Earnings Dynamics, Mobility Costs and Transmission of Firm and Market Level Shocks

Preliminary and Incomplete

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January 7, 2017

The opinions expressed in this paper are those of the authors alone and do not reflect the views of the Internal Revenue Service or the U.S. Treasury Department. This work is a component of a larger project on income risk in the United States, conducted through the SOI Joint Statistical Research Program.

Introduction: Motivation

- The canonical model of a competitive labor market predicts that firm-level productivity shocks do not transmit to workers' wages
  - This prediction is at odds with evidence from several countries (e.g. Guiso et al., 2004; Friedrich et al., 2014; Card et al., 2015)

- In the presence of mobility costs:
  - Workers not only face the risk of shocks to their productivity
  - Workers' wages may depend on productivity shocks at
    - the firm level
    - the market (i.e., region and industry) level

Introduction: Objectives and data

- The goals of this paper are to:
  1. Quantify the extent to which (persistent and transitory) firm and market level productivity shocks are transmitted to wages
  2. Recover the frictions or costs to worker mobility across firms and markets from the transmission of productivity shocks
  3. Examine the extent to which taxes, transfers and the family attenuates firm and market level shocks

- To achieve these goals, we:
  - Develop a tractable model, linking workers' wages to firm and market shocks
  - Combine US population tax records with corporate income tax returns from years 2000-2014, giving panel data on:
    - workers' wages and their firm, region and industry
    - individual and family income, pre and post tax and transfers
    - measures of firm productivity and output

Introduction: Outline

1. Presentation of the wage setting framework
   - static with workers and firms
   - static with workers and firms in different markets
   - dynamic with long-term contracts

2. Permanent-transitory earnings decomposition
   - Process with individual, firm and market level components
   - Explore non-linearities and heterogenity over time and across areas

3. Use value added data to:
   - Quantify pass through of firm and market shocks
   - Infer costs to worker mobility across firms and markets

4. Study attenuation of shocks from tax-transfer system and spouses

Wage-setting framework - Static 1

- We consider a simple labor supply model as in Card, Cardoso, Heining, and Kline (2016)
  - large population of firms indexed by j
  - large population of workers indexed by i

- Individuals have productivity x_i and heterogeneous preferences:

$$u_{ij} = \beta \log w_j + \epsilon_{ij}$$

  - where ϵ_{ij} are iid type-1 extreme value

Wage-setting framework - Static 2

- Firms generate output $y_j = \frac{a_j}{1-\alpha} (l_j)^{1-\alpha}$ where $l_j = \sum_{i \in I_j} x_i$
  - implies that efficiency units of labor x_i are perfectly substitutable
- Firms pay a wage per efficiency unit of labor

$$w_{ij} = w_j \cdot x_i$$

- This result in a the common aggregate labor supply for firm j

$$l_j(w_j) = \frac{1}{\mu} e^{\beta \log w_j}$$

  - where $\mu \propto \sum_{j'} e^{\beta \log w_{j'}}$, and
  - for large enough J we have that $\partial \mu / \partial w_j \simeq 0$

Wage-setting framework - Static 3

- We solve for the wage:

$$\max_{w_j} \frac{a_j}{1-\alpha}\left(\frac{1}{\mu}e^{\beta \log w_j}\right)^{1-\alpha} - w_j \frac{1}{\mu}e^{\beta \log w_j}$$

  - which gives the following wage per unit of efficient labor:

$$\log w_j = K + \frac{1}{1+\alpha\beta}\log a_j$$

  - and for the worker:

$$\log w_{ij} = K + \frac{1}{1+\alpha\beta}\log a_j + \log x_i$$

- Canonical model: $\beta \to \infty$ and wages do not respond to a_j
  - possible to use earnings decomp. to test for mobility costs
  - value-added data necessary to quantify mobility costs

Wage-setting framework - Extension 1

- We introduce groups $r(j)$ that represent region/industry
  - Model ϵ_{ij} as a nested Logit error with respect to grouping $r(j)$ with within group correlation $1 - \rho_g$
  - The aggregate labor supply becomes (approximately):

$$l_j(w_j) = \mu_{g(j)} e^{\rho_{g(j)}^{-1} \beta \log w_j}$$

  - We get the following wage expression:

$$\log w_j = K' + \frac{1}{1 + \alpha\beta} \log a_{r(j)} + \frac{\rho_j}{\rho_j + \alpha\beta} \log a_j$$

  - $\rho = 1$ gives previous model and $\rho < 1$ gives different pass-through
- This extension adds market level:
  - Components to earnings dynamics and decomposition
  - Productivity shocks and pass through rates

Wage-setting framework - Extension 2

- We introduce a dynamic model assuming
  - only a share λ of workers can move in each period
  - firms pays the same wage per unit of efficient labor to all workers
  - firms post contracts that specify wages for each history of shocks $w_t(h^t)$
- Firms set contracts dynamically and trade-off:
  - $w_t(h^t)$ responds to a_{jt} to hire optimally
  - $w_t(h^t)$ smoothes a_{jt} to provide insurance to stayers
- Key implications:
  - wages now depend on history of shocks (not a spot market anymore)
  - pass through rates depend on the level of insurance

