General Equilibrium Incidence of the Earned Income Tax Credit

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NTA: Labor Supply Session

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Motivation: EITC

The Earned Income Tax Credit is a massive subsidy to labor:

- $67 billion in disbursements to 27 million workers (IRS 2017)
  - 97% of credit dollars to workers with children
  - $\sim$ 20% of total labor force
  - $\sim$ 25% of women in labor force
  - $\sim$ 40% single parent families eligible
  - $\sim$ 40% HS Dropout families eligible
  - $\sim$ 7% college educated families eligible

Prior Literature

All prior EITC literature is either Partial Equilibrium or GE with the assumption of fixed wages. Prior Lit

Why is this Important?

Policy-makers need to know...

1. what the right multiplier is
2. why EITC works and why it might fail
3. what alternative policies do relative to EITC

This paper helps on all three accounts.

Research Questions

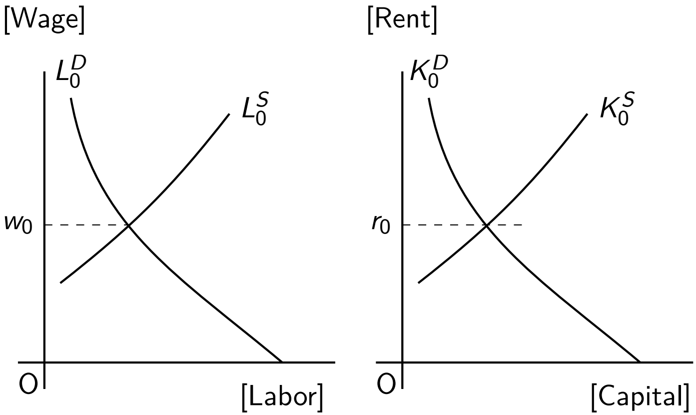
Theory:

- What is the GE incidence of heterogeneous factor supply subsidies?

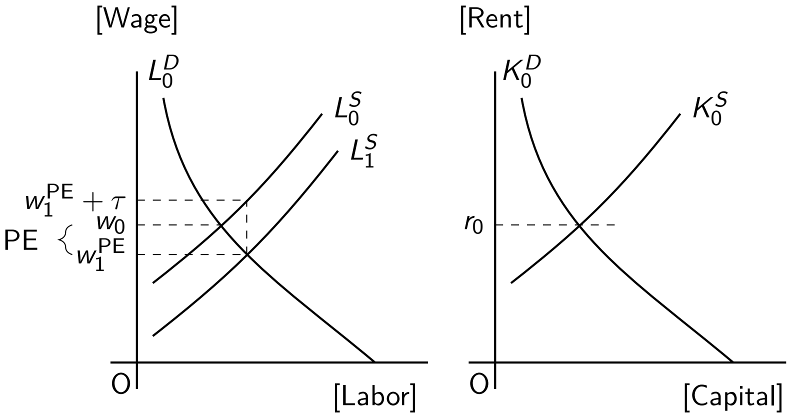
Application:

- What was the GE incidence of 1993 EITC expansion?
  - For each dollar spent, net-earnings increased by \$0.93
  - For each dollar spent, the equivalent variation was \$0.72
- How do EITC and NIT incidence differ?
  - For each dollar spent, EITC increased net-earings by \$1.28, NIT by \$0.63
  - For each dollar spent, EV for EITC was \$0.93, for NIT \$1.08

