Tax Progressivity, Performance Pay, and Search Frictions

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Introduction

Classic Trade-Off of Progressive Taxation:
Provides some insurance (or redistribution) but distorts incentives.

- A large literature studies this trade-off in frameworks where wages (labor productivities) are exogenous.
- The distortion is typically coming from the intensive margin of the labor supply.
  - Mirrlees (1971) model and New Dynamic Public Finance.
  - Conesa and Krueger (2005), Conesa, Kitao and Krueger (2008).
- This paper: wage shocks are partially endogenous due to search and moral hazard frictions.

Environment

- We adopt the environment of job-to-job transitions and performance pay developed in Ábrahám, Alvarez and Forstner (2016).
- Earnings dynamics is partially determined by job to job flows and transitions through unemployment (similarly Postel-Vinay and Robin, 2002). $\Longrightarrow$ external wage ladder
- The other determinant of earnings dynamics is performance pay due to moral hazard frictions. $\Longrightarrow$ internal wage ladder
- This environment is capable to replicate facts regarding wage dynamics within and across job spells.

Introduction: Tax Progressivity

- Workers face 'job offer risk' both between jobs and out of unemployment.
  - When a worker meets a firm, they draw match productivity.
  - This is pure luck from the workers' point of view
    $\Longrightarrow$ tax progressivity improves welfare.
- Workers face 'incentive risk' within job spell due to moral hazard.
  - Firms determine incentive pay (constrained) efficiently.
  - Progressivity makes incentive provision more expensive.
    $\Longrightarrow$ tax progressivity hurts welfare.
- Potential indirect effects
  - More insurance makes workers accept lower wages at a given level of life-time utility.
  - Job ladders through external offers become flatter.
- Overall effect is a quantitative question.

Related literature

- Optimal taxation with search frictions (but no on the job search): Golosov, Maziero and Menzio (2013), Hungerbühler, Lehmann, Parmentier, Van Der Linden (2006).
- Optimal taxation and within firm insurance: Golosov and Tsyvinski (2007), Chetty and Saez (2010), Doligalski (2016).
- Tax progressivity and optimal labor contracts: Lamadon (2016).

The model

Overview

Key model elements:

- Risk-neutral firms offer long-term employment contracts to risk-averse workers.
- A moral hazard problem arises from the assumption that match output depends stochastically on the worker's unobservable effort.
- Workers' and firms' commitment to contracts is limited.
- When a worker receives an outside offer, the present and the potential future employer compete for him by offering new contracts.

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Quantitative analysis:

- Calibration to (micro) labor market data from the U.S.
- Revenue neutral experiments with different levels of tax progressivity.

Firms/Matches

- Run by risk-neutral entrepreneurs.
- Operate a linear production technology:

$$y = Y(z, A) = zA \tag{1}$$

  - z Match-specific productivity level
  - A Worker-specific stochastic productivity factor

- $z \in \mathcal{Z} = \{z_1, z_2, \ldots, z_N\}$ is drawn from the distribution $F(z)$ when a firm and a worker meet and remains constant over time.
- The value of A depends stochastically on a worker's effort level ϵ:

$$A = \begin{cases} A^+ & \text{with probability} \quad \pi(\epsilon) \\ A^- & \text{with probability} \quad 1 - \pi(\epsilon) \end{cases} \tag{2}$$

  - $A^+ > A^-$, $\pi'(\epsilon) > 0$, $\pi''(\epsilon) \leq 0$

- Matches destroyed with exogenous probability, δ.

Workers

- Ex-ante identical and risk-averse.
- Derive utility $u(c)$ from consumption and suffer disutility $g(\epsilon)$ from exerting effort while working. (No savings.)
- While unemployed:
  - Receive benefit $b = b_0 + b_1 w_p$, where w_p is wage from previous employment.
  - Receive a job offer with probability λ_u associated with match type z.
- While employed in a z-type match:
  - Consume period net wage $(1 - T(w) - T_{pe})w$ and exert effort ϵ.
  - Receive outside job offer with probability λ_e of match type $\tilde{z}$.
  - When their current match is destroyed, workers immediately receive a new offer with probability λ_r.
- Workers die with probability $(1 - \psi)$ and are replaced by unemployed agents with $w_p = 0$.

Government

- Tax revenue is raised from
  - non-linear income taxes $T(\cdot)$
  - linear payroll taxes on workers T_{pe} and on firms T_{pf} (labor cost is $(1 + T_{pf}(w))w$)
- Tax revenue is spent on
  - exogenous government expenditure G (const across tax reforms)
  - and unemployment benefits.

Employment contracts

- Firms make offers in terms of long-term contracts.
- After offers are accepted workers and firms share surplus.
- Firms cannot observe worker's effort.
- Firms can commit to wage payments only as long as life-time profits are non-negative.
- Workers can quit to unemployment or report outside job offers.
- In both cases the original contract becomes void.

$\Rightarrow$ *Repeated moral hazard and two-sided limited commitment.*

Competition for workers

- When a worker reports an outside job offer, the two firms start competing for the worker by offering new contracts.
- Bidding takes place in the form of Bertrand competition (in terms of expected lifetime utilities U that contracts promise to the worker).
- Firms are willing to bid up to the break-even level of utility $U^*(z)$ that solves $V(U^*(z), z) = 0$.
- Relevant (reported) outside offers lead to an increase in lifetime utility for the worker, either at his current employer or through a job-to-job transition.

