

Measuring the Economic Effects of Regulations Using RegData: A Panel Data Approach

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Step 1: Measuring regulation: RegData

Step 2: Modeling production and regulation

$$Q = \theta K^{\alpha} L^{\gamma}$$

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$$Q = \theta K^{\alpha + \beta R} L^{\gamma + \delta R}$$

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$$Q_{it} = \theta_t K_{it}^{\alpha_t + \beta R_{it}} L_{it}^{\gamma_t + \delta R_{it}}$$

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$$Q_{it} = \theta_t K_{it}^{\left(\alpha_t + \sum_{j=\{USDA, DOL, EPA, IRS\}} \beta_j R_{jit} \right)} L_{it}^{\left(\gamma_t + \sum_{j=\{USDA, DOL, EPA, IRS\}} \delta_j R_{jit} \right)}$$

$$Q_{it} = \theta_t K_{it} \left(\alpha_t + \sum_{j=\{USDA, DOL, EPA, IRS\}} \beta_j R_{jit} \right) L_{it} \left(\gamma_t + \sum_{j=\{USDA, DOL, EPA, IRS\}} \delta_j R_{jit} \right)$$

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$$\text{Gross Output}_{it} = P_{it} Q_{it}$$

$$P_{it} \approx \varepsilon_i \text{IPD}_t$$

$$Q_{it} = \frac{\text{Gross Output}_{it}}{\varepsilon_i \text{IPD}_t}$$

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$$\text{Gross Operating Surplus} = PQ - mM - wL - T$$

$$\frac{\text{Gross Output}_{it}}{\varepsilon_i \text{IPD}_t} = \theta_t K_{it} \left(\alpha_t + \sum_{j=\{\text{USDA}, \text{DOL}, \text{EPA}, \text{IRS}\}} \beta_j R_{jit} \right) L_{it} \left(\gamma_t + \sum_{j=\{\text{USDA}, \text{DOL}, \text{EPA}, \text{IRS}\}} \delta_j R_{jit} \right)$$

$$\text{Gross Operating Surplus} = PQ - mM - wL - T$$

$$\text{Profit} = PQ - mM - wL - rK - T$$

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Gross Operating Surplus = $PQ - mM - wL - T$

Profit = $PQ - mM - wL - rK - T$

$rK = \text{Gross Operating Surplus} - \text{Profit}$

$$\frac{\text{Gross Output}_{it}}{\varepsilon_i \text{IPD}_t} = \theta_t K_{it} \left(\alpha_t + \sum_{j=\{\text{USDA}, \text{DOL}, \text{EPA}, \text{IRS}\}} \beta_j R_{jit} \right) L_{it} \left(\gamma_t + \sum_{j=\{\text{USDA}, \text{DOL}, \text{EPA}, \text{IRS}\}} \delta_j R_{jit} \right)$$

Gross Operating Surplus = $PQ - mM - wL - T$

Profit = $PQ - mM - wL - rK - T$

$rK = \text{Gross Operating Surplus} - \text{Profit}$

$$K_{it} \approx \frac{(rK)_{it}}{AAA_t}$$

$$\frac{\text{Gross Output}_{it}}{\varepsilon_i \text{IPD}_t} =$$

$$\theta_t \left(\frac{\text{Gross Operating Surplus}_{it} - \text{Profit}_{it}}{\text{AAA}_t} \right)^{\left(\alpha_t + \sum_{j=\{USDA, DOL, EPA, IRS\}} \beta_j R_{jit} \right)} \text{Employees}_{it}^{\left(\gamma_t + \sum_{j=\{USDA, DOL, EPA, IRS\}} \delta_j R_{jit} \right)}$$

