Voting, lobbying, and trade policy
A structural estimation framework

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* The views expressed herein are those of the author and are not necessarily those of the Federal Reserve Bank of Richmond, or the Federal Reserve System.

Motivation

State of research on the political economy of trade:

- Empirical contributions in the "old" and "new" endogenous tariff formation tradition rely on reduced-form estimates of formal (or informal) models
  - In the process they have documented empirical regularities about trade politics: i) Special interests matter; ii) geography matters; iii) institutions matter; iv) firm productivity and size matter
  - Yet several of these results are not easily reconciled
- This research appears to have one-sided benefits
  - New findings but limited theoretical progress
  - No significant expansion of theory, or new theory motivated by empirical regularities

Contrast with trade theory

- The "gravity model" of trade has been expanded to match empirical "regularities" to theory
- Resulted is new predictions, such as Eaton and Kortum 2002 and Eaton Kortum Kramarz 2011; and theoretical refinements

OUR CONTRIBUTION: STRUCTURAL FRAMEWORK

Develop a structural estimation framework of the PE of trade

- Start with a very general **two-stage political economy model**
- Match model's prediction with actual data on tariffs and NTMs

Hope to make progress in PE of trade as normal science

- Use structural parameters to create counterfactuals
- Expect process to inform theory and new predictions

MODEL PREDICTIONS: STAGE 1

District-specific tariffs t_r maximize each district's welfare (Ω_r):

$$\max \Omega_r(\mathbf{t_r}) = \sum_j \sum_m \Lambda_{jr}^m \; W_{jr}^m, \quad r = 1, \ldots, R$$

where $\mathbf{t_r} = (t_{1r}, \ldots, t_{Jr})$ is the vector of preferred tariffs for each sector j by district r
$j = 1, \ldots, J$: sectors (e.g., $J =$ NAICS 3-digit industries)
$r = 1, \ldots, R$: districts (e.g., $R = 435$)
$m = \{L, K\}$: agent types
n_{jr}^m = population of type-m agents in sector j in region r

Model has GH-flavor with a twist:

- Λ_{jr}^m is the weight district r places on the welfare of an agent of type m living in district r and working in industry j,
- Regional weights need not match the weight placed by the centralized planner on agents, industries and regions (Γ_{jr}^m)

Stage 1: District tariffs by sector (t_{jr})

- Assume **a specific factors** economic structure:
  - Agents own **labor (L)** and (shares of) **specific capital (K)**
  - Labor is mobile across sectors (j) within region (r)
- The **preferred tariff (t_{jr})** for sector j by representative from region r is given by:

$$t_{jr} = -\frac{n}{M'_j}\left[\frac{\Lambda^K_{jr} n^K_{jr}}{\lambda_r}\frac{q_{jr}}{n^K_{jr}} - \left(\frac{\lambda^L_r}{\lambda_r}\frac{D^L_j}{n^L} + \frac{\lambda^K_r}{\lambda_r}\frac{D^K_j}{n^K} - \frac{M_j}{n}\right)\right] \tag{1}$$

where $\lambda^m_r = \sum_j \Lambda^m_{jr} n^m_{jr}$, $m \in \{L, K\}$ are the weights, and $\lambda_r = \lambda^L_r + \lambda^K_r$

Stage 2: National tariffs (t_j)

The vector of sectoral tariffs $(t_1, \ldots, t_J)$ maximize aggregate (national) welfare (Ω^A):

$$\max \Omega^A(\mathbf{t}) = \sum_r \sum_j \Gamma_{jr}^K W_{jr}^K + \sum_r \sum_j \Gamma_{jr}^L W_{jr}^L$$

- Institutionally, national sectoral tariffs $t_j = 1, \ldots, J$ are the result of a bargaining game among representatives in Congress and the President

Sectoral tariffs are given by:

$$t_j^{\Omega} = -\frac{n}{M_j'} \left[\sum_r \frac{\Gamma_{jr}^K n_{jr}^K}{\gamma} \frac{q_{jr}}{n_{jr}^K} - \left(\frac{\gamma^L}{\gamma} \frac{D_j^L}{n^L} + \frac{\gamma^K}{\gamma} \frac{D_j^K}{n^K} \right) + \frac{M_j}{n} \right] \tag{2}$$

- Note that the welfare weights in Ω_r and Ω^A may differ

District and National Tariffs Differ

District vs. Aggregate:

$$t_{jr} - t_j^{\Omega} = -\frac{n}{M_j'}\left[\frac{\Lambda_{jr}^K n_{jr}^K}{\lambda_r}\frac{q_{jr}}{n_{jr}^K} - \sum_r \frac{\Gamma_{jr}^K n_{jr}^K}{\gamma}\frac{q_{jr}}{n_{jr}^K}\right]$$

Message: If welfare weights are equal and the spatial distribution of activity is uniform across regions, district's sectoral tariffs may still be different from zero if the allocation of production across jurisdictions is not homogeneous.

FROM THEORY TO DATA - I

Using (2), we can move to an econometric model designed to produce estimates of the welfare weights Λ_{jr}^{K}

Rewrite (2) using import demand elasticities $\epsilon_j = M_j'(p_j/M_j)$, where p_j is import price

$$\frac{t_j}{(P_j/M_j)} = \frac{-n}{M_j'(P_j/M_j)}\left[\sum_r \frac{\Gamma_{jr}^{K} n_{jr}^{K}}{\gamma}\frac{q_{jr}}{n_{jr}^{K}} - \left(\frac{\gamma^{L}}{\gamma}\frac{D_j^{L}}{n^{L}} + \frac{\gamma^{K}}{\gamma}\frac{D_j^{K}}{n^{K}} - \frac{M_j}{n}\right)\right]$$

Therefore, ad-valorem tariffs $\tau_j\,(= t_j/p_j)$ are:

$$\tau_j = \frac{-n}{\epsilon_j}\left[\sum_r \frac{\Gamma_{jr}^{K} n_{jr}^{K}}{\gamma}\frac{(q_{jr}/M_j)}{n_{jr}^{K}} - \left(\frac{\gamma^{L}}{\gamma}\frac{(D_j^{L}/M_j)}{n^{L}} + \frac{\gamma^{K}}{\gamma}\frac{(D_j^{K}/M_j)}{n^{K}} - \frac{1}{n}\right)\right]$$

FROM THEORY TO DATA - II

Rewriting in a form suitable for estimation:

$$\begin{aligned}\tau_j &= \sum_r \left[\frac{\Gamma_{jr}^K n_{jr}^K}{\gamma} \cdot \frac{n}{n_{jr}^K} \cdot \left(\frac{q_{jr}/M_j}{-\epsilon_j} \right) \right] \\ &- \frac{\gamma^L}{\gamma} \cdot \frac{n}{n^L} \cdot \left(\frac{D_j^L/M_j}{-\epsilon_j} \right) - \frac{\gamma^K}{\gamma} \cdot \frac{n}{n^K} \cdot \left(\frac{D_j^K/M_j}{-\epsilon_j} \right) + \frac{1}{-\epsilon_j} \end{aligned} \tag{3}$$

There are two components:

- Demand-for-protection component:
  - Since $-\epsilon_j > 0$, τ_j increases with the (regional) output-to-(national) import ratio q_{jr}/M_j
  - This is reminiscent of Grossman-Helpman model
- Consumption-distortion component:
  - τ_j decreases with the national consumption-to-import ratios D_j^L/M_j and D_j^K/M_j
  - We can simplify the second component further by assuming equal preferences and weights on consumption

FROM THEORY TO DATA - III

Suppose there is no heterogeneity between L and K in their tastes. Then their demand-to-import ratios are same:

$$\frac{D_j^K}{M_j^K} = \frac{D_j^L}{M_j^L} \left(\equiv \frac{D_j}{M_j} \right),$$

where $M_j^K = M_j \times \frac{n^K}{n}$ and $M_j^L = M_j \times \frac{n^L}{n}$. Then tariff equation is:

$$\begin{aligned} \tau_j &= \sum_r \left[\frac{\Gamma_{jr}^K n_{jr}^K}{\gamma} \cdot \frac{n}{n_{jr}^K} \cdot \left(\frac{q_{jr}/M_j}{-\epsilon_j} \right) \right] - \frac{\gamma^L + \gamma^K}{\gamma} \cdot \left(\frac{D_j/M_j}{-\epsilon_j} \right) + \left(\frac{1}{-\epsilon_j} \right) \\ &= \sum_r \left[\frac{\Gamma_{jr}^K n_{jr}^K}{\gamma} \cdot \frac{n}{n_{jr}^K} \cdot \left(\frac{q_{jr}/M_j}{-\epsilon_j} \right) \right] - \frac{q_j/M_j}{-\epsilon_j} \end{aligned} \tag{4}$$

The first equality is due to homogeneous tastes, and the second uses $D_j = q_j + M_j$. The second component is simply sector j's national output-to-import ratio.