The firm's contract design problem

An optimal contract $\mathcal{C}^*$ solves

$$
\begin{aligned}
V(U,z) \quad = \quad & \max_{\{w,\epsilon,U^+,U^-\}} z\Big[A^+\pi(\epsilon) + A^-(1-\pi(\epsilon))\Big] - (1+T_{pf}(w))w \\
+ \quad & \beta\psi(1-\delta)\Bigg\{(1-\lambda_e)\underbrace{\Big[V(U^+,z)\pi(\epsilon) + V(U^-,z)(1-\pi(\epsilon))\Big]}_{\textit{exp. continuation value, no outside offer}} \\
+ \quad & \underbrace{\lambda_e \sum_{\tilde{z}\in\mathcal{Z}}\Big[V_o(U^+,z,\tilde{z})\pi(\epsilon) + V_o(U^-,z,\tilde{z})(1-\pi(\epsilon))\Big]f(\tilde{z})}_{\textit{exp. continuation value, outside offer}}\Bigg\}
\end{aligned}
$$

subject to: (PKC), (ICC), (WPC), (FPC), $w \geq 0$, and $\epsilon \in [0, \bar{\epsilon}]$.

Policy functions: $w(U,z)$, $\epsilon(U,z)$, and $\{U^+(U,z), U^-(U,z)\}$

Promise-keeping

Promise-keeping constraint (PKC):

$$
\begin{aligned}
U \quad = \quad & u((1-T(w)-T_{pe})w) - g(\epsilon) + \beta\psi\delta \underbrace{\left\{(1-\lambda_r)U^n(w) + \lambda_r \sum_{\tilde{z}\in\mathcal{Z}} U_s(U^n(w),\tilde{z})\right\}}_{\textit{exp.cont.val., job loss}} \\
& + \beta\psi(1-\delta)\Bigg\{(1-\lambda_e) \underbrace{\left[U^+\pi(\epsilon) + U^-(1-\pi(\epsilon))\right]}_{\textit{exp.cont.val., no outside offer}} \\
& + \lambda_e \underbrace{\sum_{\tilde{z}\in\mathcal{Z}} \left[U_o(U^+,z,\tilde{z})\pi(\epsilon) + U_o(U^-,z,\tilde{z})(1-\pi(\epsilon))\right] f(\tilde{z})\Bigg\}}_{\textit{exp. continuation value, outside offer}}
\end{aligned}
$$

Incentive-compatibility

Incentive-compatibility constraint (ICC):

$$
\begin{aligned}
g'(\epsilon) \quad = \quad & \pi'(\epsilon)\beta\psi(1-\delta)\Bigg\{ \\
& \underbrace{\left(1-\lambda_e+\lambda_e \sum_{\tilde{z}:U^- \geq U_o(U^-,z,\tilde{z})} f(\tilde{z})\right)\left[U^+-U^-\right]}_{\textit{no relevant outside offer}} \\
& \underbrace{+\lambda_e \sum_{\tilde{z}:U^- < U_o(U^-,z,\tilde{z}) \leq U^+} \left[U^+ - U_o(U^-,z,\tilde{z})\right] f(\tilde{z})}_{\textit{outside offer reduces downside risk}} \\
& \underbrace{+\lambda_e \sum_{\tilde{z}:U^+ < U_o(U^-,z,\tilde{z})} \left[U_o(U^+,z,\tilde{z}) - U_o(U^-,z,\tilde{z})\right] f(\tilde{z}) \Bigg\}}_{=0 \textit{ outside offer nullifies incentives entirely}}
\end{aligned}
$$

Participation constraints

Worker's participation constraint (WPC):

$$U^n(0) \leq U^i(U, z), \quad i \in \{+, -\}$$

where

$$\begin{aligned} U^n(w_p) &= u\big(b(w_p)\big) + \\ &\quad +\beta\psi\Big\{(1-\lambda_u)U^n(w_p) + \lambda_u \sum_{\tilde{z}\in\mathcal{Z}} U_s(U^n(w_p), \tilde{z}) f(\tilde{z})\Big\} \end{aligned}$$

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Firm's participation constraint (FPC):

$$U^i(U, z) \leq U^*(z), \quad i \in \{+, -\}$$

where $U^*(z)$ solves $V(U^*(z), z) = 0$.

Surplus sharing

- We use a simple surplus sharing rule to determine the initial life time utilities for new matches out of unemployment or employment. (See Cahuc et. al. 2006.)
- Value of job offer from firm type $\tilde{z}$ to unemployed worker with previous wage w_p:

$$U_s(U^n(w_p), \tilde{z}) \quad = \quad \max\Big[U^n(w_p)\ ,\ (1-\alpha)U^n(w_p) + \alpha U^*(\tilde{z})\Big]$$

- Value of job offer from firm type $\tilde{z}$ to worker employed at firm z with promised utility value U^i:

$$U_o(U^i, z, \tilde{z}) = \max\left\{ U^i, (1-\alpha)\min\Big[U^*(z), U^*(\tilde{z})\Big] + \alpha \max\Big[U^*(z), U^*(\tilde{z})\Big] \right\}$$

- α is the 'bargaining weight' of the worker.

Calibration

Setup of the quantitative analysis

Calibration:

- Calibrated to U.S. micro data (SIPP 2004 panel) on:

▸ Data details

  - Labor market transitions (E-U, U-E, E-E).
  - Individual (residual) wage dynamics within and between jobs.

▸ Functional Forms

- Use a flexible functional form to approximate the progressivity of the US tax system.

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Tax experiments:

- Compare stationary equilibria for different levels of tax progressivity and benefit levels.