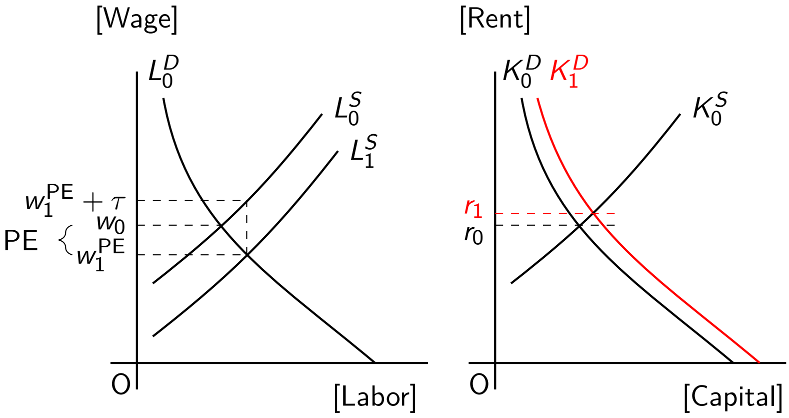
Initial Factor Market Equilibrium



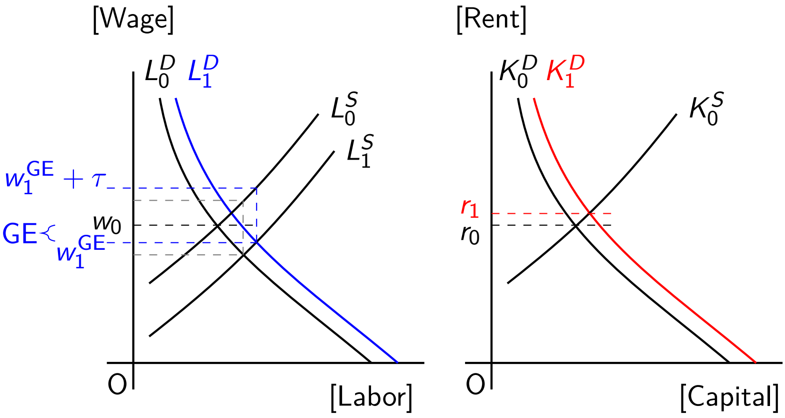
Incidence Visualization: Partial Equilibrium



Incidence Visualization: Capital Response



Incidence Visualization: General Equilibrium



Simplified Model with $\{L_1, L_2, K, \tau_1\}$

- **Environment**: perfect competition, full information, static
- **Workers**: binary choice to work or not, consume net income

  Quasi-linear in consumption, 2 skills groups with own labor elasticity

  $U^i(c,\ell) = c + v^i(1-\ell), \; i \in \{1,2\}$
- **Firms**: heterogeneous entry costs; if enter, then hire labor

  Nested CES Production technology produces homogeneous output

  $$Q_j = A_j \left[\left(\vartheta_1 (L_1^D)^{\frac{1+\rho}{\rho}} + \vartheta_2 (L_2^D)^{\frac{1+\rho}{\rho}} \right)^{\frac{\rho}{1+\rho}} \right]^{\alpha} K_j^{1-\alpha}$$
- **Gov't**: choose subsidies and benefits, finances with lump-sum tax

Simple Model: Equilibrium with $\{L_1, L_2, K, \tau_1\}$

$$\text{Labor Clearing} \quad \frac{L_1^S(w_1+\tau)}{L_2^S(w_2)} = \left(\frac{w_1/\vartheta_1}{w_2/\vartheta_2}\right)^{\rho} \tag{1}$$

$$\text{Factor Clearing} \quad \frac{L^S(w_1+\tau, w_2)}{K^S(r)} = \left(\frac{\bar{w}/\alpha}{r/1-\alpha}\right)^{-1} \tag{2}$$

$$\text{Zero Profits} \quad P = c(w_1, w_2, r) := 1 \tag{3}$$

$$\text{where } \bar{w} = \left(\vartheta_1\left(\frac{w_1}{\vartheta_1}\right)^{1+\rho} + \vartheta_2\left(\frac{w_2}{\vartheta_2}\right)^{1+\rho}\right)^{\frac{1}{1+\rho}}$$

For GE incidence, I take total derivative of the system:
3 equations, 3 unknowns (dw_1, dw_2, dr)

Simple Model: Incidence with $\{L_1, L_2, K, \tau_1\}$

Partial Equilibrium Incidence; holding w_2, L_2, r, K fixed

$$\frac{\hat{w}_1^{PE}}{\hat{\tau}} = \left(\frac{-\varepsilon_1^S}{\varepsilon_1^S - \rho}\right) < 0$$