(4) is the basis for structural estimation

FROM MODEL TO DATA

- We estimate the structural parameters by OLS using the econometric specification

$$\tau_j = \sum_{r=1}^{R} \beta_r \left(\frac{q_{jr}/M_{jr}}{-\epsilon_j} \right) + \alpha \left(\frac{q_j/M_j}{-\epsilon_j} \right) + u_j.$$

- As above,
  1. Assume $\Gamma_{jr}^K = \Gamma_r^K$, that is, welfare weights vary across districts, not within districts (across sectors)
  2. Same for labor weights. $\Gamma_{jr}^L = \Gamma_r^L$
  3. We use $\frac{n_r}{n_r^K} = 1/0.28$ for every district r (national ratio of non-production to production workers in manufacturing)
- Under these assumptions, the coefficient β_r becomes

$$\beta_r = \frac{\Gamma_r^K n_r^K}{\gamma^K + \gamma^L} \cdot \frac{n_r}{n_r^K} = \frac{\Gamma_r^K n_r^K}{\left(\sum_r \Gamma_r^K n_r^K + \sum_r \Gamma_r^L n_r^L \right)} \cdot \frac{1}{0.28}$$

ESTIMATING STRUCTURAL PARAMETERS

- To structurally estimate the model we need a few **assumptions**
  1. Estimate GH-type coefficients on variables $Z_{jr} = q_{jr}/M_{jr}$
     - 1.1 Use import demand elasticities $\epsilon_j = M_j'(p_j/M_j)$ (p_j = import price)
     - 1.2 Replace t_j with ad-valorem tariffs $\tau_j = t_j/p_j$
  2. Since M_{jr} is unavailable we approximate it as $M_{jr} = M_j \times (n_r/n)$
  3. Equal weights across sectors j within region r
  4. The consumption component is given by: $\frac{q_j/M_j}{-\epsilon_j} = \sum_{r=1}^{R} \frac{q_{jr}/M_j}{-\epsilon_j}$
  5. We aggregate districts into R "regions"
- The re-parameterized model is:

$$\tau_j = \sum_{r=1}^{R} \left[\frac{\Gamma_r^K n_r^K}{\sum_r \left(\Gamma_r^K n_r^K + \Gamma_r^L n_r^L\right)} \cdot \left(\frac{n}{n_r^K}\right) \frac{q_{jr}/M_j}{-\epsilon_j} \right] - \frac{q_j/M_j}{-\epsilon_j} + e_j.$$

  - The estimates reveal the weight on specific capital ($\sum_r \Gamma_r^K n_r^K$) relative to total welfare weights ($\sum_r \left(\Gamma_r^K n_r^K + \Gamma_r^L n_r^L\right)$)

Estimation and Data

- We estimate the **structural parameters** by OLS using the econometric specification

$$\tau_j = \sum_{r=1}^{R} \beta_r \left(\frac{q_{jr}/M_{jr}}{-\epsilon_j} \right) + \alpha \left(\frac{q_j/M_j}{-\epsilon_j} \right) + u_j.$$

- We collected **data** on:
  1. Tariffs and imports (M_j) (USITC Dataweb; Feenstra's site)
  2. Output (q_{jr}), and consumption (D_j^L and D_j^K) (County Business Patterns: 2002)
  3. Employment by type of economic agent, sector and region (n_{jr}^K and n_{jr}^L) (County Business Patterns: 2002; NBER manufacturing database)
  4. Import demand elasticities (ϵ_j) (Kee, Nicita and Olarreaga (2008)
- Data was available from different sources and at different levels of geographical and industry aggregation
- Convert the data from to NAICS 3-digit level, and map from MSAs and Counties onto the CDs for the 107th Congress (2002)

Structural Estimation

Results from three different regional groupings

Case 1: Geography

- Weights by 9 geographic subdivisions from US Census

Case 2: Political Geography

- Weights by 18 regions: 9 geographic subdivisions x Party

Case 3: Competitiveness of CDs

- Weights by 9 regions based on battleground state in 2000 Presidential election and competitiveness of Congressional seat

CASE 1: WEIGHTS BY GEOGRAPHY

Regression model for second stage welfare weights

Dependent Variable: *8-Digit Applied Tariffs, 2002*

	Variable	Coeff.	Std. err.
β_1	New England	0.046	(0.013)
β_2	Mid-Atlantic	0.115	(0.016)
β_3	East North Central	0.269	(0.015)
β_4	West North Central	0.000	–
β_5	South Atlantic	0.171	(0.010)
β_6	East South Central	0.000	–
β_7	West South Central	0.127	(0.039)
β_8	Mountain	0.026	(0.013)
β_9	Pacific	0.188	(0.030)
α	$(q_j/M_j)/\lvert\epsilon_j\rvert$	-1.00	–
β_0	Constant	0.043	(0.020)
N		8315	
Pseudo R^2		0.173	

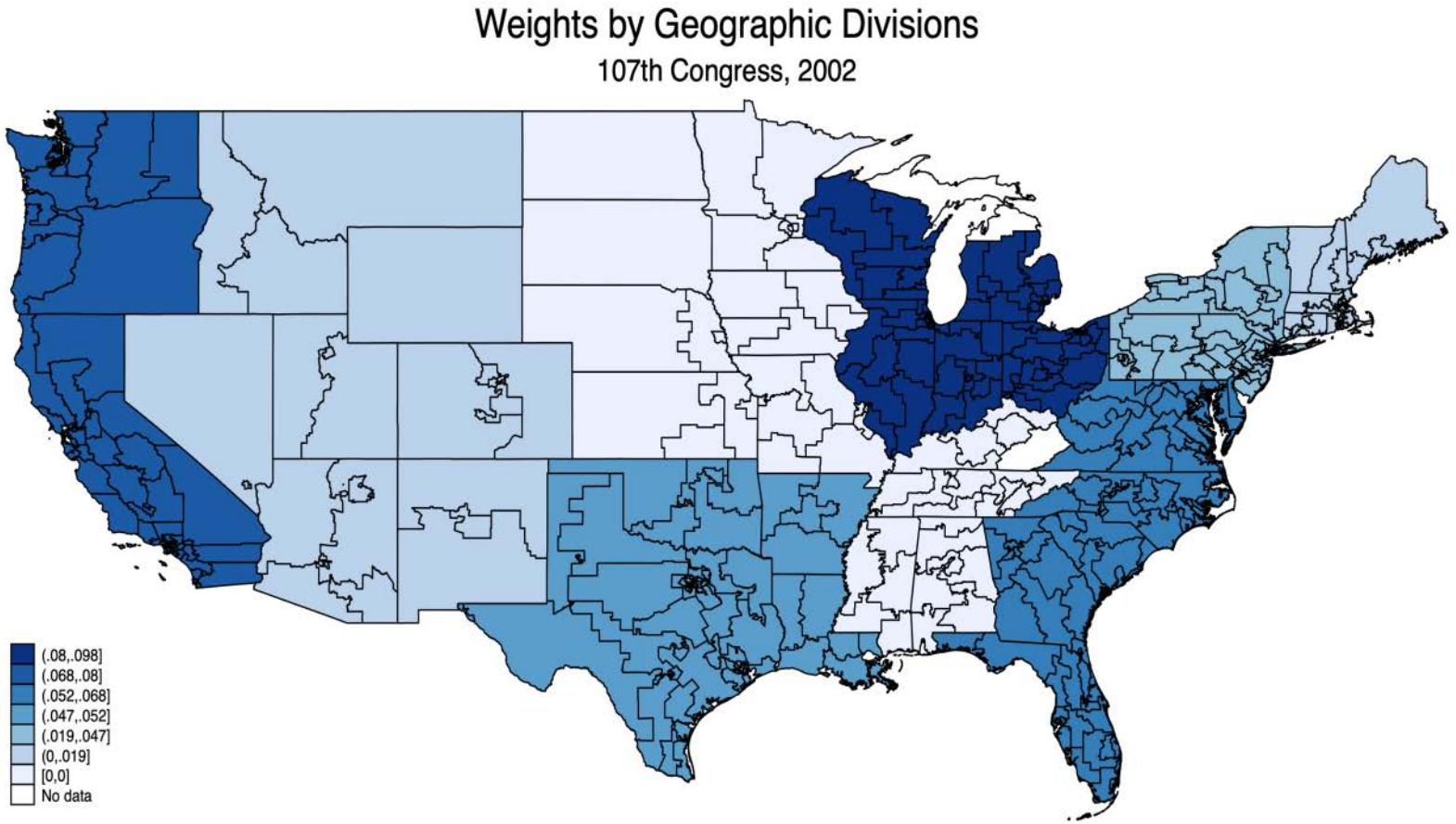
CASE 1: WEIGHTS BY GEOGRAPHY

Second Stage Welfare Weights on Specific K

Region	# Districts	Normalized K-weight
New England	23	0.019
Mid-Atlantic	65	0.047
East North Central	73	0.098
West North Central	31	0.000
South Atlantic	75	0.068
East South Central	26	0.000
West South Central	47	0.052
Mountain	24	0.011
Pacific	69	0.080
Total	433	0.375

Overall Weights for 433 Districts	
K-weight / total	0.375
L-weight / total	0.625
L-weight/K-weight	1.667

