = -\varepsilon_{1-e,b}$
- Meyer estimates $\varepsilon_{h_t,b} = -0.9$ using administrative data for UI claimants
- Subsequent studies get smaller estimates; consensus: $\varepsilon_{h_t,b} = -0.5$ (Krueger and Meyer 2002)

Hazard Model Estimates[a]

Variable	Specification (1)	(2)	(3)	(4)	(5)
Number of dependents	−.0418	−.0422	−.0416	−.0386	−.0386
	(0.0169)	(0.0171)	(0.0168)	(0.0239)	(0.0242)
1 = married, spouse present	.1302	.1221	.1315	.1006	.1001
	(0.0508)	(0.0515)	(0.0507)	(0.0722)	(0.0730)
1 = white	.2097	.2230	.2171	.2337	.2364
	(0.0572)	(0.0579)	(0.0568)	(0.0834)	(0.0841)
Years of schooling	−.0276	−.0275	−.0272	−.0177	−.0176
	(0.0083)	(0.0084)	(0.0083)	(0.0123)	(0.0124)
Log UI benefit level	−.8782	−.8157	−.8478	−.8685	−.8757
	(0.1091)	(0.1096)	(0.1088)	(0.2042)	(0.2065)
Log pre-UI after tax wage	.5630	.5651	.5530	.7289	.7411
	(0.0855)	(0.0860)	(0.0848)	(0.1415)	(0.1433)

Source: Meyer 1990

Consumption Smoothing Benefits of UI

- Gruber (1997) takes the Baily formula to the data by estimating consumption smoothing response.
- Same methodology as Meyer
  - Uses cross-state and time variation and uses drop in food consumption as the LHS variable.
  - Data: PSID food consumption

Gruber 1997

- Gruber estimates
$$\frac{\Delta c}{c} = \beta_1 + \beta_2 \frac{b}{w}$$
- Finds $\beta_1 = 0.24$, $\beta_2 = -0.28$
- Without UI, cons drop would be about 24%
- Mean drop with current benefit level ($b = 0.5$) is about 10%
- Implies a 10 pp increase in UI replacement rate causes 2.8 pp reduction in cons. drop
- Suggests that ins. markets are not perfect and UI does play a consumption smoothing role, but estimates are imprecise
    - Key area for future work: admin. consumption data

Consumption Smoothing Benefits of UI

- What is substituting for/getting crowded out by UI?
- Cullen and Gruber (2000) emphasize spousal labor supply
  - Study wives of unemployed husbands
  - Examine wives' labor supply as a fn of level of husbands' UI benefits
  - For a \$100/wk increase in UI benefit, wives work 22 hrs less per month
  - In the absence of UI, wives would work 30% more during the spell than they do now
- Engen and Gruber (1995) document that higher UI benefits lower ex-ante savings, another crowdout channel

Calibrating the Model

- Gruber calibrates Baily's model using his and Meyer's estimates:

$$\begin{aligned} \gamma \frac{\Delta c}{c} &\approx \frac{\varepsilon_{1-e,b}}{e} \\ \gamma(\beta_1 + \beta_2 \frac{b^*}{w}) &= \frac{\varepsilon_{1-e,b}}{e} \end{aligned}$$

- Solving for the optimal replacement rate yields:

$$\frac{b^*}{w} = \frac{\varepsilon_{1-e,b}/e}{\beta_2}(\frac{1}{\gamma}) - \frac{\beta_1}{\beta_2}$$

- Plugging in $\varepsilon_{1-e,b} = .43$ as in Gruber (1997) and $e = .95$ (5% unemployment rate) yields:

$$\frac{b^*}{w} = -(\frac{.43/.95}{.28} \cdot \frac{1}{\gamma}) - \frac{(-.24)}{.28}$$

Calibrating the Model

- Results: $\frac{b}{w}^*$ varies considerably with γ

γ	1	2	3	4	5	10
$\frac{b}{w}^*$	0	0.05	0.31	0.45	0.53	0.7

- Gruber: introspection and existing evidence suggests $\gamma < 2$
- Implies optimal benefit level is much lower than observed

Measurement of Risk Preferences

- Parameter that is most poorly identified: γ
- Barseghyan et al. (2012) and Einav et al. (2012) estimate risk preferences across different domains
  - Do individuals who choose more insurance for health also choose more insurance for long-term disability?
  - Find positive correlation in risk preferences but substantial heterogeneity across domains
- Suggests that appropriate value of γ is highly context-dependent
  - Could be due to behavioral factors and framing but also due to neoclassical factors

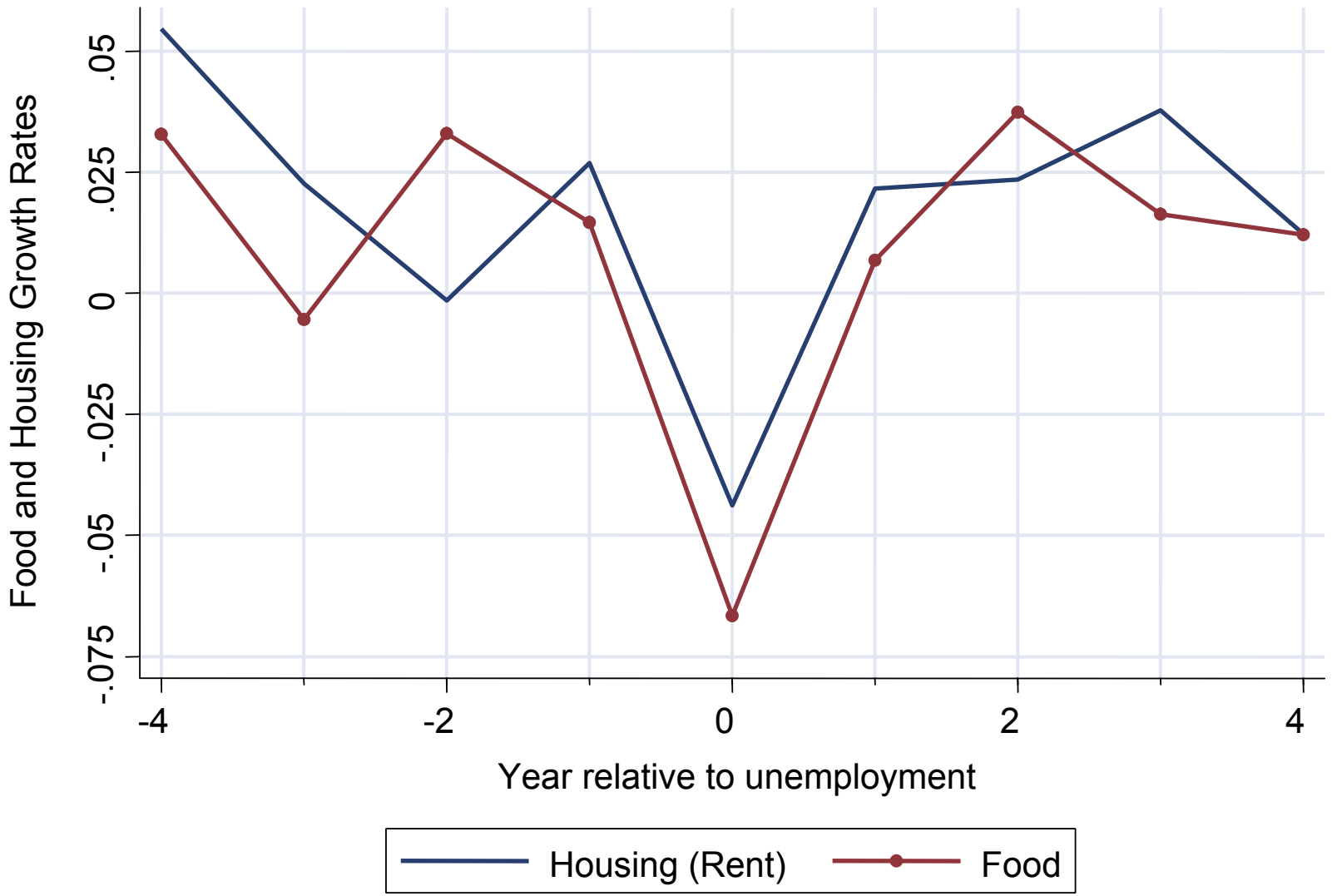
Chetty and Szeidl (2007): Consumption Commitments

- Standard expected utility model: one composite consumption good c
- Composite commodity assumes that people can cut back on all consumption goods at all times freely.
- E.g. when unemployed, cut consumption of food, housing, cars, furniture, etc.
- In practice, difficult to adjust many elements of consumption in short run because of fixed adjustment costs

Homeowners' Consumption around Unemployment Shocks

Source: Chetty and Szeidl 2007

Renters' Consumption around Unemployment Shocks



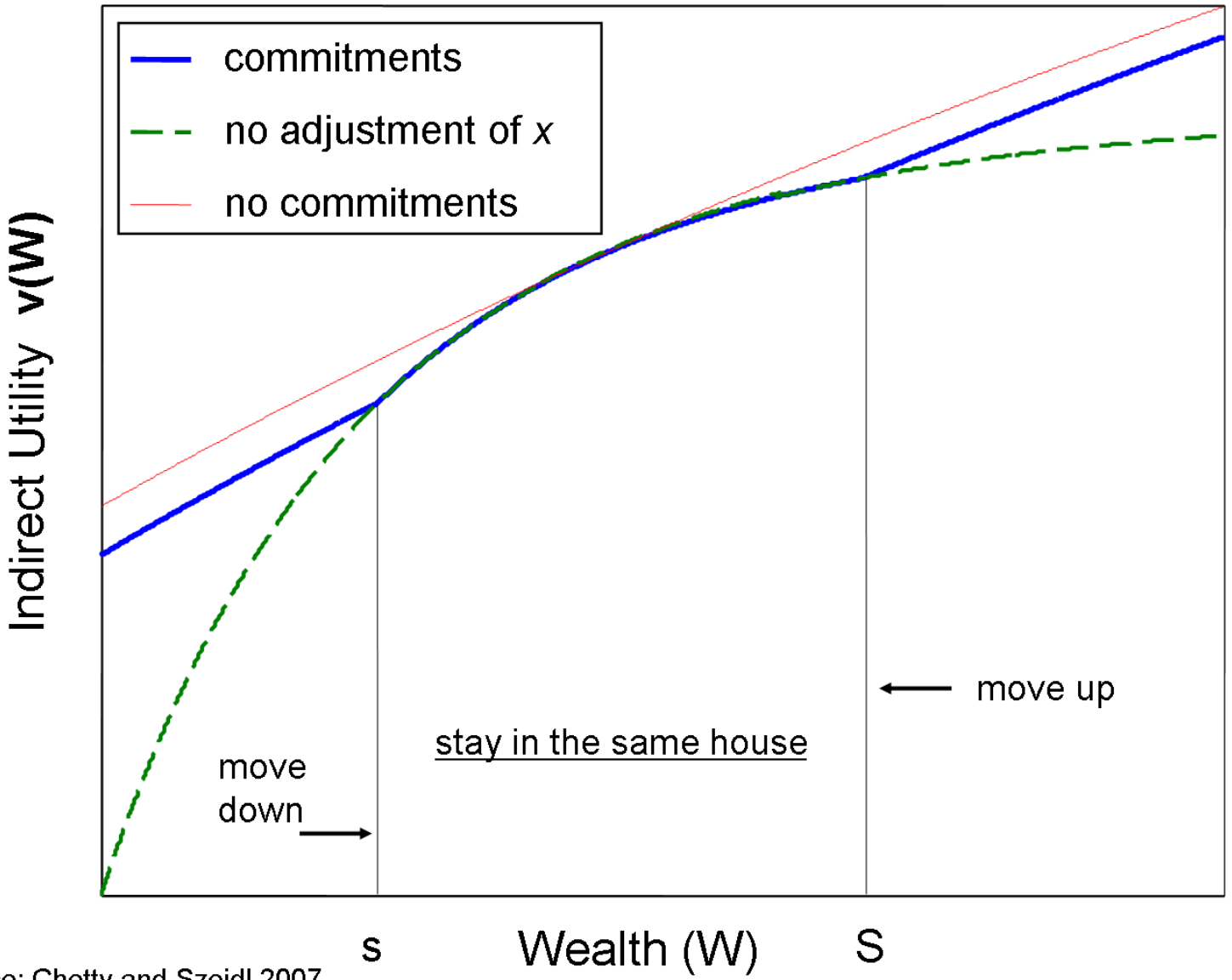
Source: Chetty and Szeidl 2007

Commitments and Risk Aversion

- How do commitments affect risk aversion?
- Utility over two goods, food and housing:

$$U(f, h) = u(f) + v(h).$$

- Adjusting h requires payment of a fixed cost k
- Agent follows an (S, s) policy



Source: Chetty and Szeidl 2007

Commitments Model: Implications for UI

- Commitments amplify risk aversion
  - Ex: 50% food, 50% housing
  - Suppose unemployed agent forced to cut expenditure by 10%
  - Then have to cut food cons by 20%, leading to larger welfare loss
- Model of commitments suggests that γ might actually exceed 4 for unemployment shocks

γ	1	2	3	4	5	10
$\frac{b}{w}^*$	0	0.05	0.31	**0.45**	0.53	0.7

- Problem: γ hard to estimate precisely by context

Alternative Formulas for Optimal UI

- Since γ and $\frac{\Delta c}{c}$ are hard to identify, recent work has sought alternative ways of calculating optimal benefit.
- Two approaches
  1. Moral hazard vs. liquidity (Chetty 2008)
  2. Reservation wage response (Shimer Werning 2007)
- Note that any formula is only one representation of optimal benefit

Chetty 2008: Moral Hazard vs. Liquidity

- Discrete time dynamic search model
- Individual lives for T periods
- Interest rate and discount rate equal to 0
- Individual loses job in period $t = 0$
- Let $u(c_t)$ denote flow utility over cons.
- Dynamic budget constraint:

$$A_{t+1} = A_t + y_t - c_t$$

- Asset limit: $A_t \geq L$

Chetty 2008: Baseline Assumptions

1. Assets prior to job loss exogenous
2. No heterogeneity
3. Fixed wages: choose only search intensity, not reservation wage

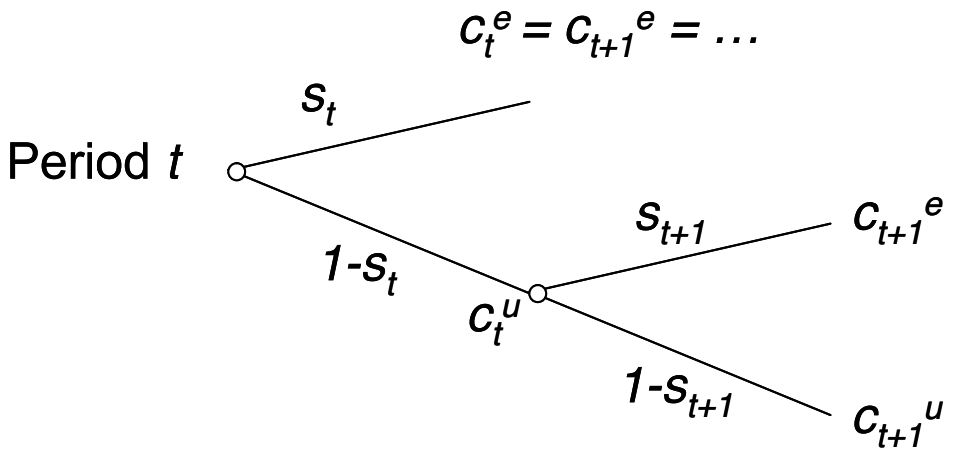
- Each of these is relaxed in paper, so model nests search models used in structural literature (e.g. Wolpin 1987)

Chetty 2008: Job Search Technology

- If unemployed in period t, worker first chooses search intensity s_t
- Finds a job that begins immediately in period t with probability s_t
- If job found, consumes c_t^e. Jobs are permanent, pay wage $w_t - \tau$.

