A Life Cycle Model of Trans-Atlantic Employment Experiences

Sagiri Kitao

University of Southern California

Lars Ljungqvist

Stockholm School of Economics and New York University

Thomas J. Sargent

New York University and Hoover Institution

5th ECB/CEPR Labour Market Workshop "Recent Trends in European Employment", December 11-12, 2008, Frankfurt am Main

Connections to Ljungqvist and Sargent's earlier inquiries

JPE -98 Turbulence and generous European benefits

- Turbulence increases European unemployment
- … but leaves U.S. unemployment unchanged.

ECMA -08 European layoff costs / stochastic aging

- In tranquil times, European unemp. below that of the U.S.
- In turbulent times, older Europeans suffer long-term unemp.

Connections to Ljungqvist and Sargent's earlier inquiries

JPE -98 Turbulence and generous European benefits

- Turbulence increases European unemployment
- … but leaves U.S. unemployment unchanged.

ECMA -08 European layoff costs / stochastic aging

- In tranquil times, European unemp. below that of the U.S.
- In turbulent times, older Europeans suffer long-term unemp.

Framework robustness

- Yes, matching and search-island (JME -07a)
- No, employment-lottery rep. family (JME -07b)

Probing the "tax story" to European unemployment

- Complete markets and employment lotteries are not necessary. Given indivisible labor, an agent can instead vary length of labor market career and save to smooth consumption (NBER Macro Annual 2006)
- …. ex-post successful agents are first to shorten careers, among ex-ante identical agents (JME -08)

Connections to Ljungqvist and Sargent's earlier inquiries

JPE -98 Turbulence and generous European benefits

- Turbulence increases European unemployment
- … but leaves U.S. unemployment unchanged.

ECMA -08 European layoff costs / stochastic aging

- In tranquil times, European unemp. below that of the U.S.
- In turbulent times, older Europeans suffer long-term unemp.

This paper OLG Bewley growth model

Ben-Porath human capital technology

Ex ante heterogeneity (high school / college)

- European minimum wage causes youth unemployment
- Low-type workers are more prone to shorten careers
- Endogenous age-dependent earnings persistence

Over the 1970s and 1980s, "an increase in covariances … larger for the older age groups and for the low-order covariances" (Moffitt & Gottschalk, 1995).

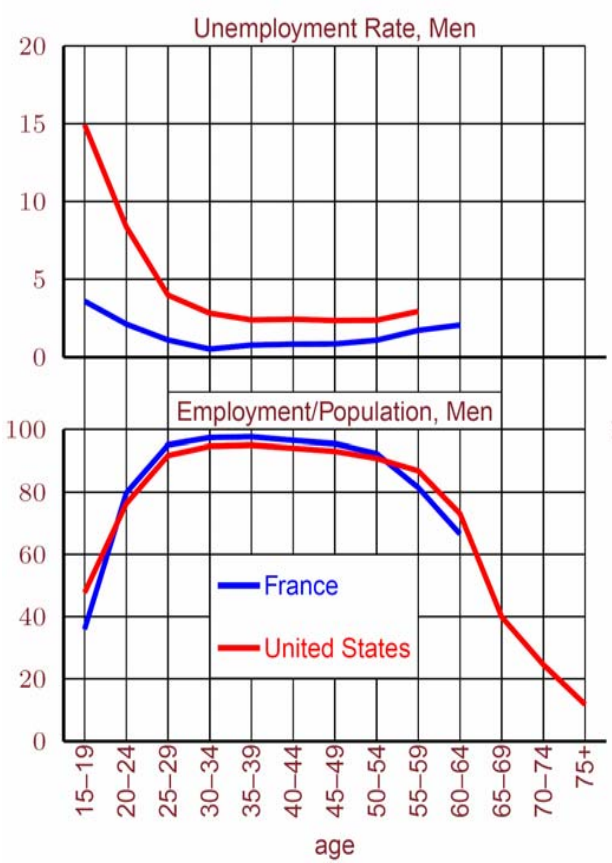
Framework robustness

- Yes, matching and search-island (JME -07a)
- No, employment-lottery rep. family (JME -07b)

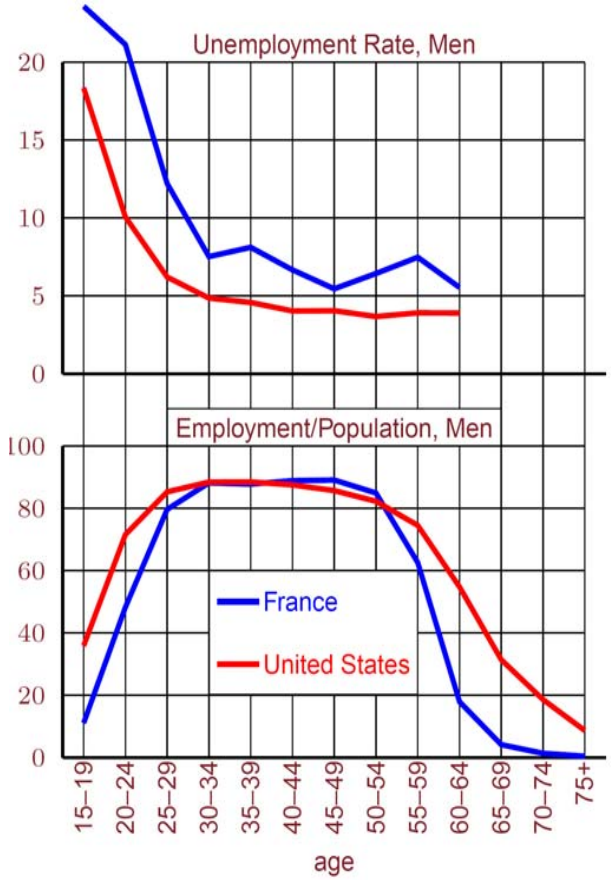
Probing the "tax story" to European unemployment

- Complete markets and employment lotteries are not necessary. Given indivisible labor, an agent can instead vary length of labor market career and save to smooth consumption (NBER Macro Annual 2006)
- …. ex-post successful agents are first to shorten careers, among ex-ante identical agents (JME -08)

1970

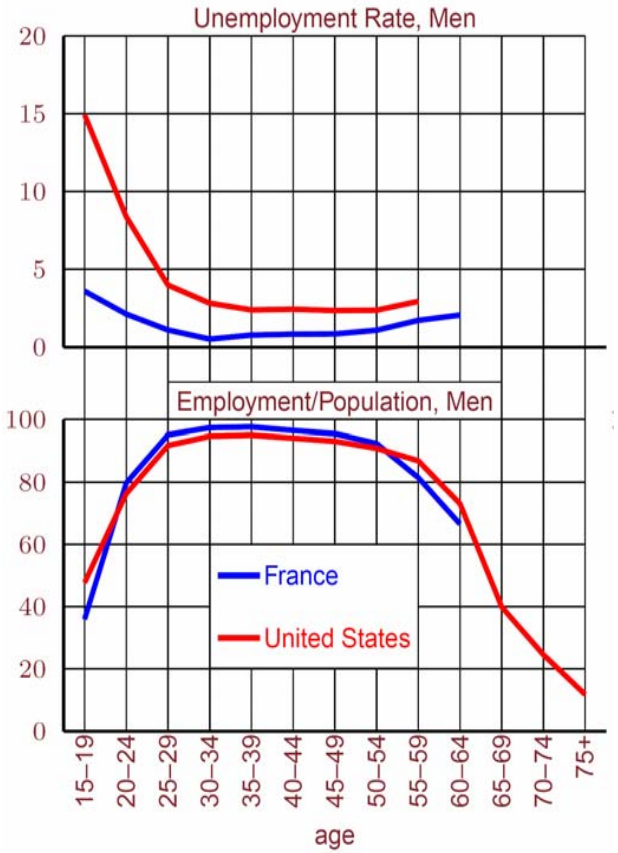


2004

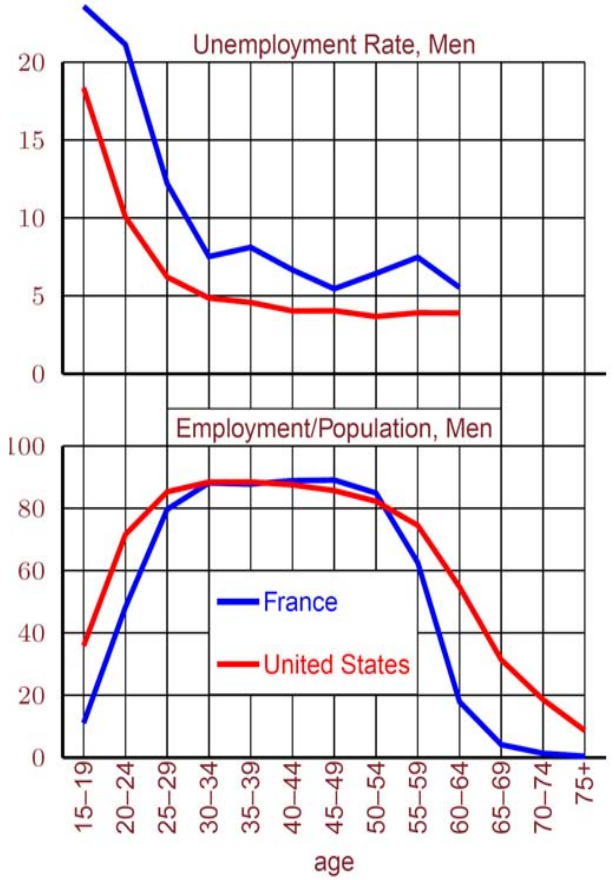


Source:
OECD
via Shimer

1970



2004



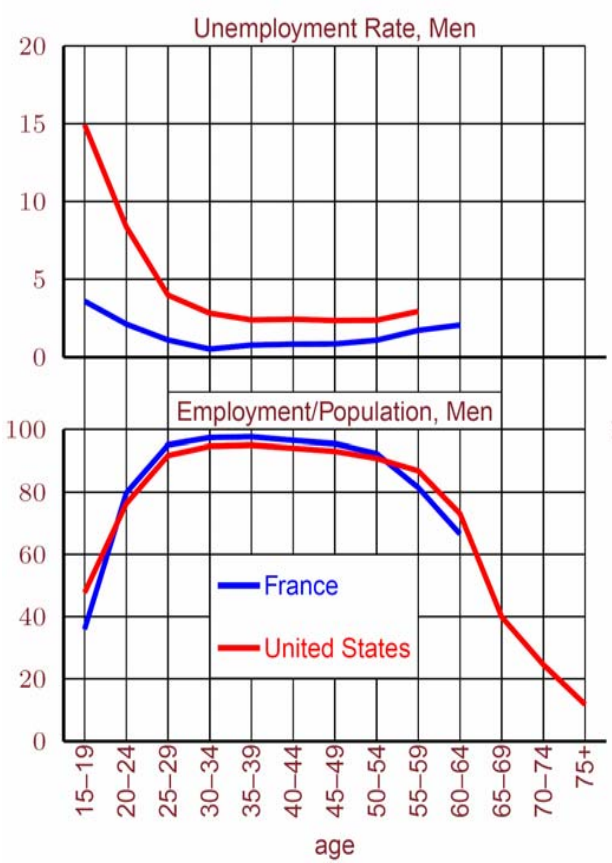
Source:
OECD
via Shimer

Benefit dependency rates[c]