Taxes

- Income tax specification from Heathcote, Storesletten & Violante (2011):

$$T(w) = t(\tilde{w}) = 1 - \tau_0 \tilde{w}^{-\tau_1} \quad , \quad \tilde{w} = \frac{w}{\bar{w}}$$

  - $t(\cdot)$: average tax rate, w: individual labor income, $\bar{w}$: average labor income
- Parameter estimates for the baseline economy (status quo) from Guner, Kaygusuz & Ventura (2013):

$$\tau_0 = 0.902 \quad , \quad \tau_1 = 0.036$$

  - Based on micro data from the U.S. IRS (all households).
- Counterfactual scenarios:
  - linear tax: $\tau_1 = 0.0$ more progressive tax: $\tau_1 = 0.072$
- Payroll taxes: $T_{pe} = 0.0675$ and $T_{pf}(w) = 0.0675 + 0.01w$

Values of model parameters and sources/targets

Parameter	Description	Value	Source
β	Discount factor	0.99	Standard
σ	CRRA parameter in $u(c)$	2	Standard
ψ	Workers' prob. of survival	0.994	Length of work life
δ	Prob. of match destruction	0.028	E-U flows
λ_u	Prob. of job offer, unemployed	0.62	U-E flows
λ_e	Prob. of job offer, employed	0.095	E-E flows
λ_r	Prob. of job offer, laid-off	0.4	Frac. wage losses (E-E)
γ	Power parameter in $g(\epsilon)$	2	Fixed
ρ	Coefficient in $\pi(\epsilon)$	3	Within-job wage changes
(A^-, A^+)	Difference, worker productivity	(0.2, 2.7)	Within-job wage changes
$(\zeta_0, \zeta_1, \zeta_2)$	Shift, shape, scale param. in $F(\cdot)$	(0.53, 2, 0.2)	Wage changes (E-E)
(b_0, b_1)	UI benefit parameters	(0.6, 0.01)	Mean wage, Mean wage losses (E-E)
α	worker's surplus sharing parameter	0.1	(modest value)

Simulated vs. empirical statistics

Statistic		Model	Data
Labor market transitions:			
E-U flows	τ^{eu}	0.023	0.024
U-E flows	τ^{ue}	0.568	0.58
E-E flows	τ^{ee}	0.036	0.036
Log wage changes between jobs:			
Mean (positive)	$\mu_{+}^{bet}(\Delta \ln w)$	0.300	0.277
Mean (negative)	$\mu_{-}^{bet}(\Delta \ln w)$	-0.413	-0.283
Std.	$\sigma^{bet}(\Delta \ln w)$	0.422	0.364
Frac. neg.	$\varpi_{-}^{bet}(\Delta \ln w)$	0.371	0.384
Log wage changes within a job:			
Mean	$\mu^{win}(\Delta \ln w)$	0.011	0.007
Std.	$\sigma^{win}(\Delta \ln w)$	0.136	0.142
Frac. neg.	$\varpi_{-}^{win}(\Delta \ln w)$	0.254	0.335
Cross-sectional wages:			
Mean	$\mu(w)$	1.157	1.146
Log Std.	$\sigma(\ln w)$	0.294	0.505