Data and sample selection

- We study administrative data from the U.S.
  - Population tax records for individuals and families
  - Corporate income tax return
    - Covering the years 2000-2014:
- In line with existing work, our baseline estimation sample:
  - Consists of prime-age men, aged 30-55
  - Excludes observations in firms with less than 10 workers
  - Drop observations with missing firm, region or industry identifiers
  - Keeps observations with at least four consecutive years of:
    - Earnings $\succeq$ full-time employment minimum-wage equivalent
    - Staying at the same firm
- This gives us a sample of
  - 22,605,429 unique individuals
  - 95,341,100 year-individual observations

Descriptive Statistics: Sample Sizes

	firm size ≥ 10		firm size ≥ 50	
	all	stayers	all	stayers
Individuals	136,645	95,341	104,316	77,312
Individuals / Firm	7,494	4,364	9,507	5,378
Firm / Ind. x Reg.	380	221	179	102
Region / Industry	524	457	459	384
Industry / Region	120	100	113	93

Descriptive Statistics: Log-Earnings

	firm size ≥ 10		firm size ≥ 50	
	all	stayers	all	stayers
Mean	11.088	11.053	11.104	11.079
Total Variance	0.664	0.675	0.666	0.652
Between-Firm Variance	0.417	0.418	0.397	0.402

Earnings process in the baseline wage-setting

- Earnings process without market level components:

$$\log w_{ijt} = f_{ij} + w^p_{ijt} + w^t_{ijt}$$

$$\begin{array}{lll} & \text{individual} & \text{firm} \\ w^t_{ijt} = & +(1-\theta^I L)\epsilon_{ijt} & +(1-\theta^F L)\epsilon^F_{jt} \\ w^p_{ijt} = w^p_{ijt-1} + & \eta^I_{ijt} + & \eta^F_{jt} \end{array}$$

  - ϵ^F_{jt} and η^F_{jt} are the transitory and permanent shocks common to co-workers in the same firm, and $E[\epsilon^I_{ijt}|j] = E[\eta^I_{ijt}|j] = 0$,

- We are interested in $\sigma^2_{\epsilon^V}, \sigma^2_{\eta^V}, \theta^V$ for $V \in \{I, F, (R, A)\}$

Link to model and testable implication

- Assume the unit-root plus MA(1) structure for $\log a_{jt}$ and $\log x_{it}$

$$\begin{aligned} \log a_{jt} &= a^p_{jt} + a^t_{jt} & \qquad \log x_{it} &= x^p_{it} + x^t_{it} \\ a^t_{jt} &= (1 - \theta^F L)\epsilon^A_{jt} & \qquad x^t_{it} &= (1 - \theta^X L)\epsilon^X_{jt} \\ a^p_{jt} &= a^p_{jt-1} + \eta^A_{jt} & \qquad x^p_{it} &= a^p_{it-1} + \eta^X_{it} \end{aligned}$$

- And given that

$$\log w_{ijt} = K + \frac{1}{1 + \alpha\beta} \log a_{jt} + \log x_{it}$$

- we get

$$\sigma^2_{\eta^F} = \frac{1}{(1 + \alpha\beta)^2} \sigma^2_{\eta^A} \qquad \sigma^2_{\epsilon^F} = \frac{1}{(1 + \alpha\beta)^2} \sigma^2_{\epsilon^A}$$

Estimation results:

	model 1	model 2	model 3
	permanent shock		
Individual	0.031	0.027	0.027
Firm		0.004	0.004
Region x Ind			0.000
Region			0.001
Industry			0.001
	transitory shock		
Individual	0.015	0.011	0.011
Firm		0.004	0.001
Region x Ind			0.002
Region			0.000
Industry			0.000
	MA coefficient		
Individual	-0.213	-0.145	-0.145
Firm		-0.420	-0.209
Region x Ind			-0.614
Region			-0.201
Industry			-0.201