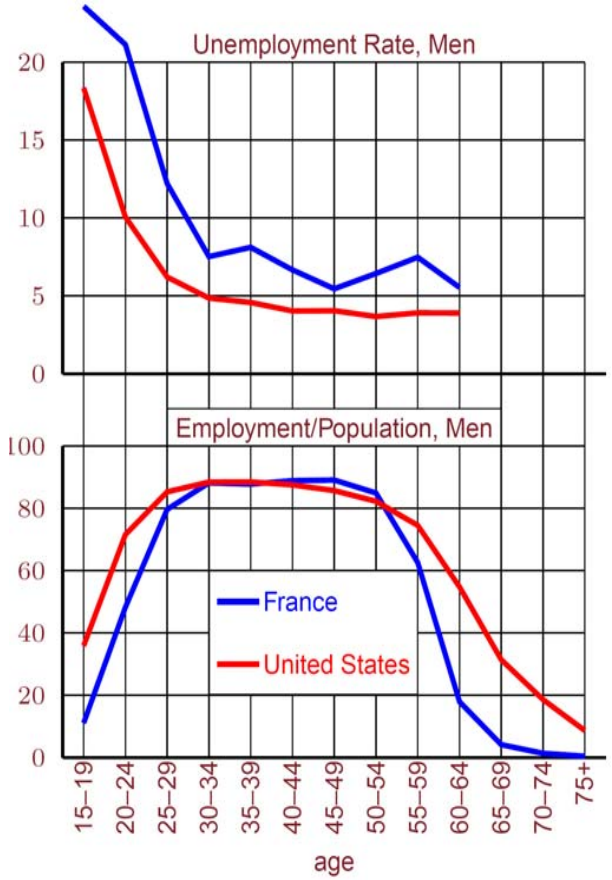
	1980	1990	1999
France	13.9	20.2	24.2
Germany	15.2	18.1	22.4
United States	16.8	15.6	13.7

Source: OECD Employment Outlook 2003

1970

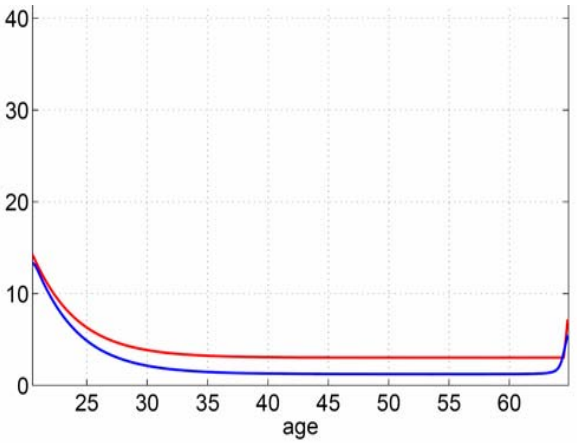


2004



Source:
OECD
via Shimer

Tranquil times



Turbulent times

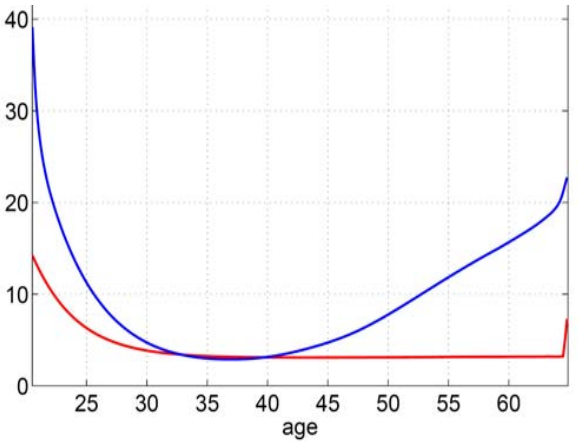


Table 1: Working parts and their sources

Model features	Outcomes	literature
Random earnings with incomplete markets	distributions of heterogenous agents	Bewley (1986)
life cycle	consumption and savings profiles	Auerbach and Kotlikoff (1987)
human capital	income profile	Ben-Porath (1967)
youthful inexperience	job churning	Neal (1999)
indivisible labor with incomplete markets	career length	Ljungqvist and Sargent (2006)
search-island(s)	unemployment	Lucas and Prescott (1974) Alvarez and Veracierto (2001)
minimum wage	youth unemployment	Pries and Rogerson (2005)
layoff costs UI	suppress unemployment promote unemployment	Mortensen and Pissarides (1999)
turbulence	volatility of earnings age-dependent persistence	Gottschalk and Moffitt (1994) Moffitt and Gottschalk (1995)

Agents

2 types; i = L, H [low type (high school) , high type (college)]

Preferences $E_0 \sum_{t=0}^{T} \beta^t \left[\log c_t - B_t\right]$

indivisible labor;

disutility of work $B_t \in \{0, B\}$

Agents 2 types; i = L, H [low type (high school) , high type (college)]

Preferences $E_0 \sum_{t=0}^{T} \beta^t \left[\log c_t - B_t\right]$ indivisible labor;

disutility of work $B_t \in \{0, B\}$

Career path working age 20-65, mandatory retirement 66-90 { survival prob. m_t }

(1) 'Inexperienced':

⇩ transition probability π

(2) 'Experienced':

Agents 2 types; i = L, H [low type (high school) , high type (college)]

Preferences $E_0 \sum_{t=0}^{T} \beta^t \left[\log c_t - B_t\right]$ indivisible labor;

disutility of work $B_t \in \{0, B\}$

Career path working age 20-65, mandatory retirement 66-90 { survival prob. m_t }

(1) 'Inexperienced': for each employment spell, efficiency units are drawn from $G_i(n)$

⇩ transition probability π

(2) 'Experienced': efficiency units $h_t(1 - l_t)$, { human capital h_t , investment $l_t \in [0, 1]$ }

Ben-Porath technology $h_{t+1} = h_t + A_i(h_t l_t)^\nu$ (no depreciation)

convert into bimonthly transition probabilities $H_i^n(h, h'; l)$

Agents 2 types; i = L, H [low type (high school) , high type (college)]

Preferences $E_0 \sum_{t=0}^{T} \beta^t \left[\log c_t - B_t\right]$ indivisible labor;

disutility of work $B_t \in \{0, B\}$

Career path working age 20-65, mandatory retirement 66-90 { survival prob. m_t }

(1) 'Inexperienced': for each employment spell, efficiency units are drawn from $G_i(n)$

⇩ transition probability π

(2) 'Experienced': efficiency units $h_t(1 - l_t)$, { human capital h_t , investment $l_t \in [0, 1]$ }

Ben-Porath technology $h_{t+1} = h_t + A_i(h_t l_t)^\nu$ (no depreciation)

convert into bimonthly transition probabilities $H_i^n(h, h'; l)$

Turbulence transition probability at an exogenous job termination $H_i^\lambda(h', h'')$

Firms

each firm creates a single job

Production function $F(z_t, k_t, n_t) = \exp(z_t)\, k_t^{\alpha} n_t^{1-\alpha}$

- z_t job-specific productivity level follows a Markov process $Z(z, z')$
- k_t physical capital (depreciation rate δ)
- μ cost of creating a new job (with productivity level z_{initial})

Firms each firm creates a single job

Production function $F(z_t, k_t, n_t) = \exp(z_t)\, k_t^{\alpha} n_t^{1-\alpha}$

z_t job-specific productivity level follows a Markov process $Z(z, z')$

k_t physical capital (depreciation rate δ)

μ cost of creating a new job (with productivity level z_{initial})

Search-island model (Alvarez and Veracierto, 2001)

$B^u(s_t)$ disutility of search

$S(s_t)$ prob. of finding labor market next period

- workers and firms are randomly matched each period
- firms hire profit-maximizing capital, after observing its worker
- anonymous labor market with a market-clearing wage rate per efficiency unit of labor

Firms each firm creates a single job

Production function $F(z_t, k_t, n_t) = \exp(z_t)\, k_t^{\alpha} n_t^{1-\alpha}$

z_t job-specific productivity level follows a Markov process $Z(z, z')$

k_t physical capital (depreciation rate δ)

μ cost of creating a new job (with productivity level z_{initial})

Search-island model (Alvarez and Veracierto, 2001)

$B^u(s_t)$ disutility of search

$S(s_t)$ prob. of finding labor market next period

- workers and firms are randomly matched each period
- firms hire profit-maximizing capital, after observing its worker
- anonymous labor market with a market-clearing wage rate per efficiency unit of labor

Endogenous and exogenous separations:

q prob. firm destroys job endogenously

λ exogenous destruction

$\tilde{\lambda} - \lambda$ additional exog. breakups for inexperienced

Government

$\Gamma(e)$	UI, last labor earnings e
$d_{\max}$	UI duration
Ω	job destruction tax
$e_{\min}$	minimum wage
τ_n	labor tax rate
τ_p	social security tax rate
τ_k	capital tax rate
$\hat{\epsilon}$	retirement benefit
X	public consumption

Government

		U.S.	Europe
$\Gamma(e)$	UI, last labor earnings e	60 % replacement rate	
$d_{\max}$	UI duration	6 months	unlimited duration
Ω	job destruction tax		
$e_{\min}$	minimum wage		
τ_n	labor tax rate		
τ_p	social security tax rate		
τ_k	capital tax rate		
$\hat{\epsilon}$	retirement benefit		
X	public consumption		

OECD Economic Studies (1996):
Net unemployment benefit replacement rates
in 1994 for single-earner households, in percent