General Equilibrium Incidence

$$\frac{\hat{w}_1^{GE}}{\hat{\tau}} = \left(\frac{\hat{w}_1^{PE}}{\hat{\tau}} + \frac{\left(\frac{s_1}{\varepsilon_1-\rho}\right)\left(\frac{\varepsilon_1}{\varepsilon_1-\rho}\right)\left(\frac{\varepsilon_K+1}{s_K} + \frac{1+\rho}{s_L}\right)}{\left(1 + \left(\frac{\varepsilon_K+1}{s_K} + \frac{1+\rho}{s_L}\right)\left(\sum_e \frac{s_e}{(\varepsilon_e-\rho)}\right)\right)}\right)$$

$$= (\text{PE}_1 + \text{Spillover}_1) \leq 0$$

- Note: If $s_1 = 0$, then GE = PE
- $|\text{GE}| = |\text{PE} + \text{Sp}| \leq |\text{PE}|$

Connect Theory to Data

Need the following parameters to quantify incidence:

- Estimated
  - Labor Supply Elasticities: $\{\varepsilon^S_{e,k}\}$ for skill level e and demographic group k
  - Labor Substitution Elasticity: $\rho = \frac{d\ln[L^D_e / L^D_{e'}]}{d\ln[w_e / w_{e'}]} < 0$
- Calculated
  - Market Cost Shares: s_e
  - Tax Changes: $\hat{\tau}_{e,k}$
- Parameterized
  - Capital Supply Elasticity: $\varepsilon_K = 1$
    Goolsbee (1998) short run estimate

Elasticity Estimates

Tax Induced Price Changes [First Stage]

$$\hat{w}_{est} = \psi_e \hat{\tau}_{est} + \Psi_e(\{\hat{\tau}_{est}\}_{e'}) \tag{4}$$

Identify Market Quantity responses [Structural Equation]

$$\hat{L}_{kest} = \varepsilon^S_{e,k} \hat{w}_{kest} \tag{5}$$

$\rightarrow$ Identified by Tax Changes Within Skill Grops

$$\left[\hat{L}_{est} - \hat{L}_{1st}\right] = \rho \left[\hat{w}_{est} - \hat{w}_{1st}\right] \tag{6}$$

$\rightarrow$ Identified by Relative Tax Changes Between Skill Groups

for some $e' = 1$ reference skill level.

Labor Supply Elasticity Results

Obs	Unmarried		Married	
33,902	w/o Children	w/ Children	w/o Children	w/ Children
Less HS	0.54 (0.10)	0.72 (0.09)	0.76 (0.09)	0.99 (0.09)
HS	0.40 (0.08)	0.58 (0.07)	0.62 (0.07)	0.85 (0.07)
Some College	0.40 (0.09)	0.58 (0.08)	0.62 (0.08)	0.86 (0.08)
BA Plus	0.10 (0.09)	0.28 (0.09)	0.32 (0.08)	0.56 (0.08)
Weak IV Tests	AR-F 38.01	KP rk LM 104.4	KP rk Wald F 57.314	MOP Effective-F 23.530

All data from MORG 90-00, 1990 Census; EITC ATRs calculated using TAXSIM. Standard Errors clustered by (140) demographic groupings. Model controls: log total cell size, FEs for demographics, State-Year, and Initial-Wage-Pct-Year. Model 1 uses 10 Instruments.

Labor Substitution Elasticity Estimates

	(1)	(2)
ρ	-2.55	-2.60
Wald SE	(0.56)	(0.50)
WIVR CI	[-3.85,-1.58]	[-3.83,-1.70]
KP rk Wald F	51.06	30.20
Anderson-Rubin F	28.39	19.33
MOP Effictive-F	51.90	20.61
# IVs	1	2
Obs	9,674	9,674

All data from MORG 90-00, 1990 Census; EITC ATRs calculated using TAXSIM. Wald Standard Errors clustered by (70) skill groupings. Weak IV Robust CIs based on Andrews (2018). Model controls: log relative total cell size, FEs for Edu-Age-Year, State-Year, and Initial-Wage-Pct-Year.