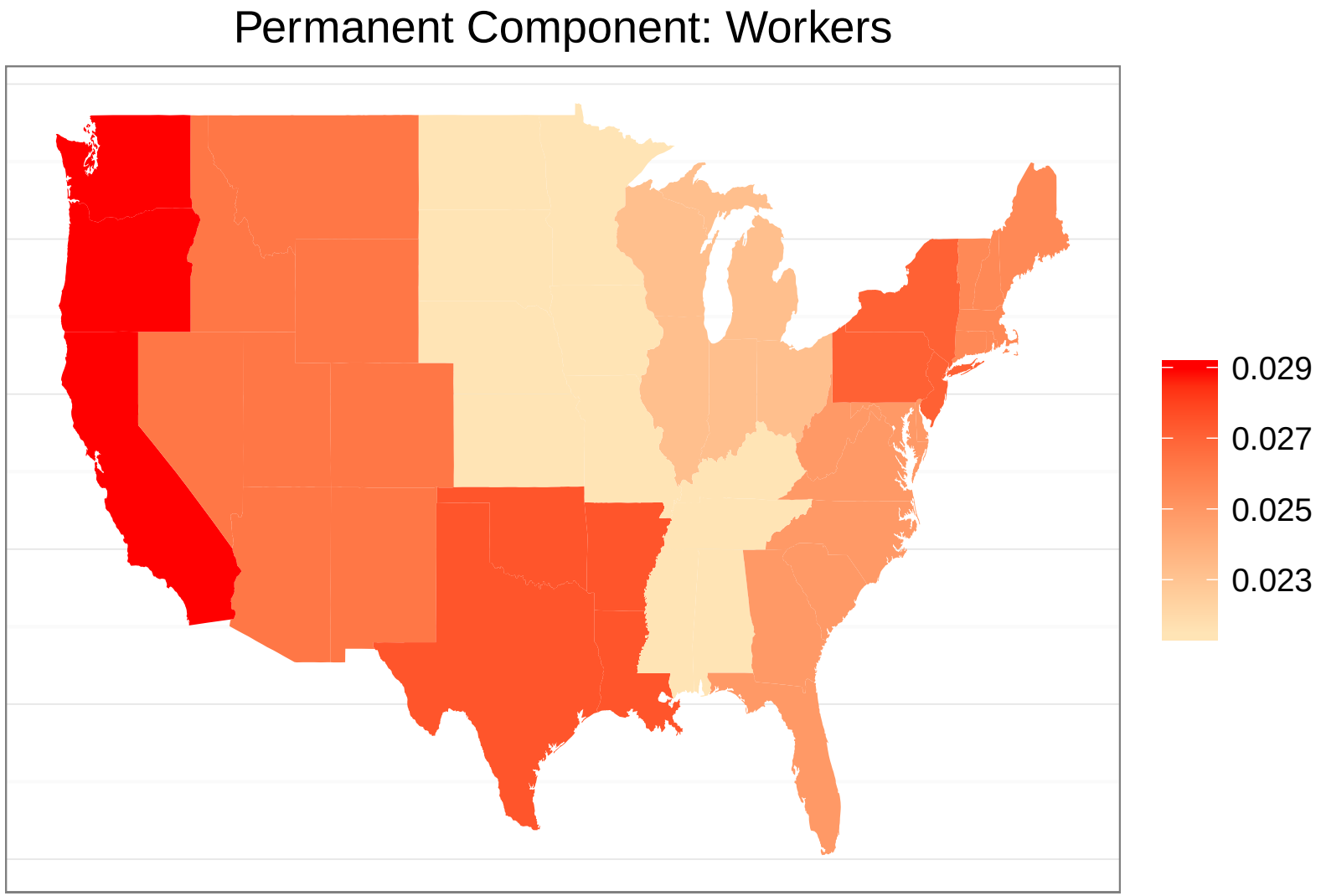
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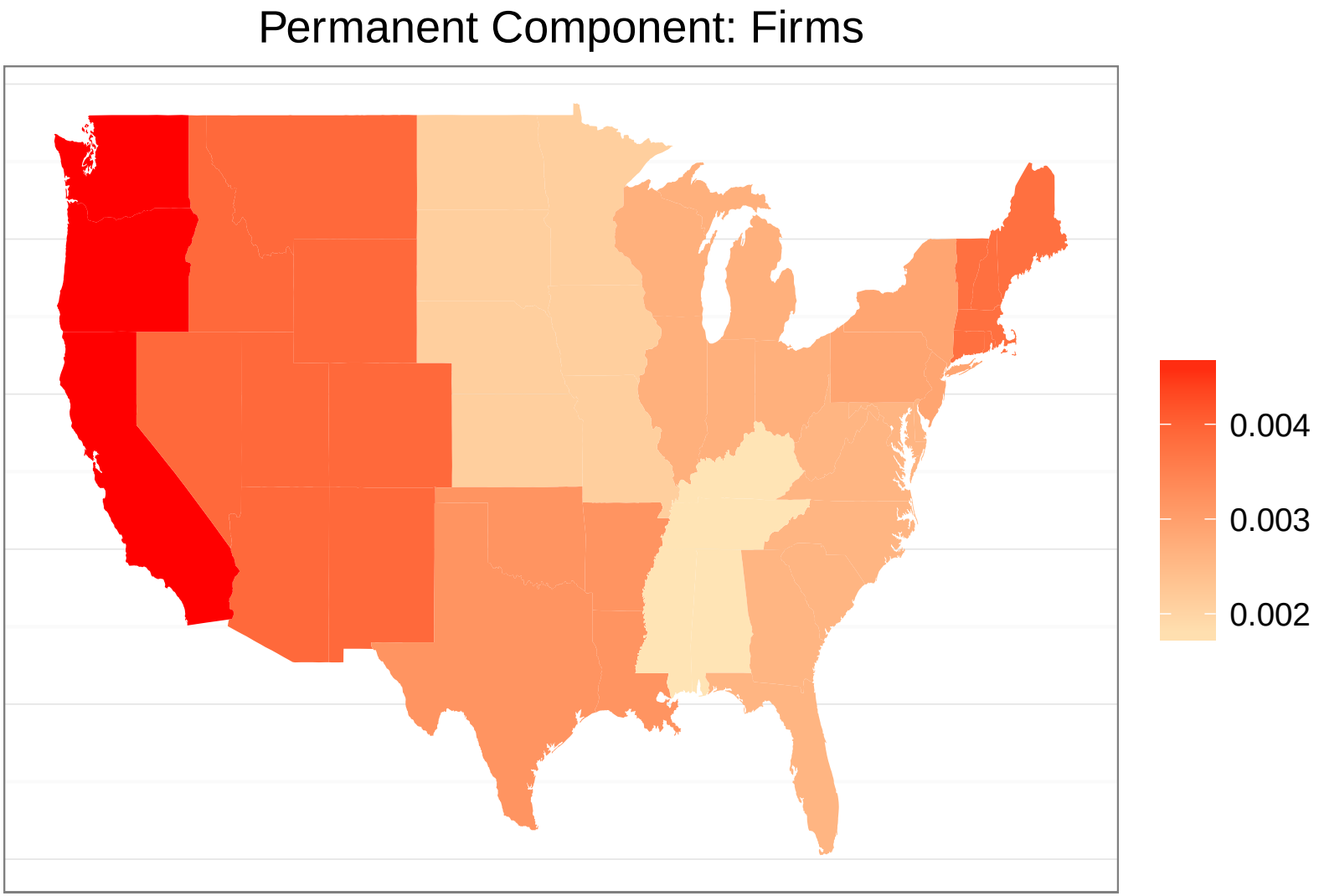
Variance decomposition

