Trade and frictional unemployment in the global economy

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What we do

- Develop a **theory** displaying rich effects of trade on unemployment:
  - Multi-country, multi-sector gravity model with trade frictions (multi-sector EK as in Costinot, Donaldson and Komunjer, 2012)
  - Labour market frictions and equilibrium unemployment ('static' DMP as in Helpman and Itskhoki, 2010)
- Provide a structural **estimation** of key parameters of the model
- **Quantify** welfare and employment effects in counterfactual scenarii
  - Abrogate NAFTA
  - TTIP
  - TPP
  - Balanced trade

What we find (Theory)

1. Trade $\rightarrow$ unemployment through expansion and reallocation effects

$$\frac{1-u_i'}{1-u_i} \equiv \frac{\ell_i'}{\ell_i} = \left(\frac{\omega_i'}{\omega_i}\right)^{1-\lambda} \left[1 - \frac{\text{Cov}\left(s_{ik} - s_{ik}', \mu_{ik}\right)}{\bar{\mu}_i}\right]$$

2. Trade liberalisation may result in higher unemployment rate
3. ACR *real wage* gains from trade formula generalizes to

$$\frac{\omega_i'}{\omega_i} = \left(\frac{\bar{\pi}_{ii}'}{\bar{\pi}_{ii}}\right)^{-\frac{1}{\lambda\bar{\theta}_i}}$$

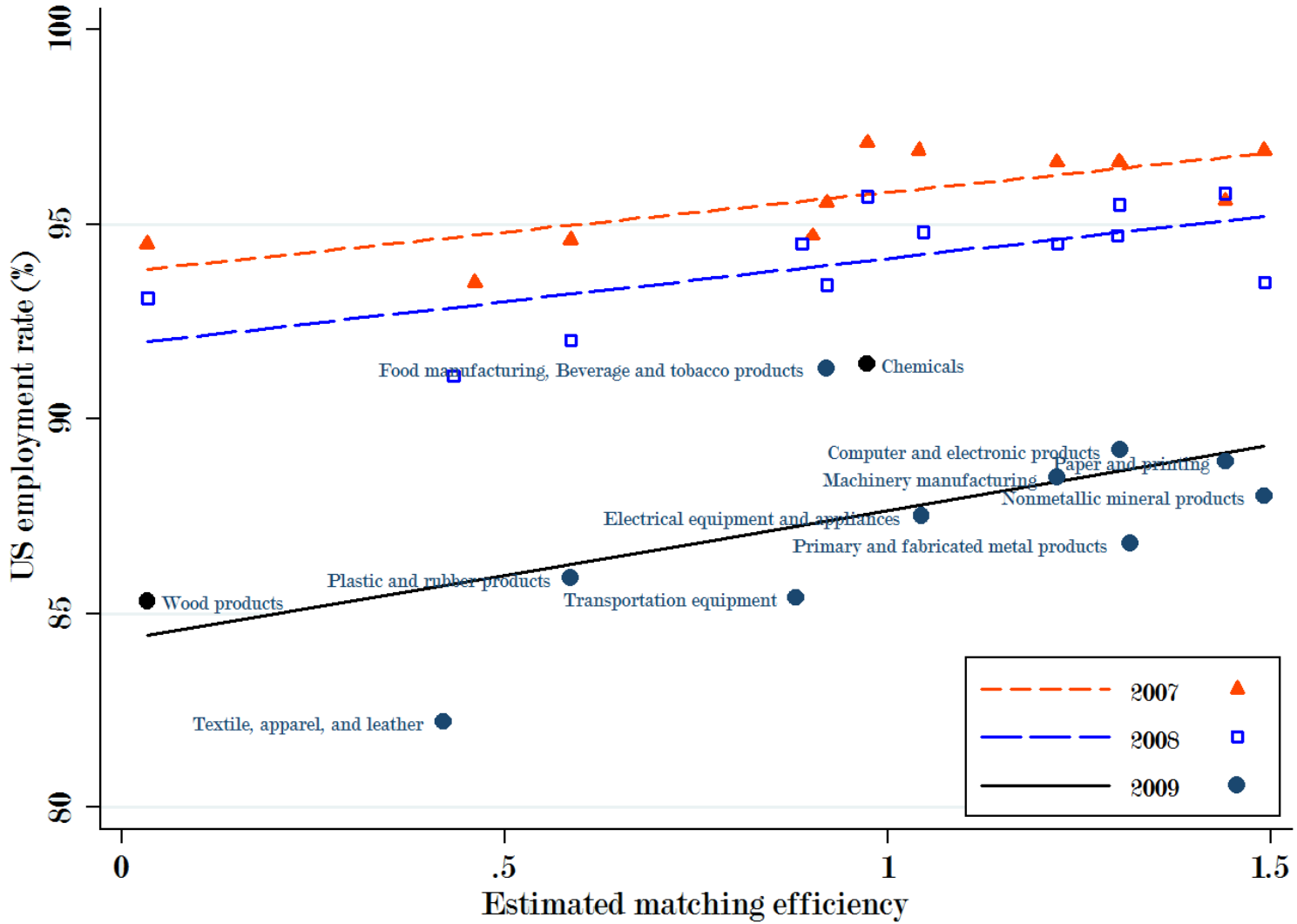
   and encompasses Ossa (2015) and Heid and Larch (2016)
4. Welfare $\neq$ real wages when society is averse to inequality
   - unemployment also matters