	U.S.	France	Germany
first year	34 (38)	79 (80)	66 (74)
second and third year	9 (14)	63 (62)	63 (72)
fourth and fifth year	9 (14)	61 (60)	63 (72)

without (with) dependent spouse

Government

		U.S.	Europe
$\Gamma(e)$	UI, last labor earnings e	60 % replacement rate	
$d_{\max}$	UI duration	6 months	unlimited duration
Ω	job destruction tax		
$e_{\min}$	minimum wage		
τ_n	labor tax rate		
τ_p	social security tax rate		
τ_k	capital tax rate		
$\hat{\epsilon}$	retirement benefit		
X	public consumption		

Hunt (J. of Labor Economics, 1995):

German unemployment benefits in 1983

First 12 months	'Arbeitslosengeld'	68% replacement rate
Thereafter,	'Arbeitslosenhilfe'	58% replacement rate
		unlimited duration, means tested

Government

$\Gamma(e)$	UI, last labor earnings e
$d_{\max}$	UI duration
Ω	job destruction tax
$e_{\min}$	minimum wage
τ_n	labor tax rate
τ_p	social security tax rate
τ_k	capital tax rate
$\hat{\epsilon}$	retirement benefit
X	public consumption

	U.S.	Europe
	60 % replacement rate	
	6 months	unlimited duration
	0	3 months of low-type earnings
	no	yes, in turbulent times

Government

		U.S.	Europe
$\Gamma(e)$	UI, last labor earnings e	60 % replacement rate	
$d_{\max}$	UI duration	6 months	unlimited duration
Ω	job destruction tax	0	3 months of low-type earnings
$e_{\min}$	minimum wage	no	yes, in turbulent times
τ_n	labor tax rate	15%	30%
τ_p	social security tax rate	10%	10%
τ_k	capital tax rate	15%	15%
$\hat{\epsilon}$	retirement benefit		
X	public consumption		

Mendoza et al. (JME, 1994) and
http://www.econ.umd.edu/~mendoza/pp/newtaxdata.pdf

Tax on labor income U.S. 28% France 46%
Germany 41%

Government

		U.S.	Europe
$\Gamma(e)$	UI, last labor earnings e	60 % replacement rate	
$d_{\max}$	UI duration	6 months	unlimited duration
Ω	job destruction tax	0	3 months of low-type earnings
$e_{\min}$	minimum wage	no	yes, in turbulent times
τ_n	labor tax rate	15%	30%
τ_p	social security tax rate	10%	10%
τ_k	capital tax rate	15%	15%
0.5 = $\hat{\epsilon}$	retirement benefit	Replacement rate low type 47% high type 25%	47% 25%
X	public consumption		

OECD study (2006):
Gross replacement rate of individuals with

	U.S.	France	Germany
50% of average earnings	50%	84%	47%
100% of average earnings	39%	53%	46%
200% of average earnings	28%	47%	38%

Government

		U.S.	Europe
$\Gamma(e)$	UI, last labor earnings e	60 % replacement rate	
$d_{\max}$	UI duration	6 months	unlimited duration
Ω	job destruction tax	0	3 months of low-type earnings
$e_{\min}$	minimum wage	no	yes, in turbulent times
τ_n	labor tax rate	15%	30%
τ_p	social security tax rate	10%	10%
τ_k	capital tax rate	15%	15%
0.5 = $\hat{\epsilon}$	retirement benefit	Net-of-tax replacement	
		low type 62.7%	78.3%
		high type 33.3%	41.7%
X	public consumption		

OECD study (2006):

Net-of-tax replacement rate of individuals with	U.S.	France	Germany
50% of average earnings	61%	98%	62%
100% of average earnings	51%	69%	72%
200% of average earnings	39%	59%	67%

Government

		U.S.	Europe
$\Gamma(e)$	UI, last labor earnings e	60 % replacement rate	
$d_{\max}$	UI duration	6 months	unlimited duration
Ω	job destruction tax	0	3 months of low-type earnings
$e_{\min}$	minimum wage	no	yes, in turbulent times
τ_n	labor tax rate	15%	30%
τ_p	social security tax rate	10%	10%
τ_k	capital tax rate	15%	15%
0.5 = $\hat{\epsilon}$	retirement benefit	Net-of-tax replacement	
		low type 62.7%	78.3%
		high type 33.3%	41.7%
X	public consumption		

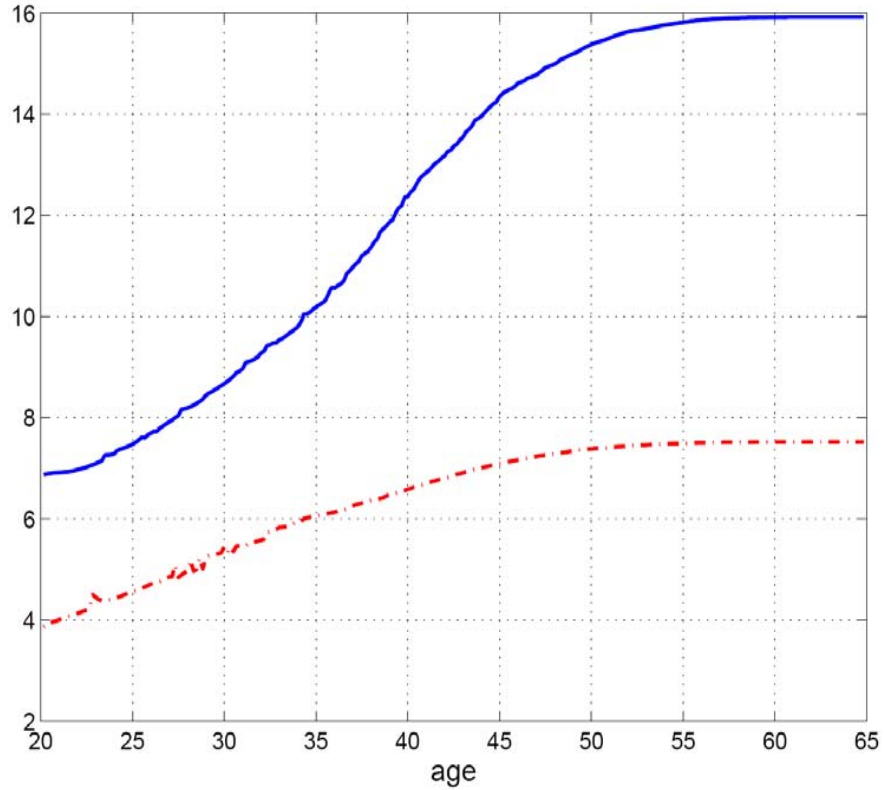
Residual

Value functions

Value function	phase of life	decisions
$\tilde{V}_i^u(a, \gamma, d, t)$	inexperienced, unemployed	c, a', s
$\tilde{V}_i^n(a, n, t)$	inexperienced, employed	c, a'
$V_i^u(a, h, \gamma, d, t)$	experienced, unemployed	c, a', s
$V_i^n(a, h, t)$	experienced, employed	c, a', l
$\hat{V}(a, t)$	old, retired	c, a'
$V^f(z)$	firm	{stay, exit}, k

a	assets	h	human capital
γ	UI benefits	i	skill type
d	elapsed duration	c	consumption
t	age	s	search intensity
n	inexperienced efficiency units	l	investment in skills

Earnings profile



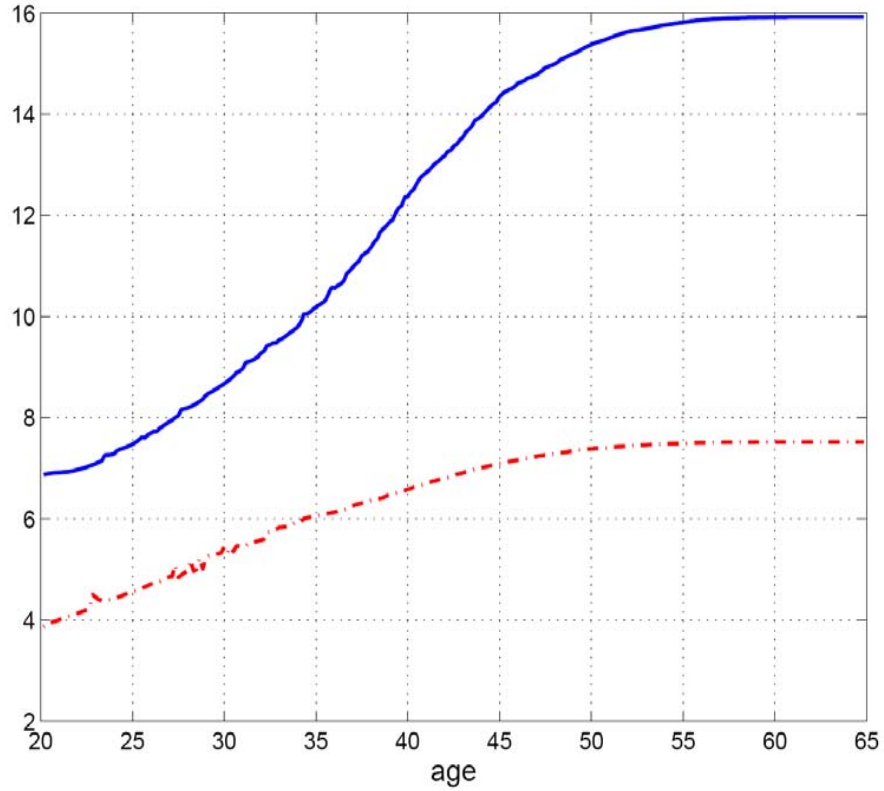
Target: U.S. Census earnings differences for non-college and college graduates at ages 25 and 50.