For every dollar of New EITC spending. . .

Table: All Women

Dollars	"PE" (1)	GE (2)
Labor	0.15	0.21
Wage	-0.37	-0.28
Earnings	-0.22	-0.07
NetEarn	0.78	0.93
Equivalent Variation	0.63	0.72

Units in table are changes in dollars of earnings, LM changes summed across demographic groups. Earnings = Wage + Labor; Net Earnings = Earnings + Transfer, Equivalent Var. = Wages + Transfer. All data from 1995 March CPS, Women from Tax Units.

Compare

Tax Reforms

I follow Rothstein (2010) in simulating two equal sized tax reforms.

Transfer Programs

- EITC: Nonlinear earned income subsidy:
  Credit = EITC(income, kids)
- NIT: Initial benefit that is taxed away with income:
  Credit = max((Benefit - income*tax-rate) , 0) $\cdot$ $1\{kids\}$

Tax Reform

Policy-makers wish to increase generosity of transfer program by $100 million.
Policy-makers calculate the percent change in in generosity assuming no behavoral responses.

Summary Stats | Tax Reform Details | Production Elasticities

Incidence Compare: All Women

Dollars	"PE" EITC (1)	"PE" NIT (2)	GE EITC (3)	GE NIT (4)
Intended	1.00	0.55	1.00	0.55
Labor	0.32	-0.42	0.35	-0.46
Wage	-0.12	0.15	-0.07	0.09
Earnings	0.20	-0.26	0.28	-0.37
NetEarn	1.20	0.73	1.28	0.63
Equivalent Variation	0.88	1.15	0.93	1.08

Units in table are changes in dollars of earnings, LM changes summed across demographic groups. Earnings = Wage + Labor; Net Earnings = Earnings + Transfer, Equivalent Var. = Wages + Transfer. All data from 1993 March CPS, Women from Tax Units.

Compare

Conclusion

Take Away Results

- Spillovers matter!
  $\rightarrow$ Distorting labor supply effects all workers
- Policy matters!
  $\rightarrow$ EITC: PE significantly underestimates GE effects
  $\rightarrow$ NIT: PE significantly overestimates GE effects

Other Effects / Future Directions

- Multiple Production Sectors $\rightarrow$ output price effects
- net-Cost of EITC for Government $\rightarrow$ lower taxes in model
- Alternative Reforms $\rightarrow$ more generous if no kids
- What would expansion effect be today with greater LFP by women?

Begin Appendix

Previous Literature

- EITC brings workers into labor force

  Dickert, Houser & Scholz (1995); Eissa & Leibman (1996); Eissa & Hoynes (2004); Fitzpatrick & Thompson (2010); Leigh (2010)

- Recent Pushback

  Klevin (2019)

- Net-EITC Effects on Gov't Budget

  Bastian & Jones (2019)

- Wages decrease with EITC generosity

  Leigh (2010); Rothstein (2010); Azmat (2018)

- Policy Options

  Expand EITC, Universal Basic Income / Negative Income Tax, In-Kind Transfers

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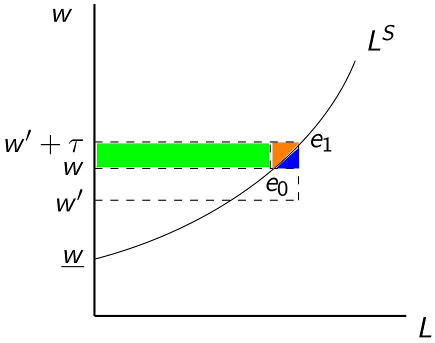
Model: Welfare

Figure: Surplus of Group with Subsidy



Green: $(dw + d\tau) \cdot L_0 =$ Equivalent Variation

Orange + Blue ≈ 0

What am I estimating?