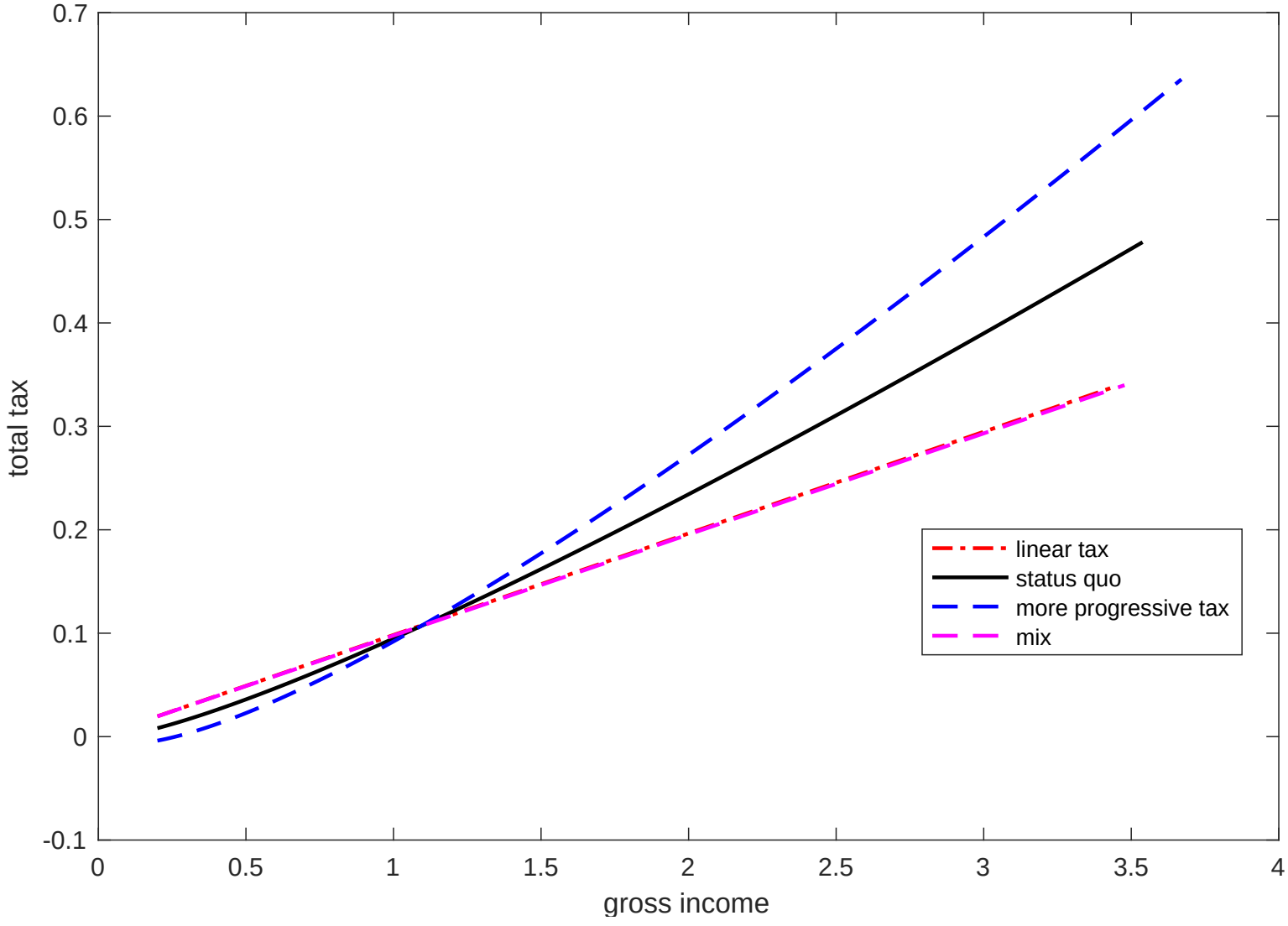
Results

Experiments

- We consider 'local' changes in tax progressivity and benefit levels.
  - Progressivity implies more insurance against transitions between jobs.
  - Changing benefits affect insurance against job loss.
- In all cases, we adjust τ_0 such that the budget is balanced.

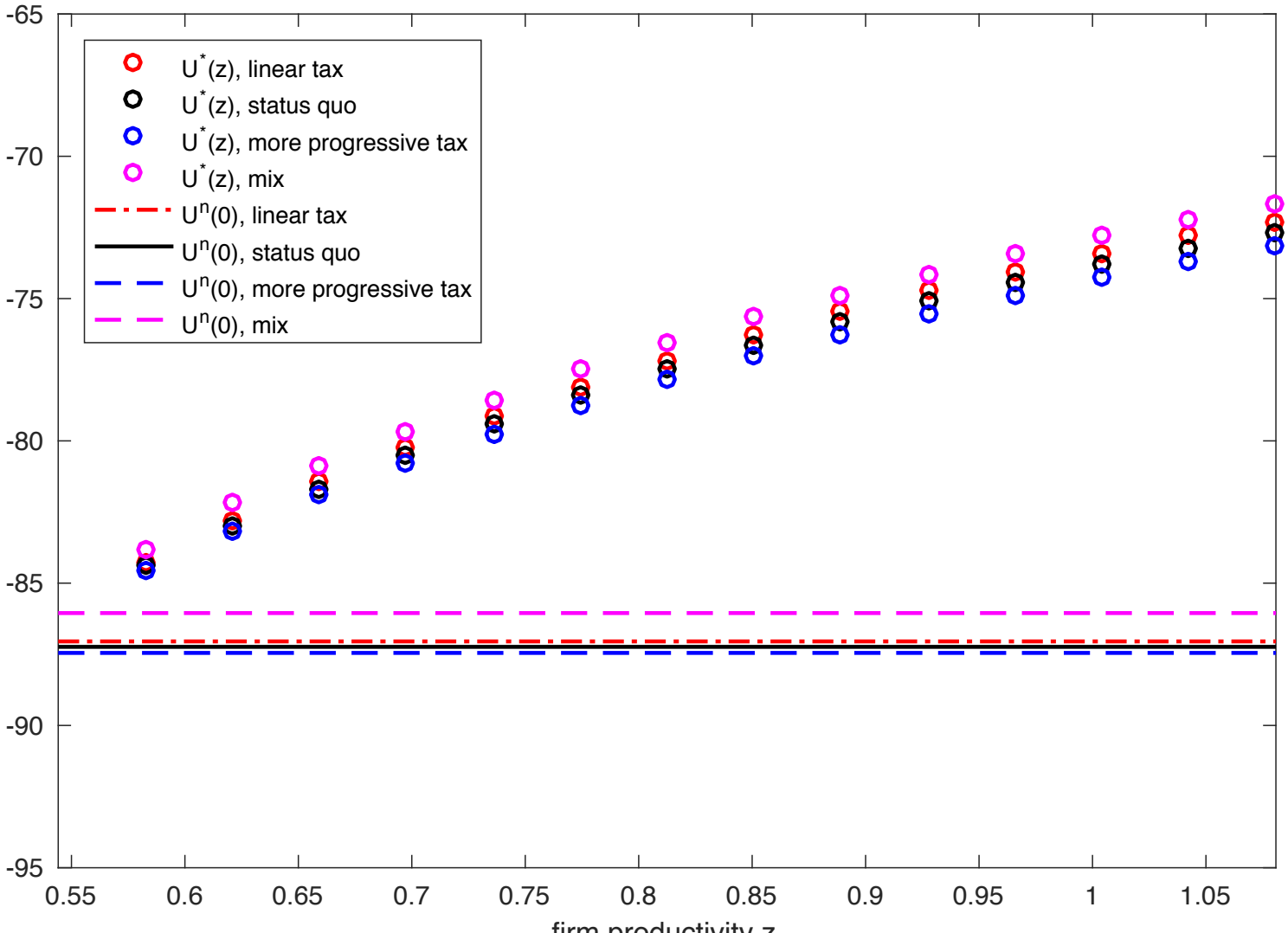
Tax reforms

linear ($\tau_1 = 0.0$) benchmark ($\tau_1 = 0.036$) more progressive ($\tau_1 = 0.072$)