What we find (Quantitative)

1. Sector-specific labor market frictions
   - Heterogeneous
   - Robust across time and OECD countries
2. Unemployment rises for some members of TTIP and TPP even in presence of gains from trade
3. Repeal of NAFTA leads to an increase in unemployment
   - of 20% in Mexico
   - of 6% in the US

Motivation

Significant and persistent differences in unemployment rates across US manufacturing sectors



Related literatures

- **Labor market outcomes of trade**: Brecher (1974); Davidson, Martin, and Matusz (1988, 1999); Davis (1998); Costinot (2009); Helpman and Itskhoki (2010); Helpman, Itskhoki, and Redding (2013); Autor, Dorn, and Hanson (2013); Carrère, Fugazza, Olarreaga, and Robert-Nicoud (2014); Heid and Larch (2016).
- **Labor market frictions as source of comparative advantage**: Cuñat and Melitz (2012); Davidson, Martin, and Matusz (1988); and Helpman and Itskhoki (2010).
- **Economic effects of TTIP and TPP:**Bertelsmann (2013); Aichele, Felbermayr, and Heiland (2014); Egger, Francois, Manchin, and Nelson (2015); Felbermayr, Heid, Larch, and Yalcin (2015); Fontagné, Gourdon, and Jean (2013); Francois, Manchin, Norberg, Pindyuk, and Tomberger (2013); Petri, Plummer and Zhai (2012).
- **Gains from trade**: Atkeson and Burstein (2010); Arkolakis, Costinot, and Rodríguez-Clare (2012); Head, Mayer, and Thoenig (2014); Melitz and Redding (2015); Edmond, Midrigan, and Xu (2015); Ossa (2015; Heid and Larch (2016).
- **Welfare criterion in a trade context**: Antràs, de Gortari, and Itskhoki (2015); Galle, Rodríguez-Clare, and Yi (2015); Porto (2015).

Plan

EK – Consumption, production, and trade

- Environment
  - One factor, 'Labor'
  - K sectors
  - I countries

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- Technology and Ricardian comparative advantage
  - TFP: $P\{z_{ik}(x) > z\} = 1 - \exp\left\{-\left(\frac{z}{z_{ik}}\right)^{-\theta_k}\right\}$
  - θ_k governs the scope for comparative advantage

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- Trade costs
  - Iceberg: $\tau_{ijk} \geq 1$ and $\tau_{iik} = 1$

DMP – Search and matching frictions in labour market

Timing:

1. Firms open vacancies and workers choose a sector
   - Matching function: $H_{ik} = \tilde{\mu}_{ik} V_{ik}^{1-\lambda} L_{ik}^{\lambda}$,
   - Matching efficiency adjusted for vacancy costs: $\mu_{ik} \equiv \frac{\tilde{\mu}_{ik}}{\nu_{ik}^{1-\lambda}}$
2. Job matches are realized and sector-specific wages w_{ik} are determined

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Equilibrium:

- Ex-ante labour mobility and risk neutral workers together imply:

$$\ell_{ik} w_{ik} = w_i$$

- Employment rate in sector k:

$$\ell_{ik} = \omega_i^{1-\lambda} \mu_{ik}$$

EK + DMP – Equilibrium

- Gravity equation:

$$E_{ijk} = \pi_{ijk}\alpha_{jk}Y_j, \quad \text{where} \quad \pi_{ijk} = \left(\frac{t_{ijk}}{T_{jk}}\right)^{-\theta}$$

where

$$t_{ijk} \equiv \frac{\tau_{ijk}}{z_{ik}\mu_{ik}} w_i^{\lambda} P_i^{1-\lambda}$$

and remoteness:

$$T_{jk} \equiv \left(\sum_{i'=1} t_{i'jk}^{-\theta}\right)^{-1/\theta}$$

EK + DMP – Equilibrium (cont.)