CASE 1: WEIGHTS BY GEOGRAPHY



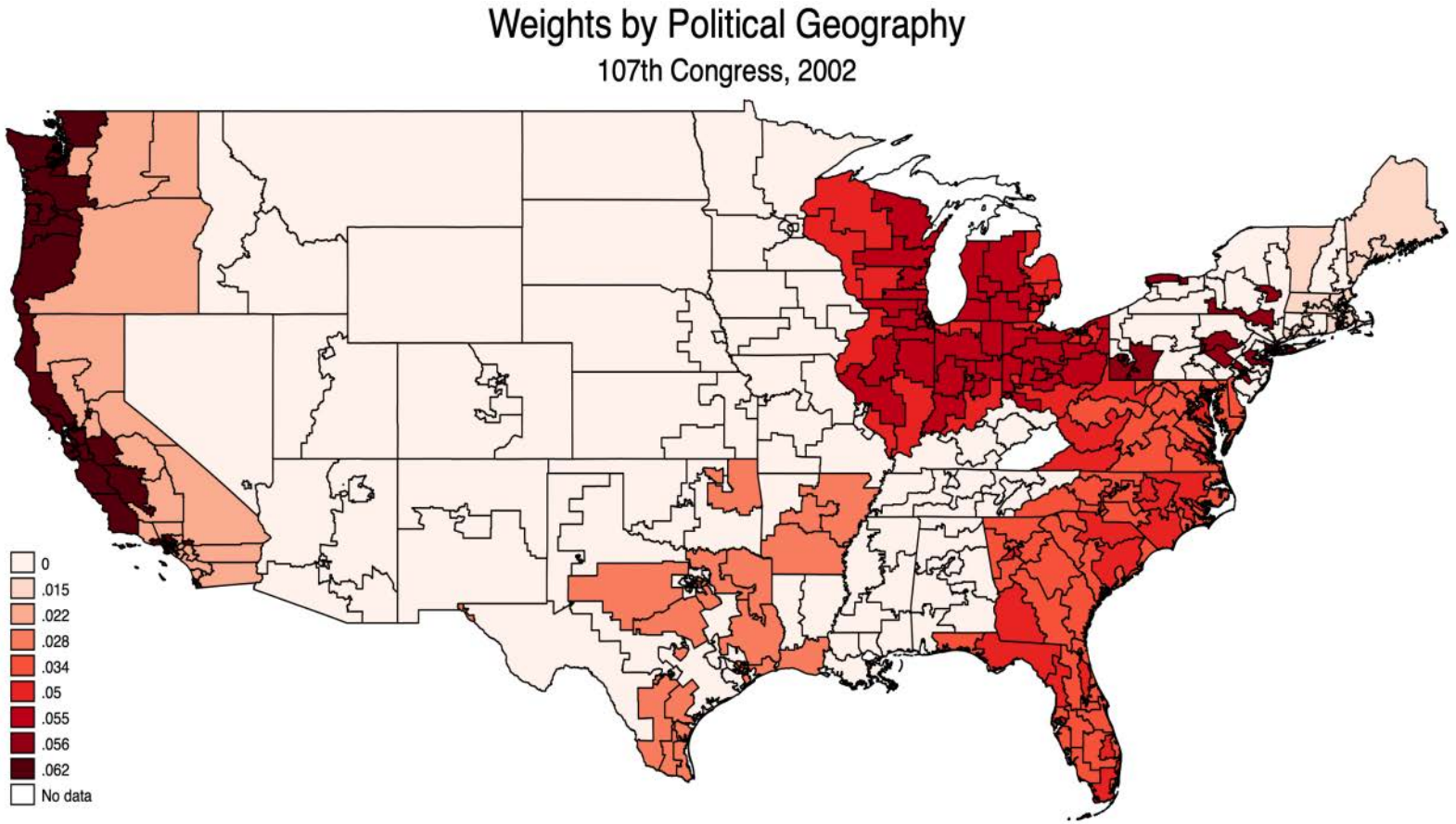
CASE 2: WEIGHTS BY PARTY & GEOGRAPHY

Estimated Weights on Specific Capital by Geography and Party

Region	Republican	Democrat
1. New England	0.000	0.015
2. Mid-Atlantic	0.000	0.056
3. East North Central	0.055	0.050
4. West North Central	0.000	0.000
5. South Atlantic	0.034	0.050
6. East South Central	0.000	0.000
7. West South Central	0.000	0.028
8. Mountain	0.000	0.000
9. Pacific	0.022	0.062
Total	0.111	0.260

Overall Weights for 433 Districts	
K-weight / total	0.371
L-weight / total	0.629
L-weight/K-weight	1.695

CASE 2: WEIGHTS BY PARTY & GEOGRAPHY



CASE 3: WEIGHTS BY ELECTORAL OUTCOMES

Regions by Political Blocs based on 2000 Elections

State-wide vote in Presidential election	House election in CD			
	Competitive	Safe Dem.	Safe Rep.	Total
Competitive	0.010	0.048	0.071	0.129
Safe Dem.	0.014	0.061	0.037	0.112
Safe Rep.	0.004	0.059	0.094	0.157
Total	0.028	0.168	0.202	0.398

Overall Weights for 433 Districts	
K-weight / total	0.398
L-weight / total	0.602
L-weight/K-weight	1.513

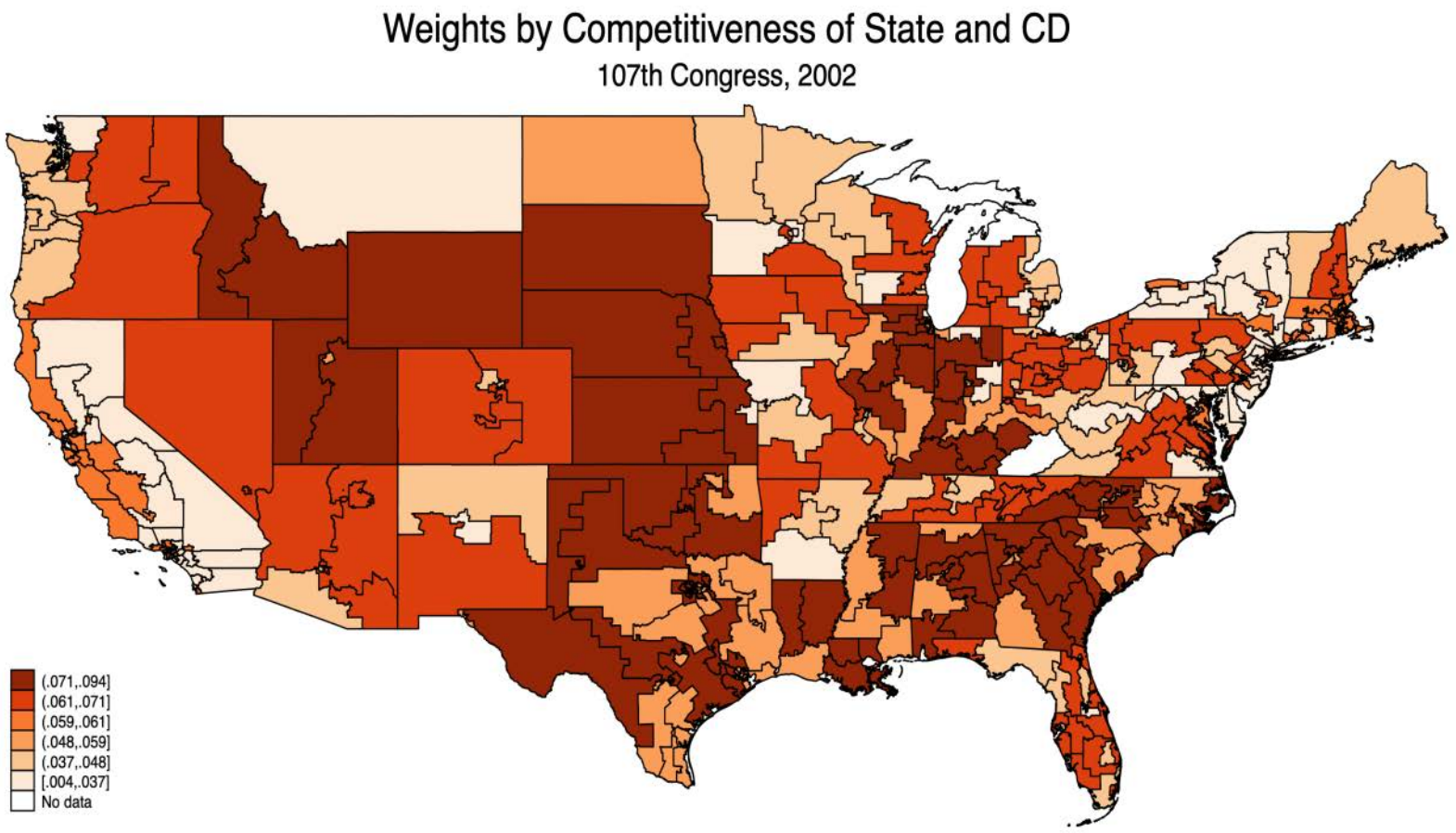
CASE 3: WEIGHTS BY ELECTORAL OUTCOMES

Regions by Political Blocs based on 2000 Elections

State-wide vote in Presidential election	House election in CD			
	Competitive	Safe Dem.	Safe Rep.	Total
Competitive	17 [.03]	17 [.16]	83 [.22]	172 [.41]
Safe Dem.	8 [.02]	75 [.16]	42 [.09]	125 [.27]
Safe Rep.	5 [.02]	51 [.11]	80 [.20]	136 [.33]
Total	30 [.07]	198 [.43]	205 [.51]	433 [1.00]

Notes: (1) Cells contain the number of districts.
(2) proportion of manufacturing workforce in brackets