$\nu = 0.8$ in the range of estimates

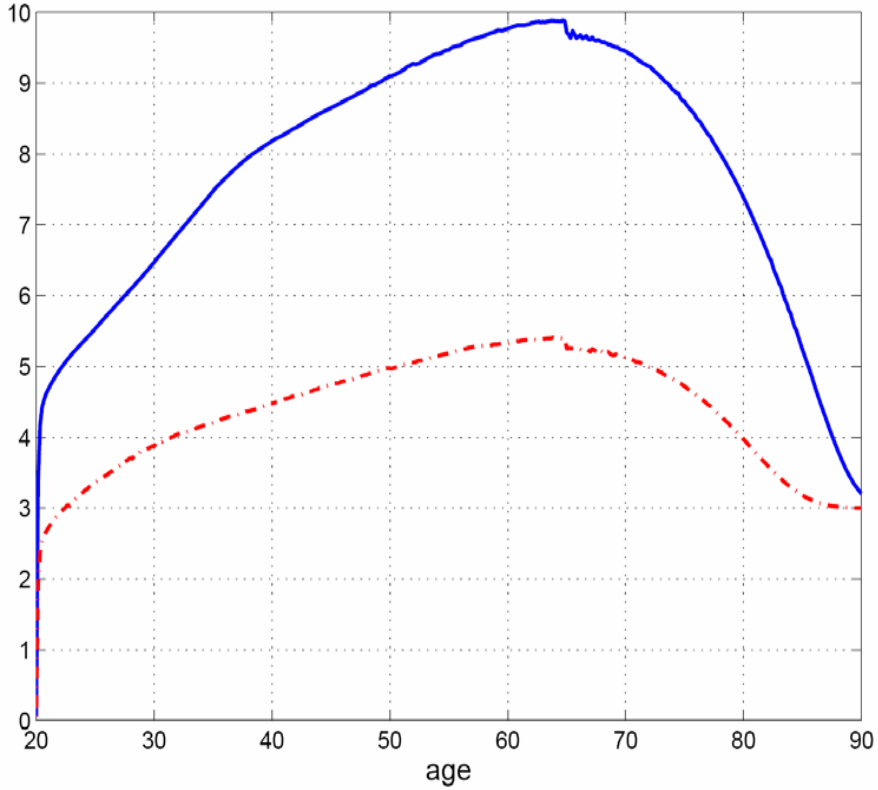
$A_i,\ h_{o,i}$ type-specific values

$$h' = h + A_i(hl)^{\nu}$$

Earnings profile



Consumption profile



Target: U.S. Census earnings differences for non-college and college graduates at ages 25 and 50.

$\nu = 0.8$ in the range of estimates

$A_i,\ h_{o,i}$ type-specific values

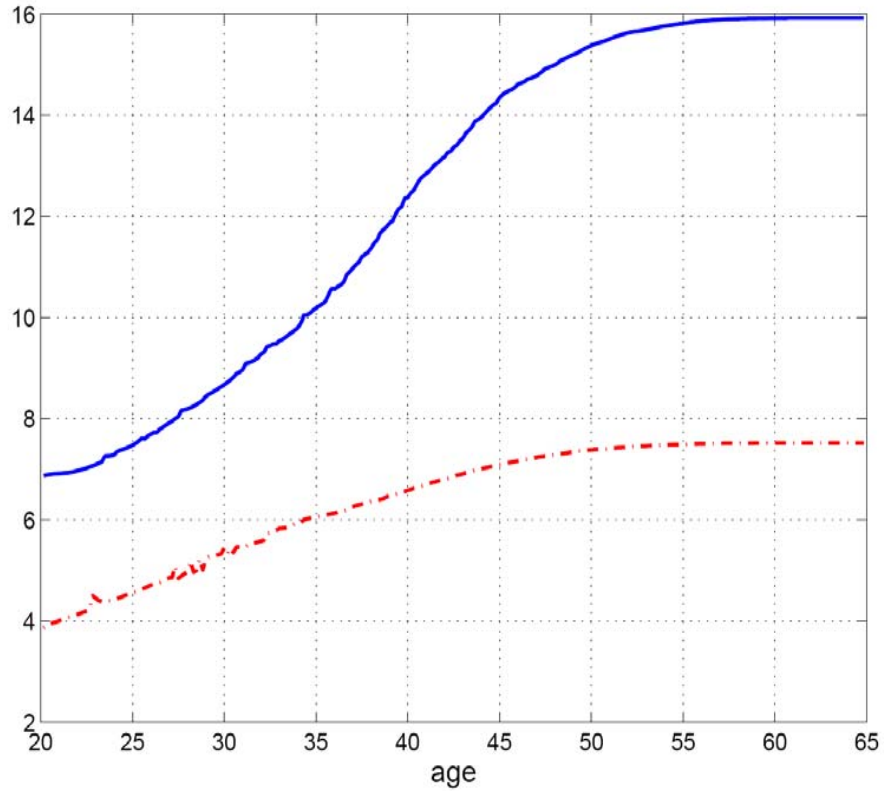
$$h' = h + A_i(hl)^{\nu}$$

Key parameters: $\beta = 0.98$

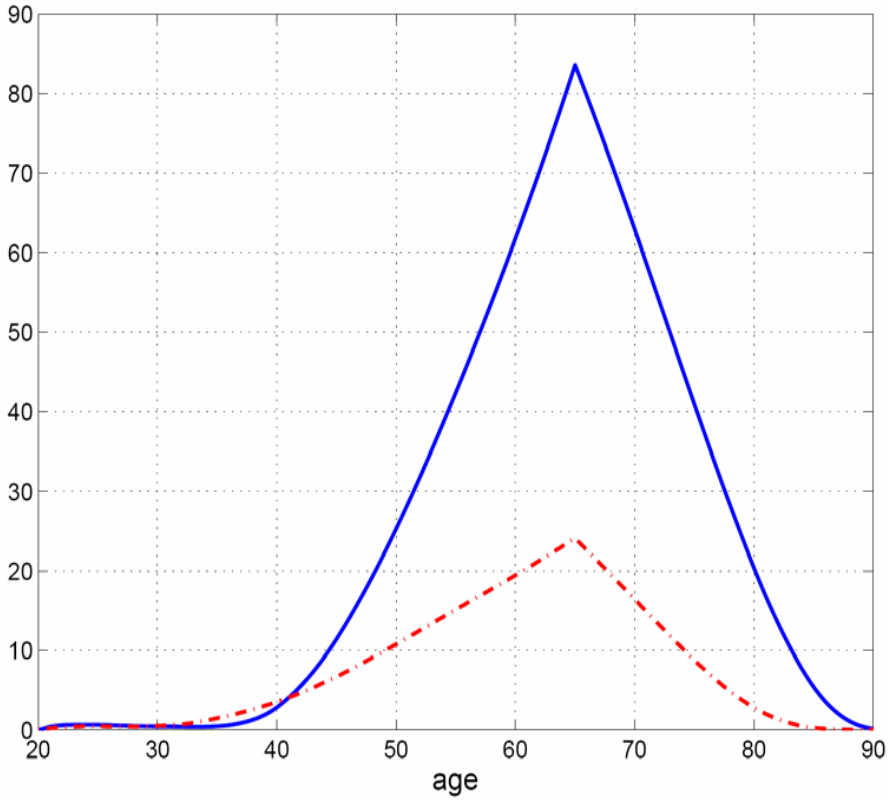
and survival probabilities $\{m_t\}$ [source: Social Security Adm.]

Gourinchas and Parker (2002):
"…the profiles are very sensitive to small variations in the discount factor"

Earnings profile



Asset profile



Target: U.S. Census earnings differences for non-college and college graduates at ages 25 and 50.

$\nu = 0.8$ in the range of estimates

$A_i,\ h_{o,i}$ type-specific values

$$h' = h + A_i(hl)^{\nu}$$

Gourinchas and Parker (2002):

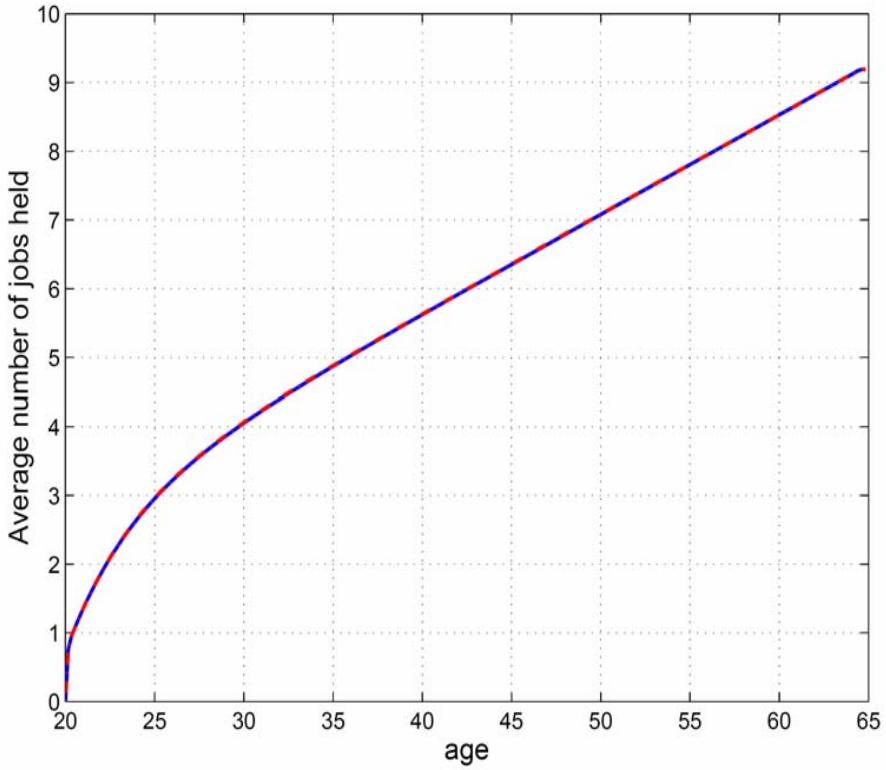
"Young consumers behave as buffer-stock agents

Around age 40, the typical household starts accumulating liquid assets for retirement…"

Workers' average number of jobs and firms' job destruction

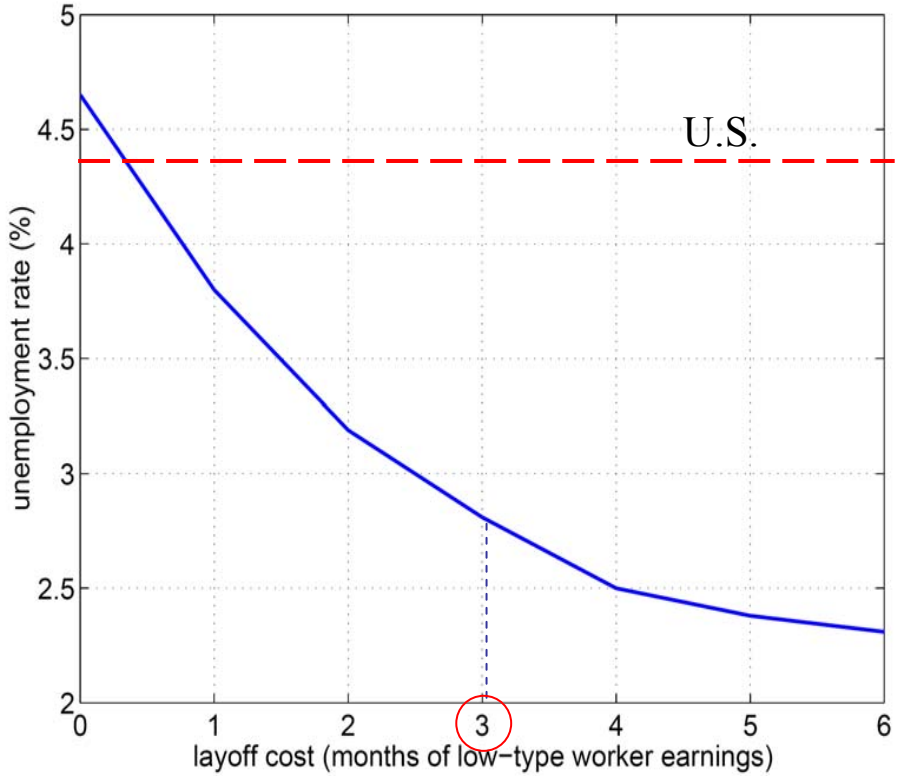
Hall (AER, 1982):
"by age 24, the average worker has held four jobs out of the ten he or she will hold in an entire career."