$$\frac{\text{Gross Output}_{it}}{\varepsilon_i \text{IPD}_t} = \theta_t \left(\frac{\text{Gross Operating Surplus}_{it} - \text{Profit}_{it}}{\text{AAA}_t} \right)^{\left(\alpha_t + \sum_{j=\{USDA, DOL, EPA, IRS\}} \beta_j R_{jit} \right)} \text{Employees}_{it}^{\left(\gamma_t + \sum_{j=\{USDA, DOL, EPA, IRS\}} \delta_j R_{jit} \right)}$$

$$\begin{aligned} \ln \left(\frac{\text{Gross Output}_{it}}{\text{IPD}_t} \right) &= \ln(\varepsilon_i) + \ln(\theta_t) \\ &+ \left(\alpha_t + \sum_{j=\{USDA, DOL, EPA, IRS\}} \beta_j R_{jit} \right) \ln \left(\frac{\text{Gross Operating Surplus}_{it} - \text{Profit}_{it}}{\text{AAA}_t} \right) \\ &+ \left(\gamma_t + \sum_{j=\{USDA, DOL, EPA, IRS\}} \delta_j R_{jit} \right) \ln(\text{Employees}_{it}) \end{aligned}$$

Step 3: Estimating the cost of regulations

- USDA, DOL, EPA, IRS
- 34 industries
- 1975 - 2012

$$Q_{it} = \theta_t K_{it} \left(\alpha_t + \sum_{j=\{USDA, DOL, EPA, IRS\}} \beta_j R_{jit} \right) L_{it} \left(\gamma_t + \sum_{j=\{USDA, DOL, EPA, IRS\}} \delta_j R_{jit} \right)$$

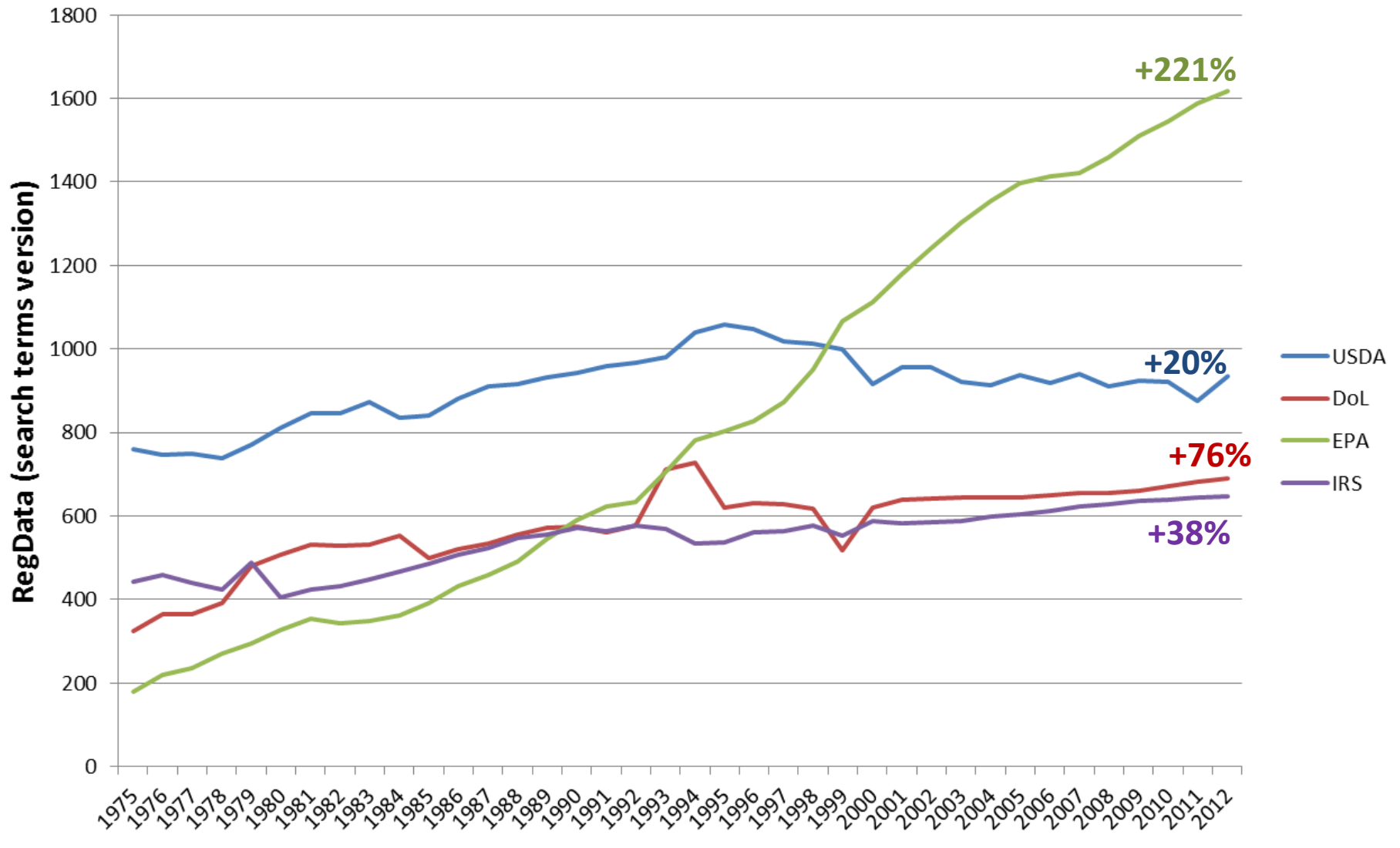
Agency j	β_j	δ_j
USDA	$-4.1 \times 10^{-5} **$	$7.9 \times 10^{-5} **$
DOL	$2.2 \times 10^{-5} **$	$-3.6 \times 10^{-5} *$
EPA	$2.1 \times 10^{-5} **$	$-4.9 \times 10^{-5} **$
IRS	$3.8 \times 10^{-5} **$	$-9.8 \times 10^{-5} **$