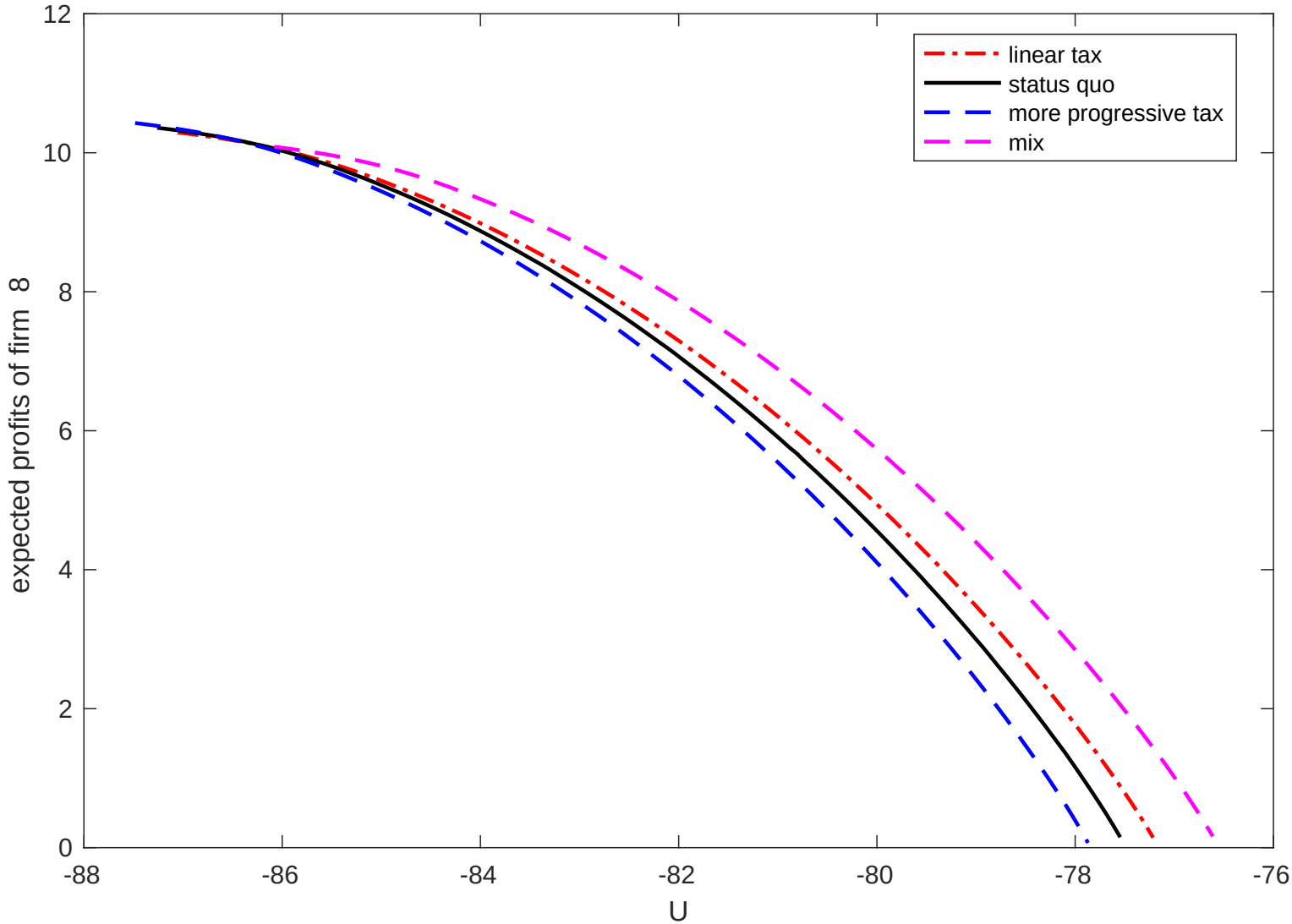
Expected utility of unemployed

- The profile of future offers becomes flatter with increased progressivity.
- Higher benefits shift the ladder up.



