Globalization, Trade Imbalances and Labor Market Adjustment

Preliminary

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Globalization and Imbalances

1. Public concern that globalization and trade deficits are detrimental to workers (e.g., wages and employment)
   - Robust evidence in diffs-in-diffs studies (ADH, Pierce & Schott, Dix Carneiro & Kovak)
   - Trump initiative to close deficit by 100 billion
2. The U.S. has run an increasingly large and persistent trade deficit over the past 30 years—two shocks of globalization
3. Trade economists ignore imbalances adjustment when studying labor market outcomes

This paper: try to understand the dynamic effects of globalization by modeling how deficits can amplify distributional consequences of trade.

Question and Approach

Concretely we want to...

i. Build a model to endogenize imbalances in a model that can speak to the distributional consequences of trade.

ii. Understand the role of trade imbalances in preventing dislocated workers from being reabsorbed

iii. Quantify the consequences of policies aimed at closing trade imbalances.

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What we do...

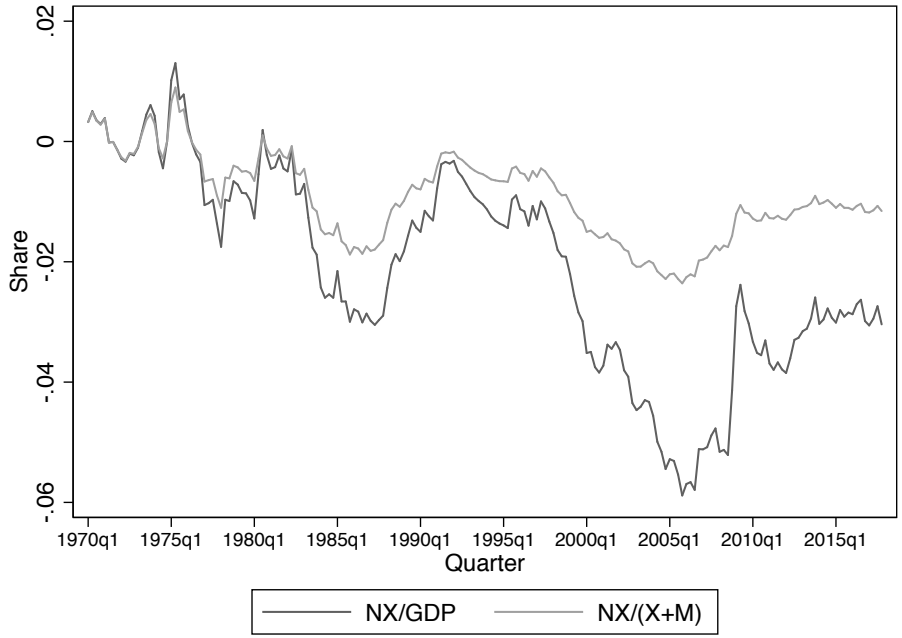
Write down a structural model of international trade with 3 key ingredients:

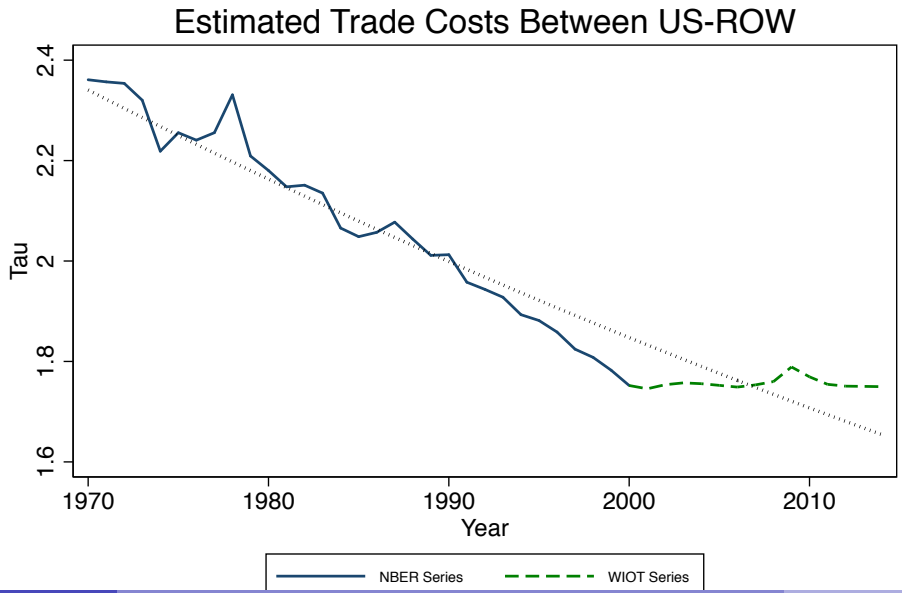
i. Rep. household consumption-saving decisions in each country
ii. Costly reallocation of workers across sectors
iii. Matching frictions in segmented labor markets

Brief Literature Review

- **Trade and Imbalances**
  - Alessandria, Choi (2017), Dekle, Eaton, Kortum (2008), Reyes-Heroles (2016), Ravikumar, Santacreu, Sposi (2016)
- **Trade and Labor Market Dyanamics**
  - Artuç, Chadhuri, McLaren (2010), Cosar, Guner, Tybout (2016), Caliendo, Dworkin, Parro (2019), Dix Carneiro (2014), Traiberman (2019)
  - Autor, Dorn, Hanson and Song (2014), Seddon & Wacziarg (2004)
- **Imbalances and Labor Market Changes**
  - Kehoe, Ruhl, Steinberg (2017), Reyes-Heroles (2018), Lyon and Waugh (2019)

Trade Liberalization and Large Deficits





Key Mechanism in the Model

Industry Level Labor Allocation with Imbalances

- In any equilibrium, labor demand equals labor supply in each sector:

$$w^i_{jt} L^i_{jt}(1 - u_{jt}) = E^i_{jt} + NX^i_{jt}$$

  where NX^i_{jt} is industry-level net exports

- Converting to shares yields:

$$l^i_{jt}(1 - u_{jt})\omega^i_{jt} \approx \alpha^i_j(1 - nx_t) + nx^i_{jt}$$

  - Shocks to nx_t must show up in one piece on the LHS: w, u, L
  - Labor market frictions determine which pieces move
  - We build a quantitative model to decompose along each piece