34 Industries, annual 1977-2012, 1071 observations

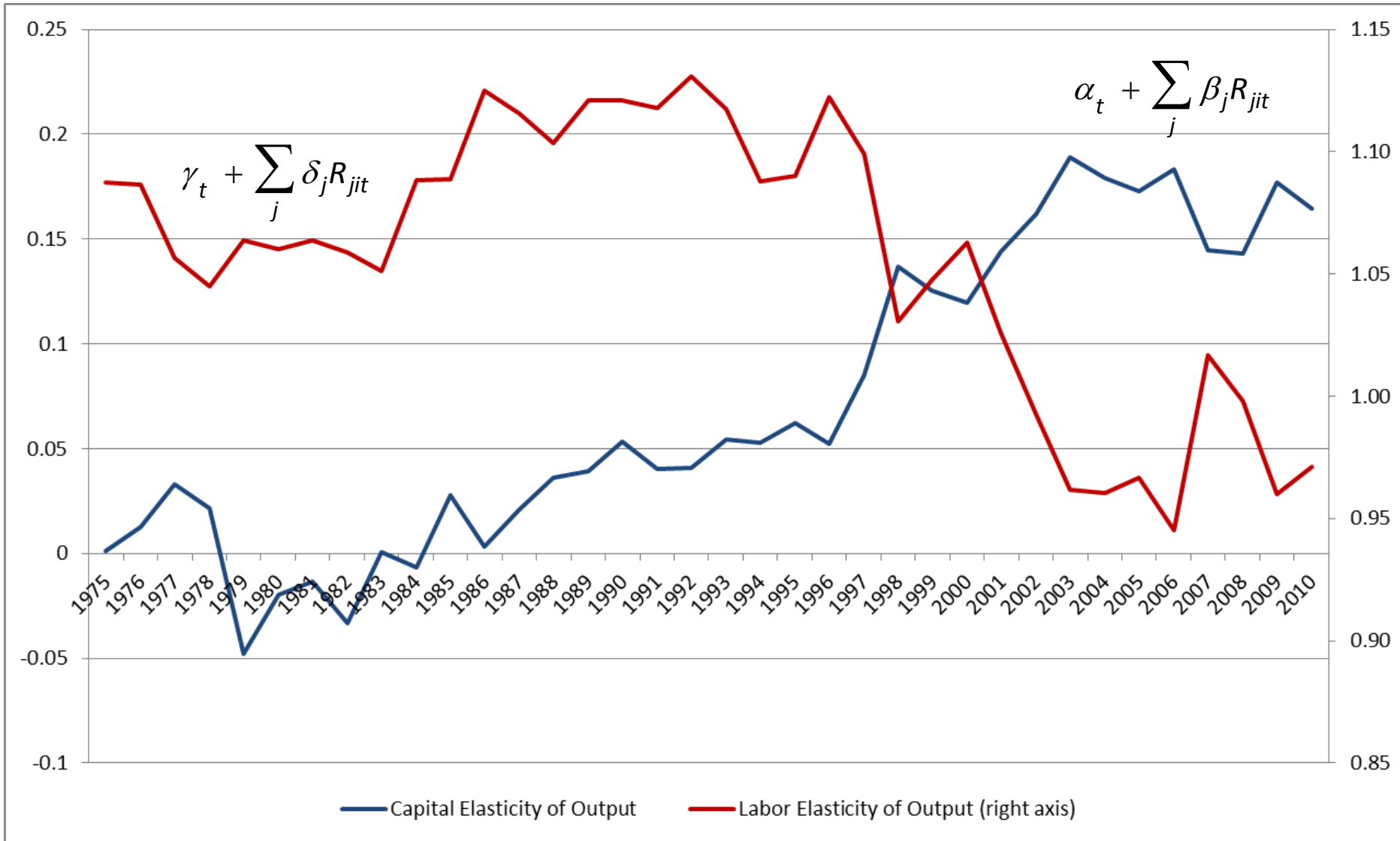
Fixed effects panel data GLS

** Significant at 1% * Significant at 5%

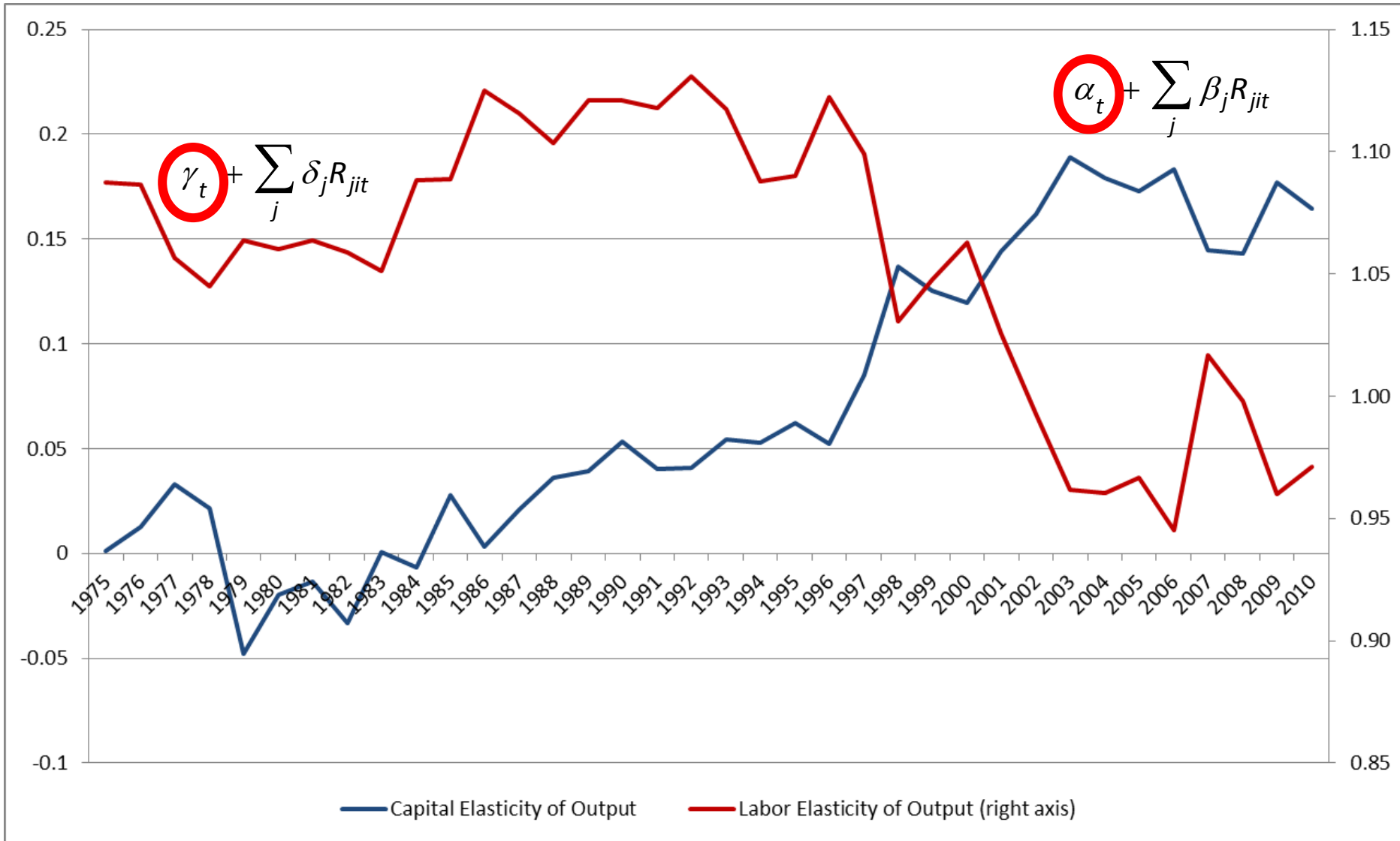
Growth of Regulations Over Time



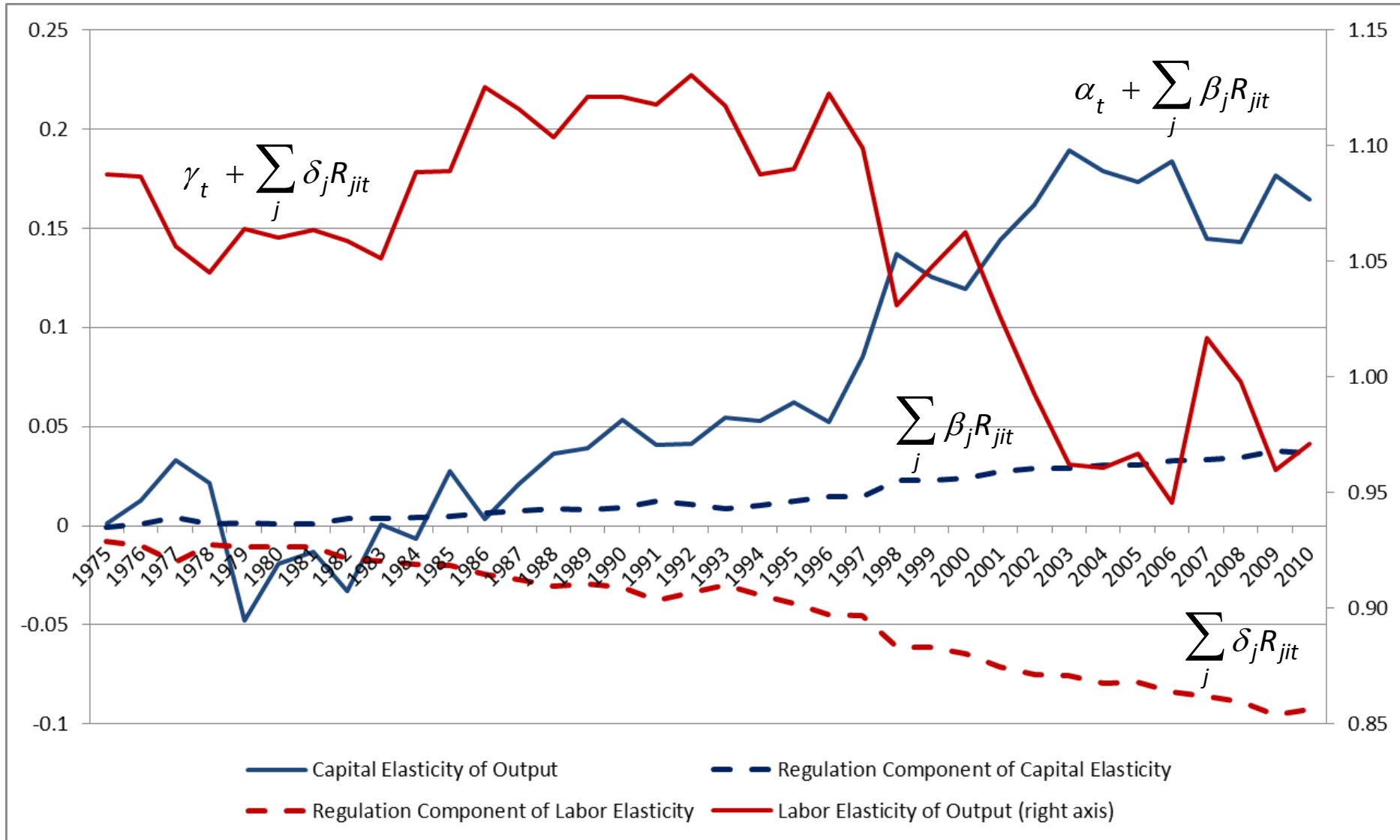
Input Elasticities Over Time



Input Elasticities Over Time



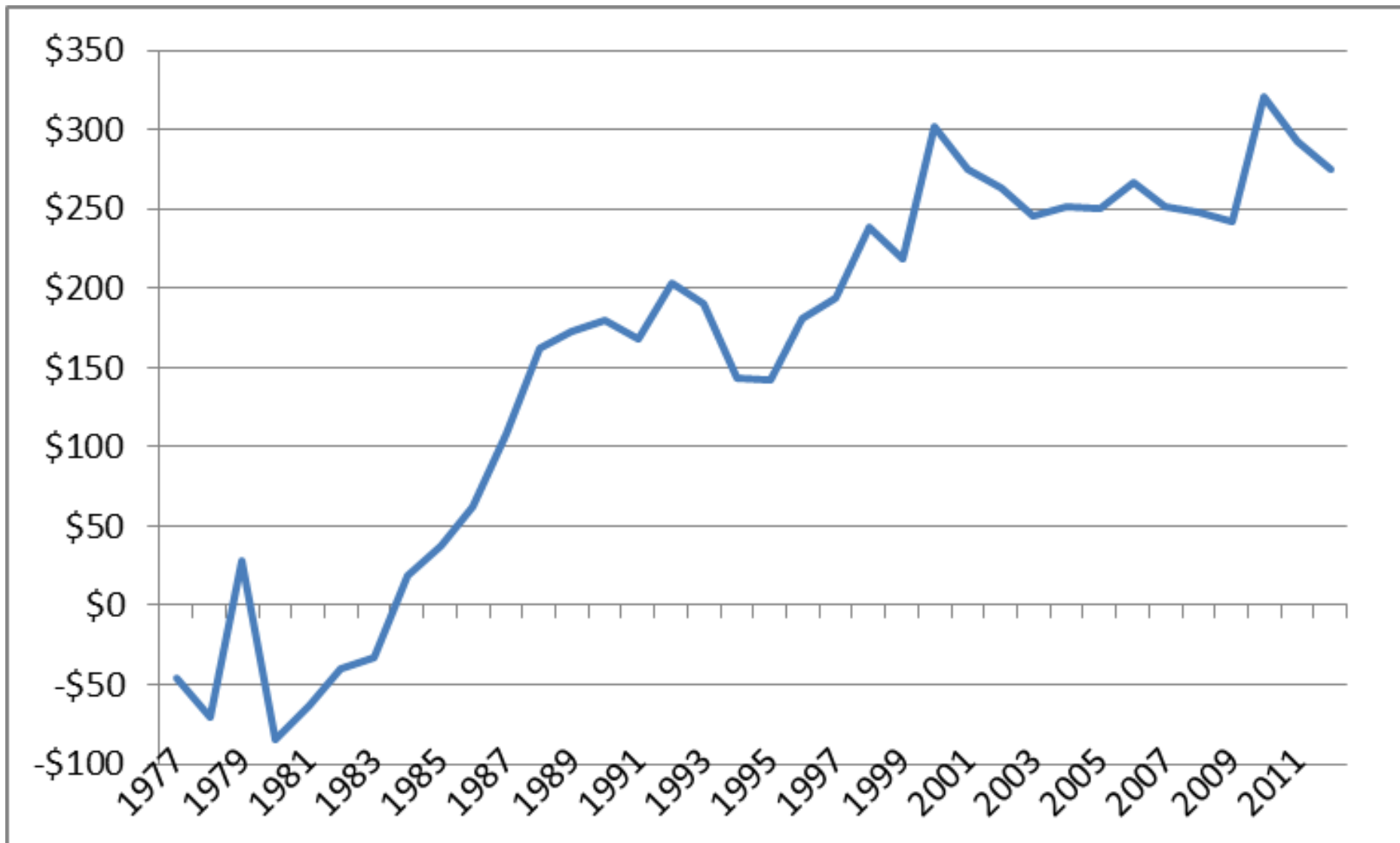
Input Elasticities Over Time