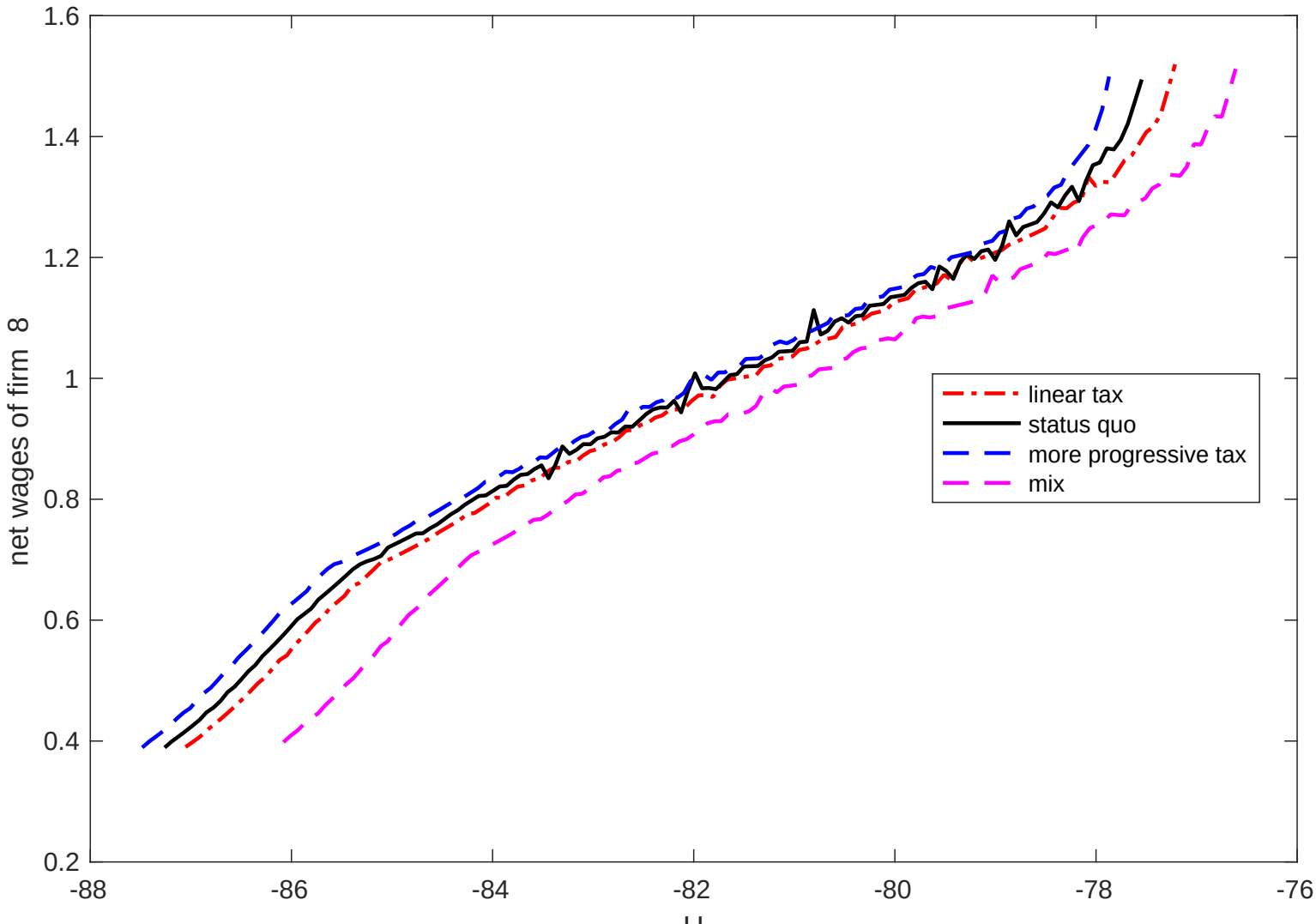
Expected profits of medium productivity firm

- Progressivity reduces profits.
- Increasing benefits increases profits (given U).



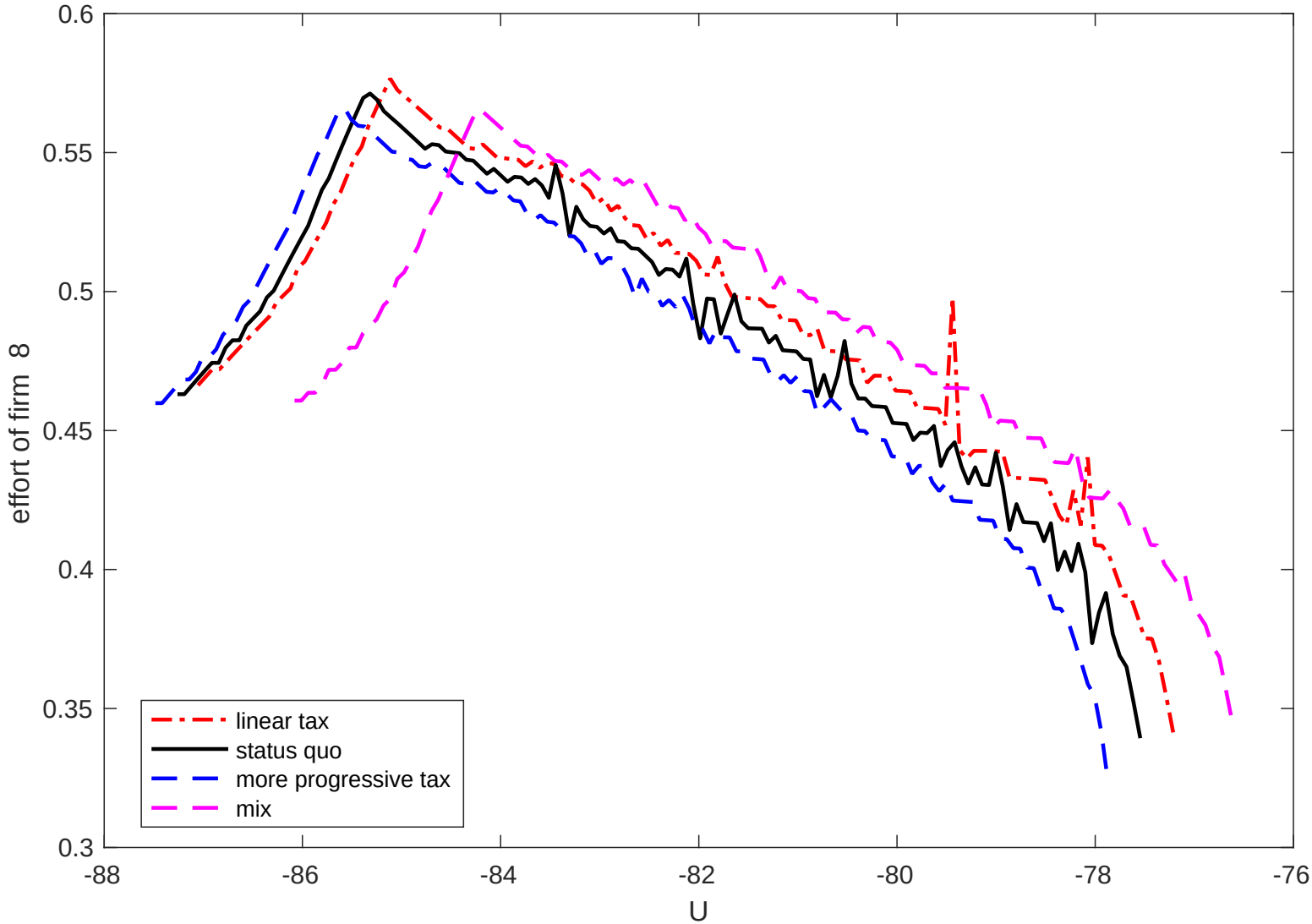
Net wages paid by medium productivity firm