Davis and Haltiwanger (NBER Macro, 1990):
"March-to-March establishment-level employment changes, we calculate that manufacturing's rates of … destruction averaged 11.3% per year … quarter-to-quarter rates are larger yet … 5.62% on a quarterly basis."



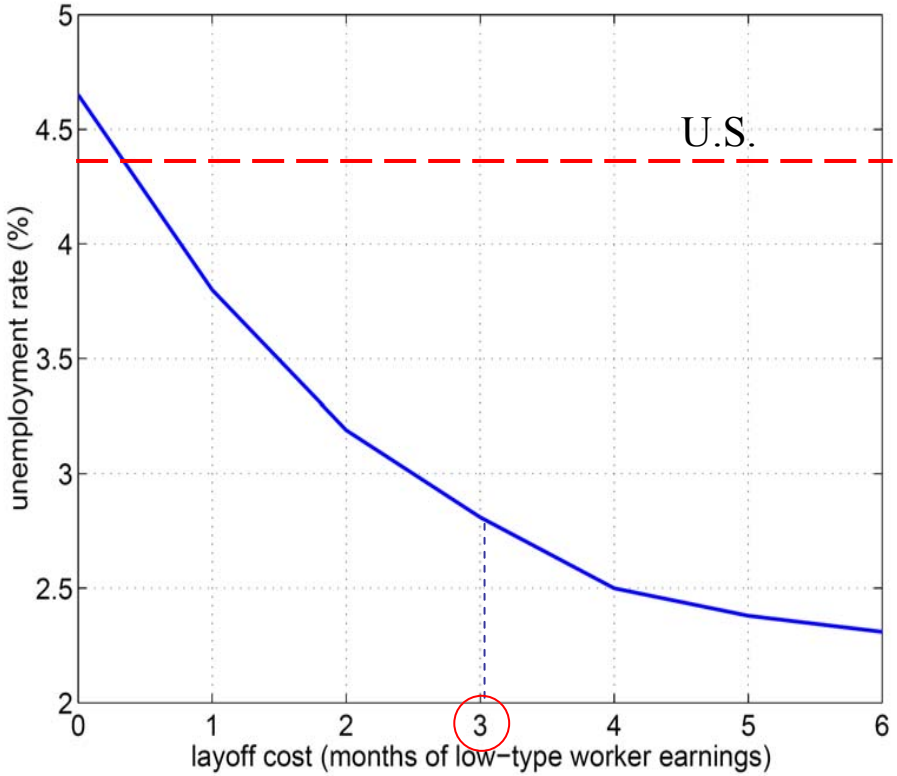
Endogenous and exogenous job destruction:		Inexperienced workers:	
$q = 0.12$	prob. firm destroys job endogenously	$\tilde{\lambda} - \lambda = 0.62$	additional breakups
$\lambda = 0.03$	exogenous job destruction	$\pi = 0.33$	prob. gaining experience

Layoff tax



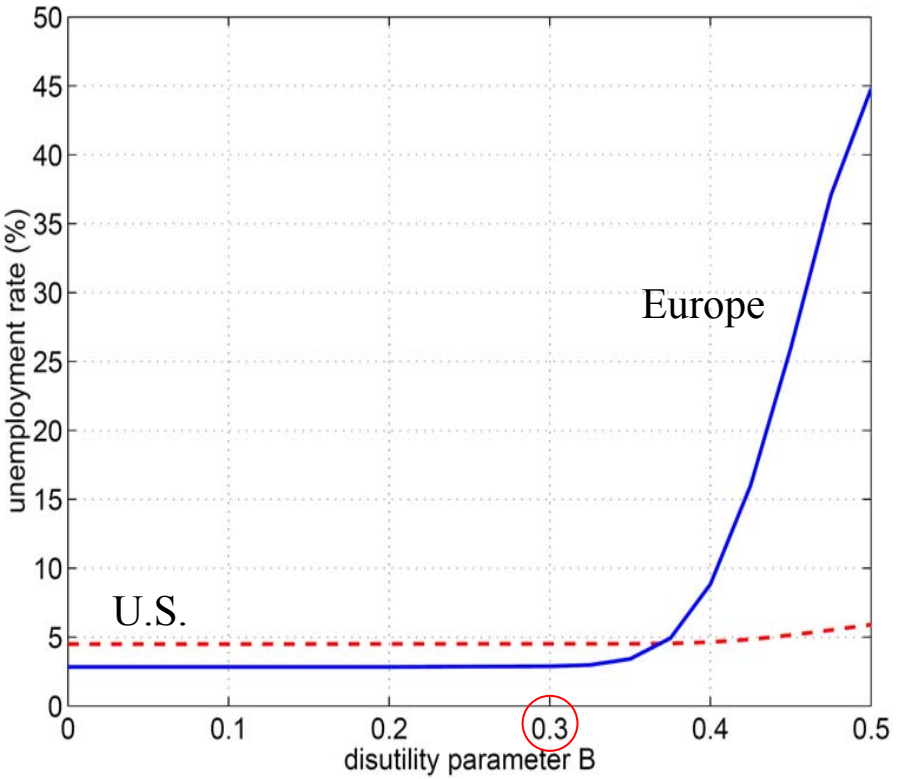
European unemployment in tranquil times as a function of the layoff tax

Layoff tax



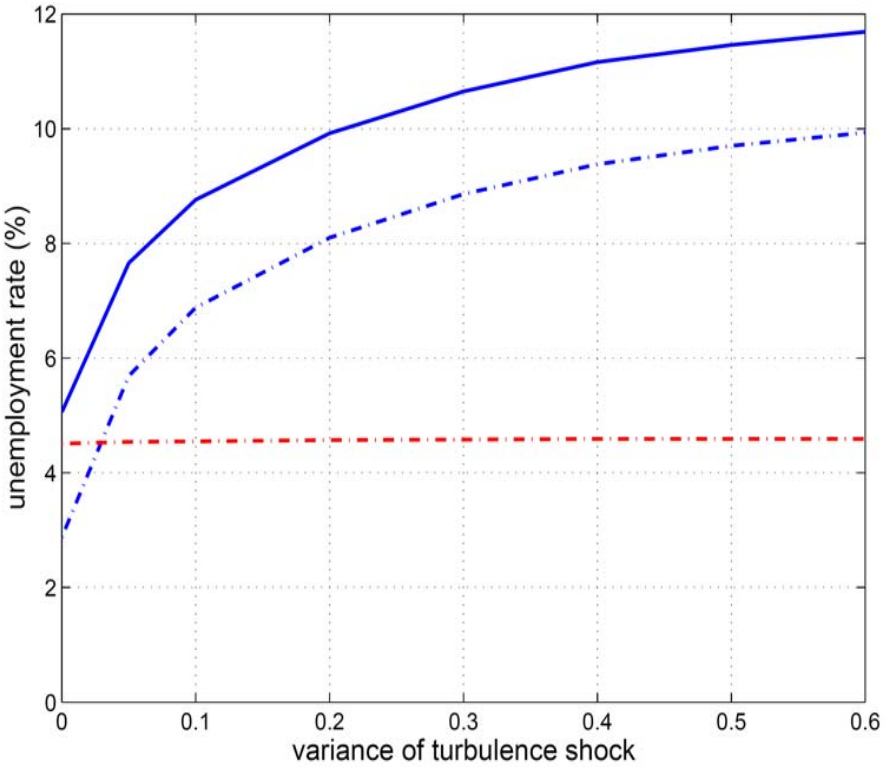
European unemployment in tranquil times as a function of the layoff tax

Disutility of work



Unemployment in tranquil times as a function of the disutility of work

Unemployment and turbulence

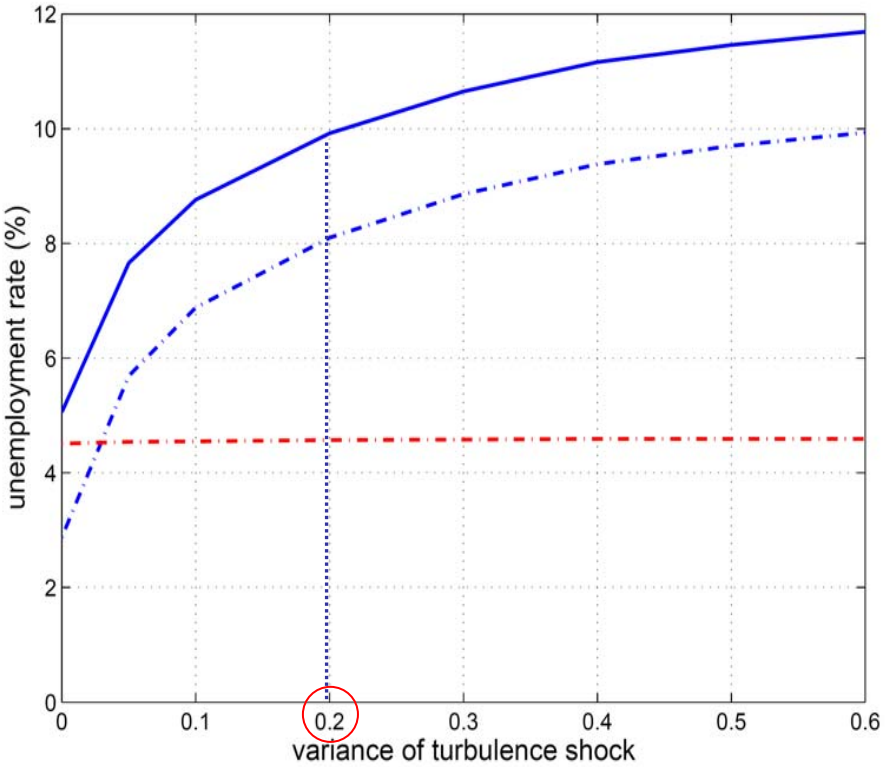


Europe with a minimum wage
(60% of a low-type worker earnings)

Europe without a minimum wage

U.S.