Chetty 2008: Job Search Technology

- If no job found: receives benefit b_t, consumes c_t^u, enters $t+1$ unemployed
- Cost of job search: $\psi(s_t)$



Chetty 2008: Value Functions

- Value function for agent who finds a job in period t:

$$V_t(A_t) = \max_{A_{t+1} \geq L} u(A_t - A_{t+1} + w - \tau) + V_{t+1}(A_{t+1})$$

- Value function for agent who does not find a job in period t:

$$U_t(A_t) = \max_{A_{t+1} \geq L} u(A_t - A_{t+1} + b_t) + J_{t+1}(A_{t+1})$$

  where $J_{t+1}(A_{t+1})$ is value of entering next period unemployed.

- Agent chooses s_t to maximize expected utility

$$J_t(A_t) = \max_{s_t} s_t V_t(A_t) + (1 - s_t) U_t(A_t) - \psi(s_t)$$

Chetty 2008: Optimal Search Behavior

- First order condition for optimal search intensity:

$$\psi'(s_t^*) = V_t(A_t) - U_t(A_t)$$

- Intuitively, s_t is chosen to equate the marginal cost of search effort with the marginal value of search effort.

- Effect of benefits on durations:

$$\partial s_t / \partial b_t = -u'(c_t^u) / \psi''(s_t)$$

Chetty 2008: Moral Hazard vs. Liquidity Decomposition

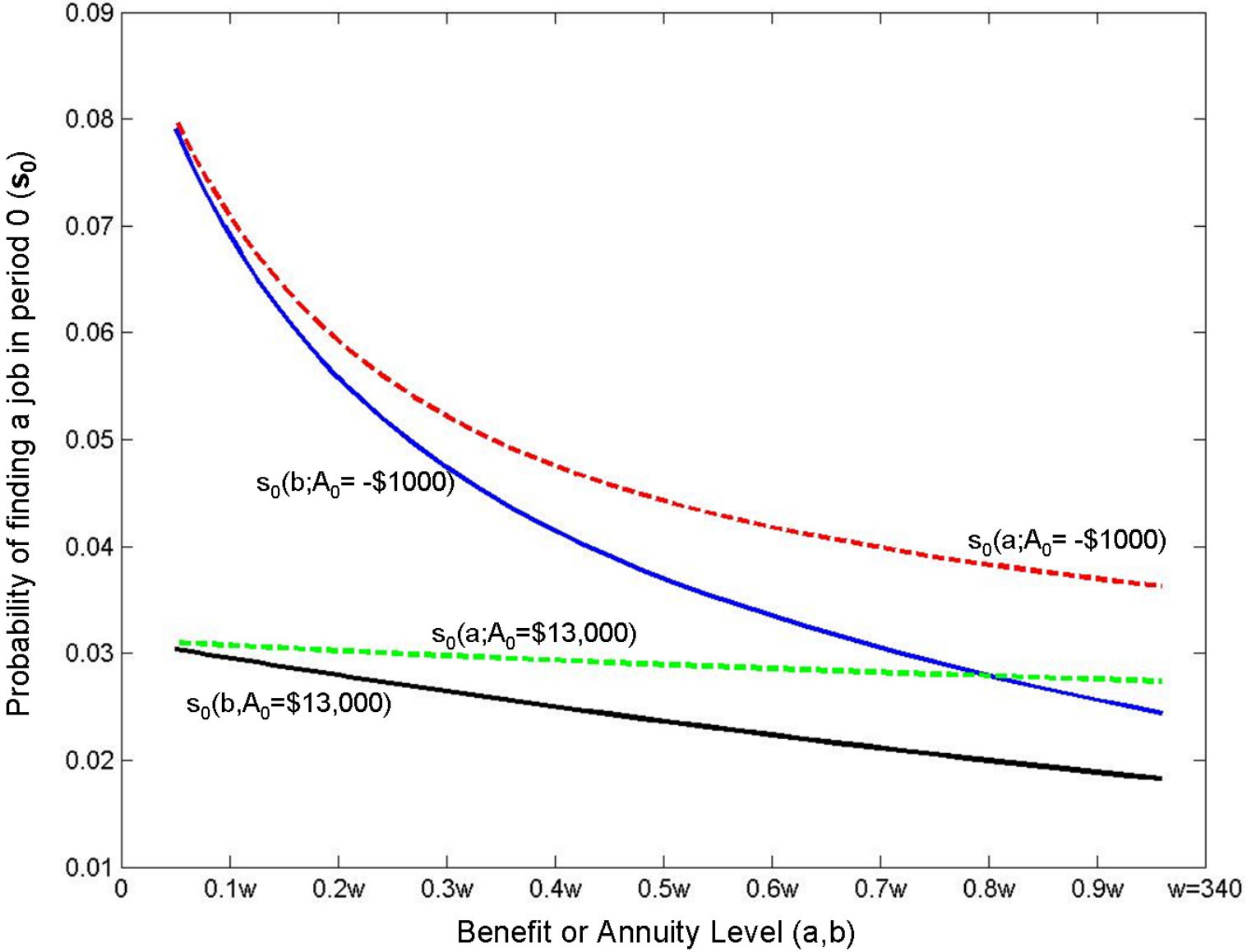
- Benefit effect can be decomposed into two terms:

$$\begin{aligned} \partial s_t / \partial A_t &= \{u'(c_t^e) - u'(c_t^u)\} / \psi''(s_t) < 0 \\ \partial s_t / \partial w_t &= u'(c_t^e) / \psi''(s_t) > 0 \\ \Rightarrow \partial s_t / \partial b_t &= \partial s_t / \partial A_t - \partial s_t / \partial w_t \end{aligned}$$

- $\partial s_t / \partial A_t$ is "liquidity effect"
- $\partial s_t / \partial w_t$ is "moral hazard" or price effect
- Liquidity and total benefit effects smaller for agents with better consumption smoothing capacity

Figure 1

UI Benefit and Liquidity Effects by Initial Assets



Source: Chetty 2008

Chetty 2008: Formula for Optimal UI

$$\begin{aligned}
\partial s_t/\partial A_t &= \{u'(c_t^e) - u'(c_t^u)\}/\psi''(s_t) \geq 0 \\
\partial s_t/\partial w_t &= u'(c_t^e)/\psi''(s_t) > 0 \\
&\Rightarrow \quad \frac{\partial s_t/\partial A_t}{\partial s_t/\partial w_t} = \frac{\text{LIQ}}{\text{MH}} = \frac{u'(c_t^u) - u'(c_t^e)}{u'(c_t^e)}
\end{aligned}$$

- Can show that the Baily formula holds in this model:

$$\frac{u'(c_t^u) - u'(c_t^e)}{u'(c_t^e)} = \frac{\varepsilon_{1-e,b}}{e}$$

- Combining yields formula that depends solely on duration elasticities:

$$\begin{aligned}
\frac{\partial s_t^*/\partial A_t}{\partial s_t^*/\partial b_t - \partial s_t^*/\partial A_t} &= \frac{\varepsilon_{1-e,b}}{e} \\
\frac{\varepsilon_{1-e,A}}{\varepsilon_{1-e,b}\frac{A}{b} - \varepsilon_{1-e,A}} &= \frac{\varepsilon_{1-e,b}}{e}
\end{aligned}$$

Intuition for Moral Hazard vs. Liquidity Formula

- Formula is a "revealed preference" approach to valuing insurance
  - Infer value of UI to agent by observing what he would do if money given as a cash-grant without distorted incentives
  - If agent would not use money to extend duration, infer that only takes longer because of price subsidy (moral hazard)
  - But if he uses cash grant to extend duration, indicates that UI facilitates a choice he would make if markets were complete
- Same strategy can be used in valuing other types of insurance
  - Make inferences from agent's choices instead of directly computing costs and benefits of the policy
  - Key assumption: perfect agent optimization

Moral Hazard vs. Liquidity: Evidence

- Two empirical strategies

1. Divide agents into liquidity constrained and unconstrained groups and estimate effect of benefits on durations using changes in UI laws.

2. Look at lump-sum severance payments to estimate liquidity effect.

TABLE 1

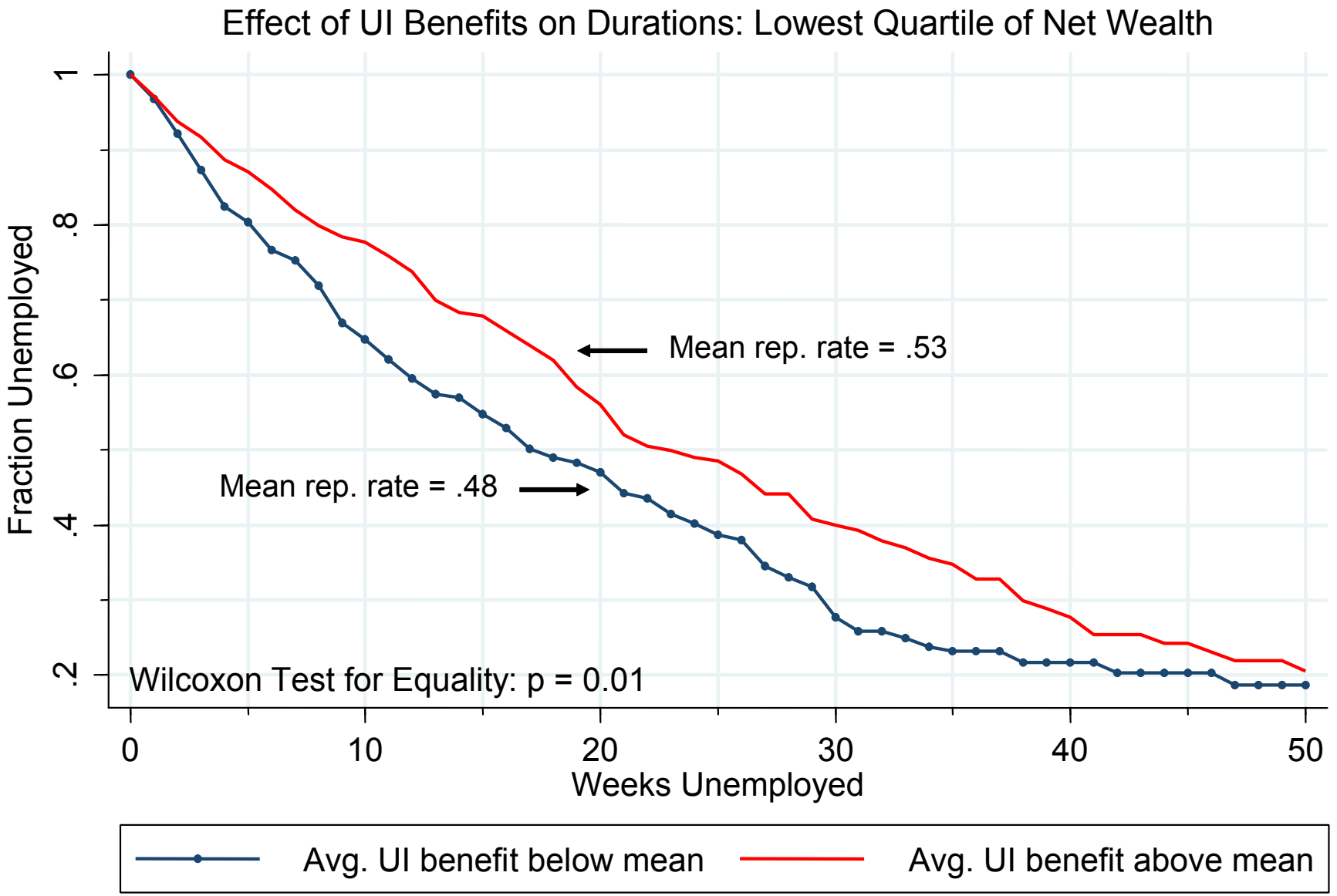
Summary Statistics by Wealth Quartile for SIPP Sample

	Net Liquid Wealth Quartile			
	1 (< -$1,115)	2 (-$1,115-$128)	3 ($128-$13,430)	4 (>$13,430)
Median Liq. Wealth	$466	$0	$4,273	$53,009
Median Debt	$5,659	$0	$353	$835
Median Home Equity	$2,510	$0	$11,584	$48,900
Median Annual Wage	$17,188	$14,374	$18,573	$23,866
Mean Years of Education	12.21	11.23	12.17	13.12
Mean Age	35.48	35.18	36.64	41.74
Fraction Renters	0.43	0.61	0.35	0.16
Fraction Married	0.64	0.59	0.60	0.63