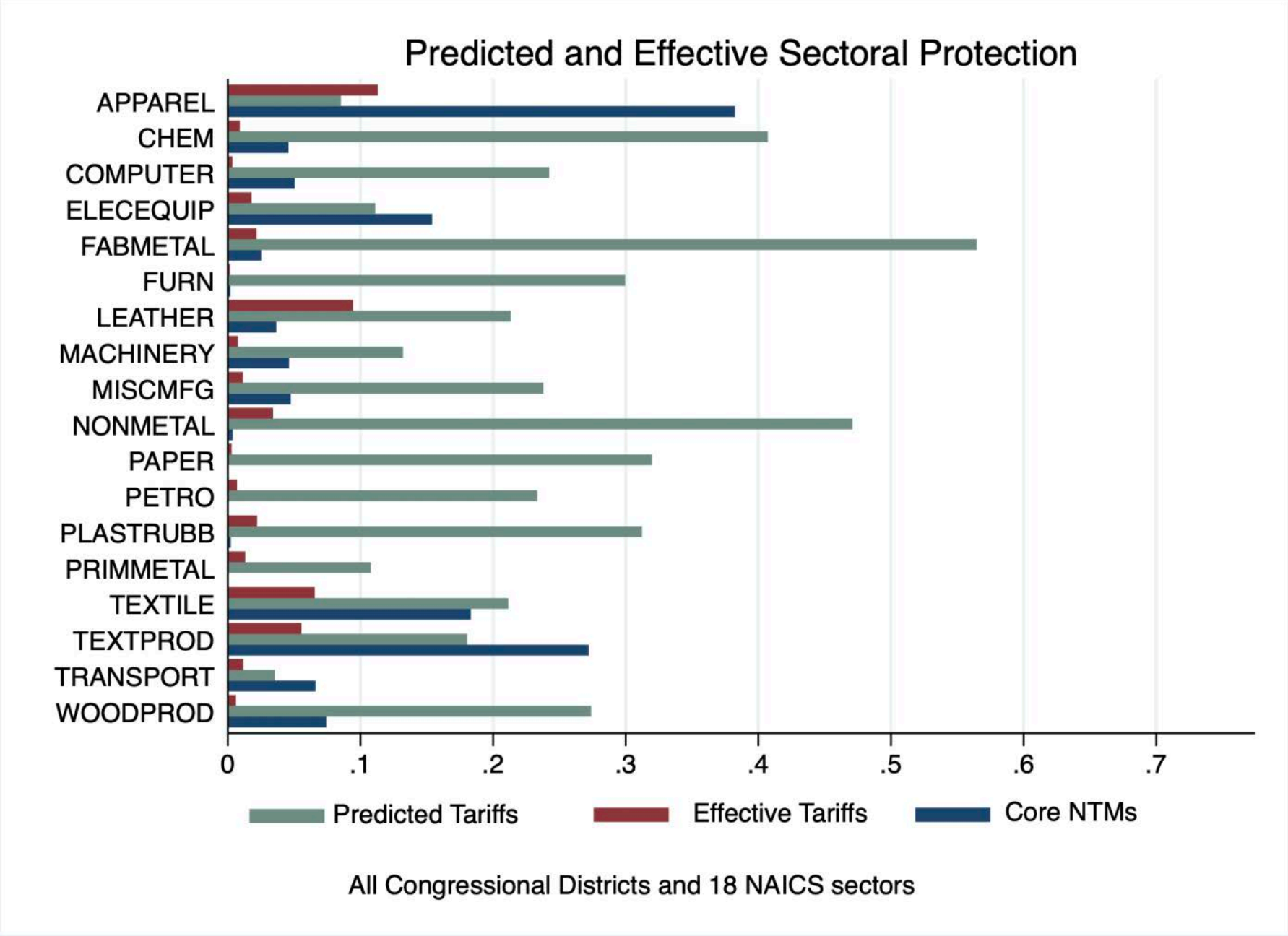
Case 3: Tariffs – Weights by Electoral Outcomes



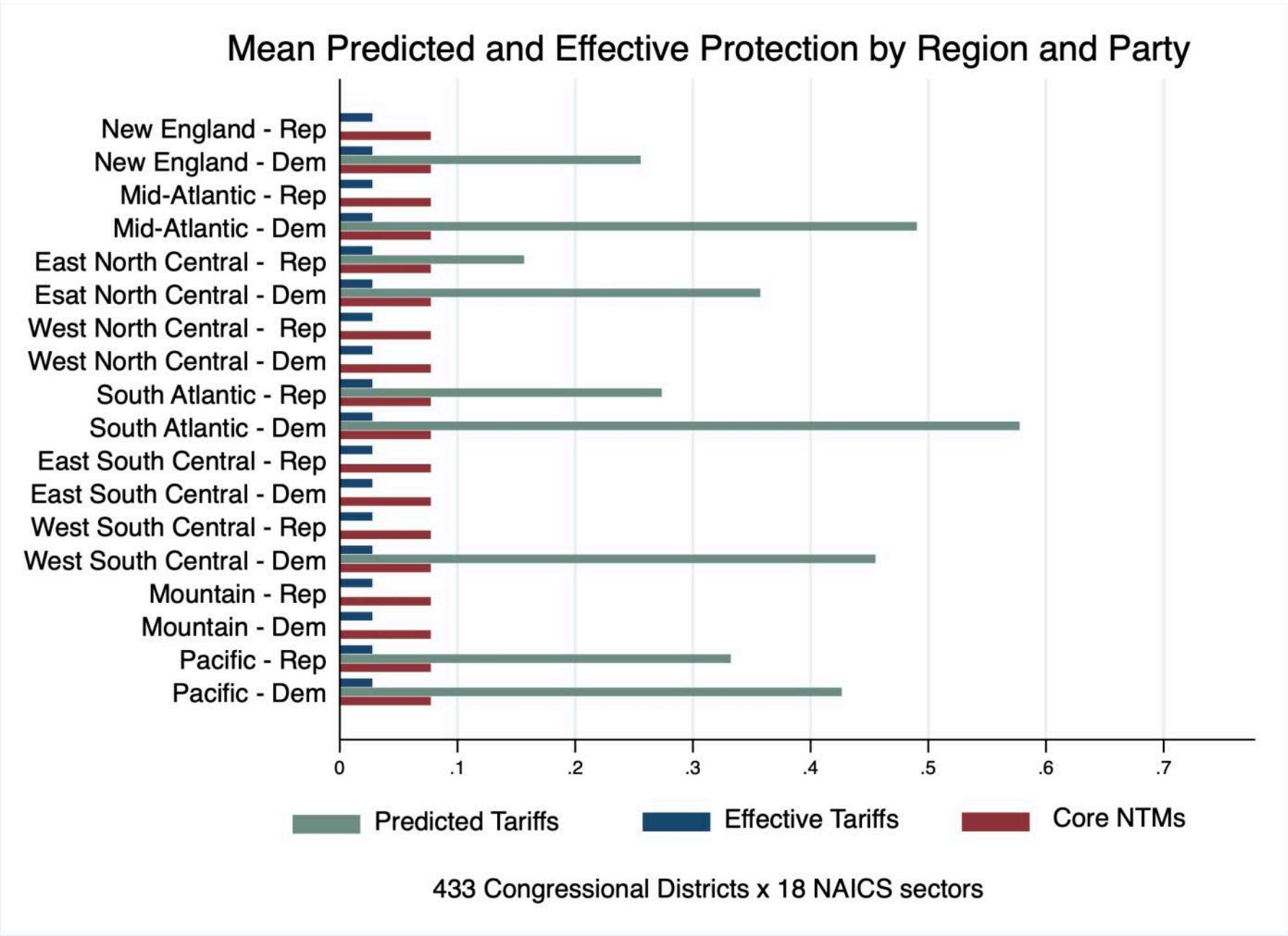
Deriving District-Specific Tariffs

- We do not observe tariffs demanded by regional representatives
- Use the parameters (weights) from the structural model to:
  - Derive the (implicit) district specific tariffs that would be demanded by a representative from a region
  - Compare with observed national tariffs (and NTMs)
- To illustrate, we present results using estimates from Case 2, where regions reflect nine geographic subdivisions and party.