- Generalized ACR (2012) formula:

$$\frac{\omega_i}{\omega_i'} = \left(\frac{\bar{\pi}_{ii}}{\bar{\pi}_{ii}'}\right)^{-\frac{1}{\lambda\bar{\theta}_i}}, \quad \text{where} \quad \bar{\pi}_{ii} \equiv \prod_{k=1}^{K}\left(\pi_{iik}^{\frac{\bar{\theta}_i}{\theta_k}}\right)^{\alpha_{ik}} \in (0,1)$$

$$\text{and} \quad \bar{\theta}_i \equiv \left(\sum_{k=1}^{K}\alpha_{ik}\theta_k^{-1}\right)^{-1}$$

Encompasses generalizations

- to multiple sectors (Ossa, 2015)
- to endogenous employment (Heid and Larch, 2016)

EK + DMP – Equilibrium (cont.)

- Trade shock and employment effects:

$$\hat{\ell}_i = (1-\lambda)\hat{\omega}_i + \frac{1}{\bar{\mu}_i} \underbrace{\sum_{k=1}^{K} \hat{s}_{ik}\left(\mu_{ik} - \bar{\mu}_i\right)}_{=\text{Cov}(\hat{s}_{ik},\mu_{ik})}$$

Two effects:

- Expansion effect:

$$(1-\lambda)\hat{\omega}_i > 0 \quad \Longrightarrow \quad \hat{\ell}_i \Big|_{\text{Cov}(\hat{s}_{ik},\mu_{ik})=0} > 0$$

- Reallocation effect:

$$\text{Cov}\left(\hat{s}_{ik}, \mu_{ik}\right) < 0 \quad \Longrightarrow \quad \hat{\ell}_i \Big|_{\hat{\omega}_i=0} < 0$$

EK + DMP – Equilibrium (cont.)

- Social welfare function and inequality aversion (Atkinson, 1970):

$$\begin{aligned}\mathbb{W}(\eta) &\equiv \left[\sum_{k=1}^{K} s_k \ell_k \omega_k^{1-\eta} + (b\omega)^{1-\eta} u\right]^{\frac{1}{1-\eta}} \\ &= \omega \left[\underbrace{(1-u) + u b^{1-\eta}}_{\text{'between' inequality}} + \underbrace{\frac{\mathbb{E}\left(\omega^{1-\eta}\right) - (\mathbb{E}\omega)^{1-\eta}}{\omega^{1-\eta}}}_{\text{'within' inequality}}\right]^{\frac{1}{1-\eta}},\end{aligned}$$

using AGI correction.

EK + DMP – Equilibrium (cont.)

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using AGI correction. Setting $\eta = 2$ and $b \to 0$:

$$\frac{\mathbb{W}'}{\mathbb{W}} - 1 = \frac{\omega'/u'}{\omega/u} - 1 \approx \frac{\omega'}{\omega} - \frac{u'}{u}$$

Plan

Estimation – Gravity

- Standard gravity regression (cross section, 2008):

$$\begin{aligned}
\ln E_{ijk} &= \beta_k^{tariff} \ln(1 + \text{tariff}_{ijk}) + \beta_k^{rta} RTA_{ij} \\
&+ \beta_k^{D} \ln \text{Distance}_{ij} + \beta_k^{cont} \text{Contiguity}_{ij} + \beta_k^{lang} \text{Common Language}_{ij} \\
&+ \beta_k^{colon} \text{Common Colonial Empire}_{ij} + \beta_k^{curr} \text{Common Currency}_{ij} \\
&+ FE_{ik} + FE_{jk} \\
&+ \epsilon_{ijk}
\end{aligned}$$

- Data:
  - Trade flows: CEPII (BACI database)
  - Tariffs: UNCTAD (TRAINS database)
  - RTA dummy: Jeffrey Bergstrand
  - Sectoral production: OECD (ISICRev3 database)

Estimation – Labor-market matching efficiencies, μ_k

- From $\ell_{ikt} = \omega_i^{1-\lambda}\mu_{ikt}$, assuming $\mu_{ikt} = \mu_{it}\mu_k$:

$$\ln \ell_{ikt} = \ln\left(\mu_{it}\omega_{it}^{1-\lambda}\right) + \ln \mu_k,$$

  - If employment rate data is available (15 aggregate sectors 'k'):

$$\ln \ell_{ikt} = FE_{it} + FE_k + \nu_{it}$$

  - If unavailable (21 disaggregated manufacturing sectors 'm'):

$$\bar{\mu}_{manuf} = \sum_m s_{imt}\mu_m$$

- One step estimation:

$$\ln \ell_{ikt} = FE_{it} + (1 - \mathbb{I}_k)\ln \mu_k + \mathbb{I}_k \ln\left(\sum_{m=1}^{21} s_{imt}\mu_m\right) + \text{error}_{ikt},$$