Using IV approach, so that means:

$$\varepsilon^{S}_{ek,\text{LATE}} = \mathbf{E}_a \left[\mathbf{E}_{ek} \left[\frac{\partial \ln[L_{ek}]}{\partial \ln[w_e]} \middle| \partial \hat{\tau}_{ek} = a \right] \right] \tag{7}$$

$$\rho_{\text{LATE}} = \mathbf{E}_b \left[\mathbf{E}_e \left[\frac{\partial \ln[L_e/L_1]}{\partial \ln[w_e/w_1]} \middle| \partial \left[\hat{\tau}_e - \hat{\tau}_1 \right] = b \right] \right] \tag{8}$$

Looking at responsiveness of labor markets if EITC tax change
– exactly what we want for incidence: “compilers” !
Implies estimate not average elasticity
– incumbent workers are “always-takers”

Back to Identification.

Supply Elasticity: Within Market

IV Estimating Equations, given instrument vector Z

$$\ln[w]_{kest} = \pi_0 + Z_{kest}\Pi_1 + [Z'_{kest} \cdot g_{e,k}]\Pi_2 + d_{ek} + d_{st} + d_{w_0^{\%},t} + e^{w}_{est} \quad (9)$$

$$\ln[L]_{kest} = \alpha_0 + \alpha_1 \ln[w]_{kest} + \alpha_{(2,g)}[\ln[w]_{kest} \cdot g_{e,k}] + d_{ek} + d_{st} + d_{w_0^{\%},t} + e^{L}_{kest} \quad (10)$$

where d_{ek} are sub-market FEs, d_{st} are state-year FEs, and $d_{w_0^{\%},t}$ FEs are initial (1988) state-market wage percentiles interacted with year dummies.

$$\widehat{\varepsilon^{S}_{e,k}} = \widehat{\alpha_1} + \widehat{\alpha_{(2,g_{e,k})}} \rightarrow_p \varepsilon^{S}_{e,k}$$

Back to Identification.

Substitution Elasticity: Between Market

IV Estimating Equations, given instrument vector Z

$$\begin{aligned} \mathrm{D}\ln[w]_{est} &= \gamma_0 + [\mathrm{D}Z_{est}]\,\Gamma_1 + \\ &\quad + \mathrm{d}_{\tilde{e}} + \mathrm{d}_{st} + \mathrm{d}_{w_0^{\%},t} + v_{est}^{w} \end{aligned} \tag{11}$$

$$\begin{aligned} \mathrm{D}\ln[L]_{est} &= \beta_0 + \beta_1 \mathrm{D}\ln[w]_{est} \\ &\quad + \mathrm{d}_{\tilde{e}} + \mathrm{d}_{st} + \mathrm{d}_{w_0^{\%},t} + v_{est}^{L} \end{aligned} \tag{12}$$

where $\mathrm{d}_{\tilde{e}}$ interacts education w/ age-groups,
and $\mathrm{D}x_{est} = x_{est} - x_{1st}$ for some $e' = 1$ reference market.

$$\widehat{\rho} = \widehat{\beta_1} \rightarrow_p \rho$$

Back to Identification.

Production Side Elasticities

For the production side:

- Labor Elasticity of Substitution :
  $\{-0.30, -2.5\}$ - Rothstein, (2008 / 2010), my own estimate
- Capital Supply Elasticity:
  $\{1.0\}$ - Conservative Guess; Goolsbee (1998) finds short run 1, medium run 2.

Calculate cost shares as the labor market share of labor compensation (wage + health benefits):

Cost Shares

$$s_{L_e} = \left(\frac{\sum_{i \in L_e} W_{ie}}{\sum_{e'} \sum_{i \in L'_e} W_{ie'}} \right) \cdot \left(\frac{\text{Total Labor Payments}}{\text{Total Factor Payments}} \right)$$