Unemployment and turbulence



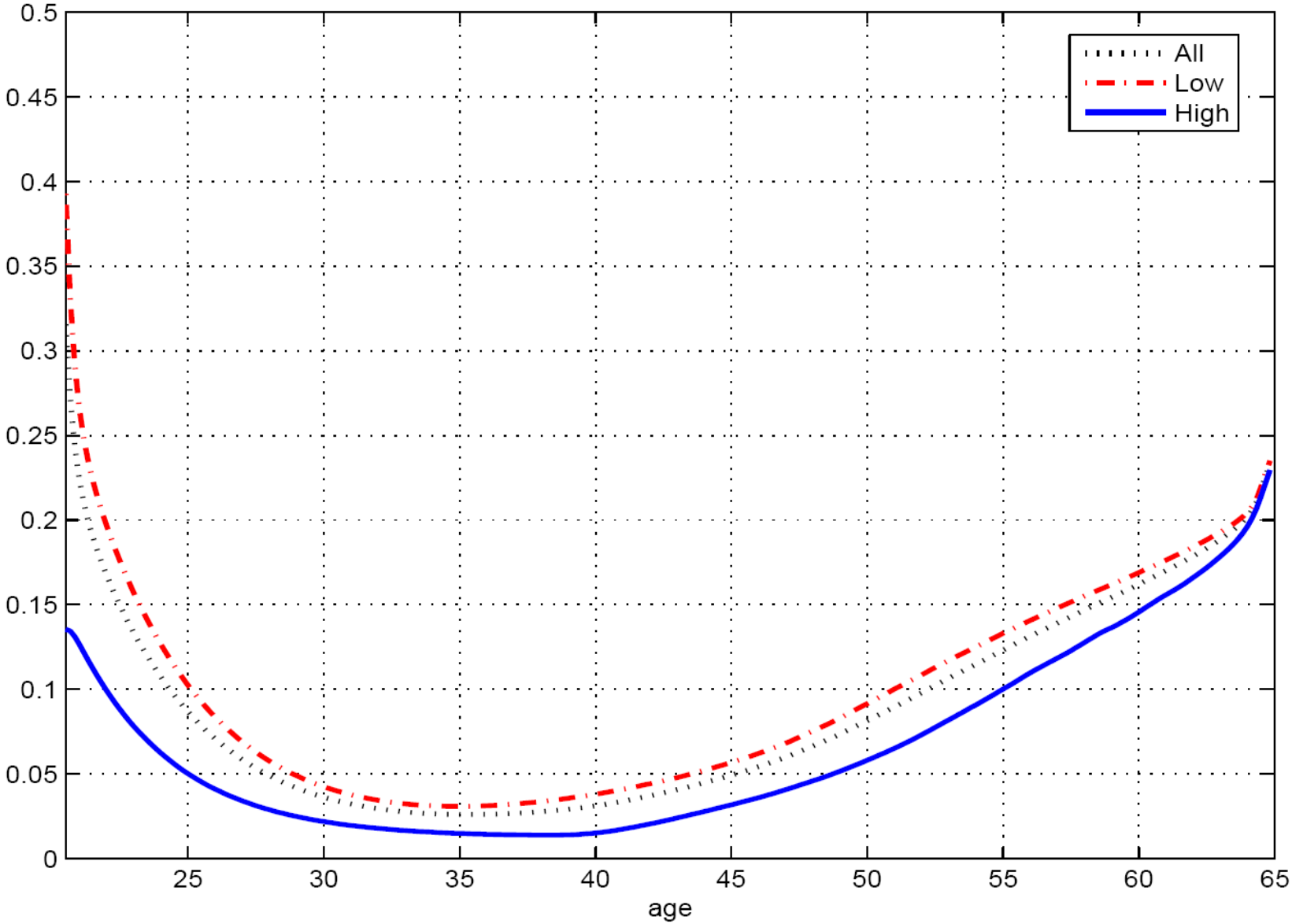
Europe with a minimum wage
(60% of a low-type worker earnings)

Europe without a minimum wage

U.S.

	Europe		U.S.	
	Tranquil	Turbulent	Tranquil	Turbulent
Low type	2.89	11.27	4.51	4.58
High type	2.86	6.78	4.50	4.55
All	2.88	9.92	4.51	4.57

European unemployment in turbulent times



Search intensity of high-type workers in Europe in tranquil times

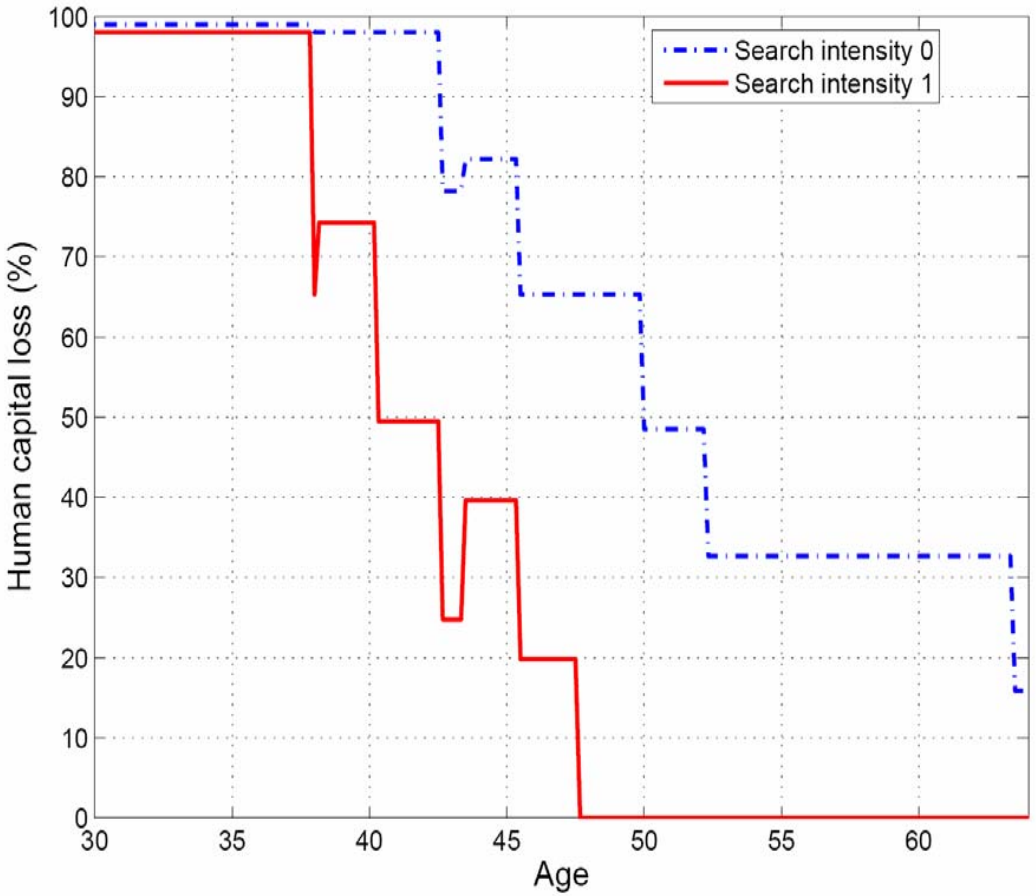
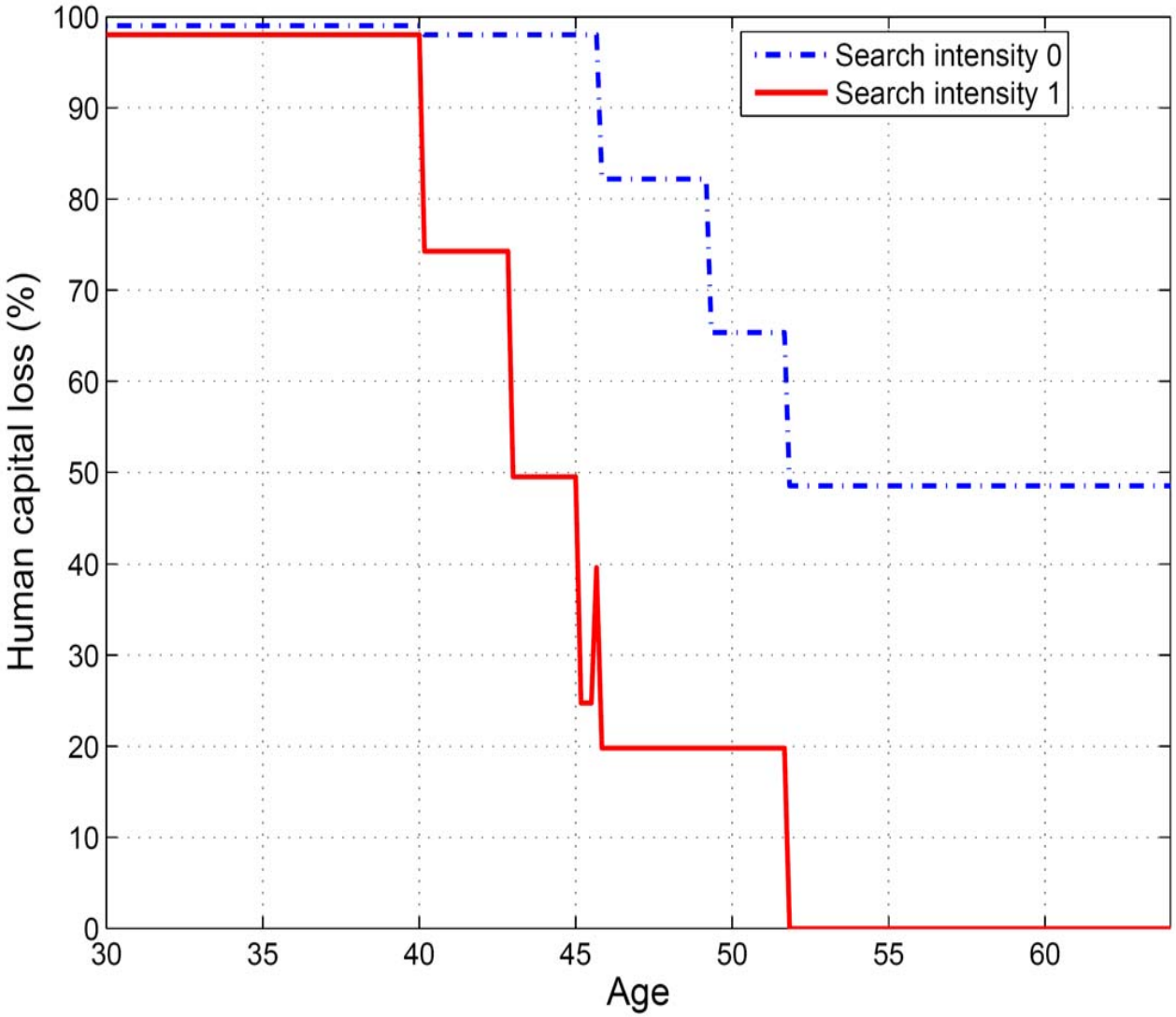