All monetary variables in real 1990 dollars

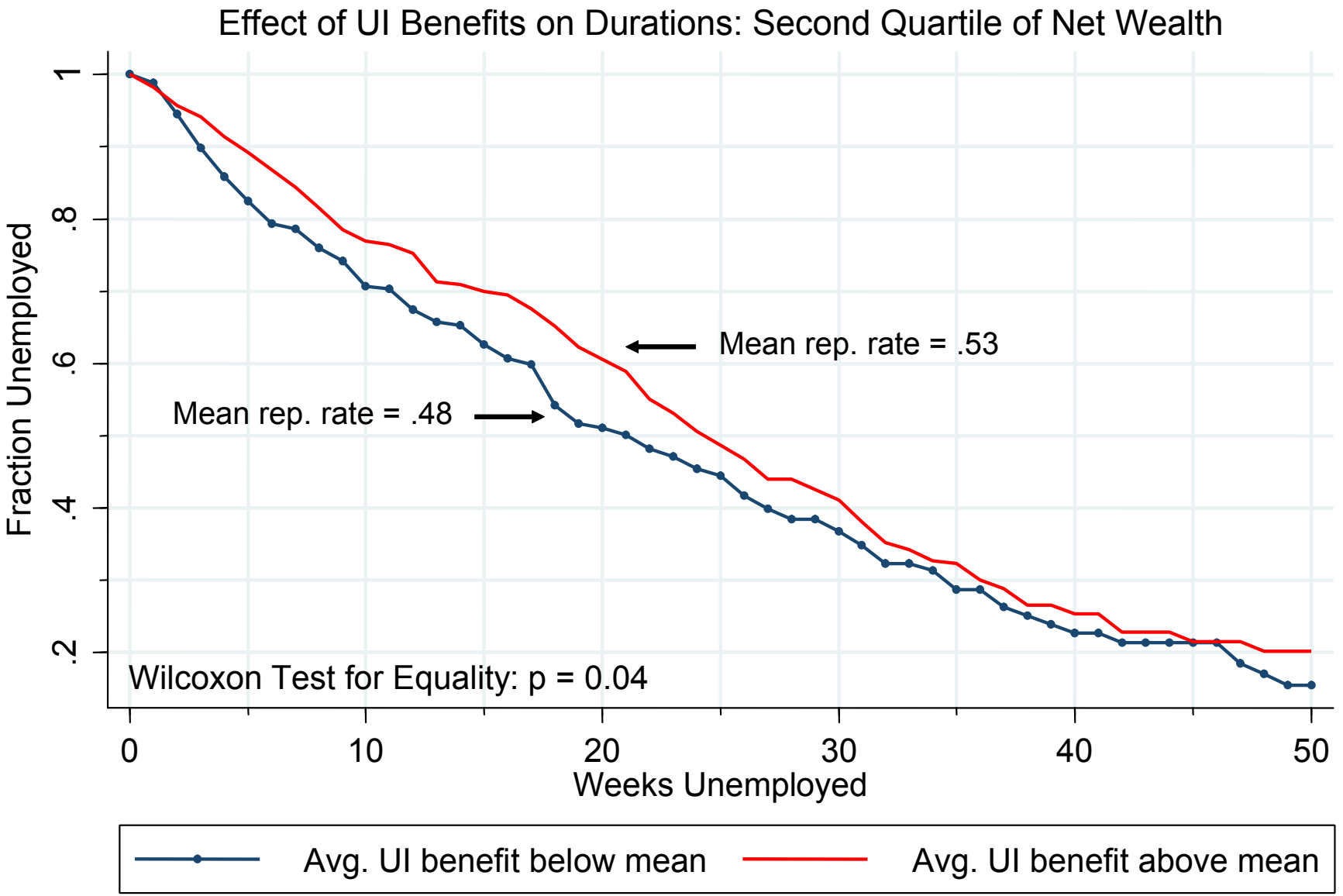
Source: Chetty 2008

Figure 3a



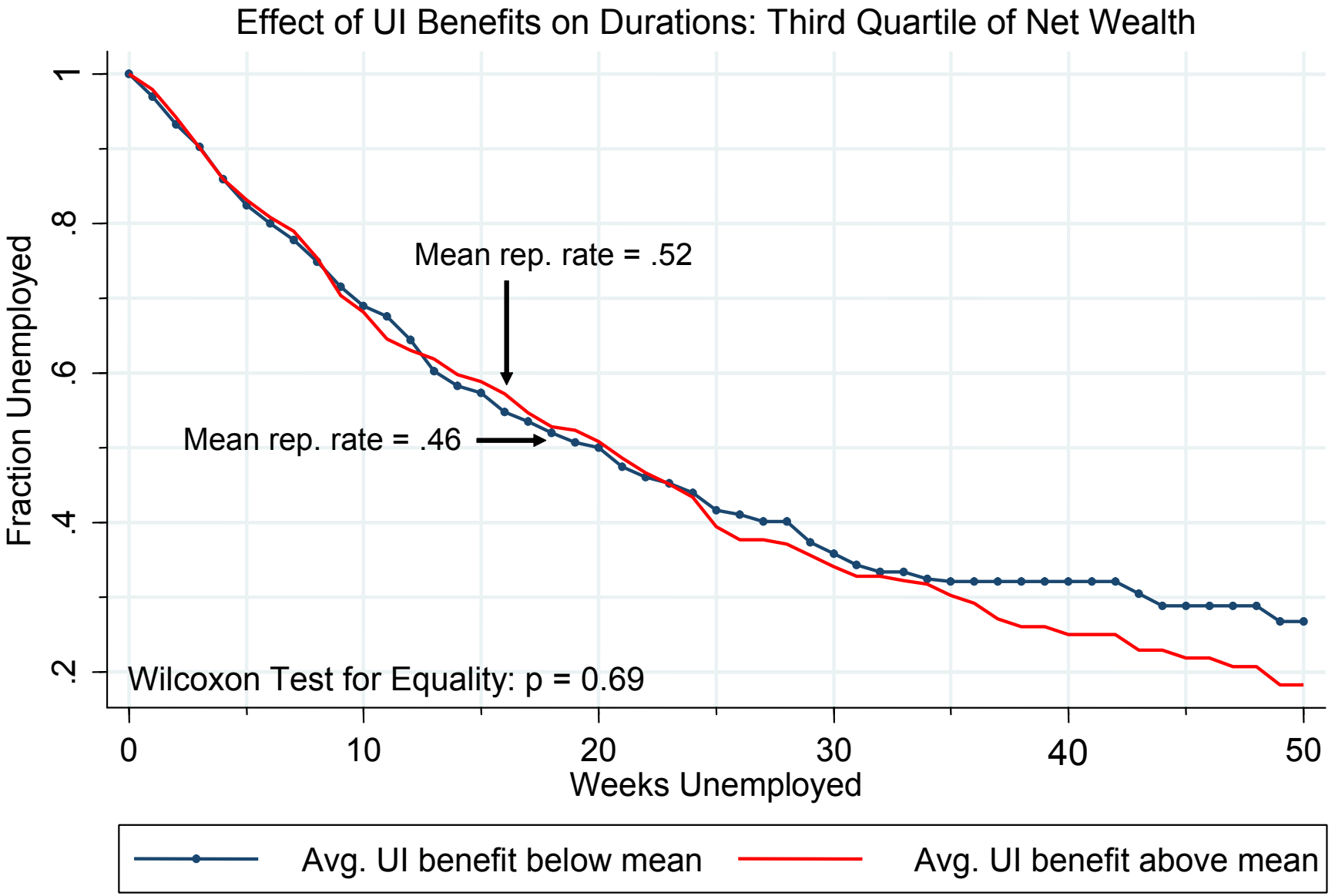
Source: Chetty 2008

Figure 3b



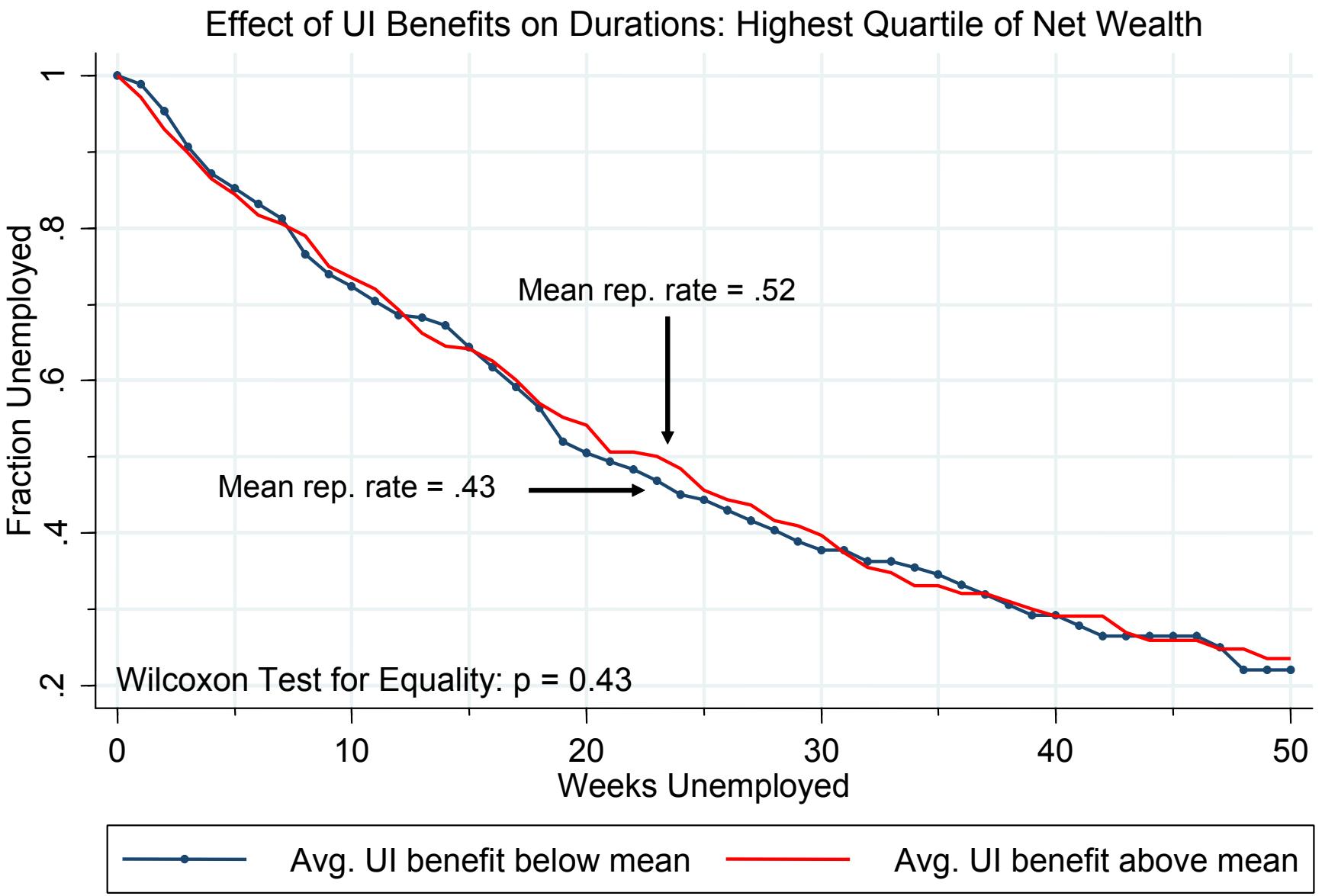
Source: Chetty 2008

Figure 3c



Source: Chetty 2008

Figure 3d



Source: Chetty 2008

TABLE 2

Effect of UI Benefits: Cox Hazard Model Estimates

	(1)	(2)	(3)	(4)	(5)
	Pooled	Stratified	Stratified with Full Controls		
	Full cntrls	No cntrls	Avg WBA	Max WBA	Ind. WBA
log UI ben	**-0.527**				
	(0.267)				
Q1 x log UI ben		**-0.721**	**-0.978**	**-0.727**	**-0.642**
		(0.304)	(0.398)	(0.302)	(0.241)
Q2 x log UI ben		**-0.699**	**-0.725**	**-0.388**	**-0.765**
		(0.484)	(0.420)	(0.303)	(0.219)
Q3 x log UI ben		**-0.368**	**-0.476**	**-0.091**	**-0.561**
		(0.309)	(0.358)	(0.370)	(0.156)
Q4 x log UI ben		**0.234**	**0.103**	**0.304**	**0.016**
		(0.369)	(0.470)	(0.339)	(0.259)
Q1=Q4 p-val		0.039	0.013	0.001	0.090
Q1+Q2=Q3+Q4 p-val		0.012	0.008	0.002	0.062
Number of Spells	4529	4337	4054	4054	4054

Source: Chetty 2008

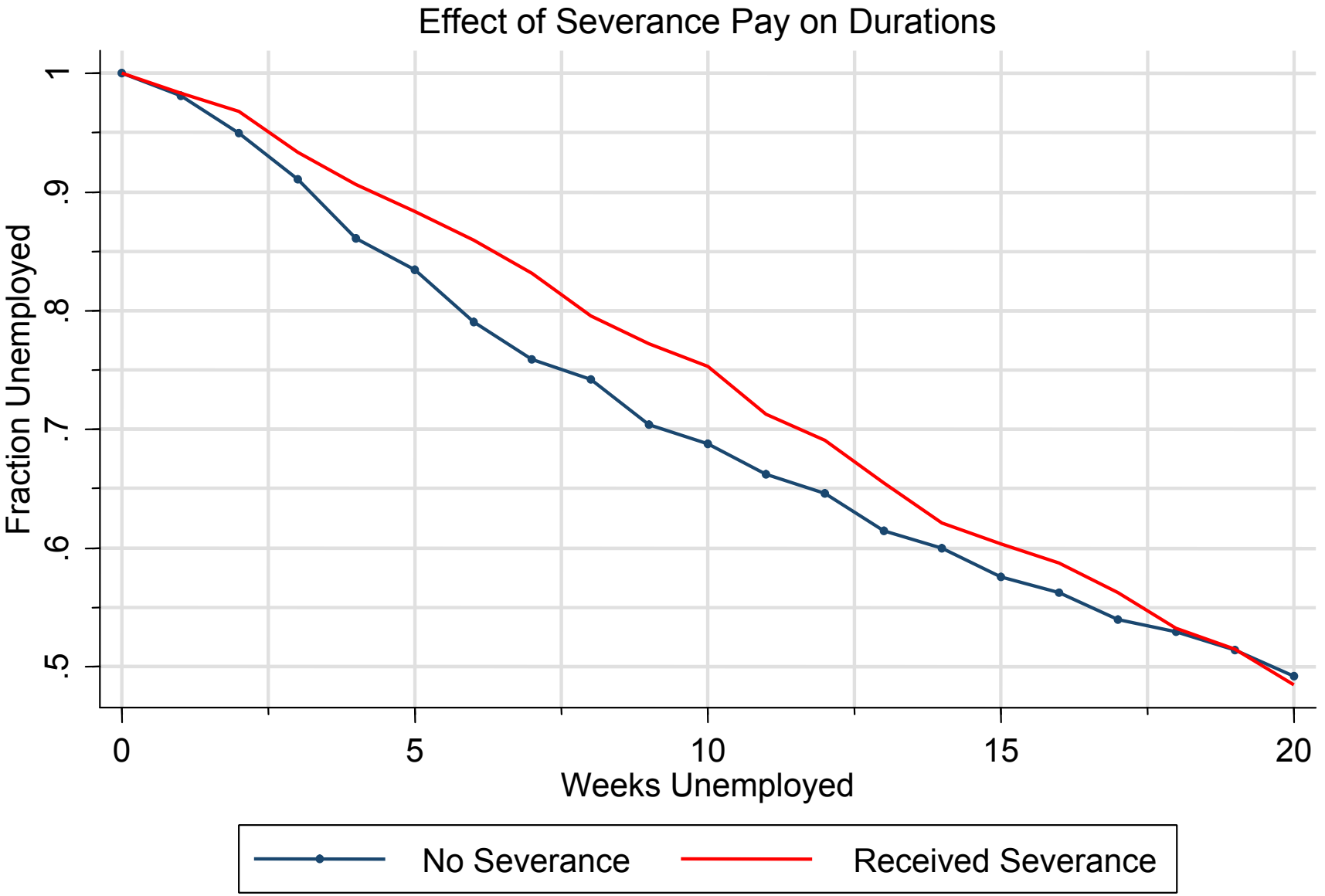
TABLE 3

Summary Statistics for Mathematica Data

	Pooled	No Severance	Severance
		(0.83)	(0.17)
Percent dropouts	14%	15%	6%
Percent college grads	17%	13%	34%
Percent married	58%	56%	68%
Mean age	36.2	35.2	40.6
Median pre-unemp annual wage	$20,848	$19,347	$30,693
Median job tenure (years)	1.9	1.5	4.8