	model 1			model 2			model 3		
	values	shares	cons. eq.	values	shares	cons. eq.	values	shares	cons. eq.
				permanent shock					
Individual	0.031	71.2%	-44.4%	0.027	62.1%	-39.5%	0.027	59.1%	-39.3%
Firm				0.004	9.4%	-6.6%	0.004	8.6%	-6.3%
Region x Ind							0.000	0.0%	0.0%
Region							0.001	2.4%	-1.8%
Industry							0.001	2.5%	-1.8%
				transitory shock					
Individual	0.012	28.8%		0.010	22.3%		0.010	21.3%	
Firm				0.003	6.2%		0.001	2.6%	
Region x Ind							0.001	2.9%	
Region							0.000	0.2%	
Industry							0.000	0.4%	
				both shocks					
Individual	0.043	100.0%		0.037	84.4%		0.037	80.4%	
Firm				0.007	15.6%		0.005	11.2%	
Region x Ind							0.001	2.9%	
Region							0.001	2.7%	
Industry							0.001	2.9%	

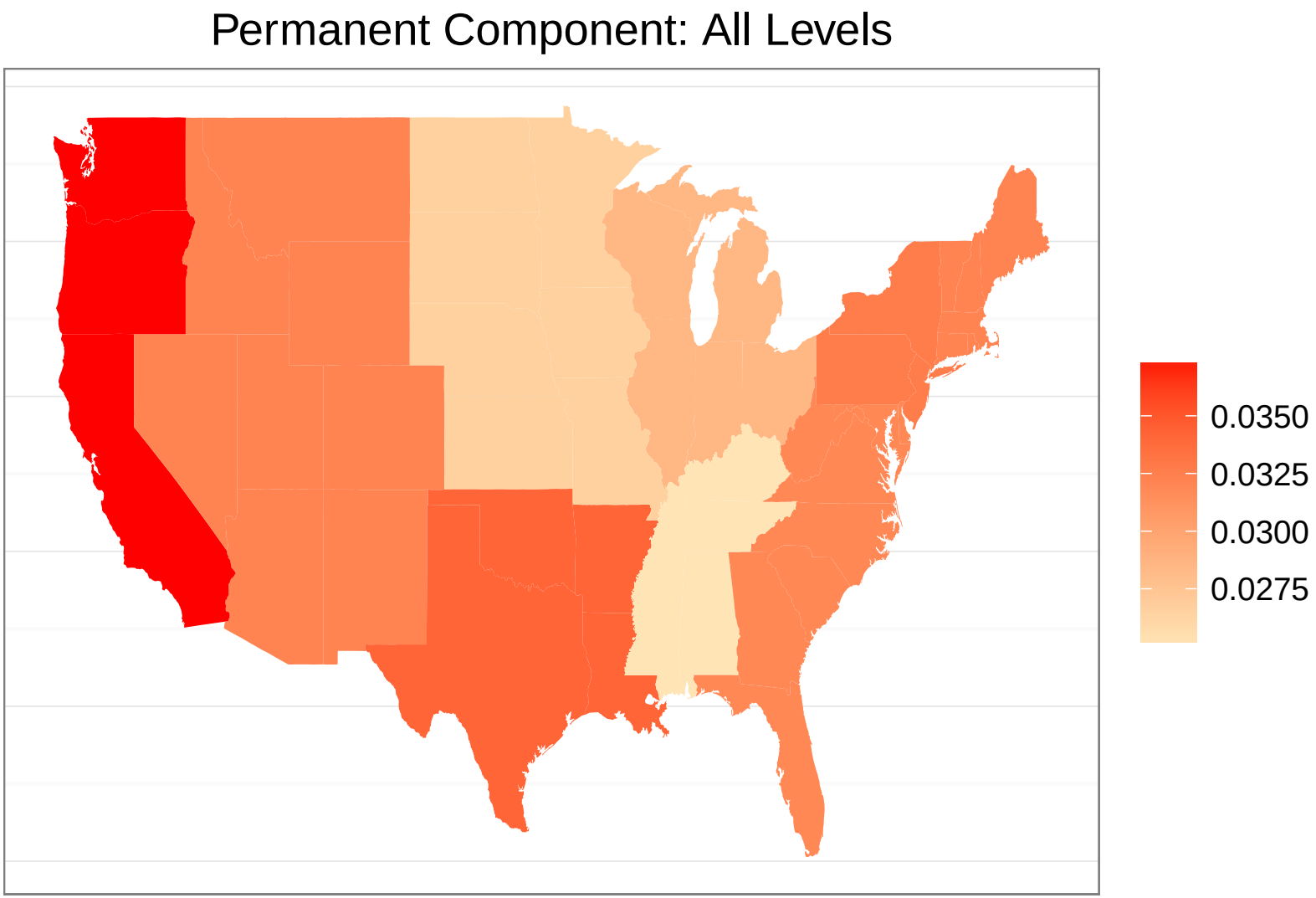
Variances of Permanent Shocks to Workers