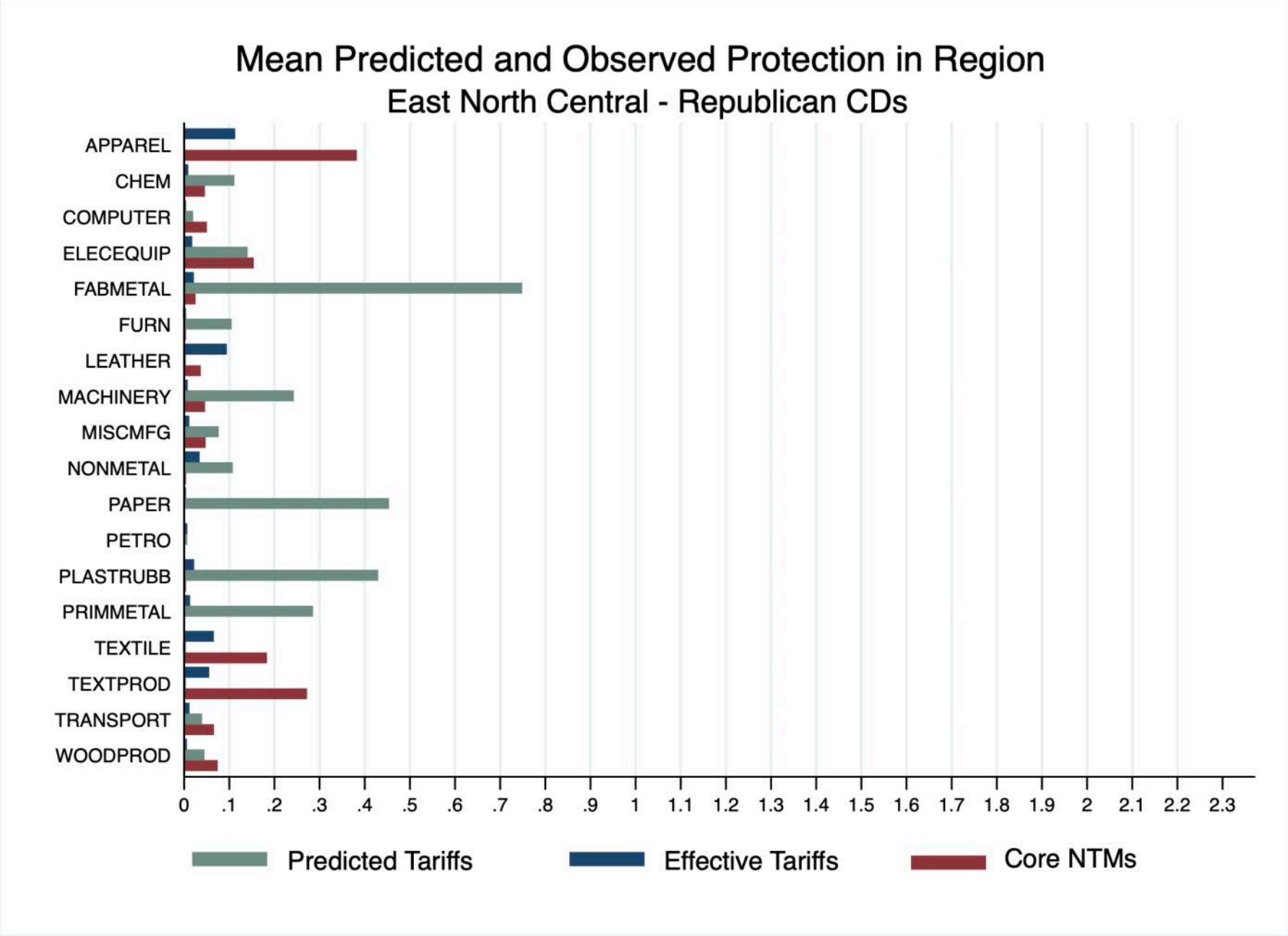
CASE 2: PROTECTION BY SECTOR



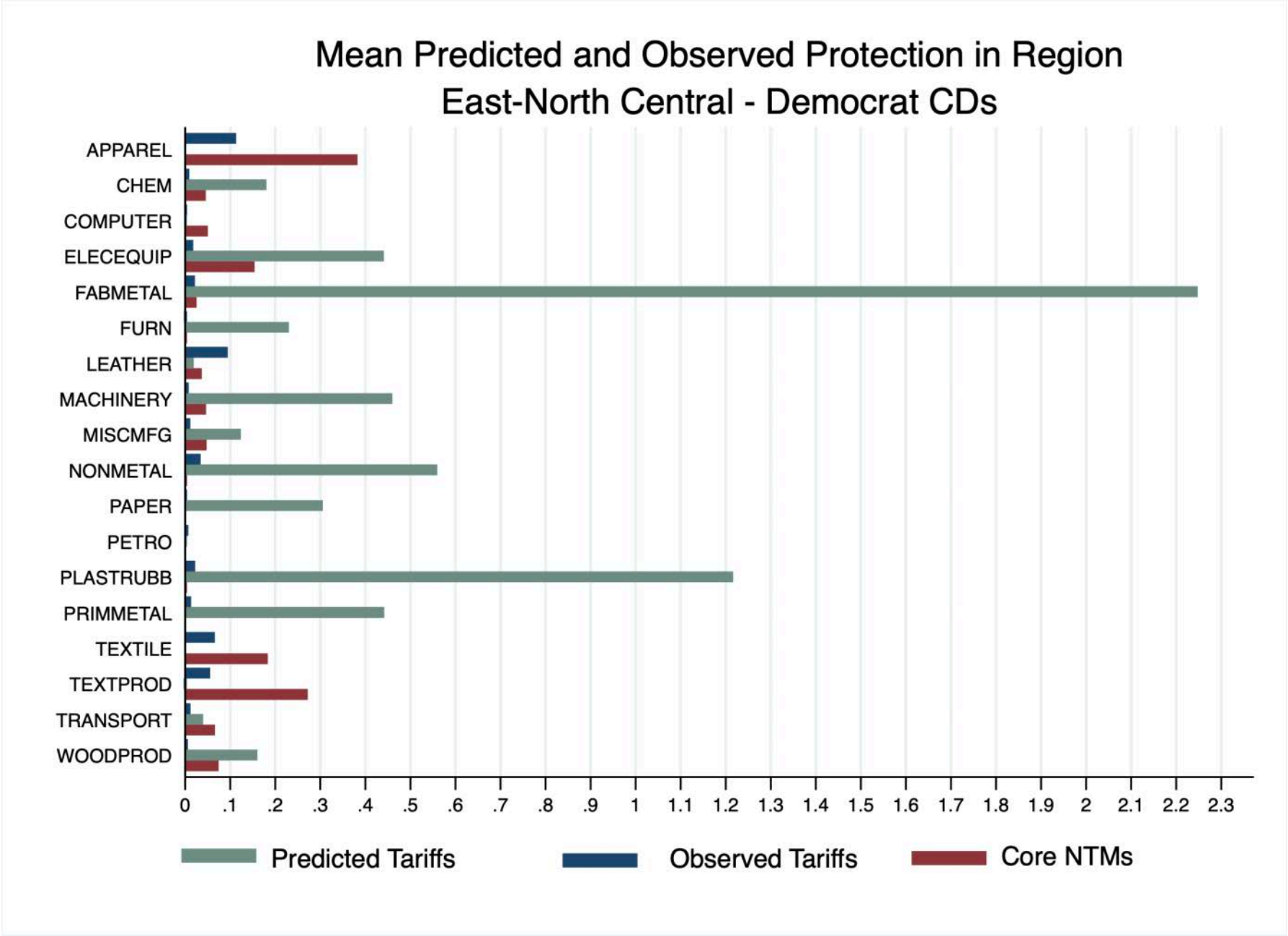
CASE 2: PROTECTION BY REGION



EXAMPLE FROM CASE 2: MIDWEST REP CDS



EXAMPLE FROM CASE 2: MIDWEST DEM CDS

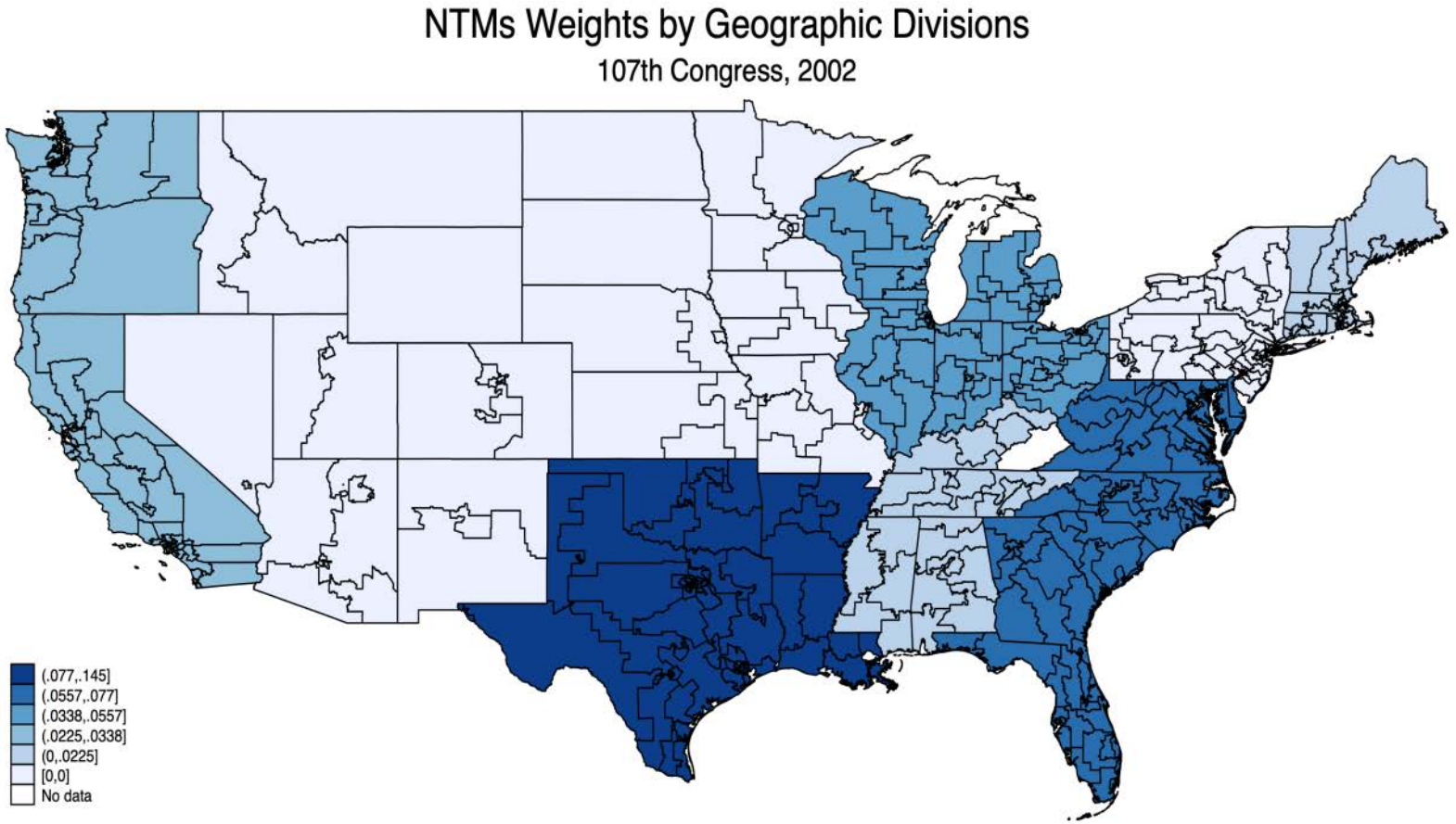


Extensions

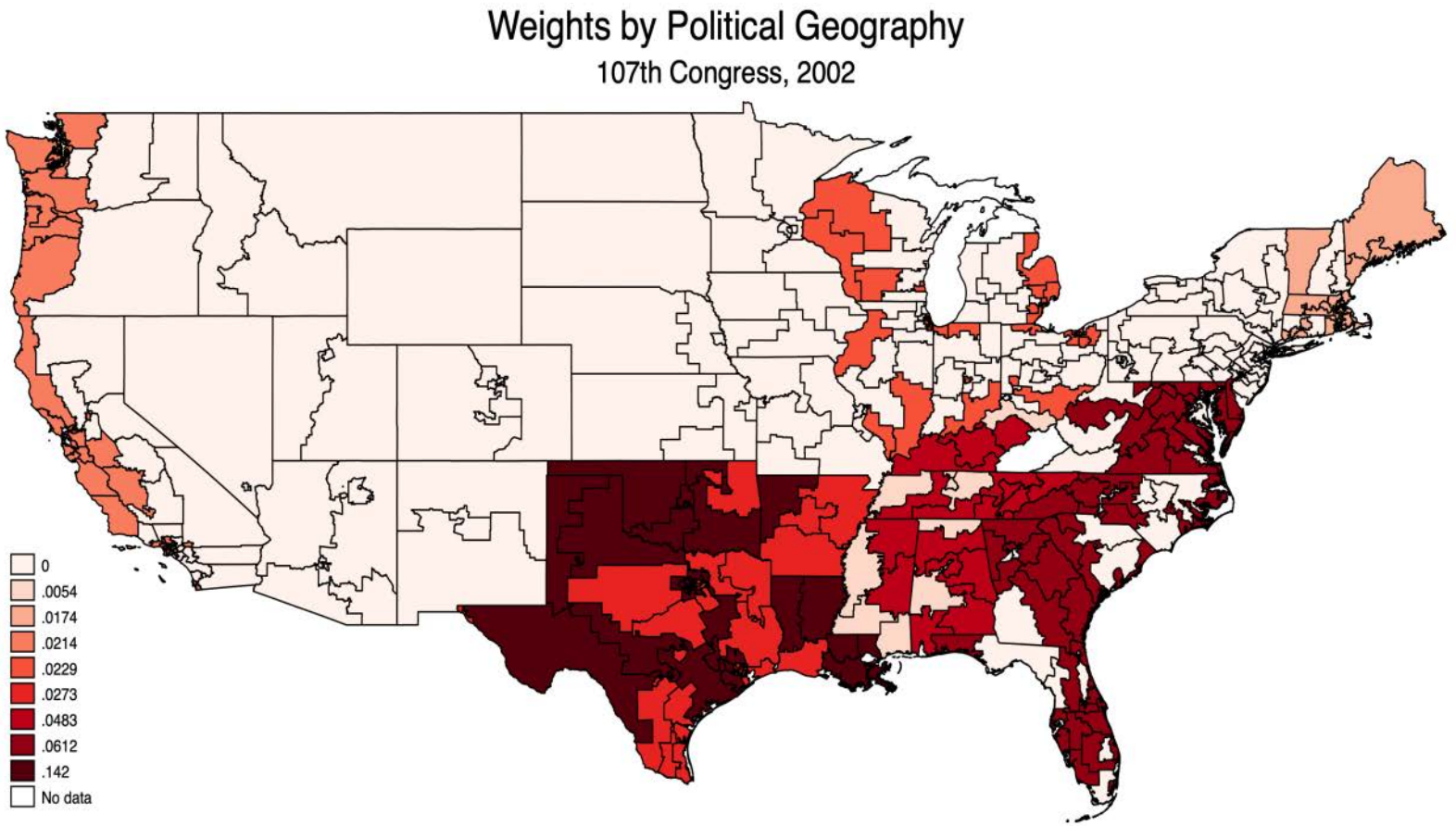
Incentives created by political dynamics on second stage

- Incentive structure varies across policy instruments
  - Tariffs are constrained by international agreements
  - NTMs enacted by delegated authority with more limited ex-post participation by Congress
  - Follow different political logic: Republican President places more weights on Republican districts

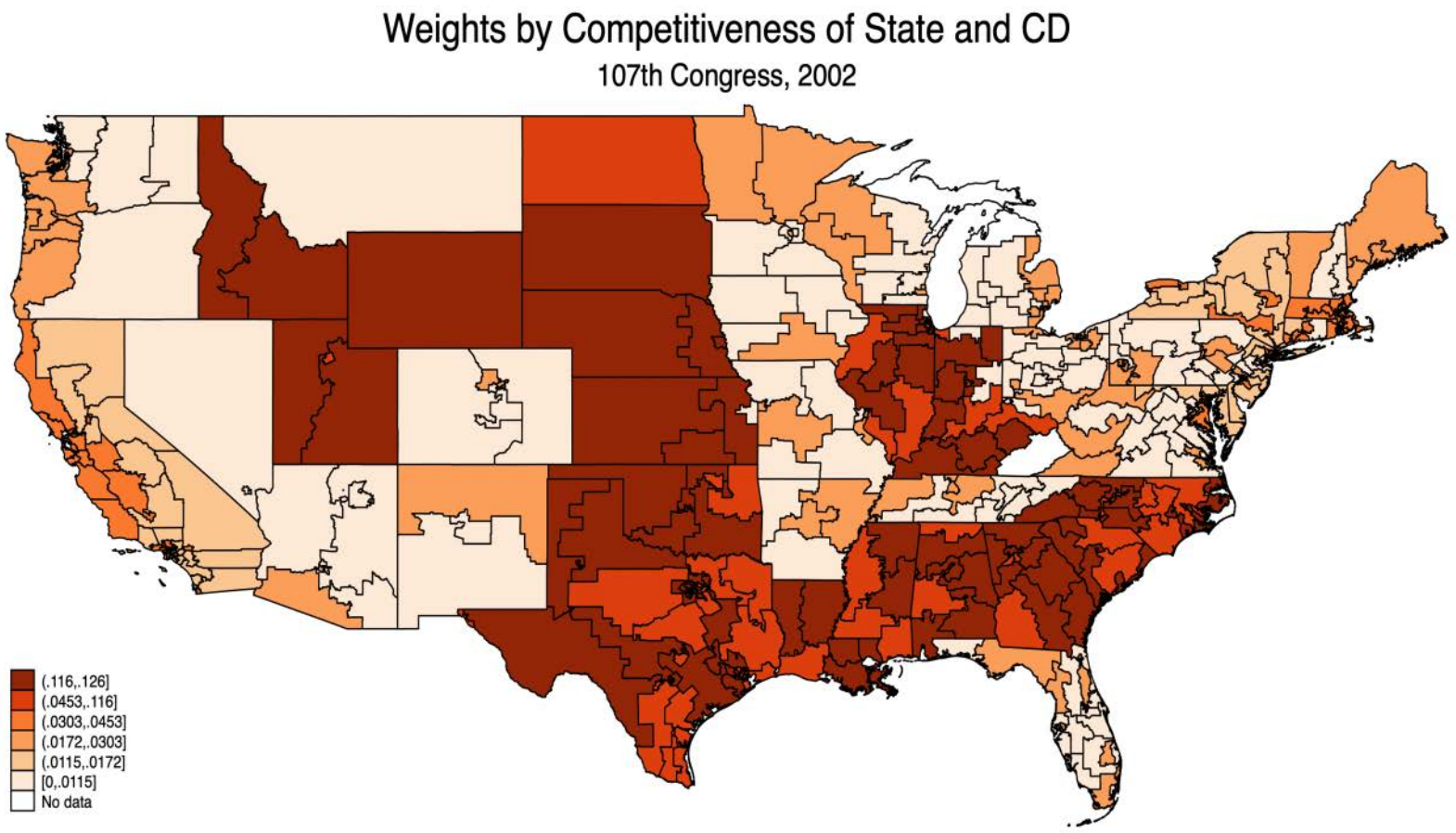
CASE 1: NTMS – WEIGHTS BY GEOGRAPHY



Case 2: NTMs – Weights by Party & Geography



Case 3: NTMs – Weights by Electoral Outcomes



Conclusion

- Results indicate that interests of labor-as-consumers matters in the determination of US tariffs and NTMs
  - The structure of protection reveals an aggregate welfare weight on special interests that is one-third the aggregate welfare weight on consumers
  - Industrial areas in Midwest are weighted more heavily, but latent demand for protection is not satisfied; could explain China-shock and party switching
- Weights on districts depend on instrument of protection: differences between tariffs and NTMs, consistent with institutional structure for enacting policies
  - Tariffs enacted by log-roll of safe CDs; marginal districts lose
  - NTMs reflect higher weights on Republican CDs: substitute for tariffs in Rep CDs, and complement tariffs in Dem CDs

Conclusion

- Structural estimation contributes to advancing theory and empirical contributions to the PE of trade
- Substantively, it allows to assess how far actual tariffs are from tariff preferences of districts
  - Help understand the political fallout from the China shock
  - Address questions such as: why did the Democratic Party, which has historically represented areas and voters hurt by trade, tended to vote for liberalization in Congress?