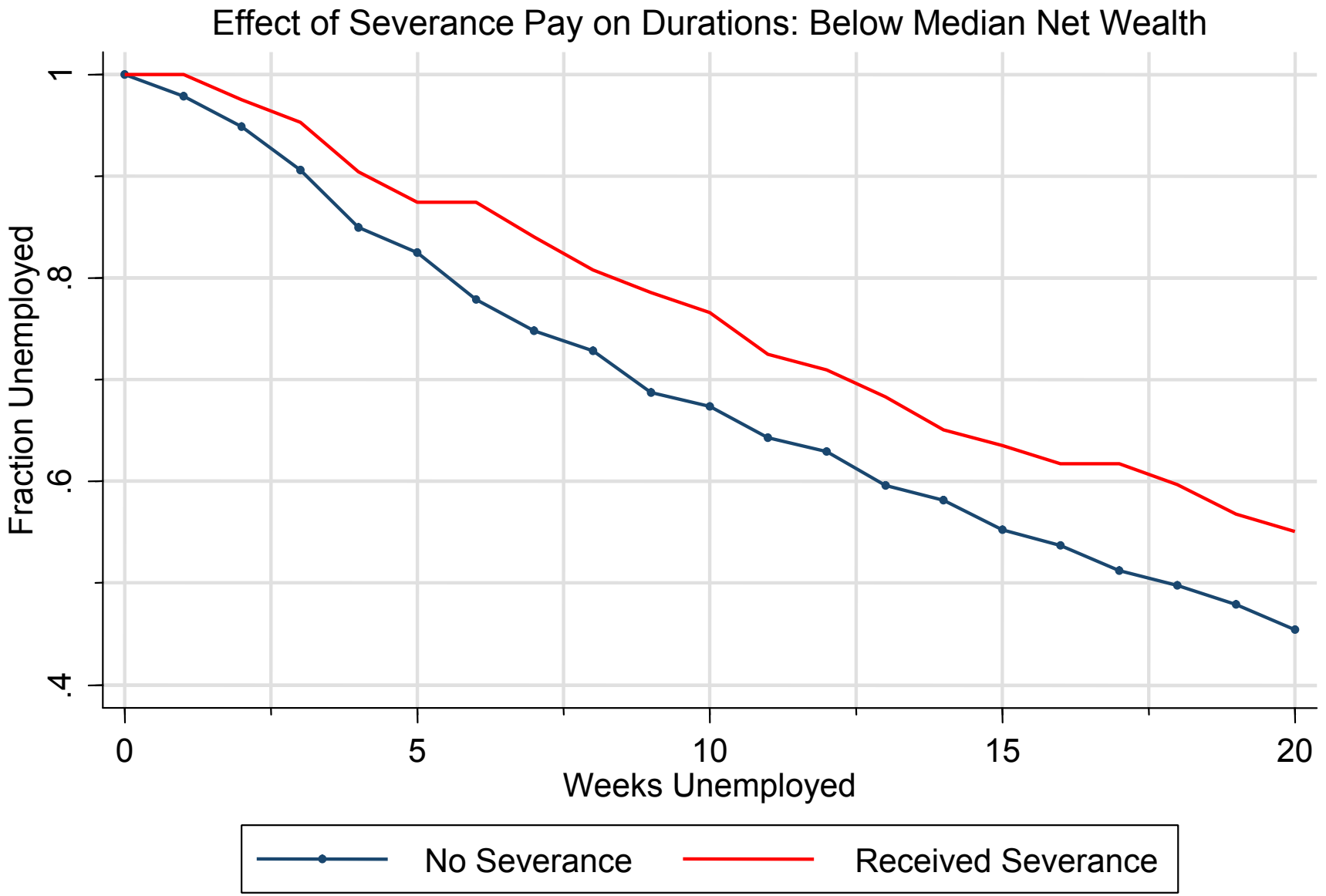
Source: Chetty 2008

Figure 5



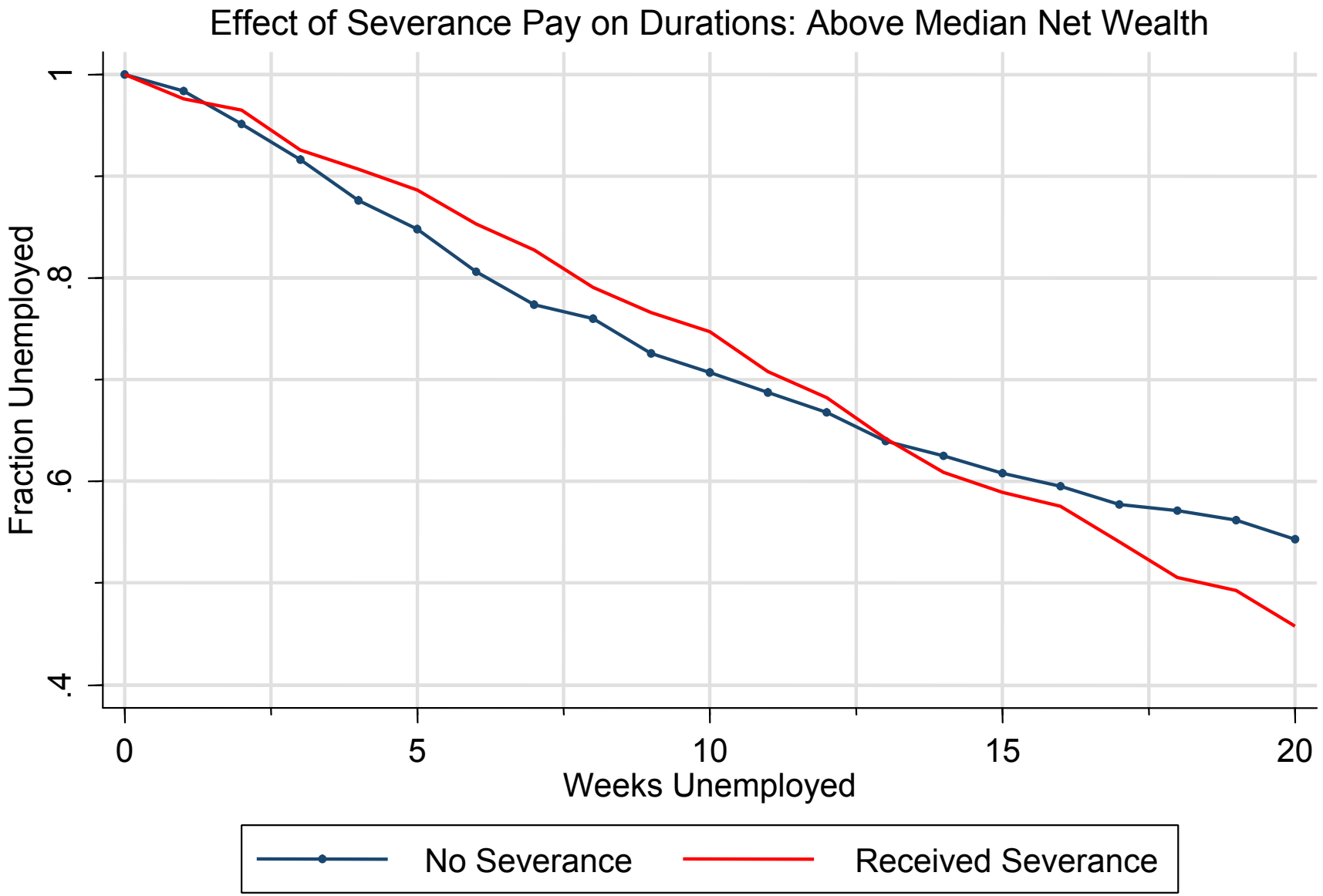
Source: Chetty 2008

Figure 6a



Source: Chetty 2008

Figure 6b



Source: Chetty 2008

TABLE 4

Effect of Severance Pay: Cox Hazard Model Estimates

	Pooled	By Liquid Wealth	By Sev. Amt.
Severance Pay	**-0.233**		
	(0.071)		
(Netliq < Median) x Sev Pay		**-0.457**	
		(0.099)	
(Netliq > Median) x Sev Pay		**-0.088**	
		(0.081)	
(Tenure < Median) x Sev Pay			**-0.143**
			(0.055)
(Tenure > Median) x Sev Pay			**-0.340**
			(0.119)
Equality of coeffs p-val		<0.01	0.03

N=2428; all specs. include full controls.

Source: Chetty 2008

Chetty 2008: Implications for Optimal UI

- Plug reduced-form estimates of de/dA and de/db into formula to calculate dW/db
- Welfare gain from raising benefit level by 10% from current level in U.S. (50% wage replacement) is \$5.9 bil = 0.05% of GDP
  - Small but positive
- In structural models calibrated to match sufficient statistics, dW/db falls rapidly with b
  - Small dW/db suggests we are currently near optimal benefit level

Card, Chetty, and Weber 2007

- Use discontinuities in Austria's unemployment benefit system to estimate liquidity effects
- Severance payment is made by firms out of their own funds
- Formula for sev. pay amount for all non-construction workers:

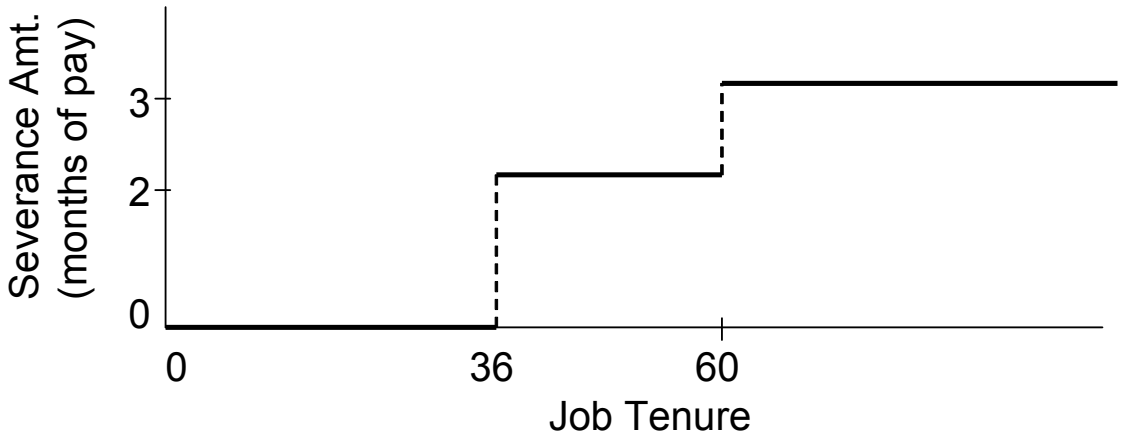
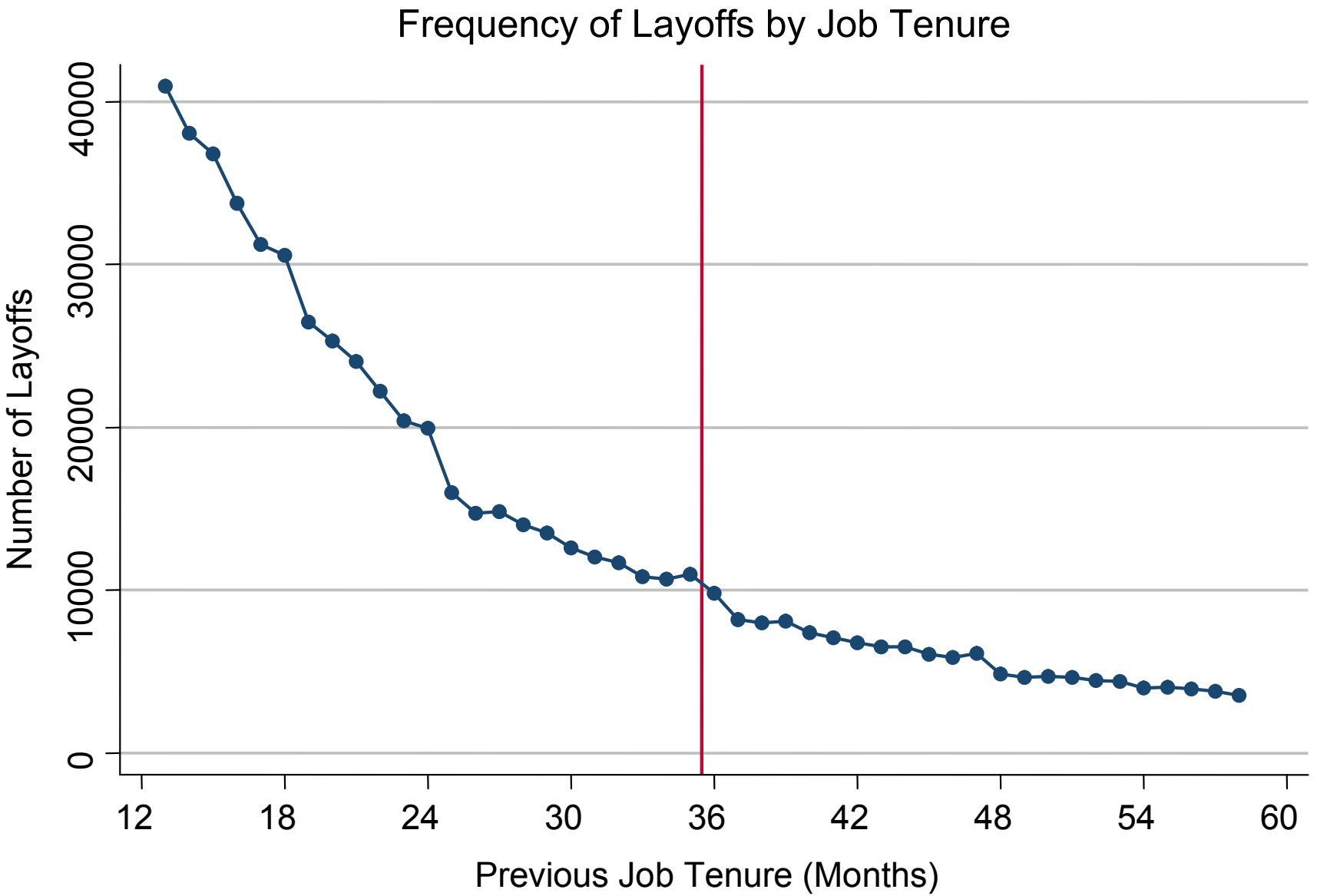