Model Environment

The World

- There are $i \in \{1, ..., I\}$ countries
- Transporting goods across space entails iceberg trade costs

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- Representative family$\Rightarrow$ collective savings
- Workers choose to work in $j \in \{1, ..., J\}$ sectors
- Switching sectors incurs uninsurable costs

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- Every sector has continuum of varieties, ω
- Free entry into varieties/sectors
- After paying entry cost, firms receive idiosyncratic productivity

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Markets

- **Labor Market** features matching frictions + bargaining
- **Goods Market** is competitive
- **Bonds Market** is one-period, non-contingent bonds

Household: Family Utility Function

- Mass N_t^i of workers/consumers organize into families
  - Income is pooled and consumption is constant
  - Labor market frictions are *technological*—family obeys them
- Family in country i maximizes the objective function:

$$\max_{\{C_t, L_t\}} \quad \sum_{t=0}^{\infty} \delta^t \log C_t$$

$$\text{subj. to} \quad P_t C_t + B_{t+1}^i = \sum_{j=1}^{J} E(w_{jt}) L_{jt} + R_t B_t^i$$

$$\text{Labor Market Frictions}, \{L_{0j}, B_{0j}\}$$

Household: Final Goods Demand

- J tradable sectors comprised of a continuum of varieties, $\omega \in [0, 1]$
  - Within-sector demand is CES across varieties leading to standard demand functions:

$$c_{jt}^{i}(\omega) = Q_{jt}^{i}\left(\frac{p_{jt}^{i}(\omega)}{P_{jt}^{i}}\right)^{-\eta}$$

- H is services—another sector with $\tau = \infty$
- Consumers have Cobb-Douglass preferences over industries so that:

$$\begin{aligned} Q_{jt}^{i} P_{jt}^{i} &= \alpha_{j}^{i} E_{t}^{i} \\ H_{t}^{i} &= \alpha_{H}^{i} E_{t}^{i} \end{aligned}$$

Household: Bond Markets and the Euler Equation

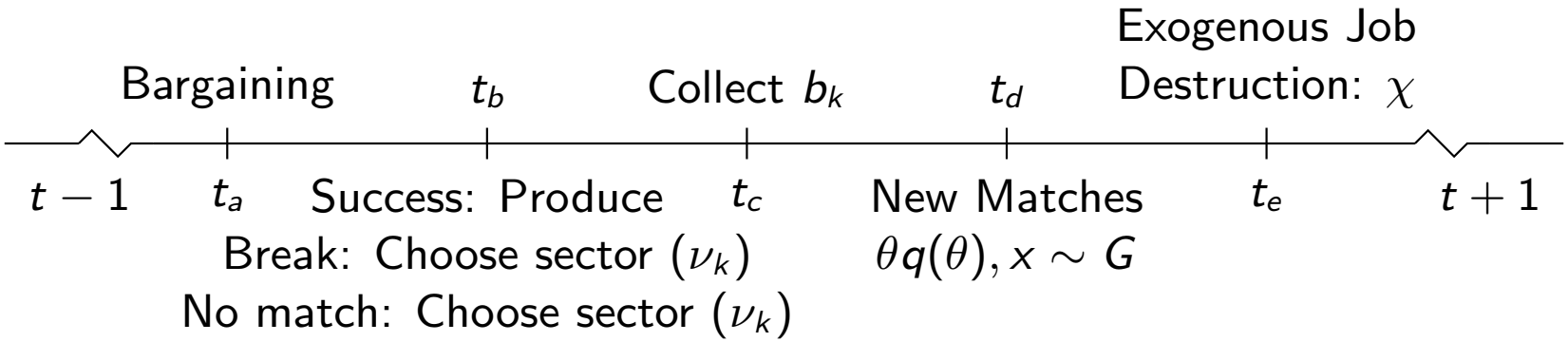
- Household buys and sells one-period riskless bonds
  - Bonds with face value B_{t+1}^i delivers a *bundle* of tradable goods
  - EE:

$$\frac{u'\left(c_i^t\right)}{L_i^t} = \widetilde{\delta}_t^i \frac{u'\left(c_i^{t+1}\right)}{L_i^{t+1}} \frac{R^{t+1}}{P_i^{t+1}/P_i^t}.$$

  - Trade impacts deficits through P and savings shocks effects trade through δ_t^i shocks

- What determines the CA?
  - Differences in initial allocation of assets as in Caliendo, Dworkin and Parro (2018)
  - Changes in trade costs as in Reyes-Heroles (2016)
  - Changes in foreign demand for savings as in Kehoe, Ruhl and Steinberg (2016) [Savings glut; world aging]
  - Reallocation can change income (and income trajectory)

Timing in the Labor Market



- At the beginning of the period: matched workers produce, unemployed workers consume home production
- Unemployed workers draw new matches
- Death shocks realized
- Newly and continuing employed can pay to switch sectors

Firms: Entry

- Unlimited mass of potential entrants pays κ_j^i to operate in sector j in country i
- Matching is random and occurs with probability $q(\theta)$
  - θ is labor market tightness—ratio of vacancies to unemployed
  - Firms match with *one* worker max
- Upon matching, firms and workers draw initial productivity $x \sim G(x)$
- Value function for a potential entrant:

$$V = -\frac{\kappa pz}{P} + \delta \left[q(\theta) \int_{\bar{x}}^{\infty} J(s) dG(s) + (1 - q(\theta)(1 - G(\bar{x}))) \max\{0, V\} \right]$$

  - δ is $\tilde{\delta}$ titled by $(u'_t/p_t)/u'_{t+1}/p_{t+1})$.
  - J is value function of operating firm (next)
  - Cutoff rule is optimal
  - **Free Entry Condition:** Entry pushes *ex-ante* profits to 0

Firms: Production

- Every firm has access to variety level productivity:

$$z_j(\omega) \sim Frechet(\lambda)$$

- Production is linear in variety level and match productivity:

$$Y_{\omega_j}(x) = z_j(\omega)x$$

- Productivity is constant, but death occurs with prob χ
- Value function for a firm:

$$J(x) = \frac{px - w(x)}{P} + \delta\left[(1-\chi)J(x) + \chi \times 0\right]$$

Value of Unemployment

For unemployed workers at start of period:

$$U_k = E\left(\max_{k'} \left\{ -C_{kk'} + \varepsilon_{k'} + b_{k'} + \delta\theta_{k'} q(\theta_{k'})(1-\chi_{k'}) \int_{\bar{x}_{k'}}^{\infty} [W_{k'}(s) - U_{k'}] dG(s) + \delta U_{k'} \right\} \right)$$