- With high progressivity, firms pay (barely) higher net (and gross) wages.
- With increasing benefits they lower net (and gross) wages.



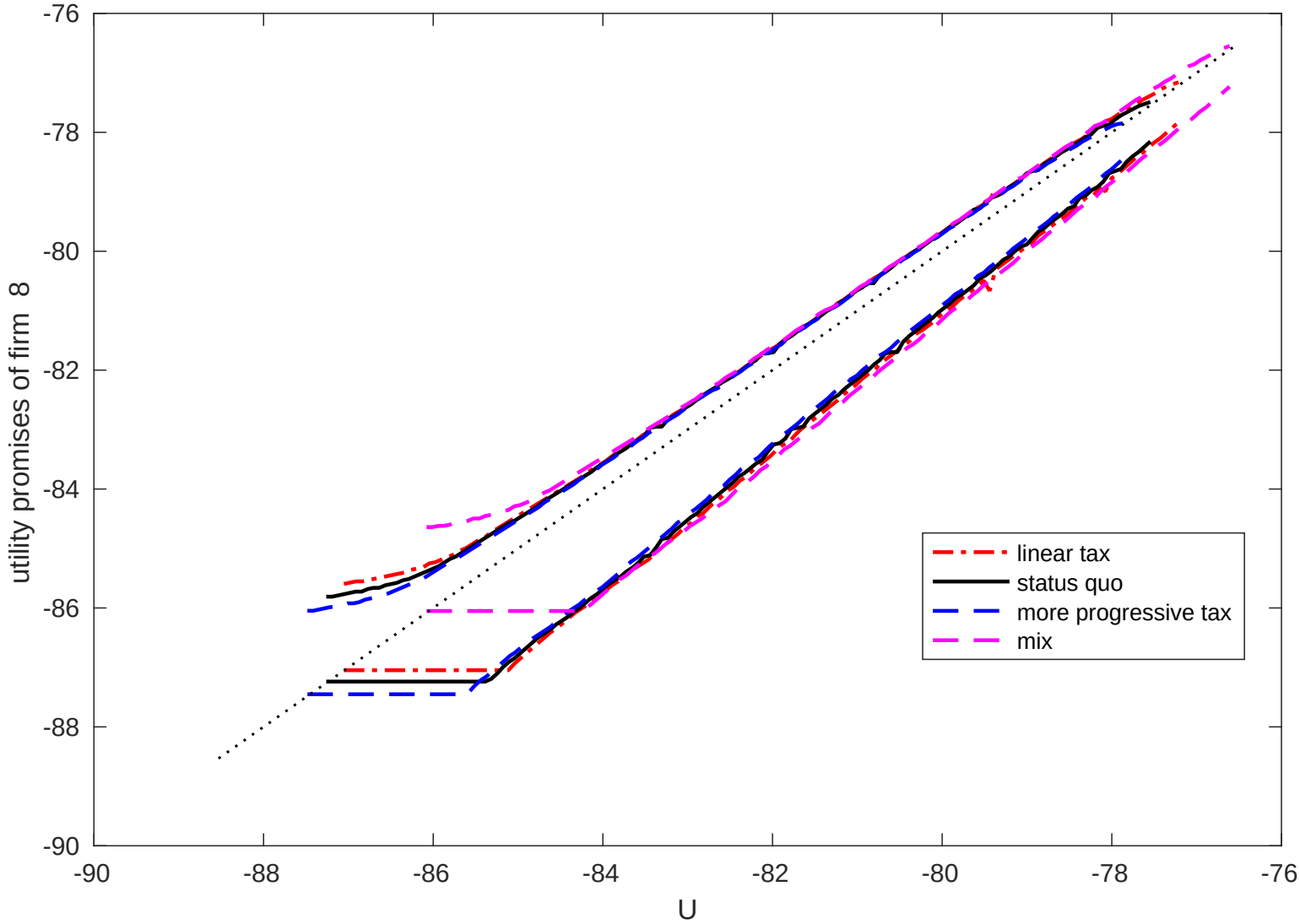
Effort

- Firms typically demand lower effort with higher progressivity.
- Firms typically demand higher effort with higher benefits.



Utility promises by medium productivity firm

- Utility promises need to increase to satisfy the promise keeping constraint.