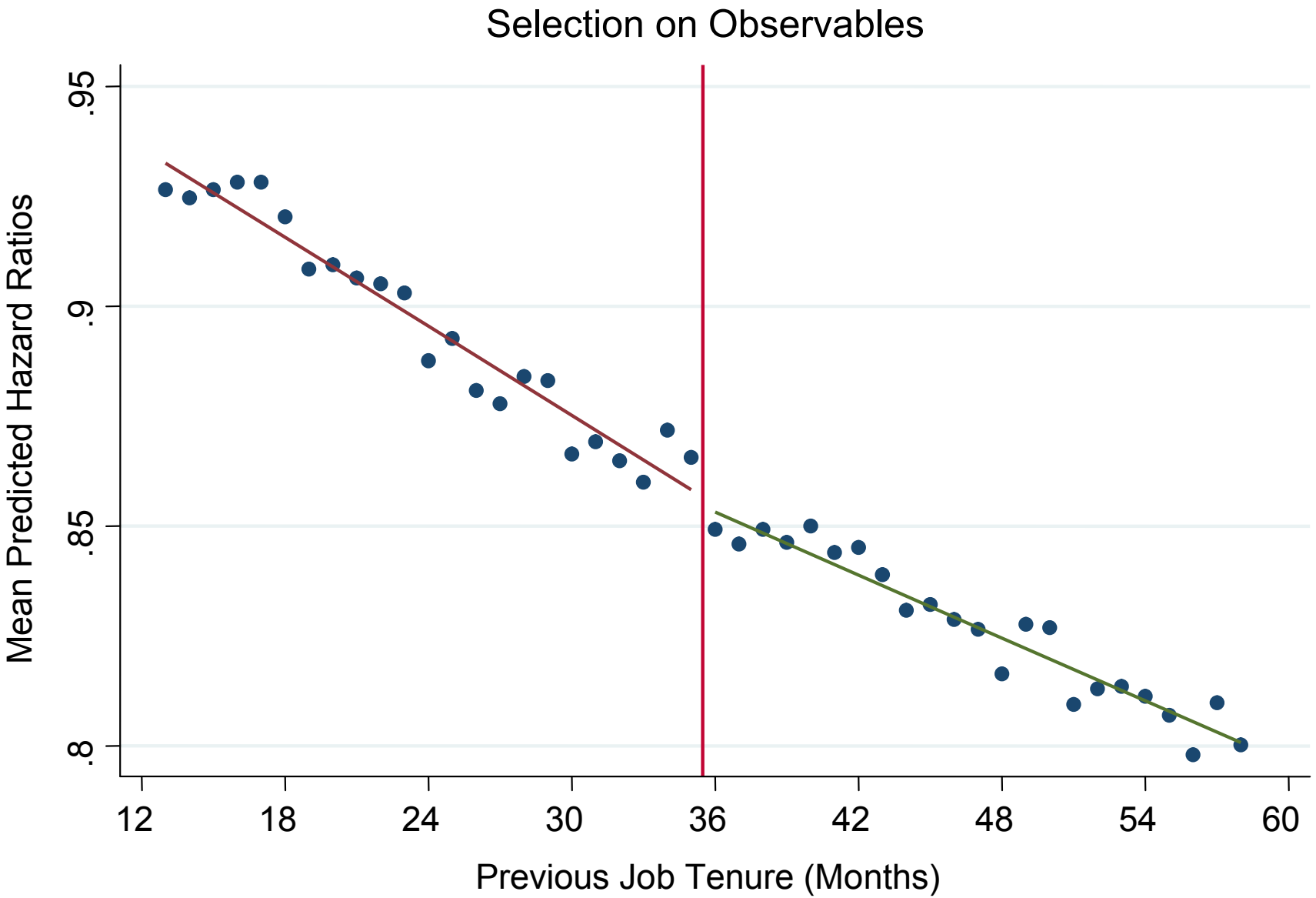
Figure 3



Source: Card, Chetty, and Weber 2007

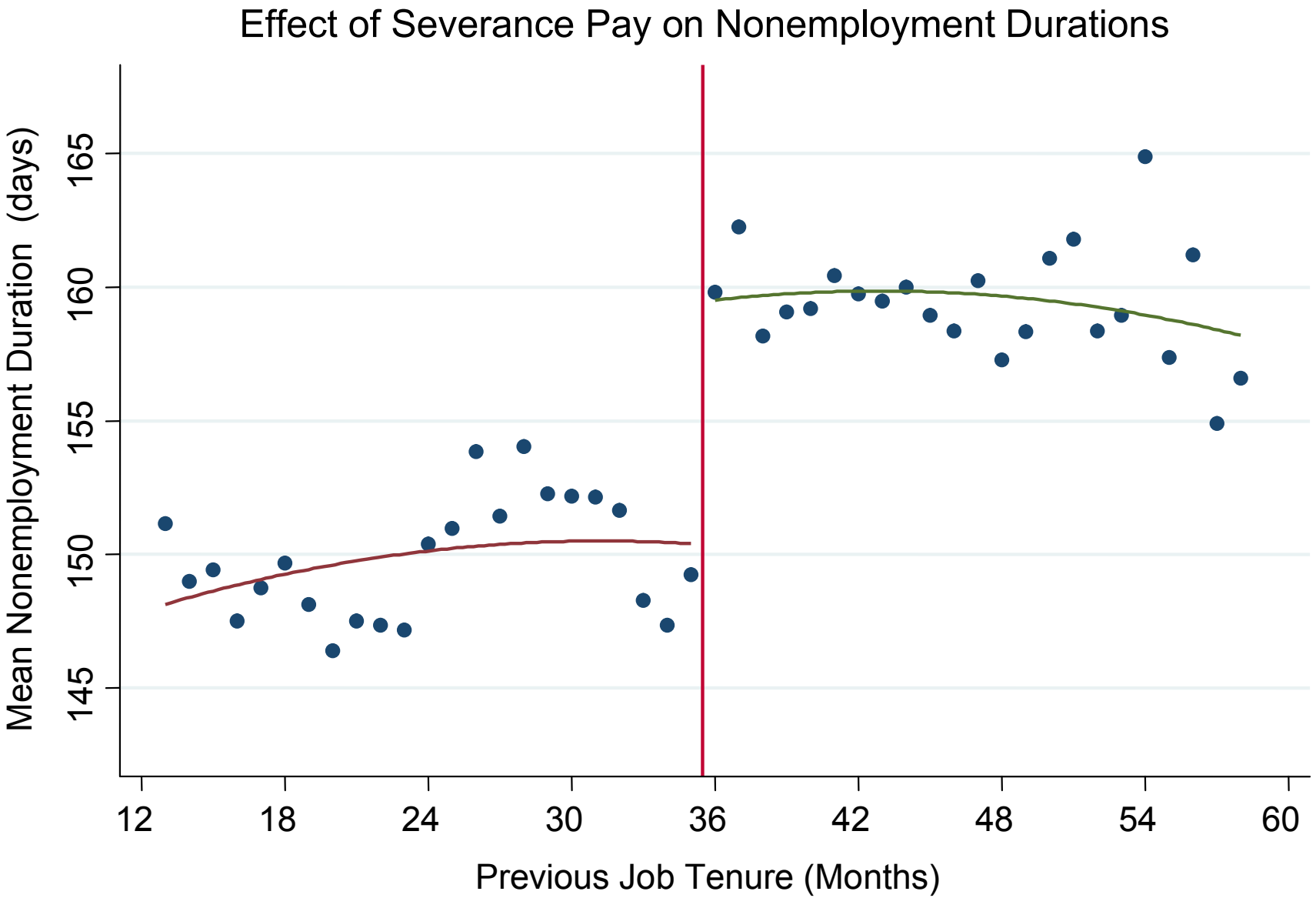
Source: Card, Chetty, and Weber 2007

Figure 4



Source: Card, Chetty, and Weber 2007

Figure 5a



Source: Card, Chetty, and Weber 2007

TABLE 3a

Effects of Severance Pay and EB on Durations: Hazard Model Estimates

	(1) **Restricted Sample**	(2) **Restricted Sample**	(3) **Full Sample**
Severance pay	-0.122		-0.125
	(0.019)		(0.017)
Extended benefits		-0.084	-0.093
		(0.018)	(0.016)
Sample size	512,767	512,767	650,922

NOTE--All specs are Cox hazard models that include cubic polynomials with interactions with sevpay and/or extended benefit dummy.

Source: Card, Chetty, and Weber 2007

Shimer and Werning 2007: Reservation-Wage Model

- Reservation wage model: probability of finding job (e) determined by decision to accept or reject a wage offer, not search effort
- Wage offers drawn from distribution $w \sim F(x)$
- Agent rejects offer if net wage $w - t$ is less than outside option b, implying that probability of finding a job is $e = 1 - F(b + t)$
- Agent's expected value prior to job search:

$$W(b) = (1 - F(b + t))E[u(w - t)|w - t > b] + F(b + t)u(b)$$

- Reservation wage prior to job search satisfies

$$u(\bar{w}_0 - t) = W(b)$$

Shimer and Werning 2007: Reservation-Wage Formula

- Government's problem is

$$\max W(b) = \max u(\bar{w}_0 - t) = \max \bar{w}_0 - t$$

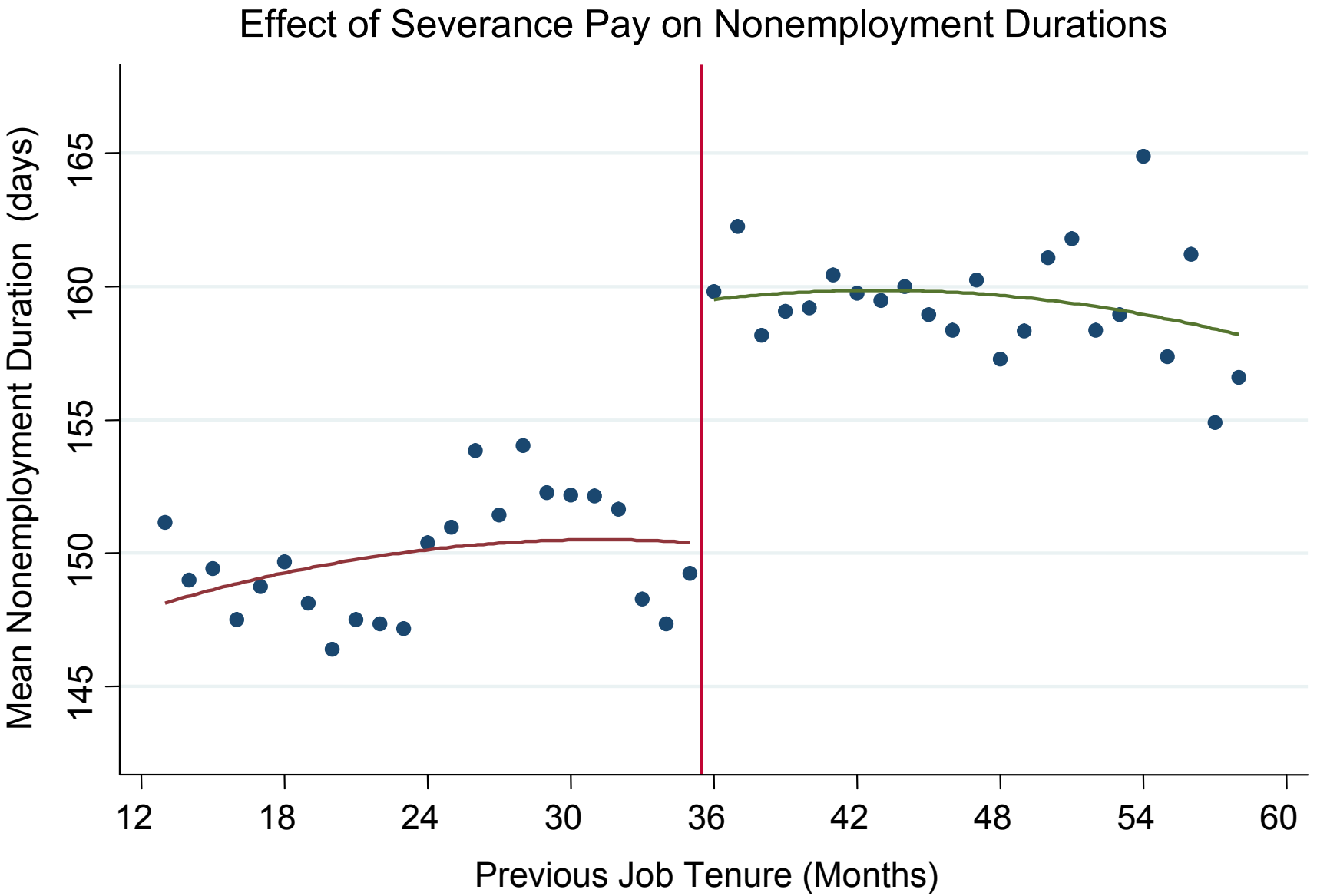
- It follows that

$$\begin{aligned} \frac{dW}{db} &= \frac{d\bar{w}_0}{db} - \frac{dt}{db} \\ &= \frac{d\bar{w}_0}{db} - \frac{1-e}{e} \cdot \left(1 + \frac{1}{e} \cdot \varepsilon_{1-e,b}\right) \end{aligned}$$

Shimer and Werning 2007: Reservation-Wage Formula

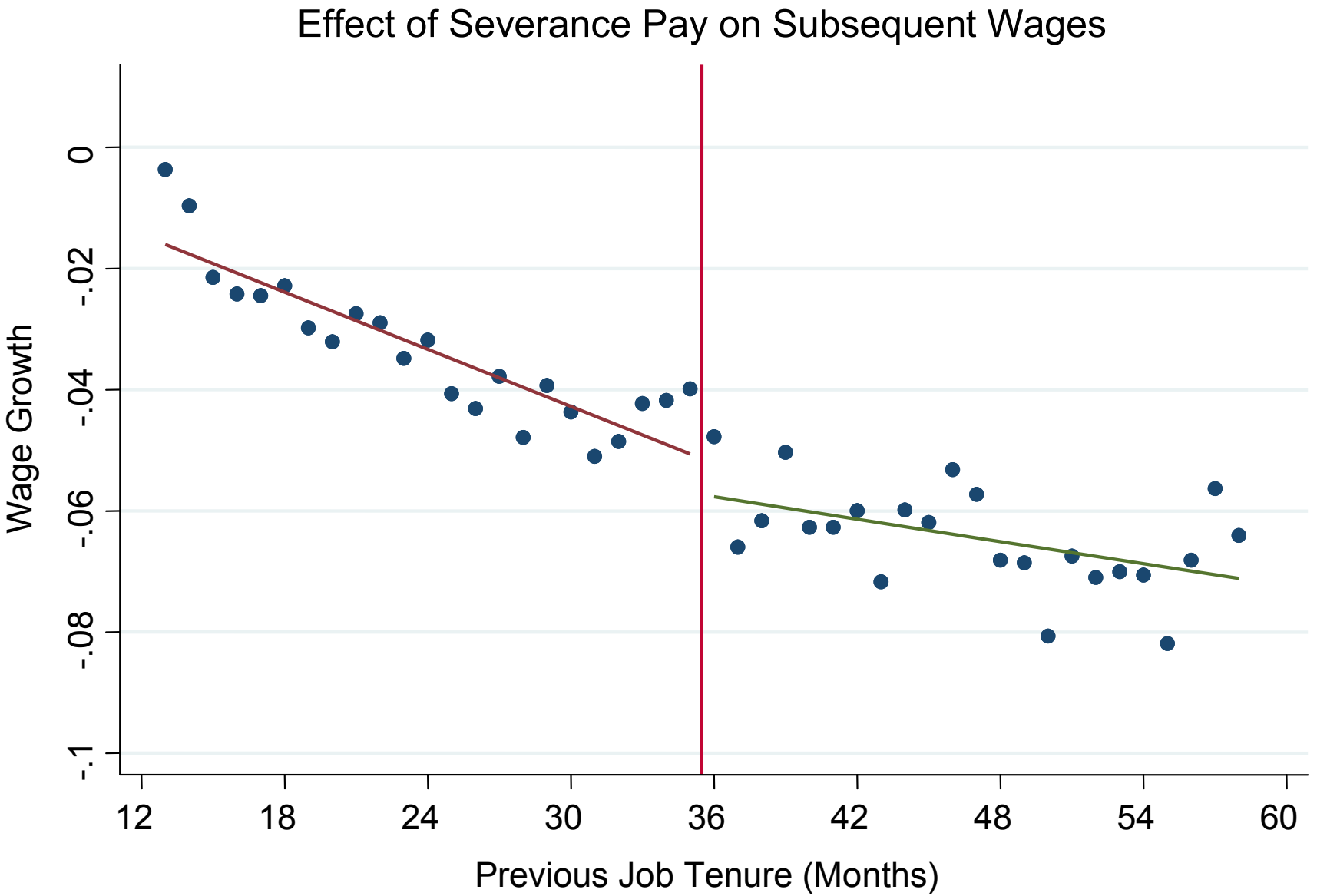
- Implement formula using estimates of $\frac{d\bar{w}_0}{db}$ reported by Feldstein and Poterba (1984)
  - Find gains from raising UI benefits 5 times larger than Chetty (2008)
- But reservation wage elasticity estimates questionable
- Do greater benefits $\longrightarrow$ longer durations $\longrightarrow$ better outcomes later on? No.
  - Ex: evidence from Austrian discontinuity (Card, Chetty, Weber 2007)
  - Note: all the formulas above take such match quality gains into account via envelope conditions