Estimated Average Annual Effect of Regulatory Growth on Output

Agency	Regulations Since 1975	Effect on (Real) Output
USDA	+20%	-4.5%
DOL	+76%	2.8%
EPA	+221%	-1.7%
IRS	+38%	-1.2%
Combined		-4.0%

Estimated Lost RGDP in Each Year (billions 2012\$)



Step 4: Estimating benefit of regulations

- DOL
- 1975 - 2012

$$\begin{aligned} \text{Casualties per worker}_{it} &= \alpha_i + \beta_1 R_{i,t-1}^{DOL} + \beta_2 \left(R_{i,t-1}^{DOL} \right)^2 \\ &+ \sum_{s=1}^3 \theta_s \left(\frac{\text{OSHA inspections}}{\text{workers}} \right)_{i,t-s} \\ &+ \sum_{s=1}^3 \phi_s \left(\frac{\text{OSHA violations}}{\text{workers}} \right)_{i,t-s} \end{aligned}$$

$$\text{Casualties per worker}_{it} = \alpha_i + \beta_1 R_{i,t-1}^{DOL} + \beta_2 (R_{i,t-1}^{DOL})^2 + \sum_{s=1}^3 \theta_s \left(\frac{\text{OSHA inspections}}{\text{workers}} \right)_{i,t-s} + \sum_{s=1}^3 \phi_s \left(\frac{\text{OSHA violations}}{\text{workers}} \right)_{i,t-s}$$

Relationship between DOL regulations and casualties

Regressor	Lag	Coefficient
DOL regulations	1	0.00003 **
(DOL regulations) ²	1	-1.8 x 10 ⁻⁹ **
OSHA Inspections	1	-0.029 ***
	2	0.022 ***
	3	-0.032 ***
OSHA Violations	1	0.059 ***
	2	-0.017
	3	0.035 ***