Data + Labor Market Def

Data

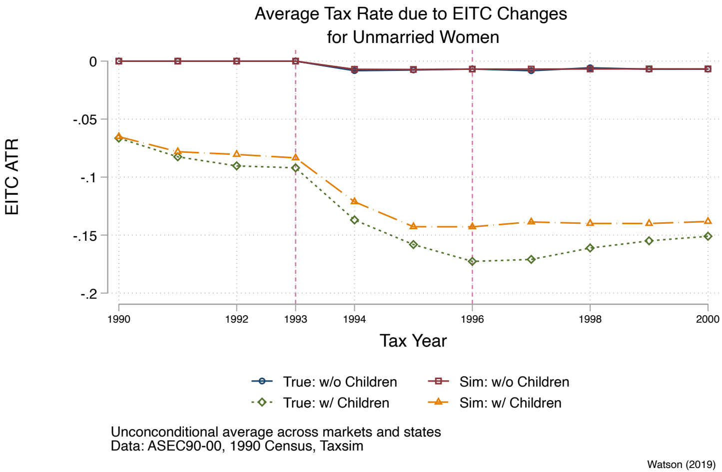
- CPS MORG 1988-2000, women 16-65 (IPUMS)
- 1990 Census 5% sample, women 16-65 (IPUMS)
- CPS ASEC 1995, women 20-59 (IPUMS)
- NBER Internet TAXSIM

Empirical Labor Market Definition

- Labor markets based on age-education-marriage status
  $\rightarrow$ 72 skill groups
- This pools all other characteristics, including parental status
- This meant as a crude skill proxy

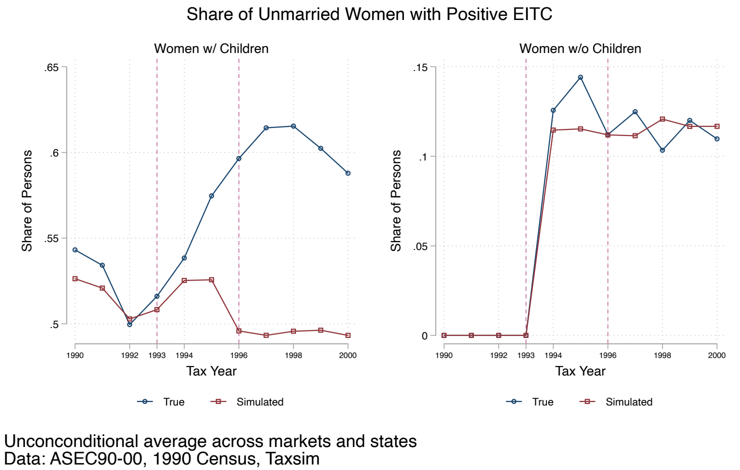
Back to Identification.

Figure: Simulated vs True Share Receiving EITC



Back to Identification.

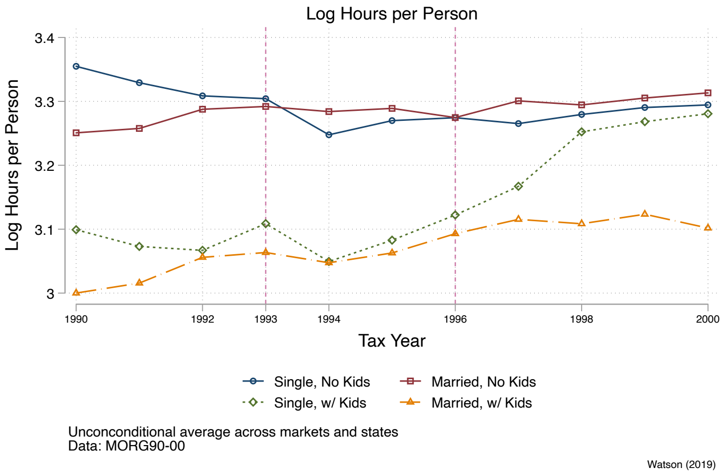
Figure: Simulated vs True Share Receiving EITC



Watson (2019)