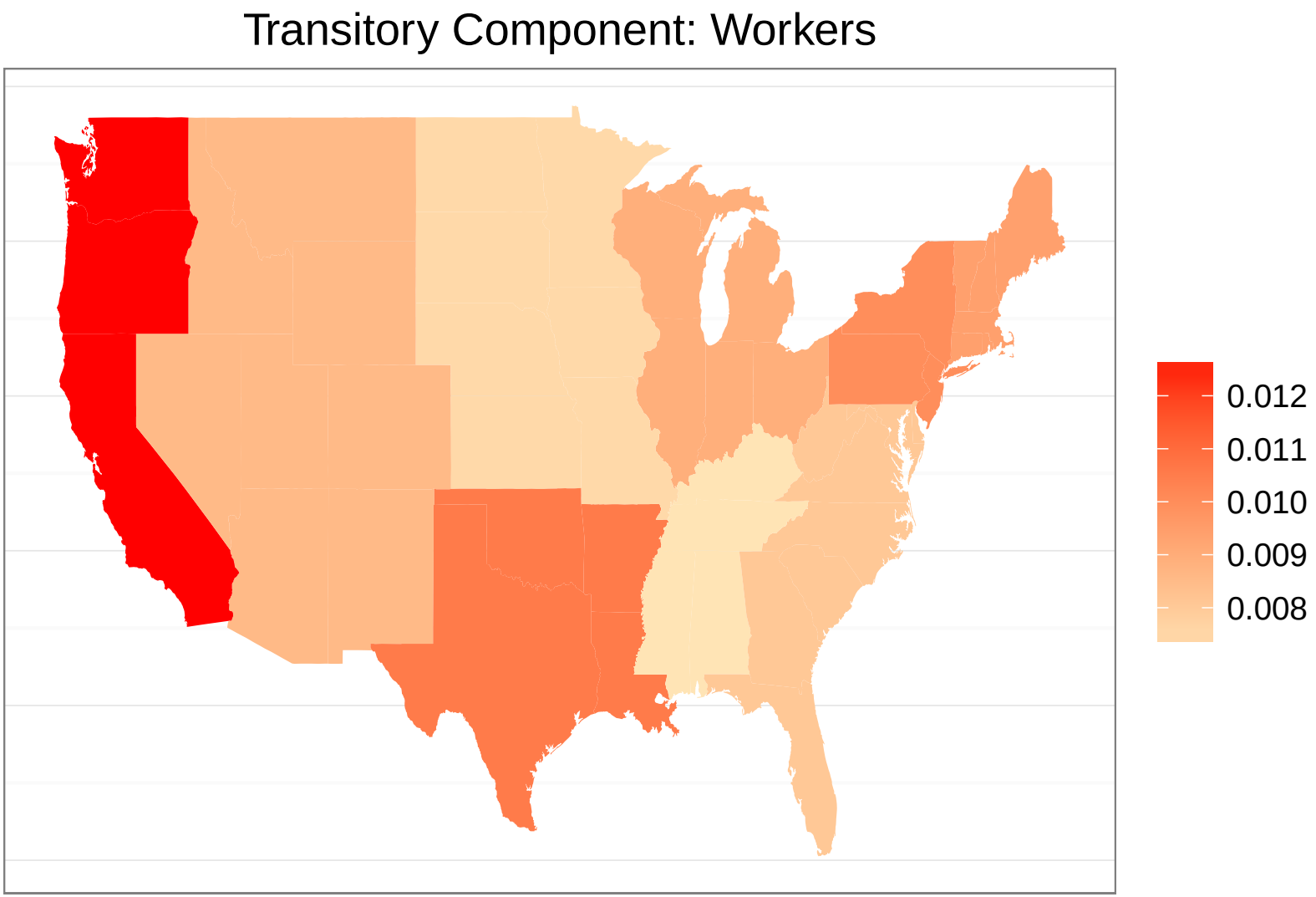
Variances of Permanent Shocks to Firms



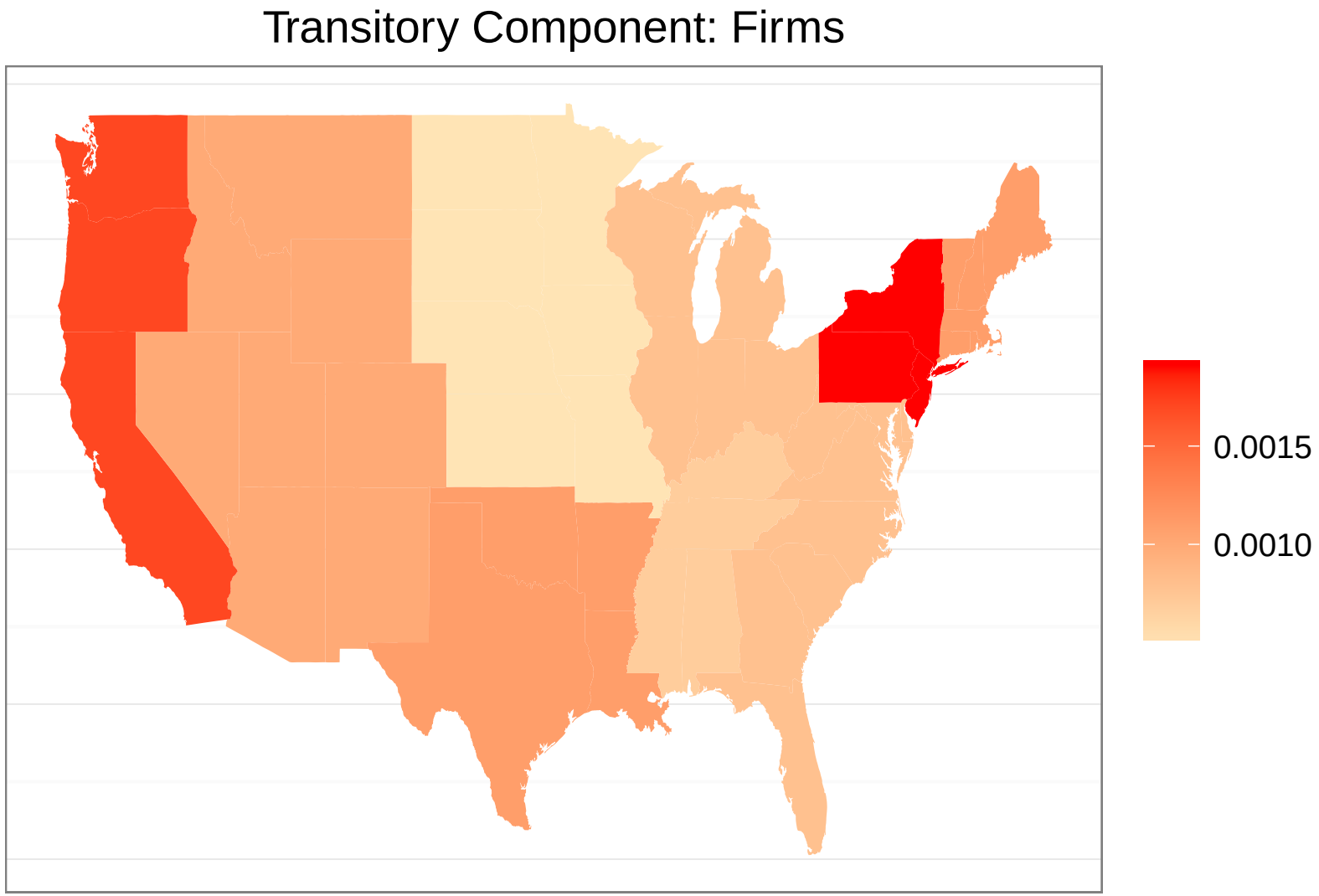