- If $\theta q(\theta) = 0$ and reinterpret b_j as wage, this is ACM
- With only one sector, this is Pissarides, Chapter 2

Employed Workers

- Free entry into varieties $\Rightarrow$ wages equalized within sector across varieties—only x matters
- Value function for employed in j:

$$W_j(x) = \frac{w_j(x)}{P} + \delta\left[(1-\chi)W(x) + \chi U_j\right]$$

- Wages are determined by period Nash Bargaining:

$$W(x) - U = \beta\left(W(x) + J(x) - V - U\right)$$

Job Creation and Destruction

Job Creation:

$$JC^i_{jt} = L^i_j u^i_j \times \theta^i_{jt} q(\theta^i_{jt})$$

Job Destruction:

$$JD_{it^i} = L^i_{jt}(1 - u^i_{jt}) \times \left(\underbrace{\chi}_{\text{Exog.}} + \underbrace{\max\left\{ G(\bar{x}^i_{jt+1}) - G(\bar{x}^i_{jt}), 0 \right\}}_{\text{Endog.}} \right)$$

- Melitz-style firm reallocation impacts both JC/JD:
  1. Entry channel $\Rightarrow$ shifts in θ
  2. Exit channel $\Rightarrow$ job destruction

Model: Prices, Production, and Trade

- Free mobility and entry across varieties $\Rightarrow p_j(\omega)z_j(\omega) = p'_j(\omega)z'_j(\omega)$
  - Why? If not, firms in j would only post for variety offering highest expected revenue until all equalized. Proof details in paper.
  - Denote $\tilde{w}_j = p_j(\omega)z_j(\omega)$
- By perfect competition price of variety ω of sector j from h to i given by:

$$p_j^{ih}(\omega) = p_j^{ih}(\omega)\tau_j^{ih} = \frac{\tilde{w}_{i,j}}{z_j^i(\omega)}\tau_j^{ih}$$

  - Clearly $\tilde{w}_{i,j}$ is equivalent of unit cost in EK!
- Bring in trade as in EK (and let prices move over time) so the price paid in i is given by:

$$p_{jt}^i(\omega) = \min_{h=1,\ldots,I}\left\{\frac{\tau_{jt}^{ih}\tilde{w}_{jt}^h}{z_{jt}^h(\omega)}\right\}$$

  - All aggregate trade patterns and prices are *exactly* as in EK

Equilibrium

A steady state equilibrium is a vector of prices, $\{\tilde{w}_j^i\}$, labor allocations, $\{L_j^i, u_j^i\}$, outputs, $\{Y_j^i\}$, transition rates across sectors, $\mathbf{S}^i$, wage policies, $\{w_j^i(x)\}$ and policy rules for firms and workers, $\{\bar{x}_j^i\}$ such that:

1. The policy rules solve workers and firms' Bellman equations
   - **FEC:** $V_j = 0$
   - **Worker/Firm Indifference:** $W_j(\bar{x}_j^i) = U_j, J(\bar{x}_j^i) = 0$
2. Net zero job creation: $JC_j^i = JD_j^i$
3. Transitions are stationary: L_j^i/L^i solves unit eigenvalue of $\mathbf{S}^i$
4. Wages solve the Nash Bargaining problem
5. Labor Markets Clear: $Y_j^i = L_j^i(1 - u_j^i)E(w_j^i(x)|x > \bar{x}_j^i)$
6. Goods Markets Clear: Standard EK market clearing
7. Bonds Markets Clear: $\sum_i B^i = 0$

Steady State

- Key insight: $\tilde{w}_{ij}$ acts like prices in country i, industry j *and* determines wage schedule
  - $\tilde{w} = \beta \times dw(x)/dx$
  - Implies $w(x), J(x)$ and $W(x)$ are linear function.
- Key equations for steady state labor block:
  - FEC: $\kappa \tilde{w}/P = \delta q(\theta) \int_{\bar{x}}^{\infty} J(s) dG(s)$
  - Outside option Bellman Equation:

$$\Omega_i = \log\left(\sum_k \exp\left\{\frac{-C_{ik} + \delta U_i - \delta U_k}{\zeta}\right\}\right)$$

$$U_i = b + \left(1 - \theta_i q_i\left(\theta_i\right)\left(1 - G(\bar{x}_i)\right)\right)\Omega_{k,i} + \delta\theta q_i\left(\theta_i\right)\beta_k \frac{\tilde{w}_i}{P}\left(\int (s - \bar{x}) dG(s)\right) + \delta U_i$$

  - Worker indifference condition: $W(\bar{x}) = U$
- Trade block = Gravity
- Intertemporal block = Standard Euler Equation