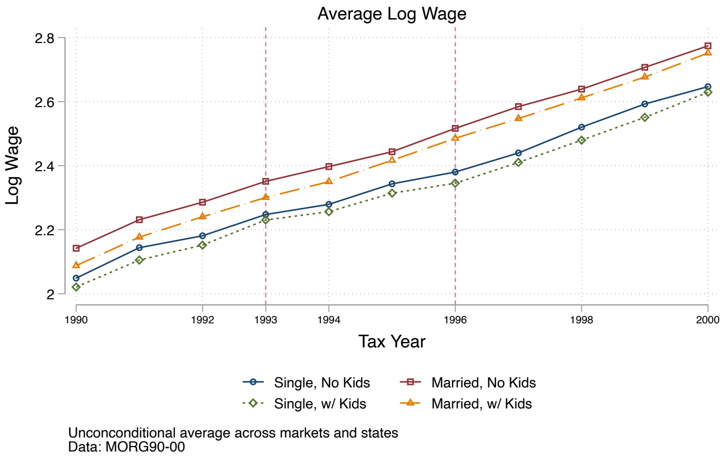
Back to Identification.

Figure: Log Total Hours per Person



Back to Identification.

Figure: Average Log Wage



Watson (2019)

Back to Identification.

Empirical Instruments

Easy to calculate $\hat{\tau}_{kest}$

Define the EITC ATR as:

$$\tau = \frac{(\text{EITC})^{\text{Actual}} - (\text{EITC})^{\text{No Work}}}{(\text{Tax Unit Labor-Earnings})^{\text{Actual}}}, \tag{13}$$

where $(\text{EITC})^{\text{No Work}}$ is a counterfactual value if the woman's labor income was zero.

Back to Identification.

Empirical Instruments

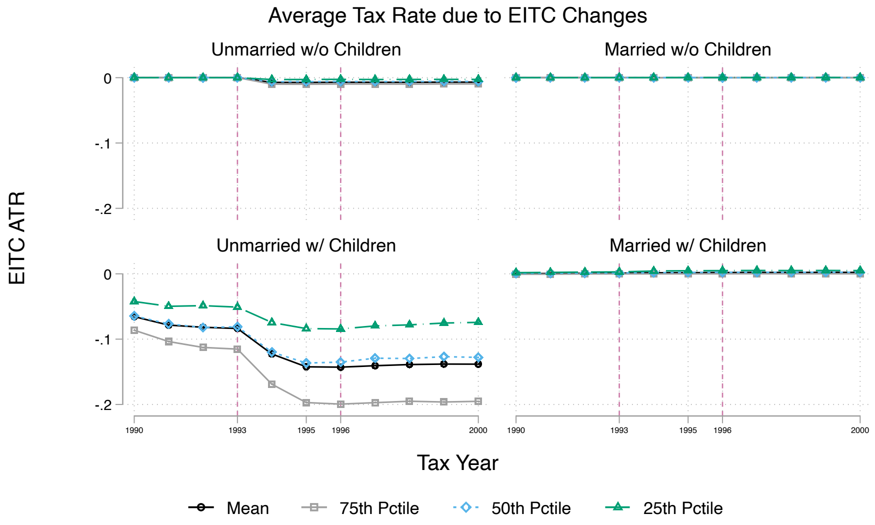
But spillover terms, $\Psi_{est}(\{\hat{\tau}_{est}\})$, depend on $\{\{\varepsilon_{e,k}\}, \rho\}$!

For a given labor market $e' = \{\text{Edu, Age, Marriage}\}$,
approximate $\Psi_{e'st}(\{\hat{\tau}_{est}\})$ using

- $\mathbf{E}[\ \hat{\tau}_{est} \mid S, T, G = g]$
- $\Pr(\ \text{EITC}_i > 0 \mid i \in S, T, G = g)$

where $\{g\}_G$ are subgroups based on age, education, marriage matched to market e'

Back to Identification.



Variation across skills & states
Data: 1990 Census, Taxsim

For a dollar of New EITC spending...

Table: Aggregate 'Dollar' Effects: All Women

Dollars	$\rho = -0.3$ "PE" (1)	$\rho = -0.3$ GE (2)	$\rho = -2.5$ "PE" (3)	$\rho = -2.5$ GE (4)
Labor	-0.42	0.18	0.15	0.21
Wage	-1.48	-0.41	-0.37	-0.28
Earnings	-1.89	-0.22	-0.22	-0.07
NetEarn	-0.89	0.78	0.78	0.93
EV	-0.48	0.59	0.63	0.72
PE/GE	-	-0.81	-	0.88

Units in table are changes in dollars of earnings, LM changes summed across demographic groups. Earnings = Wage + Labor; Net Earnings = Earnings + Transfer, Equivalent Var. = Wages + Transfer. All data from 1995 March CPS, Women from Tax Units.