Variances of Permanent Shocks in total



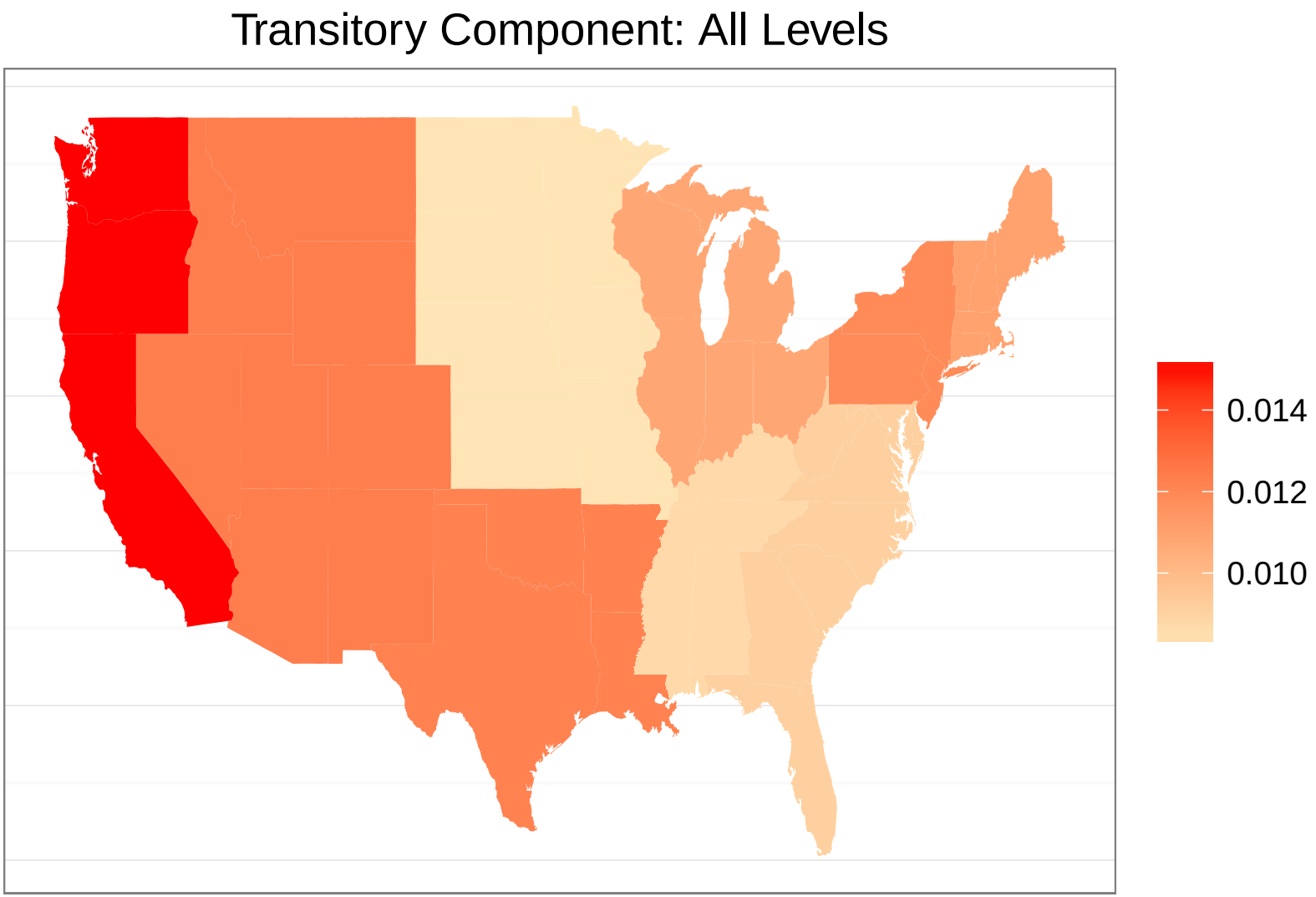
Variances of Transitory Shocks to Workers