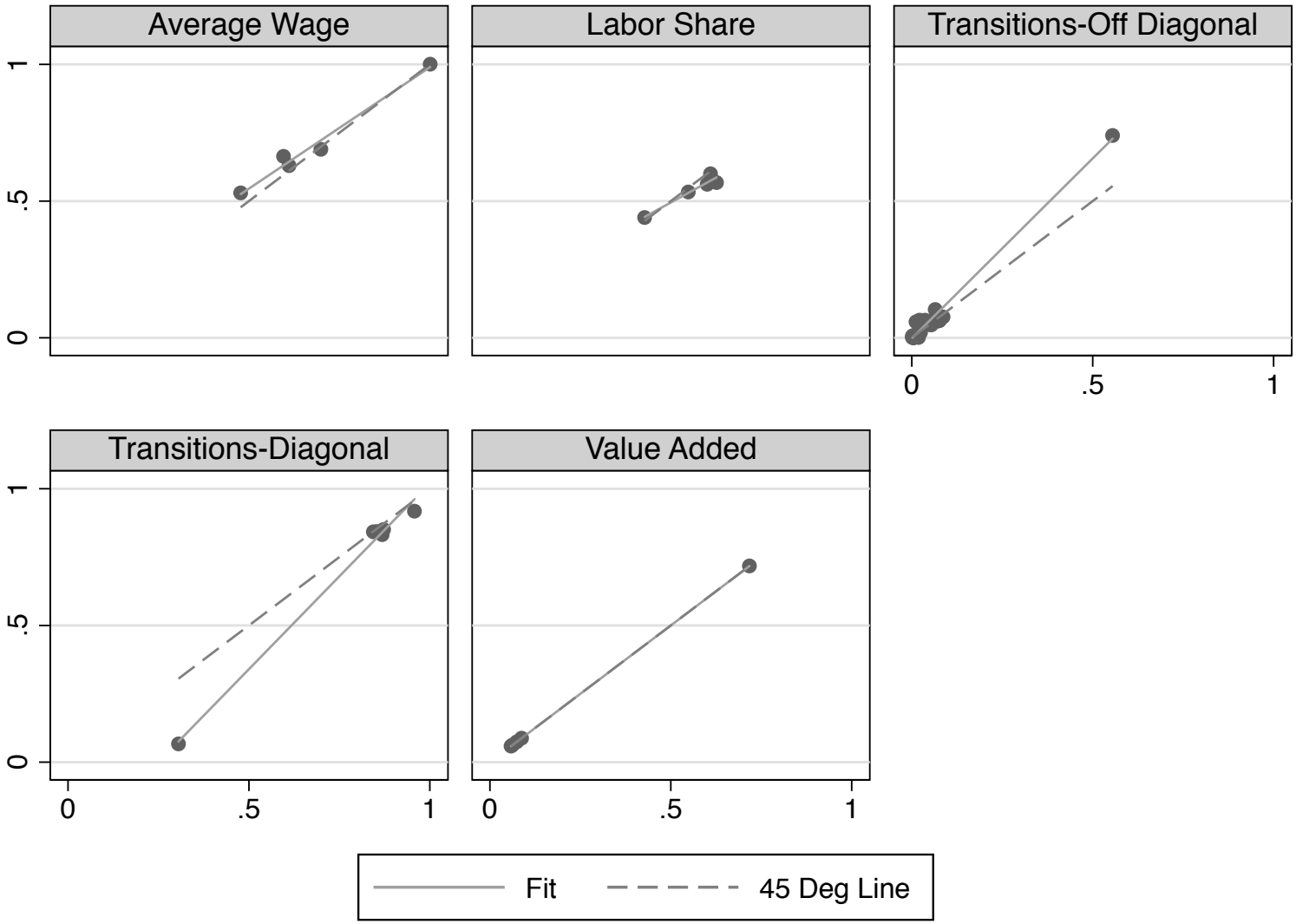
Calibration + Estimation

- Labor and final goods demand from WIOD
- We use standard numbers from the literature for trade elasticities:
  - $\theta = 4$ in all sectors (for now)
- From the trade model one can solve for:
  - Path of labor demand $\Rightarrow$ path of wages
  - Path of productivities
  - Path of trade shocks
- We observe transition rates across sectors from CPS
  - We assume relative costs of sectoral reallocation are the same across countries, but allow country-specific shifters
  - Switching cost levels pin down wage dispersion
- CPS + EU Klems gives us additional moments for matching model:
  - Labor share in GDP
  - Unemployment rate
  - Sectoral allocations
- We calibrate matching elasticity from common estimates in literature, $q(\theta) = m\theta^{1/3}$.