Production Side Elasticities

For the production side:

- Labor Elasticity of Substitution :
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- Capital Supply Elasticity:
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Calculate cost shares as the labor market share of labor compensation (wage + health benefits):

Cost Shares

$$s_{L_e} = \left(\frac{\sum_{i \in L_e} W_{ie}}{\sum_{e'} \sum_{i \in L'_e} W_{ie'}} \right) \cdot \left(\frac{\text{Total Labor Payments}}{\text{Total Factor Payments}} \right)$$

Back to TR Main.

Tax Reforms

I model each tax unit's (naive) subsidy change as:

Subsidy Change

$$\text{Subsidy}_{i,\text{Reform}} = \left(\frac{\$100m}{\sum_i \text{Subsidy}_{i,\text{Initial}}} \right) \cdot \text{Subsidy}_{i,\text{Initial}}$$

I model $\hat{\tau}$ as the change in ATR from the policy:

Tax Change

$$\hat{\tau}_d = \sum_{i \in L_d} \left(\frac{\text{Subsidy}_{Reform} - \text{Subsidy}_{\text{Initial}}}{\text{Tax Unit Adj Gross Income}} \right)_i$$

For Subsidy $\in$ {EITC, NIT}

Back to TR Main.

Summary Statistics: Back to TR Main

	Age	Anykids	Married	Get Eic
Unmarried Women	33.25	0.00	0.00	0.00
Married Women	47.54	0.00	1.00	0.00
Unmarried Mothers	34.51	1.00	0.00	0.66
Married Mothers	36.90	1.00	1.00	0.10
Total	37.99	0.45	0.57	0.11
	Less HS	HS Only	Less BA	BA+
Unmarried Women	0.26	0.26	0.30	0.18
Married Women	0.15	0.42	0.23	0.21
Unmarried Mothers	0.25	0.39	0.26	0.10
Married Mothers	0.13	0.38	0.28	0.22
Total	0.19	0.35	0.27	0.19
	Worker	Wage	Share of Workers	Cost Share
Unmarried Women	0.73	10.09	0.30	0.19
Married Women	0.69	11.17	0.25	0.17
Unmarried Mothers	0.68	9.60	0.12	0.07
Married Mothers	0.72	10.83	0.33	0.22
Total	0.71	10.54	1.00	0.66

All data from 1993 March CPS. Women from Tax Units. Wage in $1993

Incidence Compare: All Women

Dollars	$\rho = -0.3$ "PE" EITC (1)	NIT (2)	GE EITC (3)	NIT (4)	$\rho = -2.5$ "PE" EITC (5)	NIT (6)	GE EITC (7)	NIT (8)
Intended	1.00	0.55	1.00	0.55	1.00	0.55	1.00	0.55
Labor	0.14	-0.17	0.36	-0.42	0.32	-0.42	0.35	-0.46
Wage	-0.48	0.55	-0.07	0.08	-0.12	0.15	-0.07	0.09
Earnings	-0.34	0.38	0.29	-0.34	0.20	-0.26	0.28	-0.37
NetEarn	0.66	1.38	1.29	0.66	1.20	0.73	1.28	0.63
EV	0.52	1.55	0.93	1.08	0.88	1.15	0.93	1.08
PE/GE	-	-	0.59	1.44	-	-	0.95	1.06
NIT/EITC	-	2.98	-	1.16	-	1.31	-	1.16

Units in table are changes in dollars of earnings, LM changes summed across demographic groups
Earnings = Wage + Labor; Net Earnings = Earnings + Transfer, Equivalent Var. = Wages + Transfer
All data from 1993 March CPS, Women from Tax Units