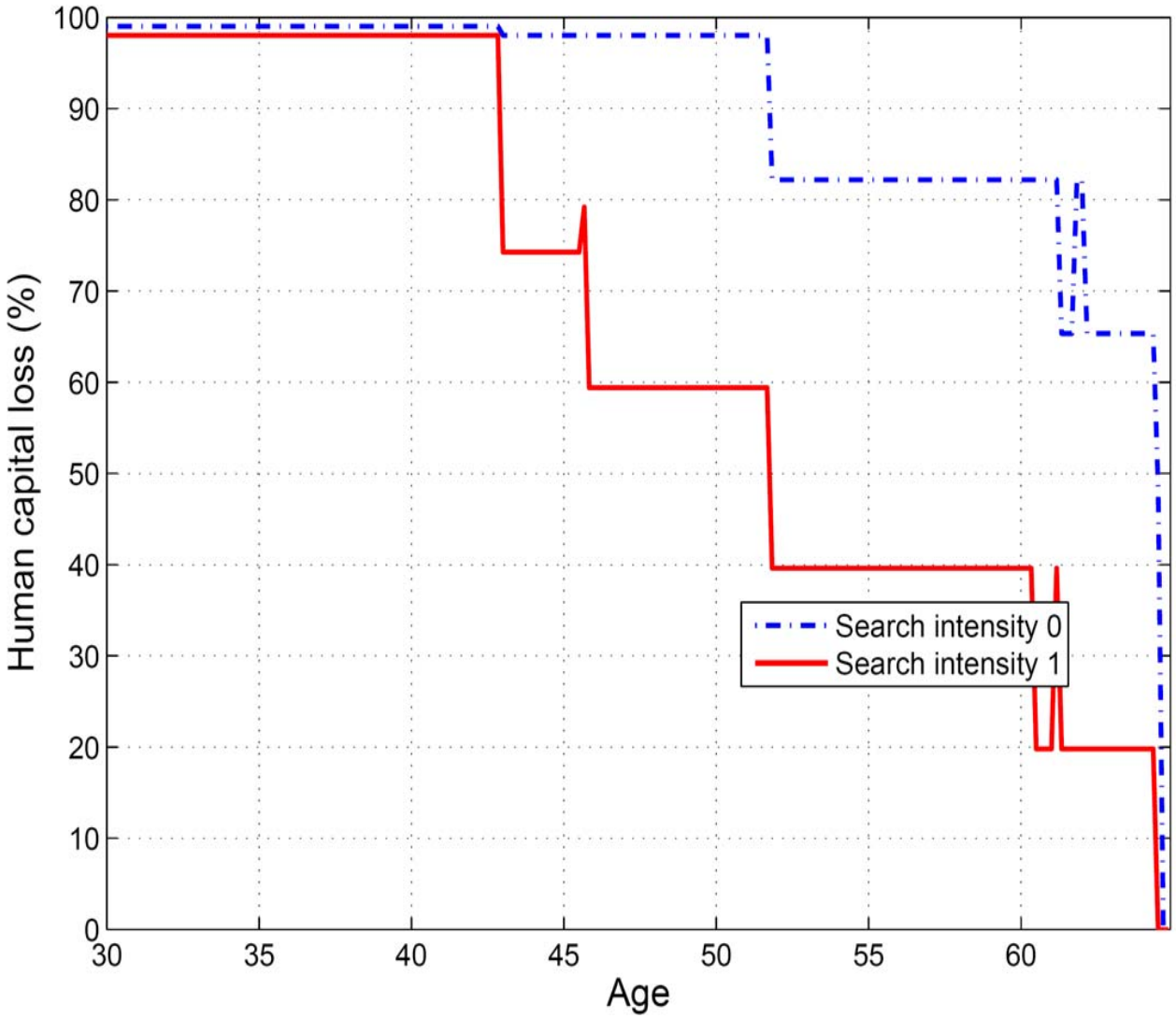
Figure 7: Optimal search intensity of the average high-type worker in Europe in tranquil times, as a function of age and 'human capital loss'. The agent is assumed to hold the average wealth level and to be entitled to benefits based on average earnings in her age group. The search intensity is plotted for different levels of human capital below the average level in her age group, where the difference between these numbers is interpreted as her 'human capital loss'. The solid (dashed) line is the contour curve for full (zero) search intensity.