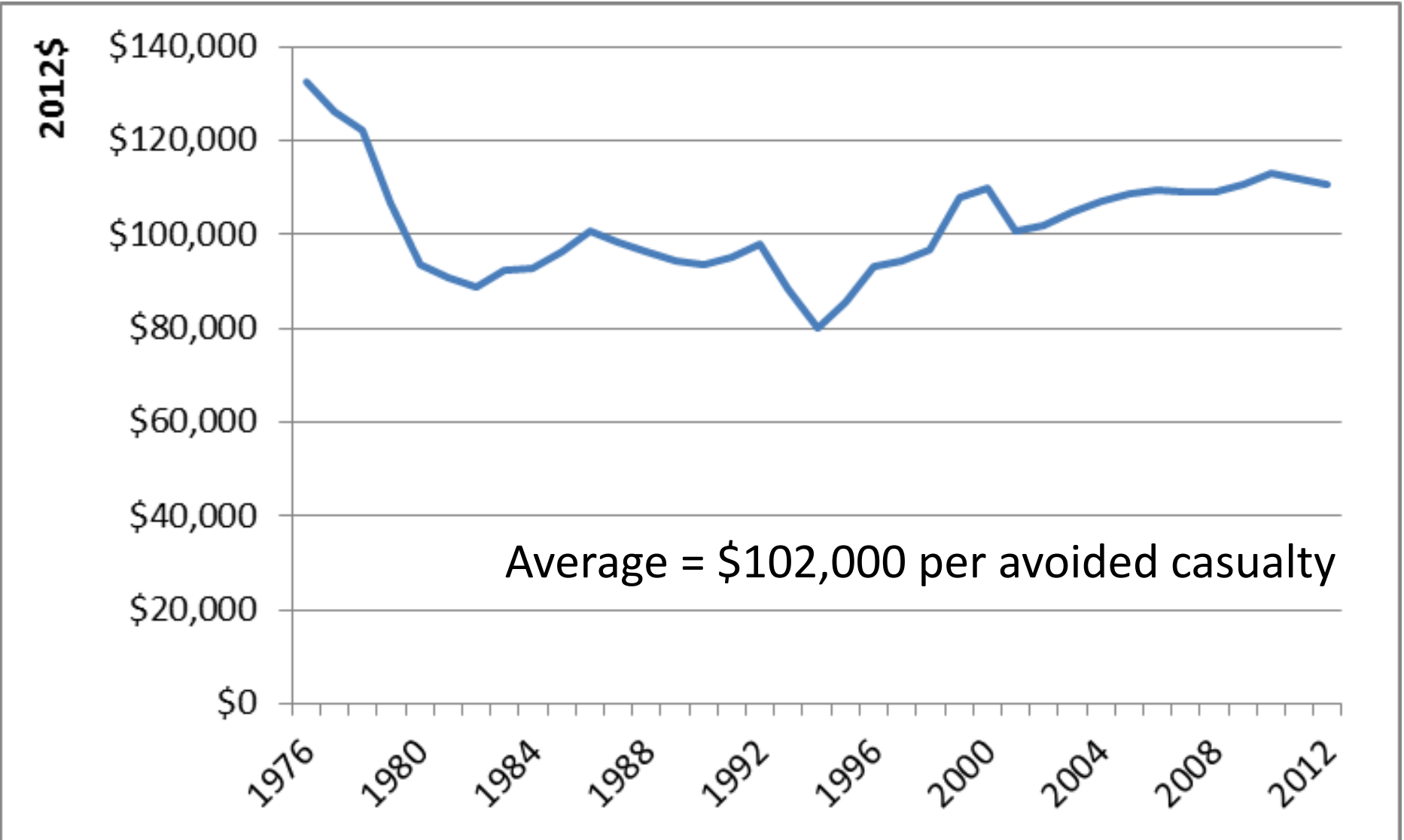
62 Industries, 2088 observations, R² = 0.20

*** Significant at 1% ** Significant at 5% * Significant at 10%

Step 5: Costs vs. Benefits

- DOL
- 1975 - 2012

Lost GDP per Worker Casualty Due to Changes in DOL Regulations



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