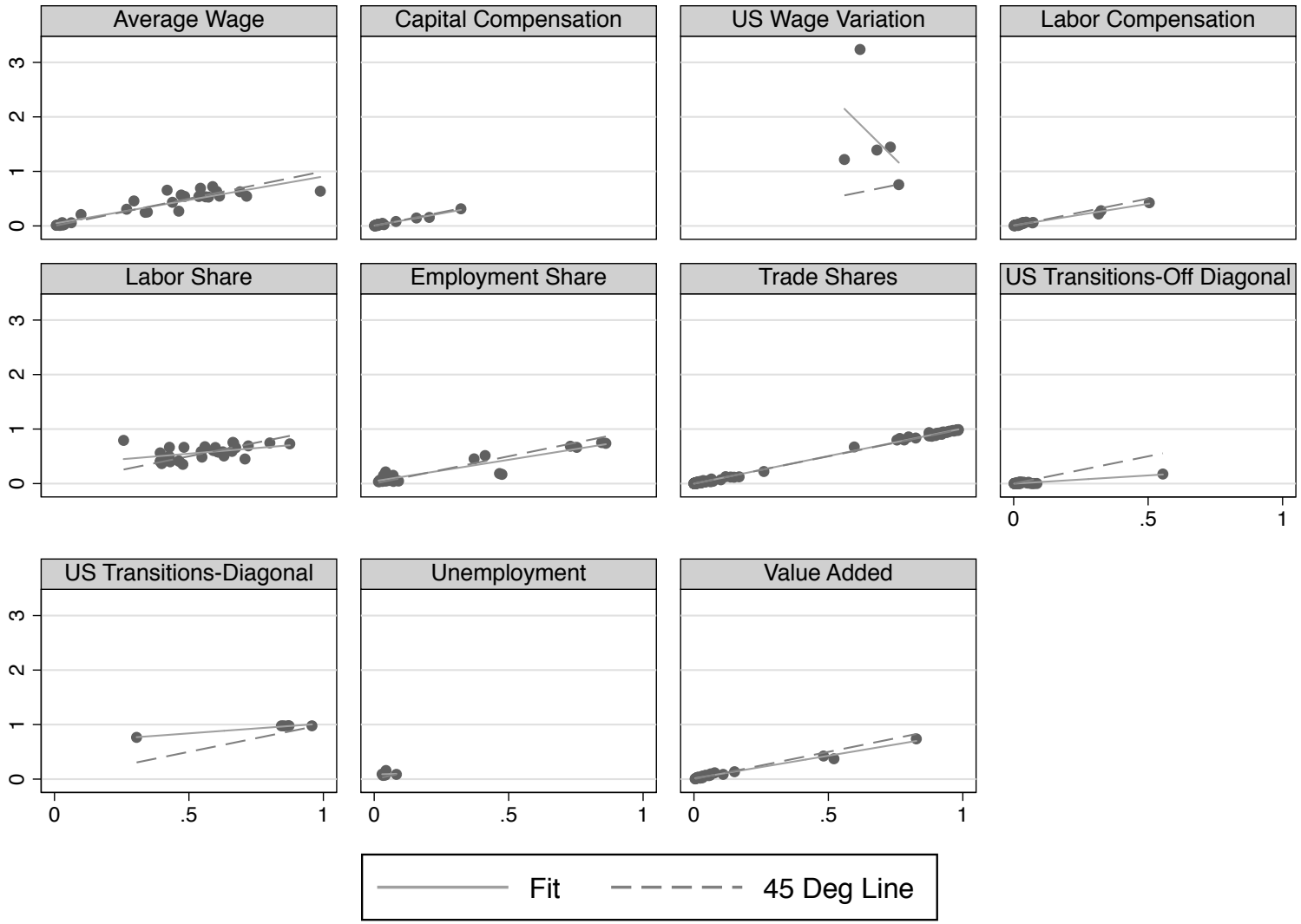
Solving the Model

- The steady state has a block recursive structure conditional on NX:
  - Given a guess of L and $\bar{x}$ (quantities)...
  - Solve for θ
  - Solve EK as an inner loop for prices/wages
  - Solve Bellman equations for U, V
  - Update $\bar{x}$ using $W(\bar{x}) = U$ and L using invariant distribution of transition matrix, Π
- Transition dynamics given initial equilibrium:
  - Three loops:
    1. Outer: Guess $\{NX_t\}$
    2. Inner 1: Given NX_T, solve terminal SS
    3. Inner 2: Shooting algorithm on the path of labor allocations
    4. Update NX using computed income/consumption allocations + Euler Equation
- So far we have calibrated steady state in 2000

Closed Economy Fit



Open Economy Fit



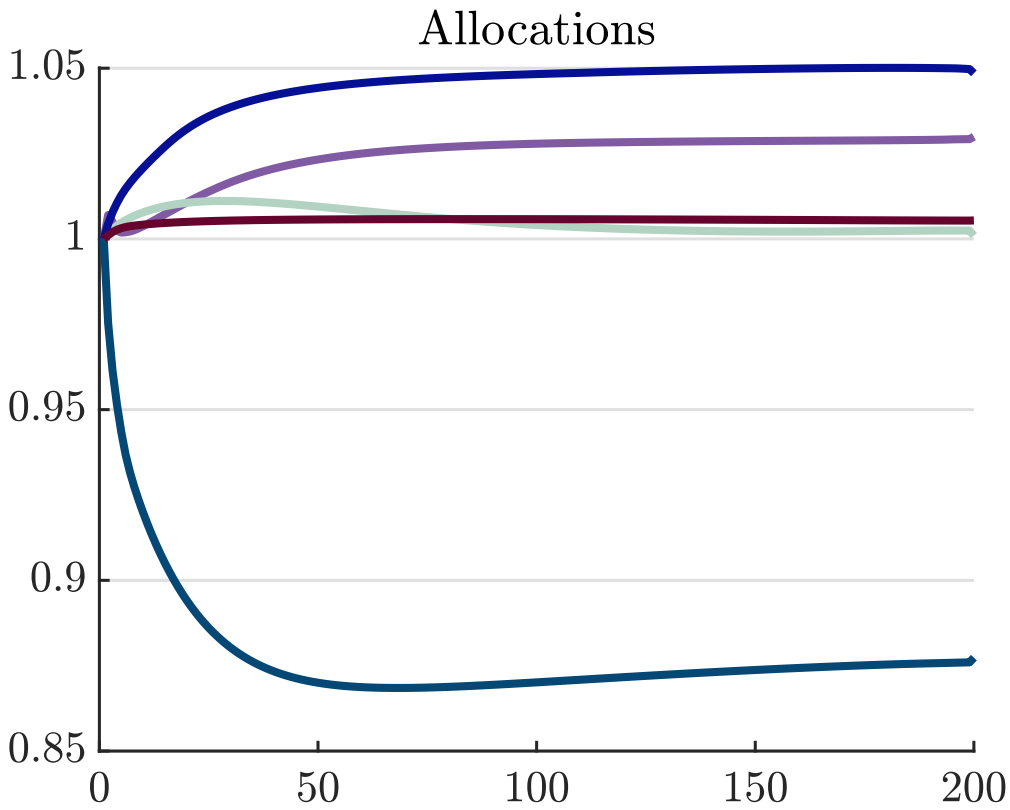
Model Fit Discussion

Current fit for the open economy is still updating

- Moments well matched for US—we do not observe transitions for other countries
- Wages in open economy harder to pin down
- Parameters are within range of prior estimates but b is an exception. Current estimate is $b \approx -5$.

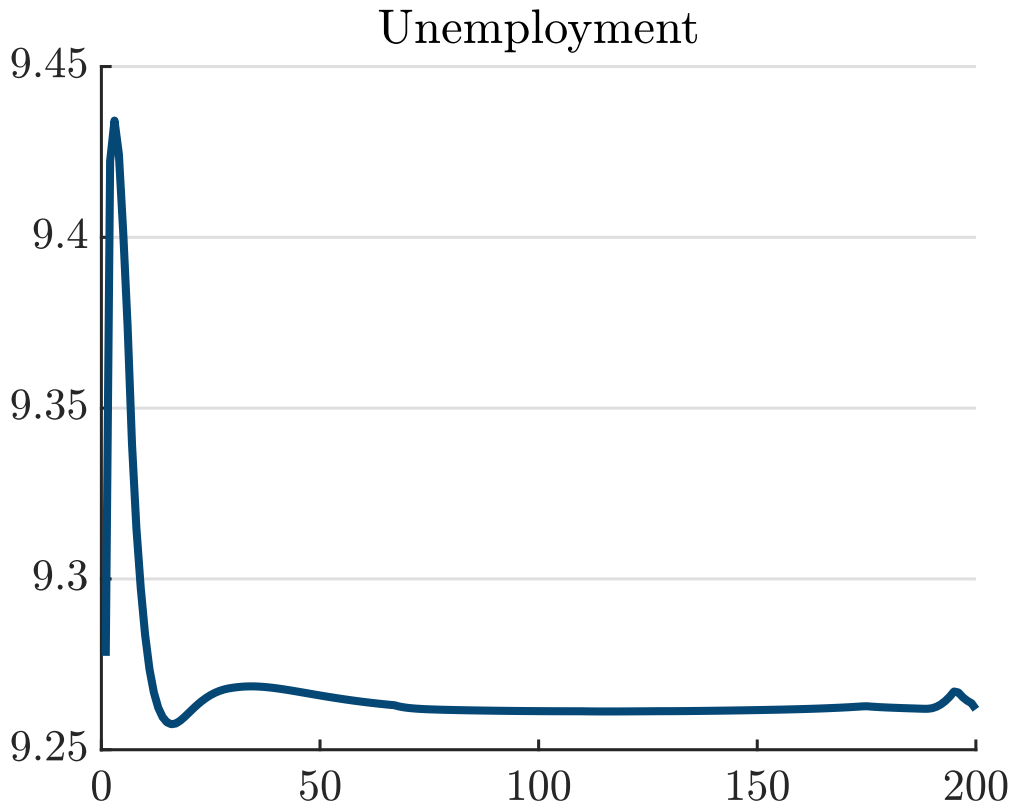
- For today:
  - Shock to Chinese CA *without* endogenous deficits (5x more productive in man, 2x elsewhere)
  - Simpler version of the model with 2 countries, reduced form labor supply