Figure 5a



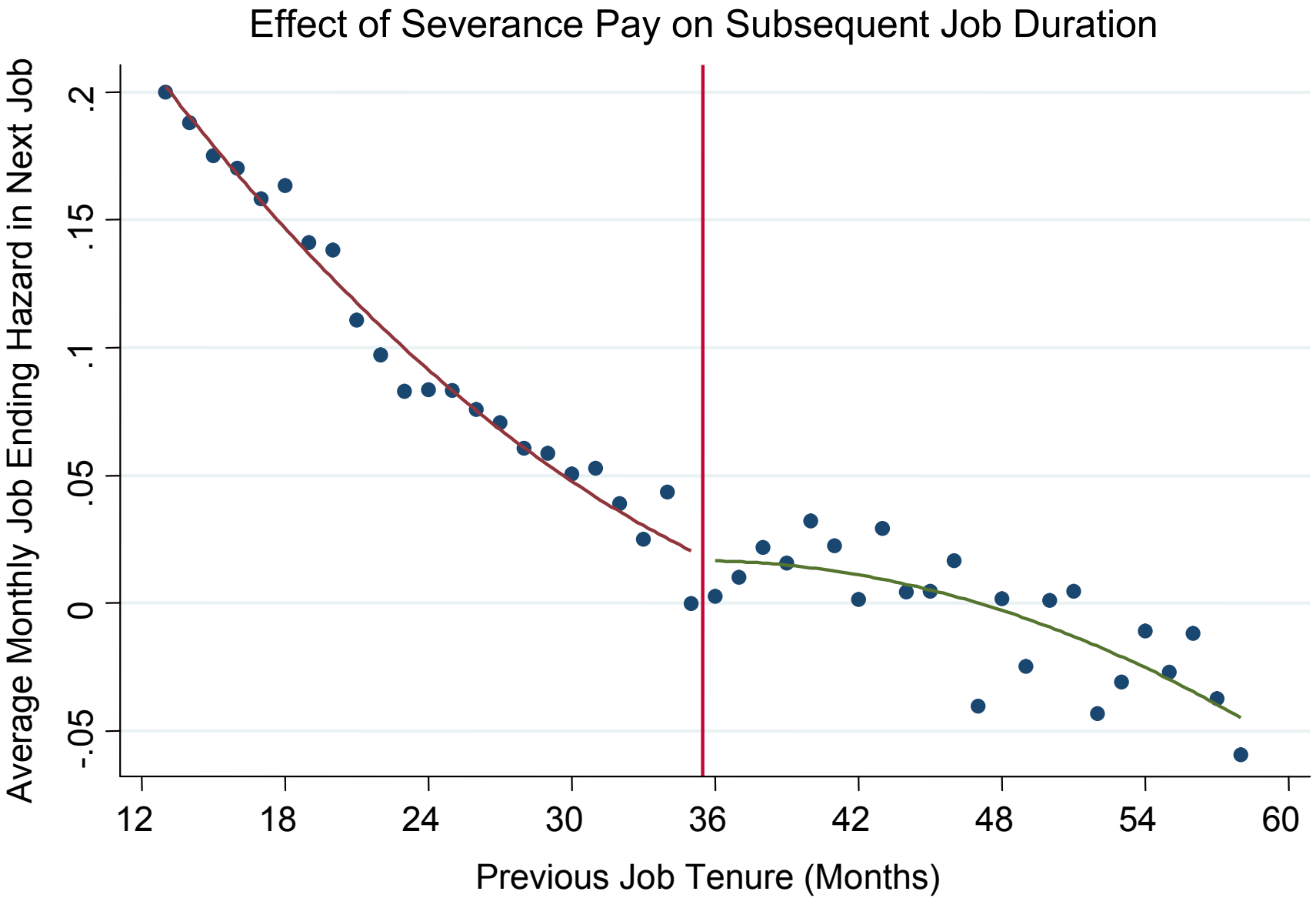
Source: Card, Chetty, and Weber 2007

Figure 10a



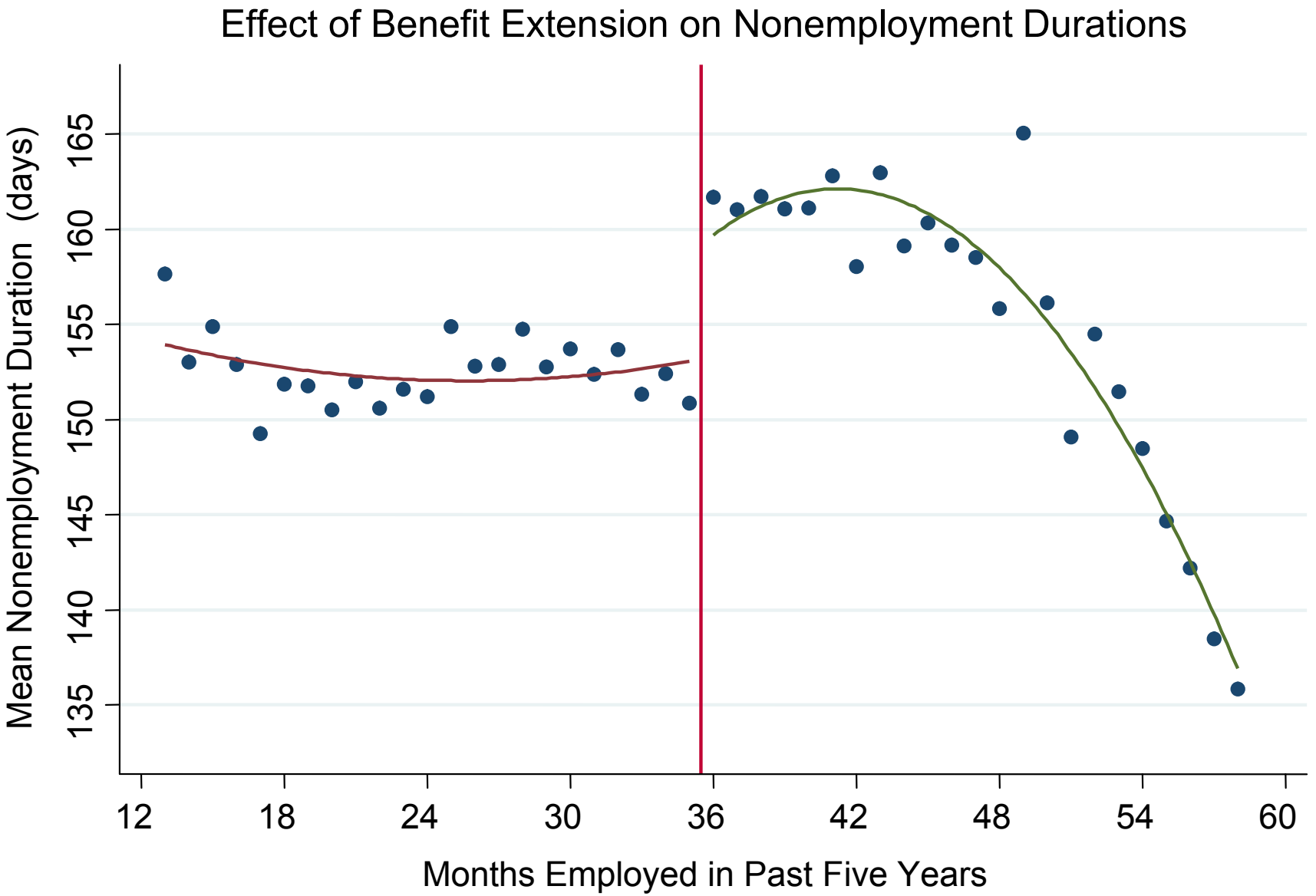
Source: Card, Chetty, and Weber 2007

Figure 10b

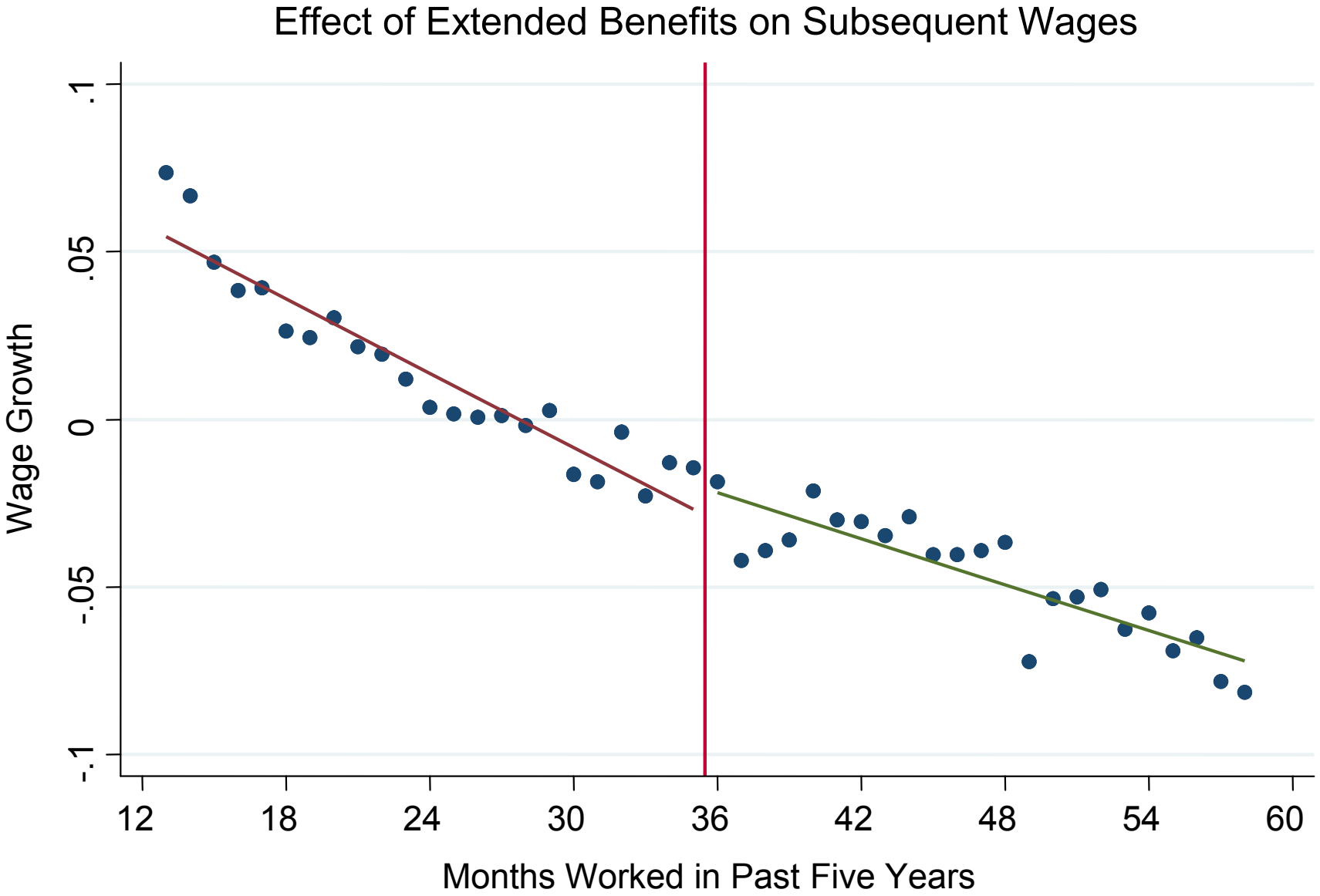


Source: Card, Chetty, and Weber 2007

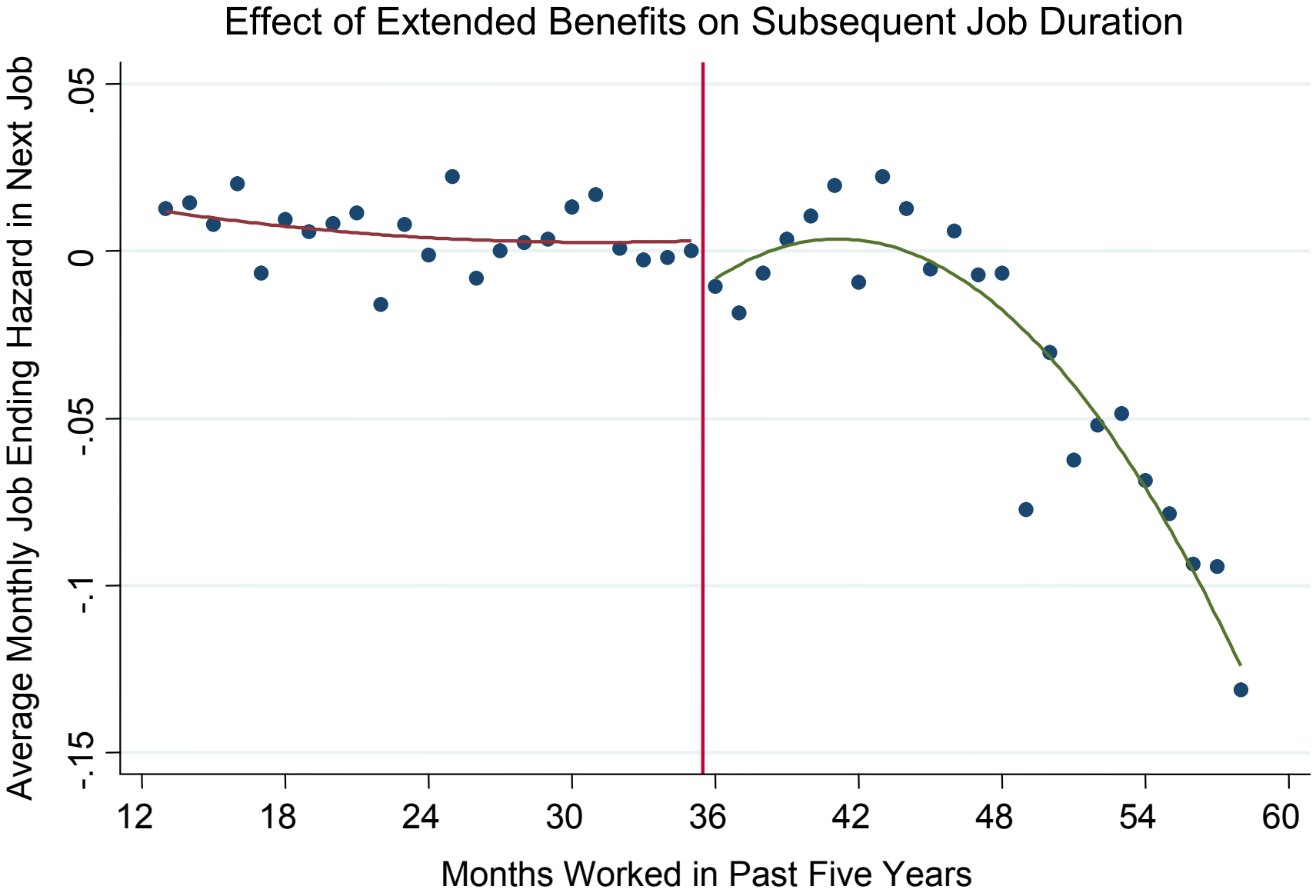
Figure 9a



Source: Card, Chetty, and Weber 2007



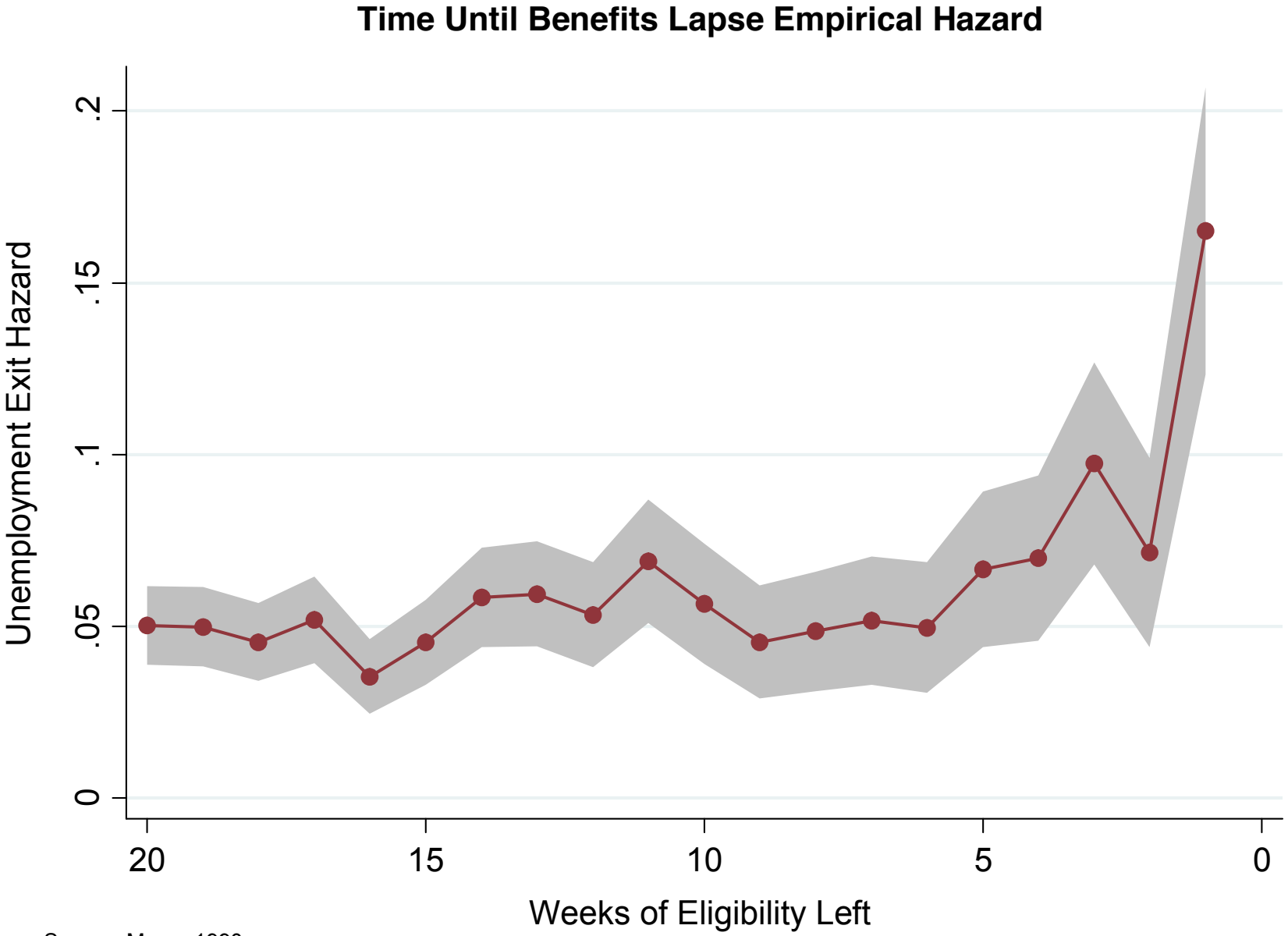
Source: Card, Chetty, and Weber 2007



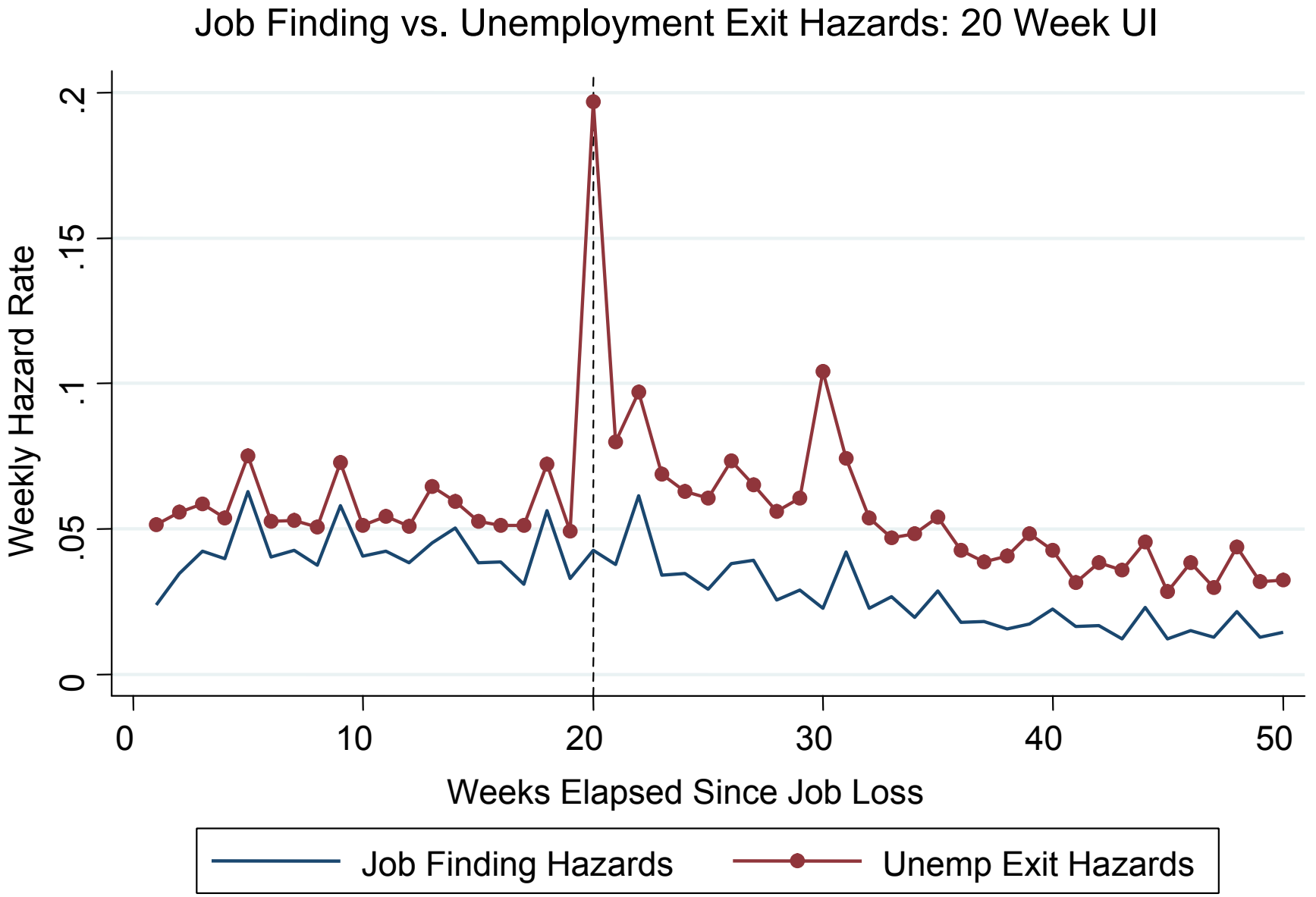
Source: Card, Chetty, and Weber 2007

Spike at Benefit Exhaustion

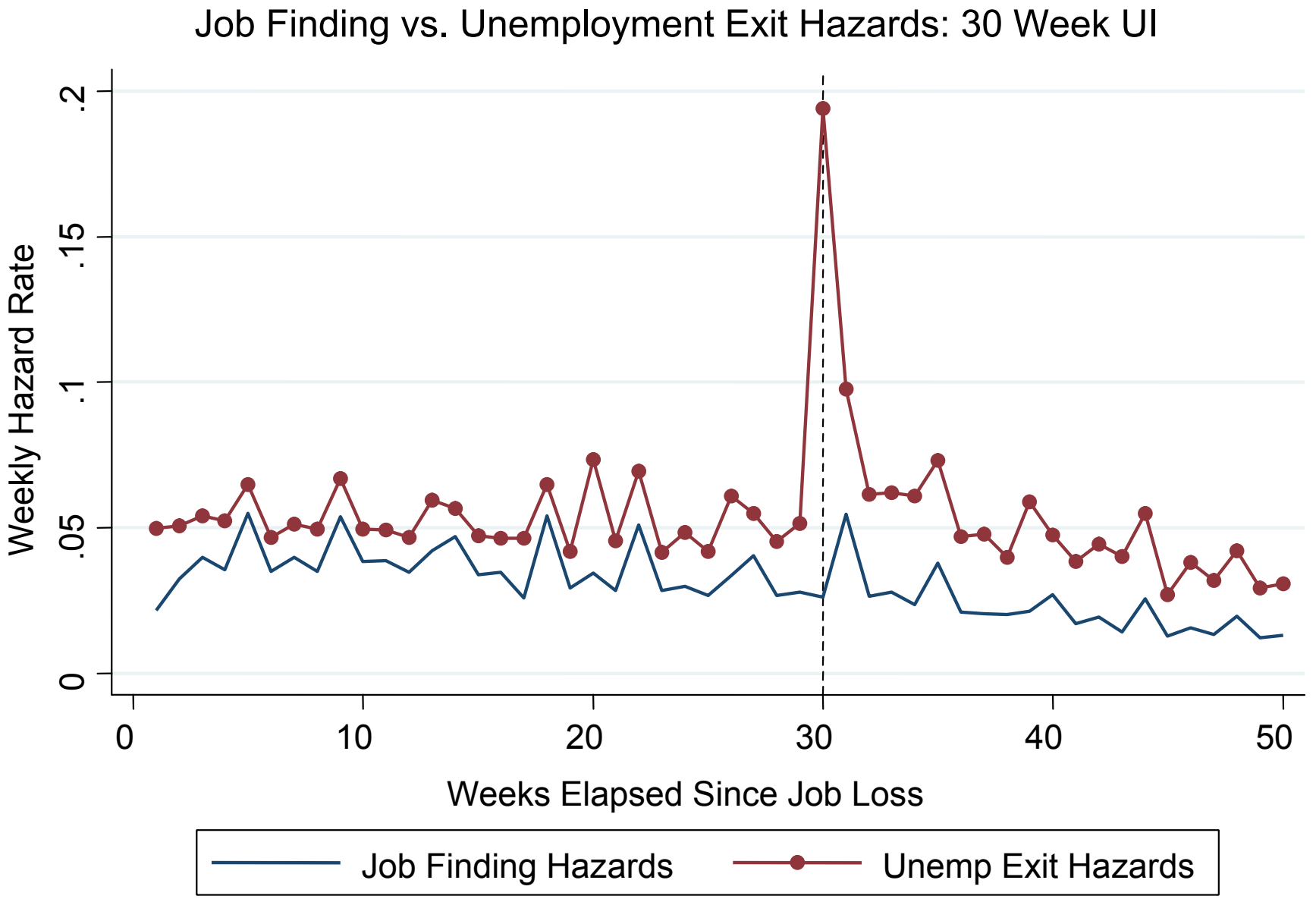