EXTENSIONS: LOBBYING

Incentives created by political dynamics on second stage

- Extend analysis to special interest influence and lobbying (Appendix)
  - Theoretical issues: where lobbying occurs is consequential
  - Empirical issues: estimating the model with lobbying is more intensive in data

LOBBYING

Suppose that lobbying is organized at the national level and decided by the owners of the specific factors (sectors)

- A subset of sectors $L \subset J$ are organized
- Government chooses tariff vector $\mathbf{t}$ that maximizes $a\Omega + C$

  Ω: welfare, C: campaign contributions, a: trade-off between welfare and contribution dollars (Grossman and Helpman (1994))

- Equivalent to solving the following problem:

$$\max \mathcal{U}(\mathbf{t}) = \sum_{j \in L} W_j^K + a\Omega = \sum_r \sum_{j \in L} W_{jr}^K + a \sum_r \sum_{j \in J} \sum_m \Gamma_{jr}^m W_{jr}^m,$$

- For organized sectors ($j \in L$):

$$t_j^{\mathcal{U}} = -A \frac{n}{M_j'} \left\{ \sum_r \left(\frac{\Gamma_{jr}^K n_{jr}^K}{\gamma} + \frac{n_{jr}^K}{a\gamma} \right) \frac{q_{jr}}{n_{jr}^K} - \left[\frac{\gamma^L}{\gamma} \frac{D_j^L}{n^L} + \left(\frac{\gamma^K}{\gamma} + \frac{n_j^K}{a\gamma} \right) \frac{D_j^K}{n^K} \right] + \frac{1}{A} \frac{M_j}{n} \right\}$$

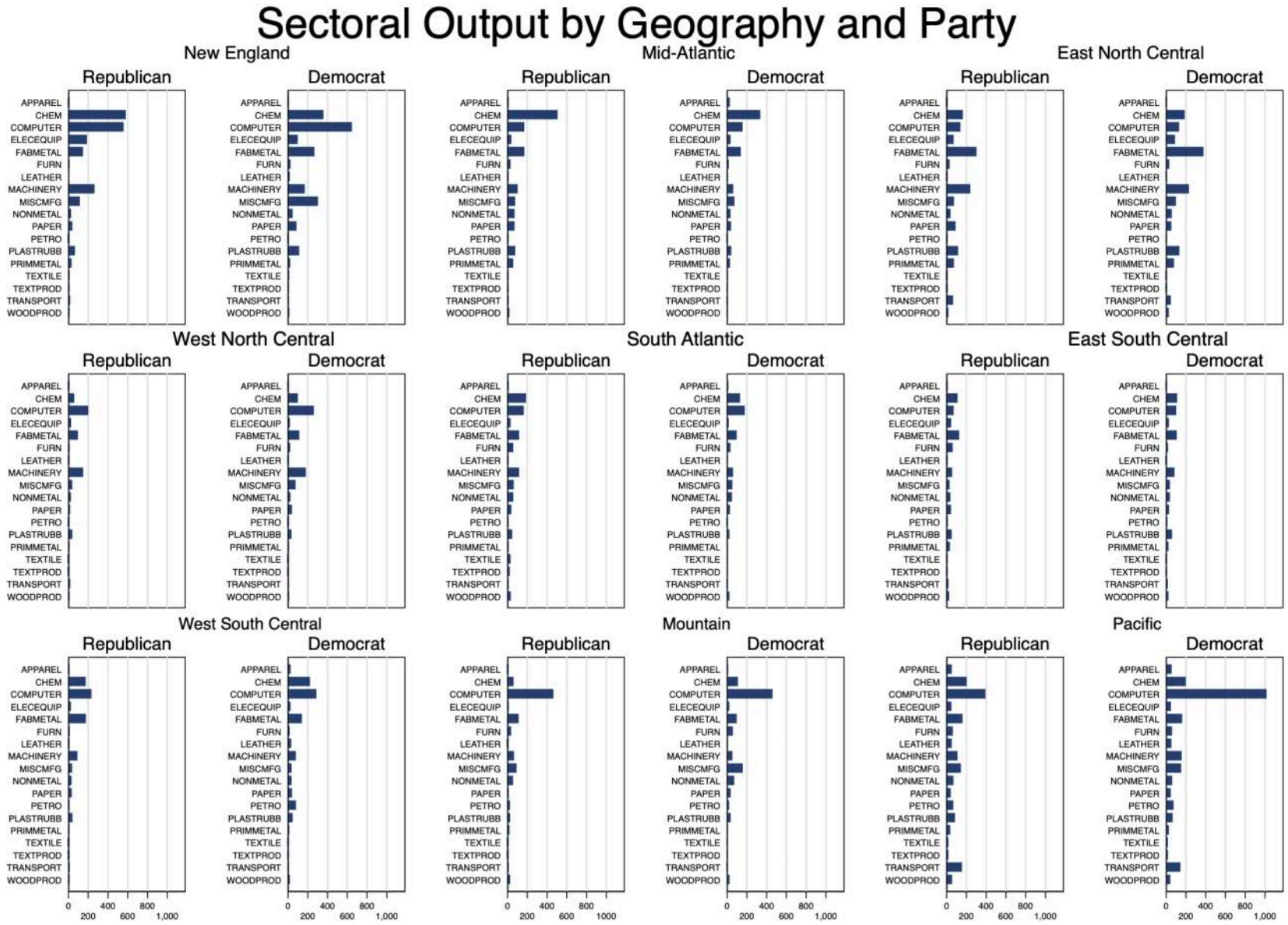
  where $A \equiv a\gamma/(a\gamma + n_j^K)$

- For sectors that are not organized ($j \in J \backslash L$), $t_j^{\mathcal{U}} = t_j^{\Omega}$ (previous eq. (2)):

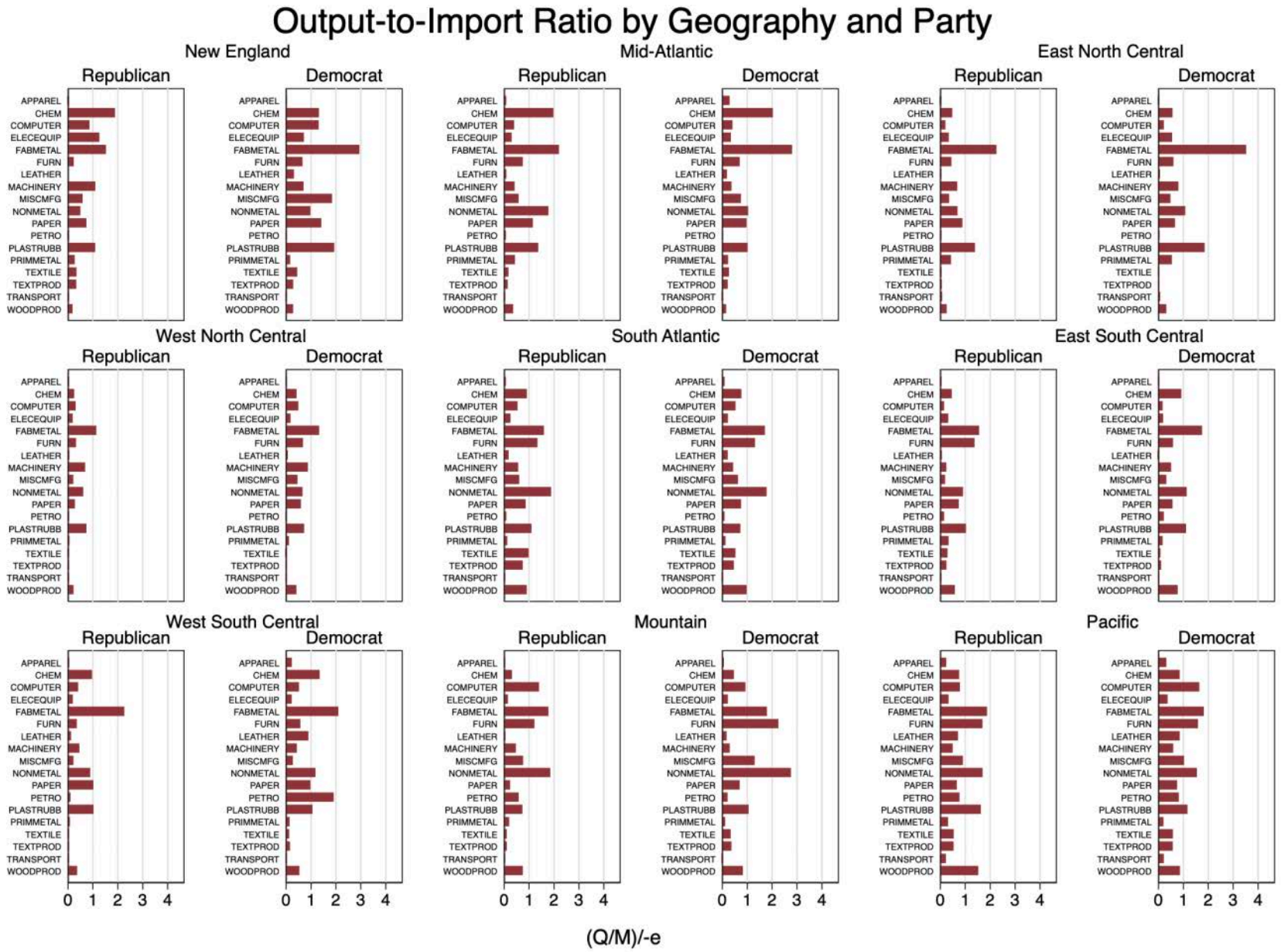
$$t_j^{\Omega} = -\frac{n}{M_j'} \left\{ \sum_r \frac{\Gamma_{jr}^K n_{jr}^K}{\gamma} \frac{q_{jr}}{n_{jr}^K} - \left[\frac{\gamma^L}{\gamma} \frac{D_j^L}{n^L} + \frac{\gamma^K}{\gamma} \frac{D_j^K}{n^K} \right] + \frac{M_j}{n} \right\}$$

Thank you!