Reallocation Dynamics - US



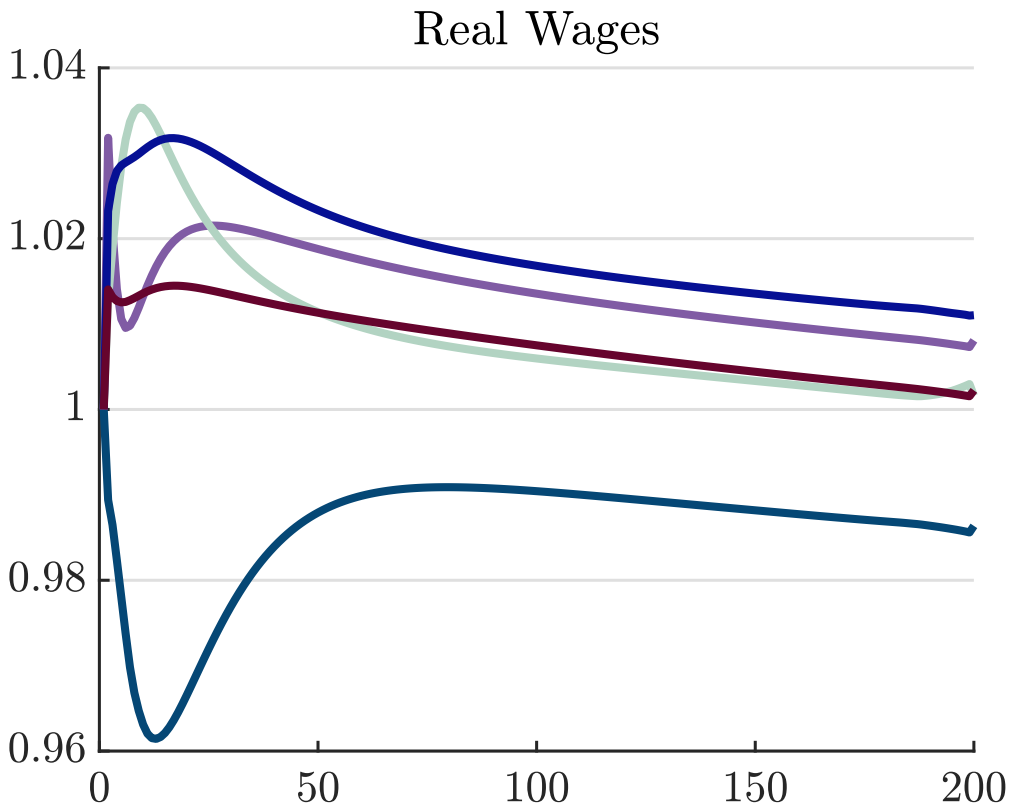
- Reallocation is slow (50 periods) due to large adjustment costs
- How do changes in allocation translate to welfare?

Long and Short Run Impacts on Unemployment - US



- Unemployment jumps up initially
- Response is very muted (not deficits + small b)

Long and Short Run Impacts on Wages - US



- Real Wages effects in manufacturing are 3x larger in SR!
- Long run wages differentials are much smaller

Dynamics Simulations

A simplified version of the model

Assumptions:

- 2 Countries, 3 sectors (CA/non-CA/nontradable)
- Symmetric countries in parameters
- Two Differences:
  - Ricardian CA: $T^1_{Ct} > T^1_{At}$, $T^2_{Ct} = T^1_{At}$ and $T^2_{At} = T^1_{Ct}$ for all t.
  - Initial distribution of wealth: $B^1_t > 0$ such that $B^1_t + B^2_t = 0$.
- **Shock**: Trade costs from 4.5 to 1.5 (calibrated for US NX)
  - *Equivalent to assuming Chinese productivity growth*