- Most striking evidence for distortionary effects of social insurance: "spike" in hazard rate at benefit exhaustion
  - Katz and Meyer (1990), Meyer (1990), ...
- Traditional measure of hazard: exiting UI system
- Preferred measure based on theory: finding a job
- The two could differ if workers transit off of UI but are still jobless
  - Ex. may not go to pick up last unemployment check
  - Particularly important in European context, where you can remain registered on UI indefinitely



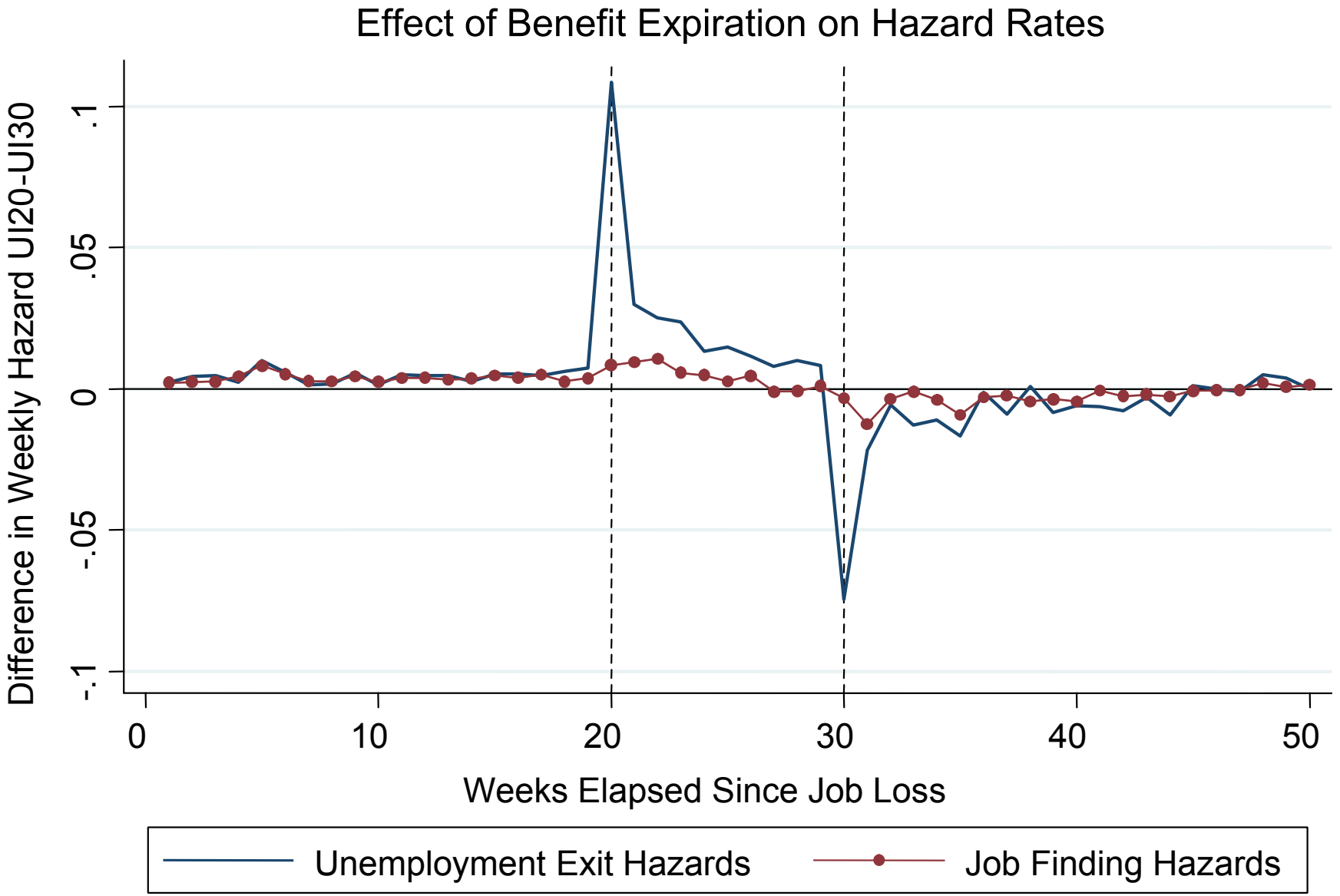
Source: Meyer 1990



Source: Card, Chetty, Weber 2007b (AER P&P)