Welfare Effects of Progressivity

- Welfare is reduced when progressivity increases, profits increase, output drops a bit.

	linear	benchmark	more progressive
$U^n(0)$, cons. equiv.	+0.26%	0.00%	-0.28%
Mean expected utility, $\bar{U}$	-81.5	-81.8	-82.0
Expected profits, match with newborn:			
Firm 2, $V\left(U^n(0), z_2\right)$	-6.87%	0.00%	+5.95%
Firm 8, $V\left(U^n(0), z_8\right)$	-0.63%	0.00%	+0.65%
Firm 15, $V\left(U^n(0), z_{15}\right)$	-0.10%	0.00%	+0.10%
Mean expected profits, $\overline{V(U,z)}$	-0.48%	0.00%	+0.49%
Mean output, $\bar{y}$	+0.40%	0.00%	-0.40%

Decomposition of ex ante welfare

- Progressive taxation has a direct (mechanical) effect on welfare as it reduces dispersion of net wages (consumption). This tends to increase welfare.
- However, firms will adjust their long term contracts and bargaining thresholds: indirect (behavioral) effect.
- We isolate the first effect by measuring the welfare change while keeping the firms' policies (wages, effort and utility thresholds) constant across the tax reforms.

Decomposition of ex ante welfare

- Direct and behavioral effects are larger but work in the opposite directions.

	linear	benchmark	more progressive
Total effect	0.26%	0.00%	-0.28%
Direct effect	-0.48%	0.00%	+0.46%
Behavioral effect	+0.74%	0.00%	-0.74%

- Intuition: higher progressivity makes it more difficult to incentivise effort. The external ladder becomes flatter.
- Taking earnings as exogenous can lead to misleading conclusions.

Welfare Effects of Increasing Benefits

- Welfare increases. Profits are affected more. Output drops.
- (Welfare is highest with increased benefits and linear taxes. +1.61%.)

	benefits -2%	benchmark	benefits +2%
$U^n(0)$, cons. equiv.	-1.41%	0.00%	+1.37%
Mean expected utility, $\bar{U}$	-82.5	-81.8	-81.0
Expected profits, match with newborn:			
Firm 2, $V\left(U^n(0), z_2\right)$	+14.73%	0.00%	-15.98%
Firm 8, $V\left(U^n(0), z_8\right)$	+2.17%	0.00%	-2.13%
Firm 15, $V\left(U^n(0), z_{15}\right)$	+1.07%	0.00%	-1.06%
Mean expected profits, $\overline{V(U,z)}$	+1.82%	0.00%	-1.81%
Mean output, $\bar{y}$	+0.25%	0.00%	-0.24%

Decomposition of ex ante welfare

- Higher benefits increase welfare both via the direct effect of more insurance and via adjusted behavior (firm policy).

	benefits -2%	benchmark	benefits +2%
Total effect	-1.41%	0.00%	+1.37%
Direct effect	-0.24%	0.00%	+0.23%
Behavioral effect	-1.17%	0.00%	+1.14%

- Intuition: higher benefits shift the entire "external job ladder" upwards.
- It is self-financed, increasing wages will finance it.

Conclusion

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- Evaluating tax progressivity or unemployment benefit reforms may be misleading if the response of new employer offers is not taken into account.
- From the workers point of view, less progressivity and increasing benefits are welfare-enhancing.

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Future work:

- Improve calibration. Sensitivity to different surplus sharing rules.
- Different notion of welfare: how to include profits? Free entry.
- Minimum wages.
- Savings.

Appendix

Data background (1/2)

The SIPP 2004 panel:

- Longitudinal survey of representative households in the U.S.
- Households are interviewed every 4 months.
- At each interview, detailed monthly labor market information for each household member over the preceding 4 months (the *wave*) is collected.
- In particular, information on up to two wage or salary jobs of an individual (employer i.d., starting and ending dates, earnings, . . .) is recorded for each wave.
- We include observations from January 2004 to December 2006.
- We restrict the sample to male workers aged 20 to 65 years who were employed in at least one month over the panel span in a job that was neither self-employment nor family work without pay.

Back

Data background (2/2)

- We classify individuals as *employed*, *unemployed*, or *not in the labor force* based on their labor market status in the second week of each month.
- Our measure of *monthly job-to-job transitions* comprises all workers in the sample who (i) were employed in the second week of both months, (ii) were not unemployed in any of the weeks in between, (iii) held main jobs with different employers in the second weeks of each months, and (iv) did not return to a job that was previously recorded as their main job.
- For those individuals who do not report an hourly pay rate (around 1/2 of the sample), we impute an individual's *real hourly wage* at his main job from total earnings on this job over the wave, the number of hours typically worked on that job, and the total number of weeks employed in that job over the wave.
- *Residual wages* are estimated through a pooled regression of log real hourly wages on five education groups, a non-white dummy, four regional groups, as well as year dummies.

Back

Functional forms and distributions

- CRRA utility from consumption: $u(c) = \left(c^{1-\sigma}\right)/(1-\sigma), \quad \sigma > 0$
- Disutility from effort: $g(\epsilon) = \epsilon^{\gamma}, \quad \gamma > 0$
- Probability of high worker productivity: $\pi(\epsilon) = 1 - \exp\{-\rho\epsilon\}, \quad \rho > 0$
- Weibull sampling distribution for match-specific productivity levels:

$$z \sim WB(\zeta_0, \zeta_1, \zeta_2)$$

  - $(\zeta_0, \zeta_1, \zeta_2)$ are the shift, shape, and scale parameters of $F(\cdot)$.
  - The distribution is discretized with a total of 15 productivity levels.

Back