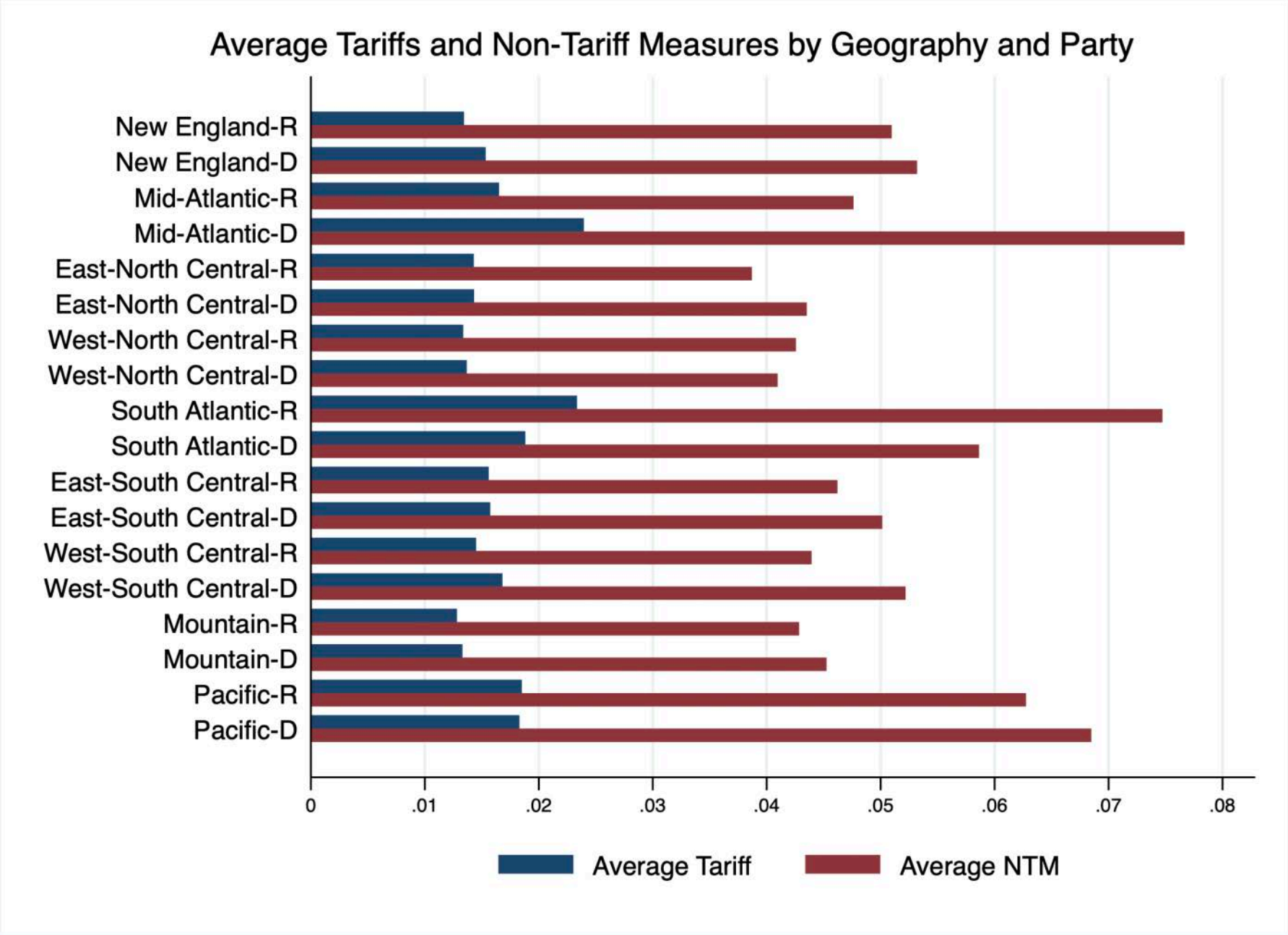
ESTIMATES FROM CASE 2: OUTPUT BY REGION



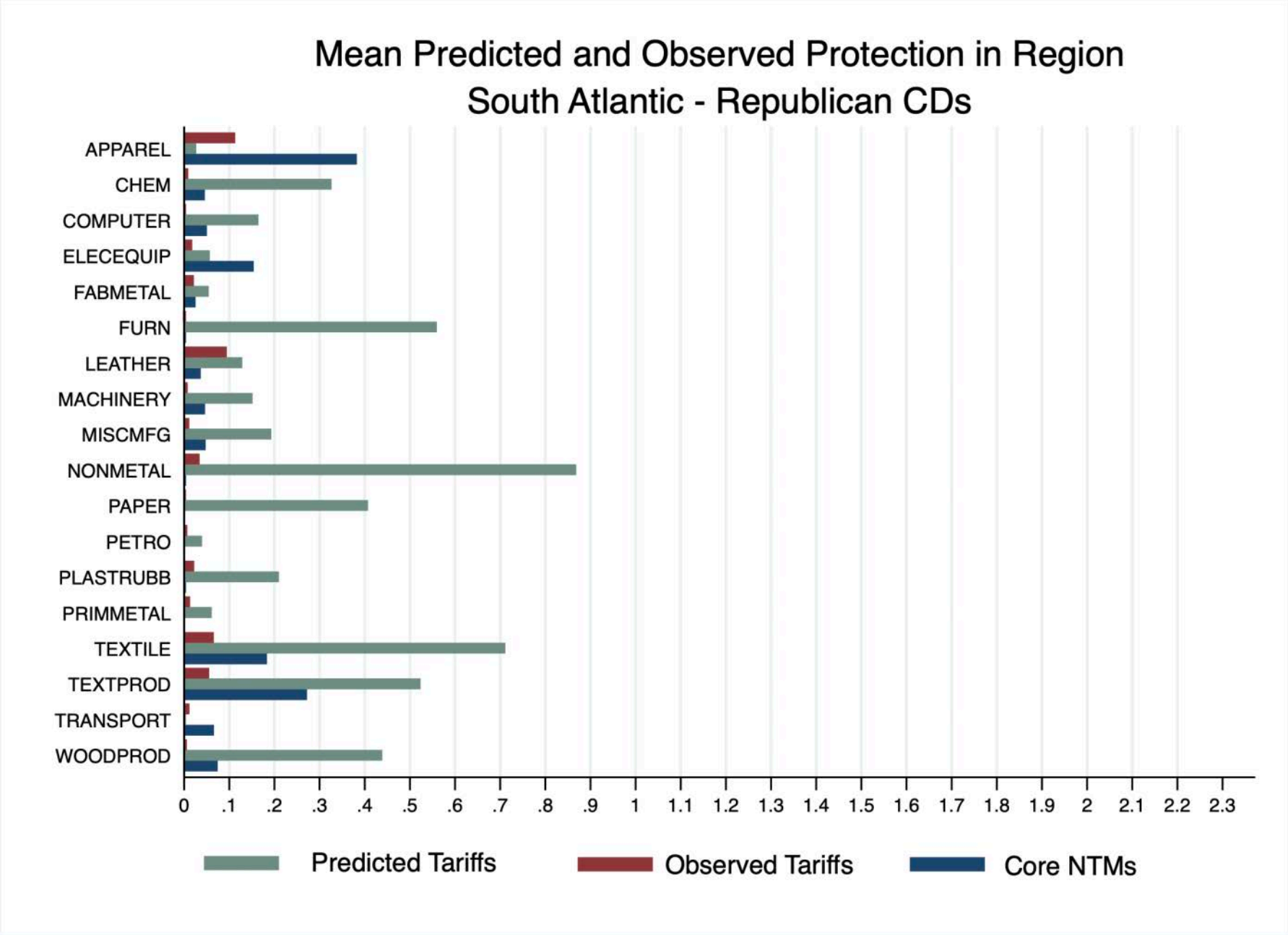
ESTIMATES FROM CASE 2: OUTPUT/IMPORT



Estimates from Case 2: Tariffs and NTMs



ESTIMATES FROM CASE 2: SOUTH ATLANTIC - REP



ESTIMATES FROM CASE 2: SOUTH ATLANTIC - DEM