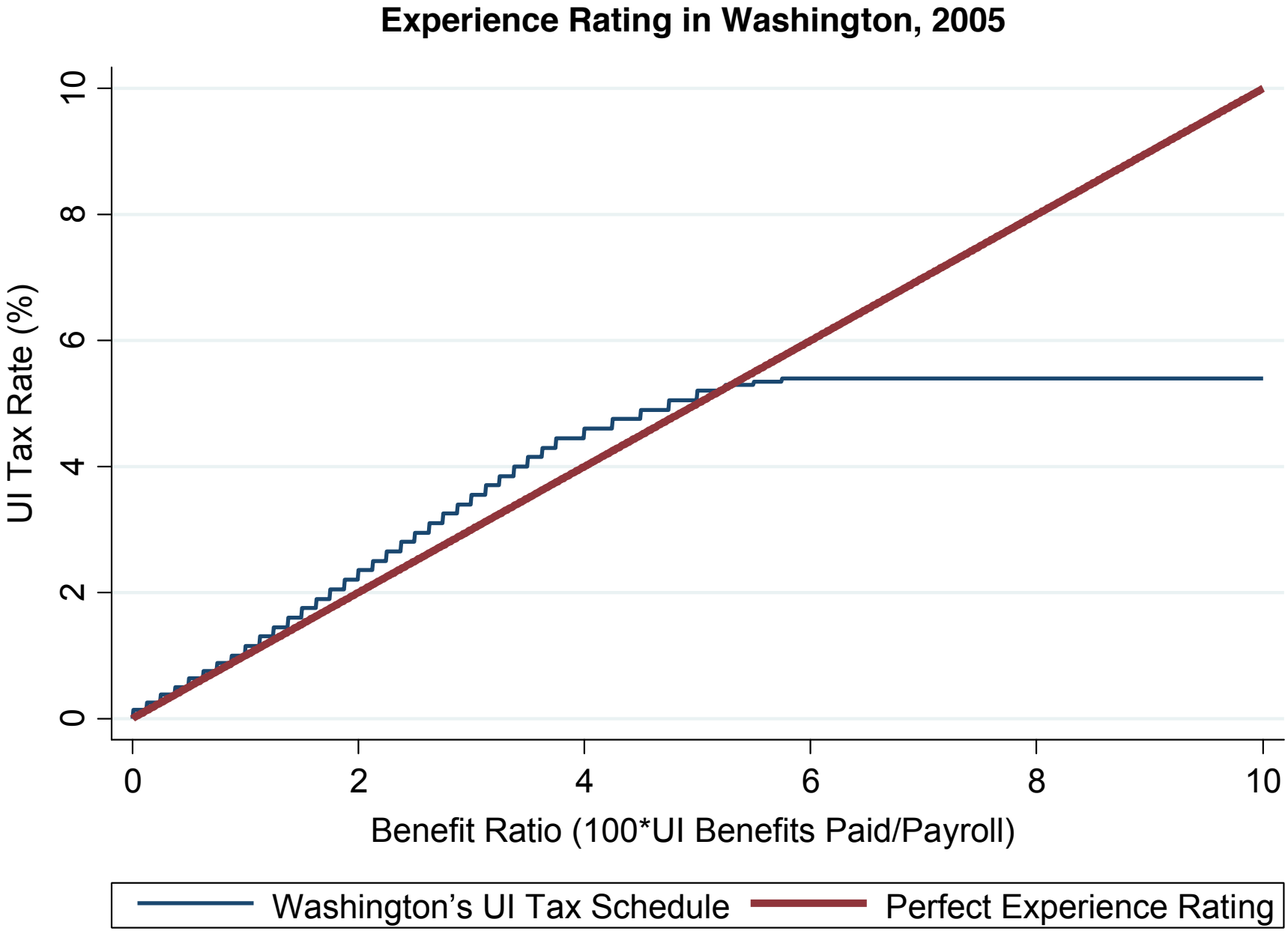
Source: Card, Chetty, Weber 2007b (AER P&P)



Source: Card, Chetty, Weber 2007b (AER P&P)

UI and Firm Behavior

- Preceding discussion assumed perfect experience rating of UI
  - Firms' layoff incentives are not distorted
- But in practice, UI is not perfectly experience rated
- Feldstein (1976, 1978) shows:
  - Theoretically that imperfect experience rating effect can raise rate of temporary layoffs
  - Empirically that this effect is large in practice



Source: Washington State Joint Legislative Task Force on Unemployment Insurance Benefit Equity 2005

UI and Firm Behavior: Feldstein 1976 model

- Firms offer workers stochastic contracts, with wage and probability of temporary layoff
- Two states: high demand and low demand
- In equilibrium, competitive firms will offer contract that pays worker his marginal product in expectation over two states at cheapest cost to firm
- Firm profits by laying off workers with imperfect exp rating
- Layoffs generate first-order gain in profits at a second-order cost from added risk to worker
- In an imperfectly experience-rated economy, firms choose a positive rate of layoffs in low output state

Feldstein 1978: Empirical Results

- First observation: more than half of firms are above the max rate or below the min rate
    - No marginal incentive for these firms to reduce layoffs.
- Uses cross-state/time variation in UI benefits
- 10% increase in UI benefits causes a 7% increase in temp layoff unemployment
- Effect is twice as large for union members as non-union, suggesting worker-firm coordination.

Topel 1983

- Feldstein does not directly show that imperfect exp rating is to blame for more temp layoffs b/c not using variation in experience rating itself
- Topel (1983) uses state/industry variation in financing of UI
  - Variation in tax rate on firms from min/max thresholds for exp rating
  - Finds that imperfect subsidization accounts for 31% of all temp layoff unemployment, a very large effect
- See Krueger and Meyer (2002) for review of more recent studies, which find similar results but smaller magnitudes

UI Savings Accounts

- Alternative to UI transfer-based system (Feldstein and Altman 2007)
  - Instead of paying UI tax to government, pay into a UI savings account.
  - If unemployed, deplete this savings account according to current benefit schedule
  - If savings exhausted, government pays benefit as in current system (financed using a tax).
- Idea: people internalize loss of money from staying unemp longer.
  - Reduces distortion from UI while providing benefits as in current system.
  - But modelling this formally is difficult: to internalize incentives at retirement, people must be forward looking, but then no need to force them to save.

Feldstein and Altman 2007

- Address feasibility: How many people hit negative balance on UI account and just go back to old system?
- Simulate how UI savings accounts would evolve using actual earnings histories from PSID.
- Calculations imply that only 1/3 of spells will occur with negative balances, so most people still have good incentives while unemployed.
- Total tax payments are less than half what they are in current system.
- In their simulation, benefits are identical; only question is how costs change.

Feldstein and Altman 2007

- Calculation of changes in present value of lifetime wealth from switch to UISA by income quintile:

	Q1	Q2	Q3	Q4	Q5
Present Value Gain:	**-$95**	**+$22**	**-$67**	**+$94**	**+$468**

- Net PVG is positive
- Without change in behavior, how is the pie larger?
  - Reason: discounting at 2% but earning 5.5% interest

Takeup

- Mean takeup rate is very low – a major puzzle in this literature (Currie 2004)
  - Why leave money on the table?
- Andersen and Meyer (1997) show that after-tax UI replacement rate affects level of takeup.
  - So at least some seem to be optimizing at the margin.
- Takeup low in many govt. programs. (UI, food stamps, EITC, etc.)
- Possible explanations: myopia, stigma, hassle, lack of info.

Black, Smith, Berger, and Noel 2003

- Experiment in KY where some UI claimants were randomly assigned to receive re-employment services
  - E.g., assisted job search, employment counseling, job search workshops, retraining programs
  - Treatment [$N = 1236$] required to receive services in order to get UI benefits
  - Control [$N = 745$]: exempt from services

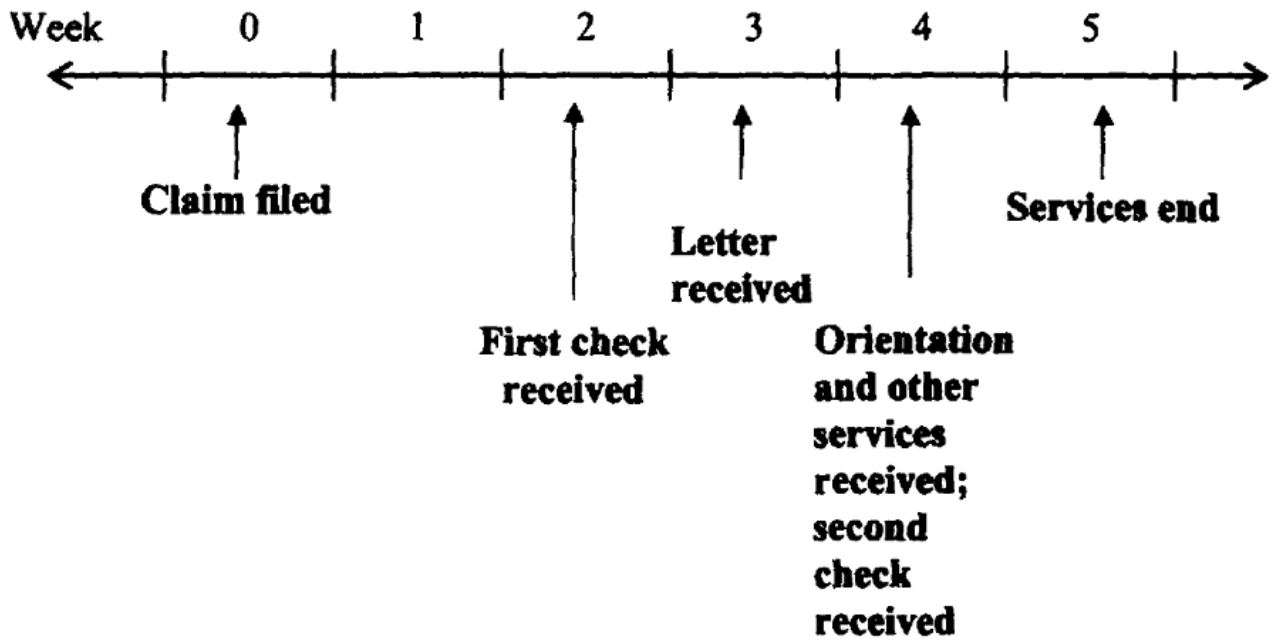


FIGURE 1. TIMELINE FOR TYPICAL UI CLAIMANT IN KENTUCKY WPRS PROGRAM

Source: Black, Smith, Berger, and Noel 2003

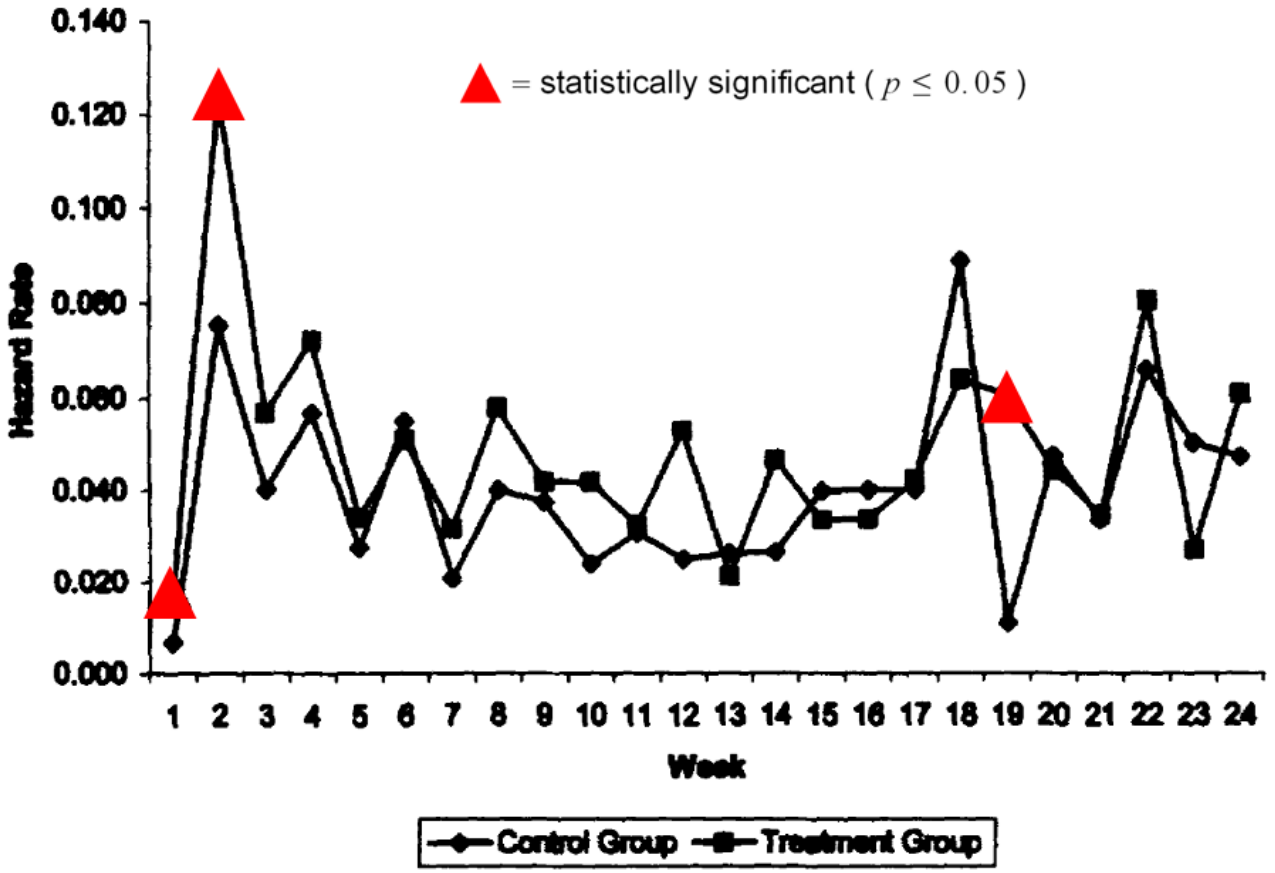


FIGURE 2. HAZARD FUNCTIONS OF THE TREATMENT AND CONTROL GROUPS, KENTUCKY WPRS EXPERIMENT, OCTOBER 1994 TO JUNE 1996

Source: Black, Smith, Berger, and Noel 2003

TABLE 2—IMPACT OF TREATMENT ON DURATION OF BENEFITS AND EARNINGS: KENTUCKY WPRS EXPERIMENT, OCTOBER 1994 TO JUNE 1996

Outcome measures	(1) Fixed-effect regression estimates	(2) Matching estimates
Number of weeks receiving UI benefits	−2.241	−2.045
	(0.509)	(0.411)
	[0.000]	[0.000]
UI benefits received	−143.18	−81.44
	(100.3)	(81.6)
	[0.077]	[0.159]
Fraction exhausting benefits	−0.024	−0.030
	(0.023)	(0.0019)
	[0.152]	[0.0055]
Earnings in the year after the start of the UI claim	1,054.32	1,599.99
	(588.0)	(475.2)
	[0.037]	[0.001]
N	1,981	1,981

Source: Black, Smith, Berger, and Noel 2003

Black, Smith, Berger, and Noel 2003: Results

- Treatment group exit UI system earlier, receiving 2.2 fewer weeks of benefits on average
- Most significant increase in exits in wks 2-3, when notified of mandatory services

General Equilibrium: Acemoglu and Shimer 1999

- UI can be efficiency-enhancing in equilibrium.
- Standard models focus only on distortionary costs, and assume that total output always lower when UI is provided.
- But this ignores potentially important GE effect: more risky jobs provided in eq. if workers are insured.
- Provision of UI raises availability of risky jobs (e.g. tech jobs) and can raise efficiency in equilibrium
- So if workers are risk averse, tradeoff may not be very hard – both raise output and insure them better.

Dynamics: Path of UI Benefits

- Classic reference is Shavell and Weiss (1979), who solved for optimal path of benefits in a 3 period model.
- Tradeoff: upward sloping path $\longrightarrow$ more moral hazard but more consumption-smoothing benefits.
- Recent literature that is very active in this area: "new dynamic public finance" – optimal path of unemployment and disability programs.
  - Hopenhayn and Nicolini (1997) – numerical simulations for case where govt can control consumption
  - Shimer and Werning (2008) – with perfect liquidity and CARA utility, optimal benefit path is flat

Optimal Insurance in Behavioral Models

- We do not have a model consistent with the data that can explain both savings behavior pre-unemployment and search behavior post-unemployment
    - Evidence that unemployment is indeed costly and benefits can improve welfare a lot for certain liquidity-constrained groups
    - Simple rational model cannot rationalize level of savings that people have when they get unemployed
- Interesting direction for future research: optimal SI with behavioral considerations (see e.g., Spinnewijn 2009)