Search intensity of high-type workers in the U.S. in tranquil times



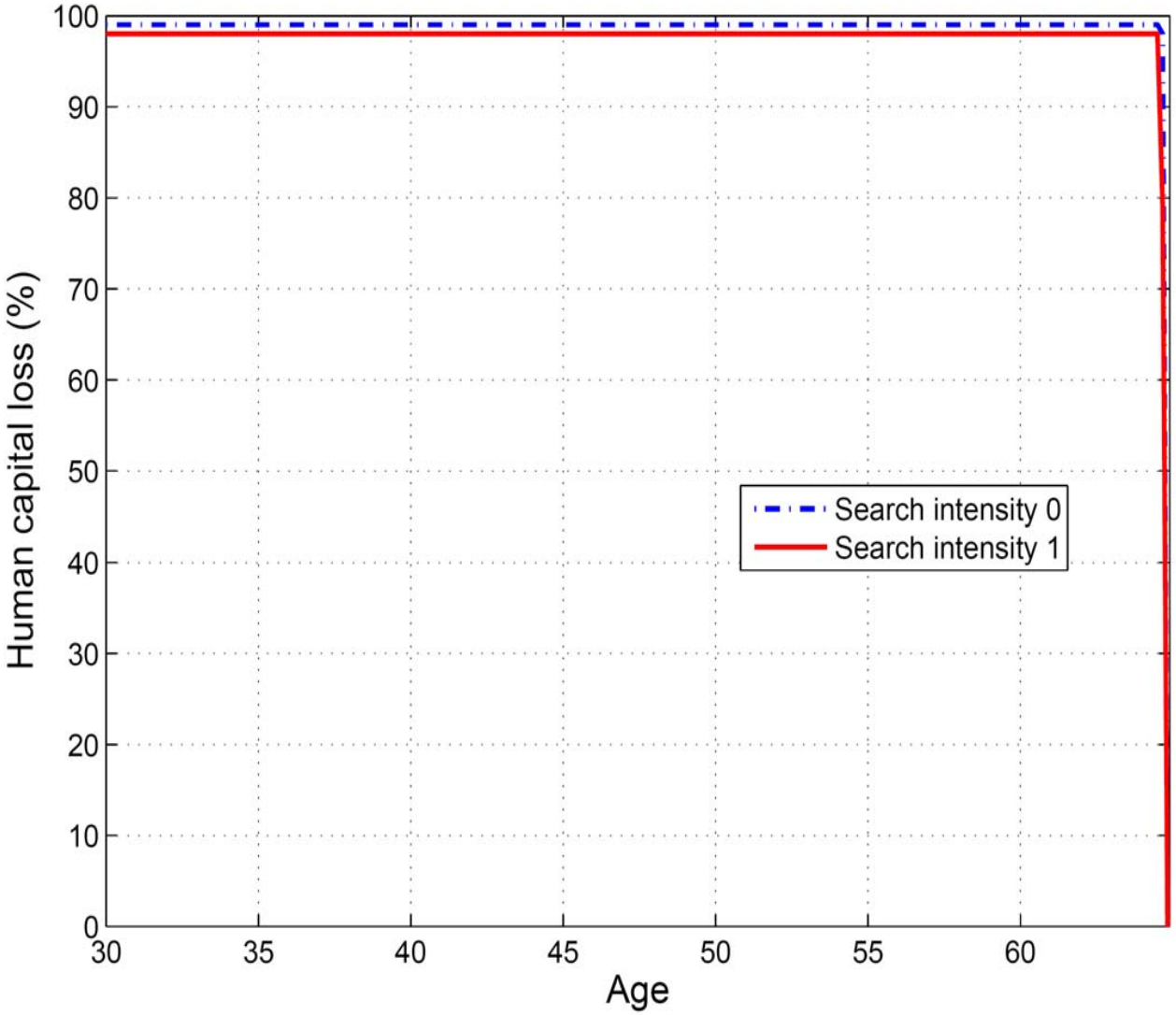
First period of unemployment

Search intensity of high-type workers in the U.S. in tranquil times



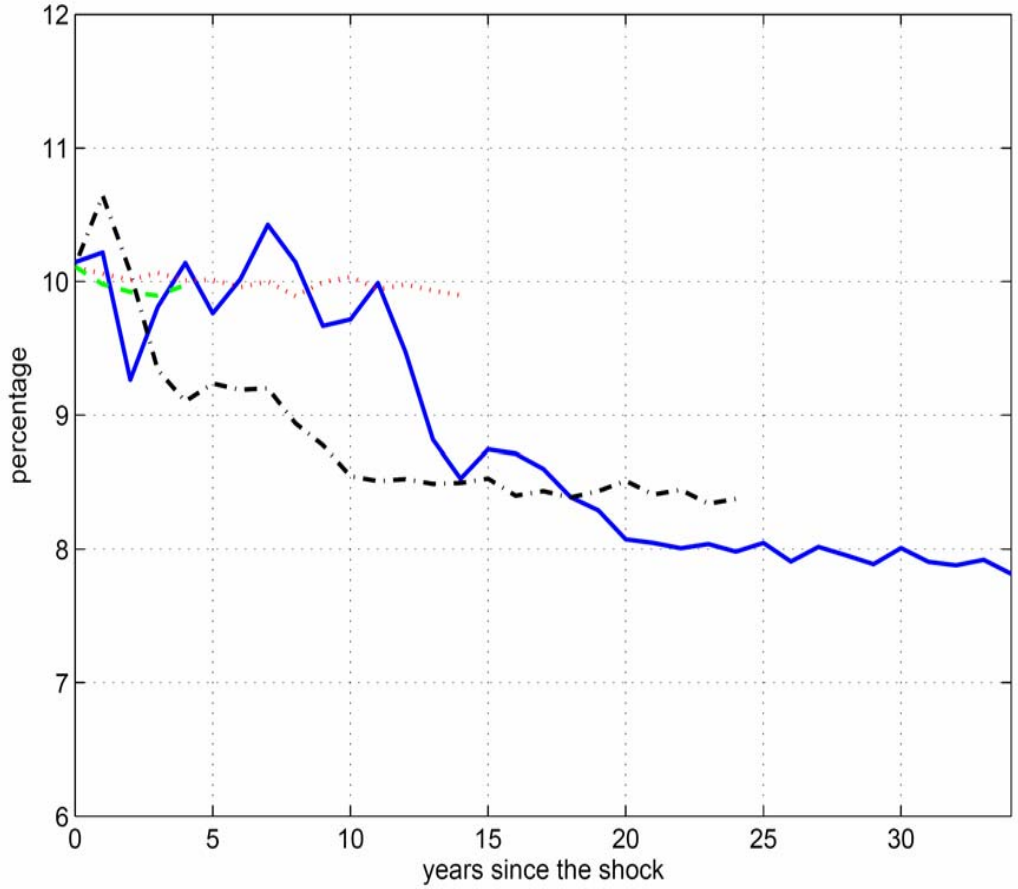
Second period of unemployment

Search intensity of high-type workers in the U.S. in tranquil times



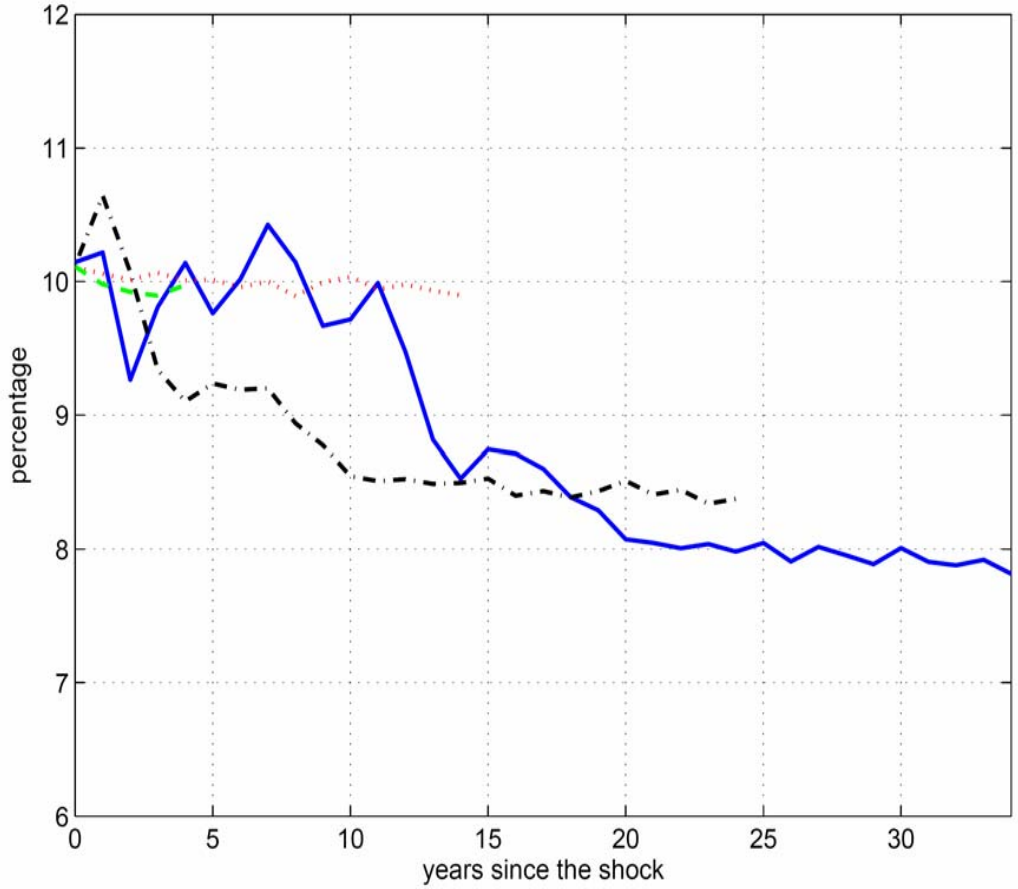
Third period of unemployment

High-type workers loss of earnings relative to the age-earnings profile, after a human capital loss that causes earnings to drop by 10% (U.S. tranquil times)



Samples of the population at age 30, 40, 50 and 60 suffer the loss of human capital, without any other change to their state vectors (incl. employment status)

High-type workers loss of earnings relative to the age-earnings profile, after a human capital loss that causes earnings to drop by 10% (U.S. tranquil times)



Samples of the population at age 30, 40, 50 and 60 suffer the loss of human capital, without any other change to their state vectors (incl. employment status)

Over the 1970s and 1980s, "an increase in covariances … larger for the older age groups and for the low-order covariances" (Moffitt & Gottschalk, 1995).

	Tranquil times				Turbulent times				Change in percent			
	ALL	25-34	35-44	45-54	ALL	25-34	35-44	45-54	ALL	25-34	35-44	45-54
lag 1-4	0,0253	0,0201	0,0290	0,0270	0,0291	0,0202	0,0327	0,0343	15.02	0.50	12.76	27.04
lag 5-9	0,0214	0,0118	0,0238	0,0267	0,0240	0,0117	0,0255	0,0322	12.15	-0.85	7.14	20.60
lag 10-15	0,0186	0,0061	0,0160	0,0239	0,0201	0,0060	0,0163	0,0270	8.06	-1.64	1.87	12.97

European unemployment in turbulent times

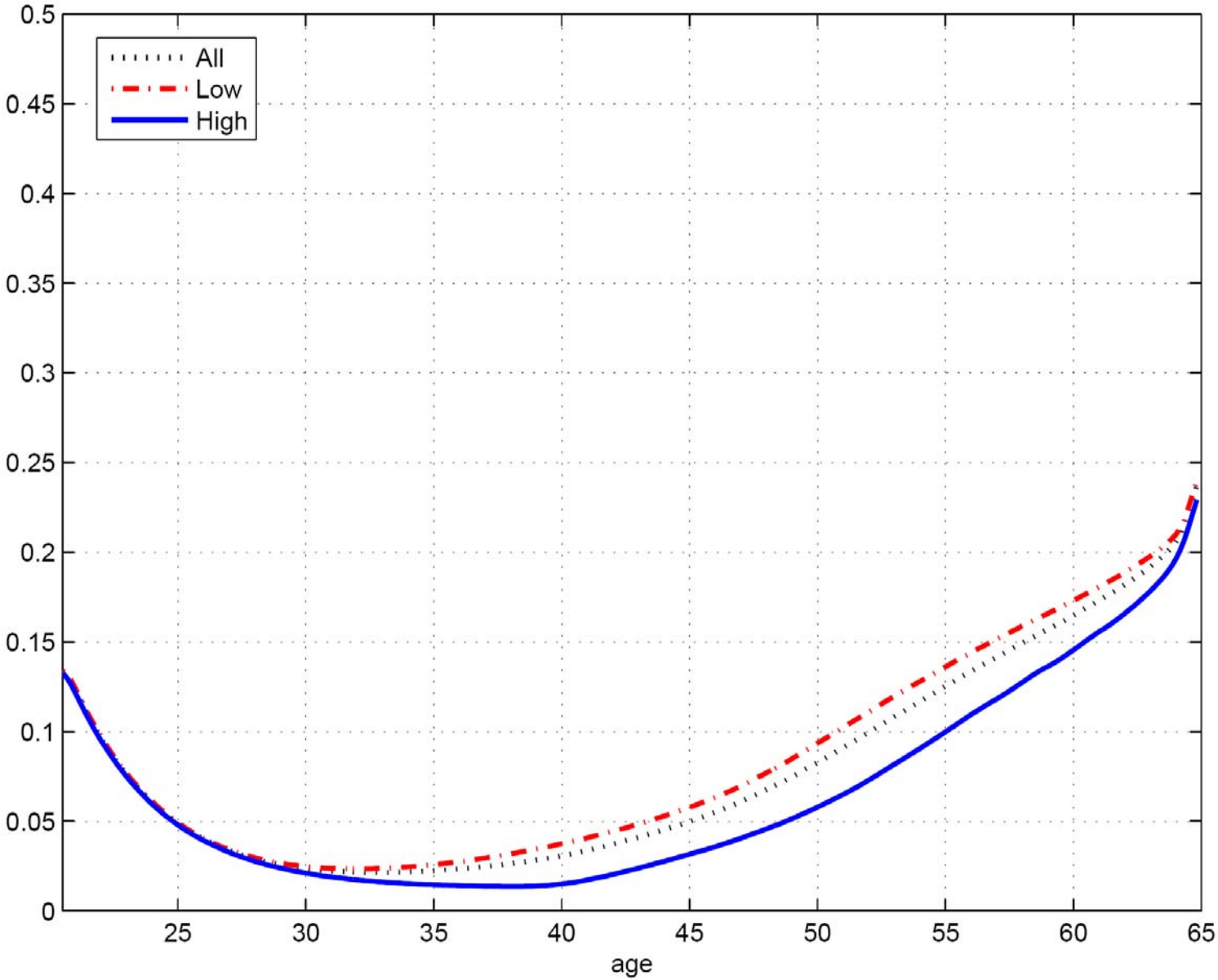


Table with all the usual statistics (by worker type and age)

Unemployment rate

Inflow rate into unemployment

Average duration of unemployment

Distribution of long-term unemployment

Average job tenures

Wealth holdings

Decomposition of earnings volatility