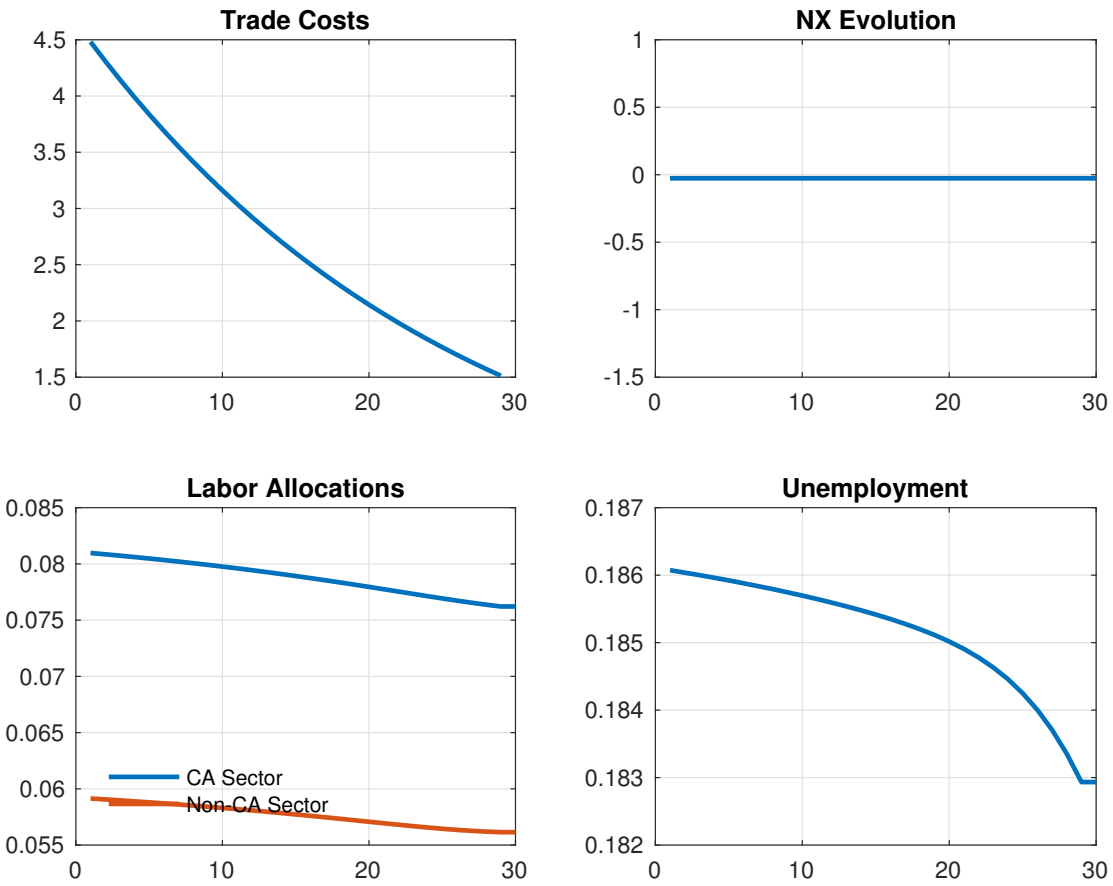
We consider two polar cases for labor market frictions:

1. Perfect labor mobility ($w^i_{jt} = w^i_t$ for all j)
2. No labor mobility ($L^i_{j,t}$ exogenously given and fixed).

Both cases with reduced form of labor supply elasticity

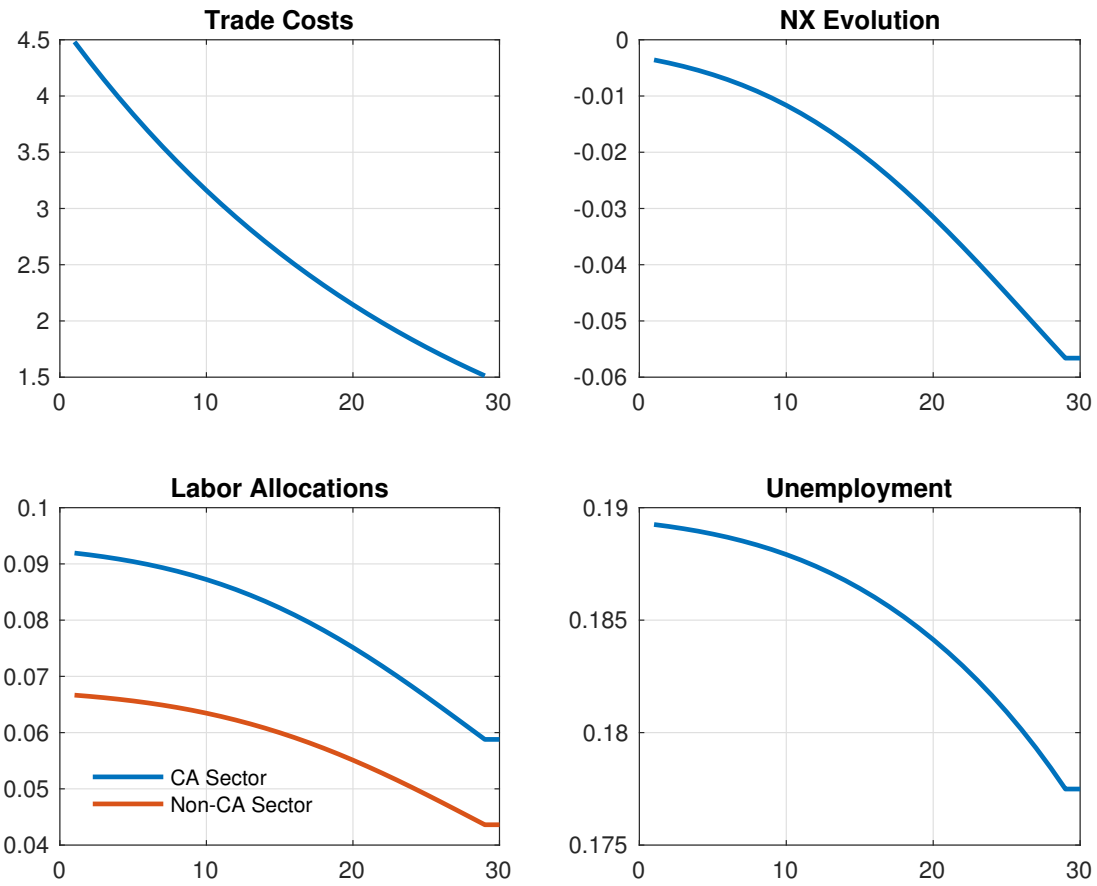
Simulations

Baseline: Perfect Mobility, Repeated Statics



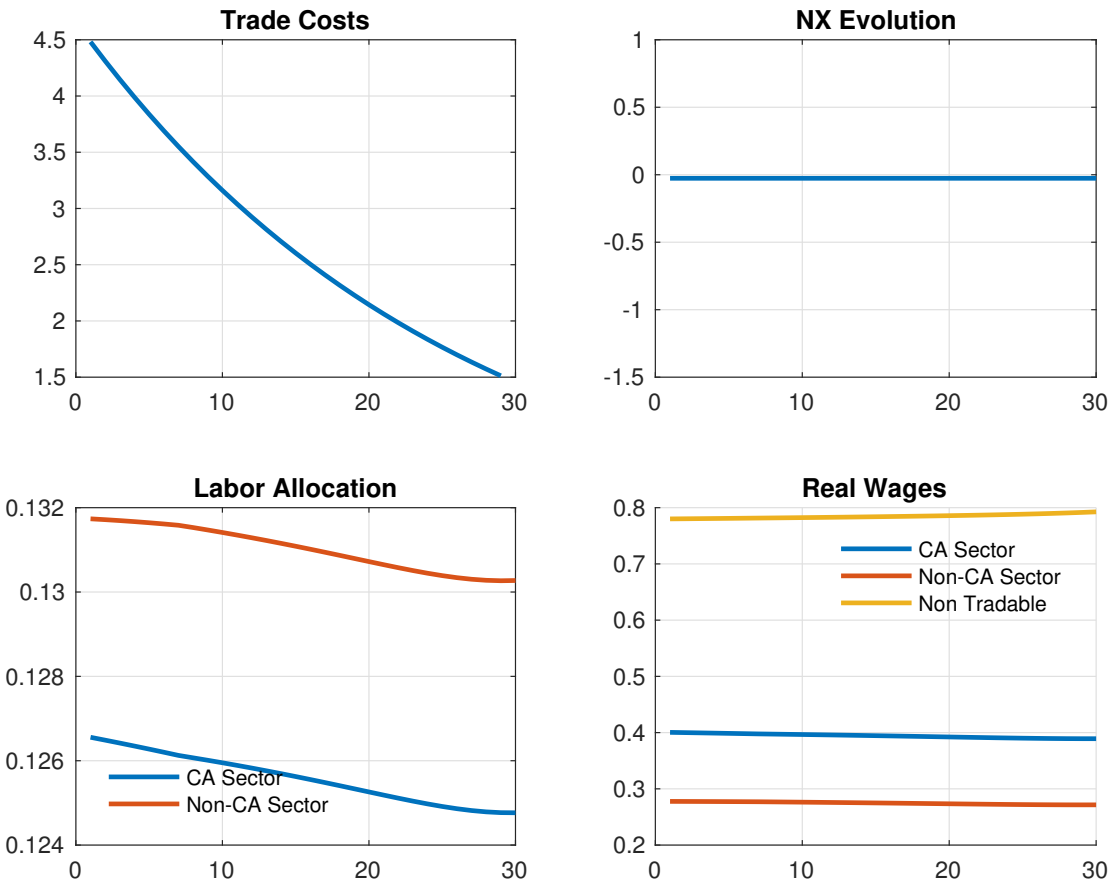
Simulations

Perfect Mobility and Endogenous Deficits



Simulations

No Mobility, Repeated Statics



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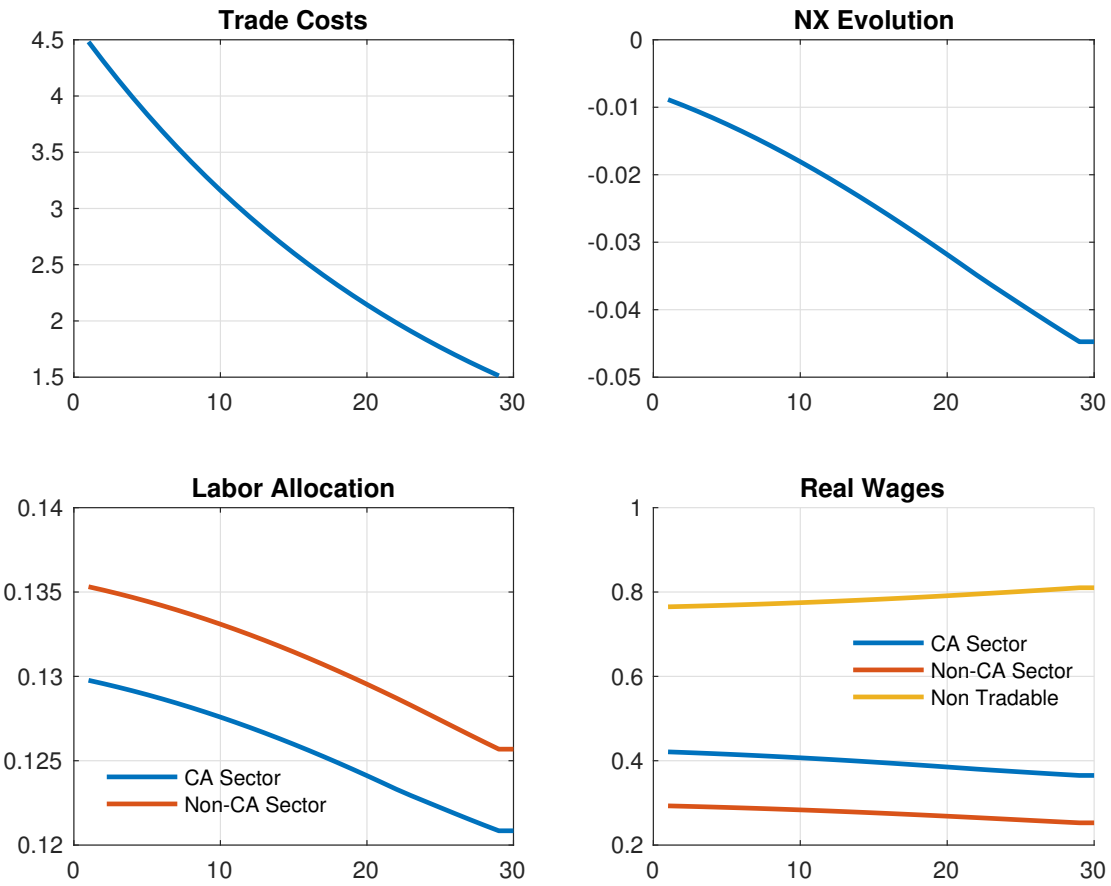

Conclusion + Next Steps

1. Today:
   - Built a model with three margins of changes: wages, labor supply, and labor allocation
   - Showed that transition dynamics of shocks can show non-monotonicities
   - Simulated key mechanism in the model: deficits unlink the "insurance" of export sector growth from import competition

2. Going Forward:
   - Data collected and trade-side calibration complete:
     - Estimating open economy model
   - Counterfactual experiments:
     - Estimate welfare consequences of China Shock taking imbalances into account
     - Calculate impact of US increase in tariffs on China that close bilateral deficit by 20%
     - Calculate employment and wage impacts of US increase in tariffs that close total deficit by 20%
     - Estimate impact of changes in CN savings rate