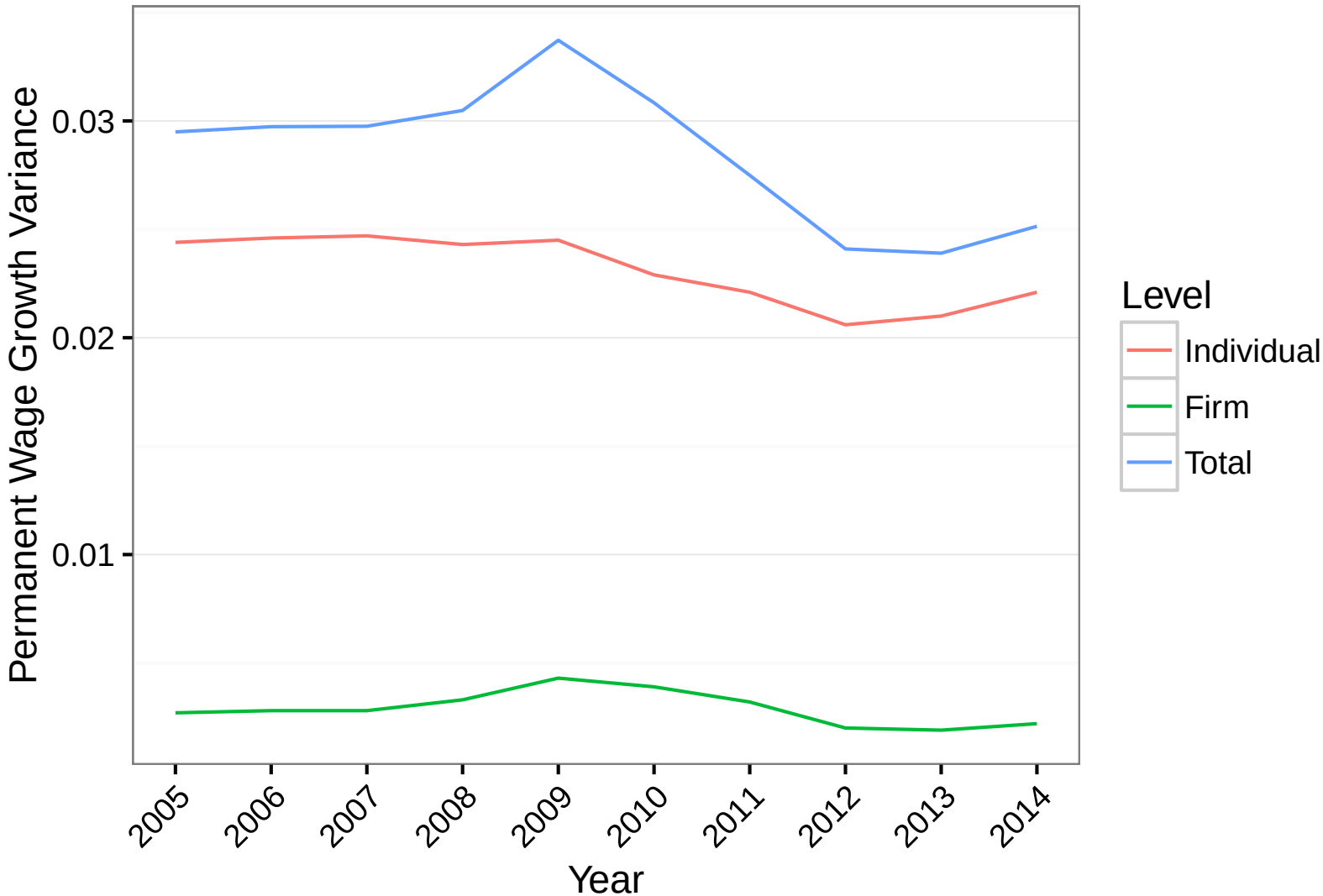
Variances of Transitory Shocks to Firms



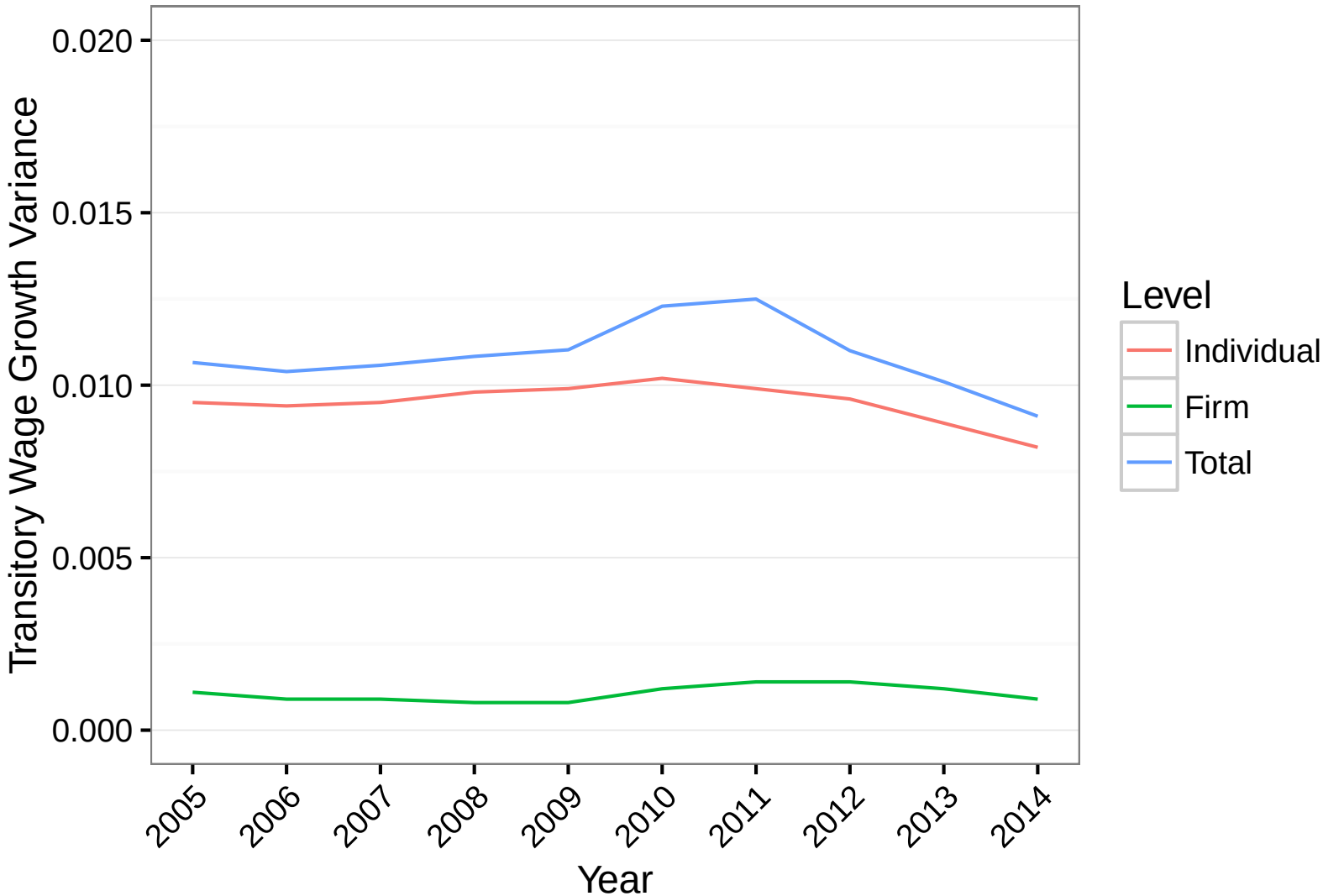
Variances of Transitory Shocks in Total



Time variation: Permanent Shocks



Time variation: Transitory Shocks



Conclusion

- We use U.S. tax data to study earnings dynamics and transmission of firm and market level shocks

- Our results will be informative about:
  - Costs to worker mobility across firms and markets
  - Sources of inequality, and how they vary
    - over time
    - between areas
    - across the income distribution
  - Sources of 'insurance':
    - tax-transfer system
    - spouses
    - long-term contracts

Card, D., A. R. Cardoso, J. Heining, and P. Kline (2016): "Firms and Labor Market Inequality: Evidence and Some Theory," .

Estimation results, size≥ 50:

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Model Ext1

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Var decomposition ≥ 50