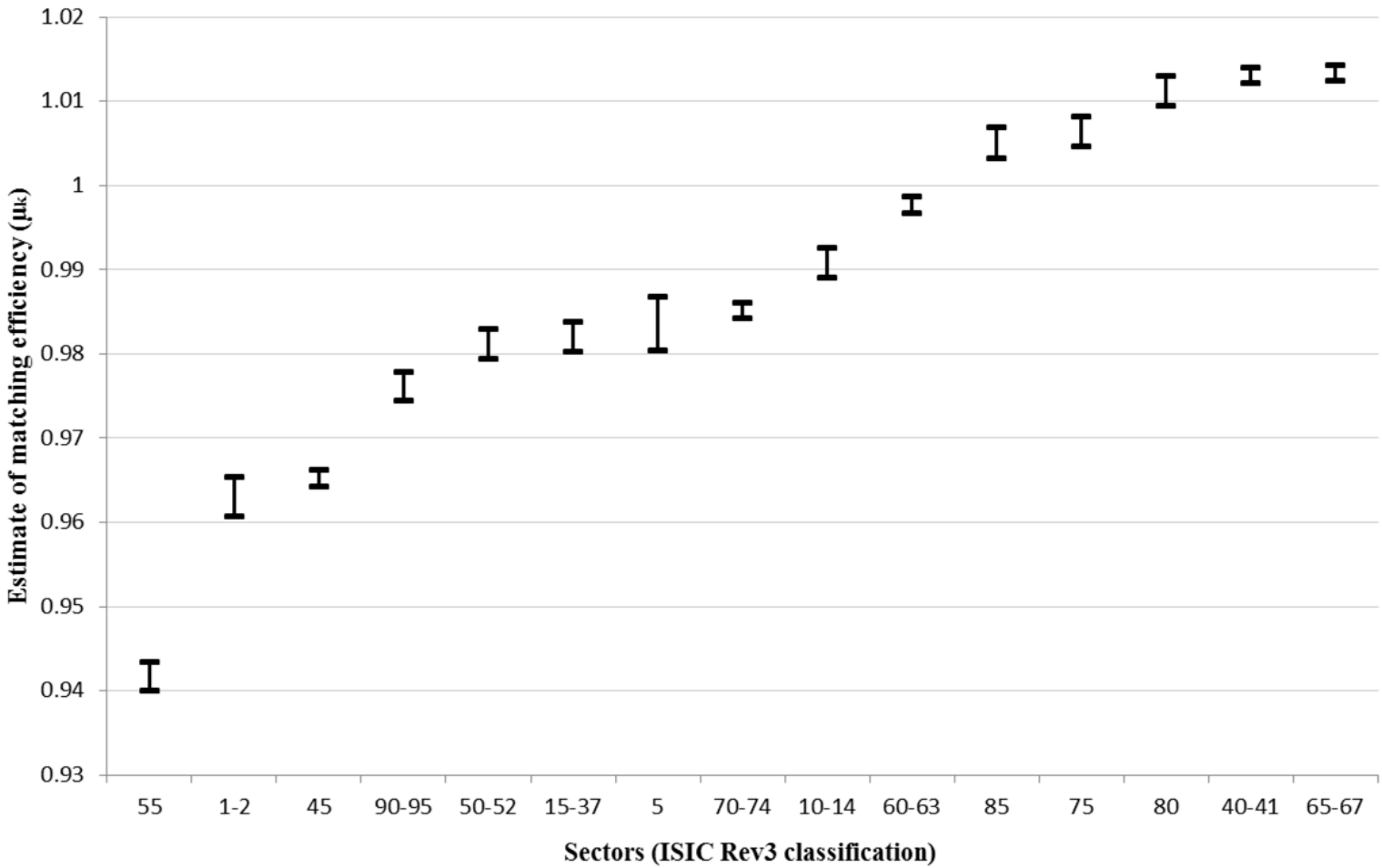
where $\mathbb{I}_k = 1$ if $k = manuf$, otherwise 0.

Estimation – Labor-market matching efficiencies, μ_k (cont.)

- Data (35 sectors, 25 OECD countries, 2001-2008):
  - Yearly unemployment rates by country and sector: ILO (KILM database)
  - Unemployment rates by manufacturing sector (USA): BLS
- Examples examples

Estimation – Labor-market matching efficiencies, μ_a

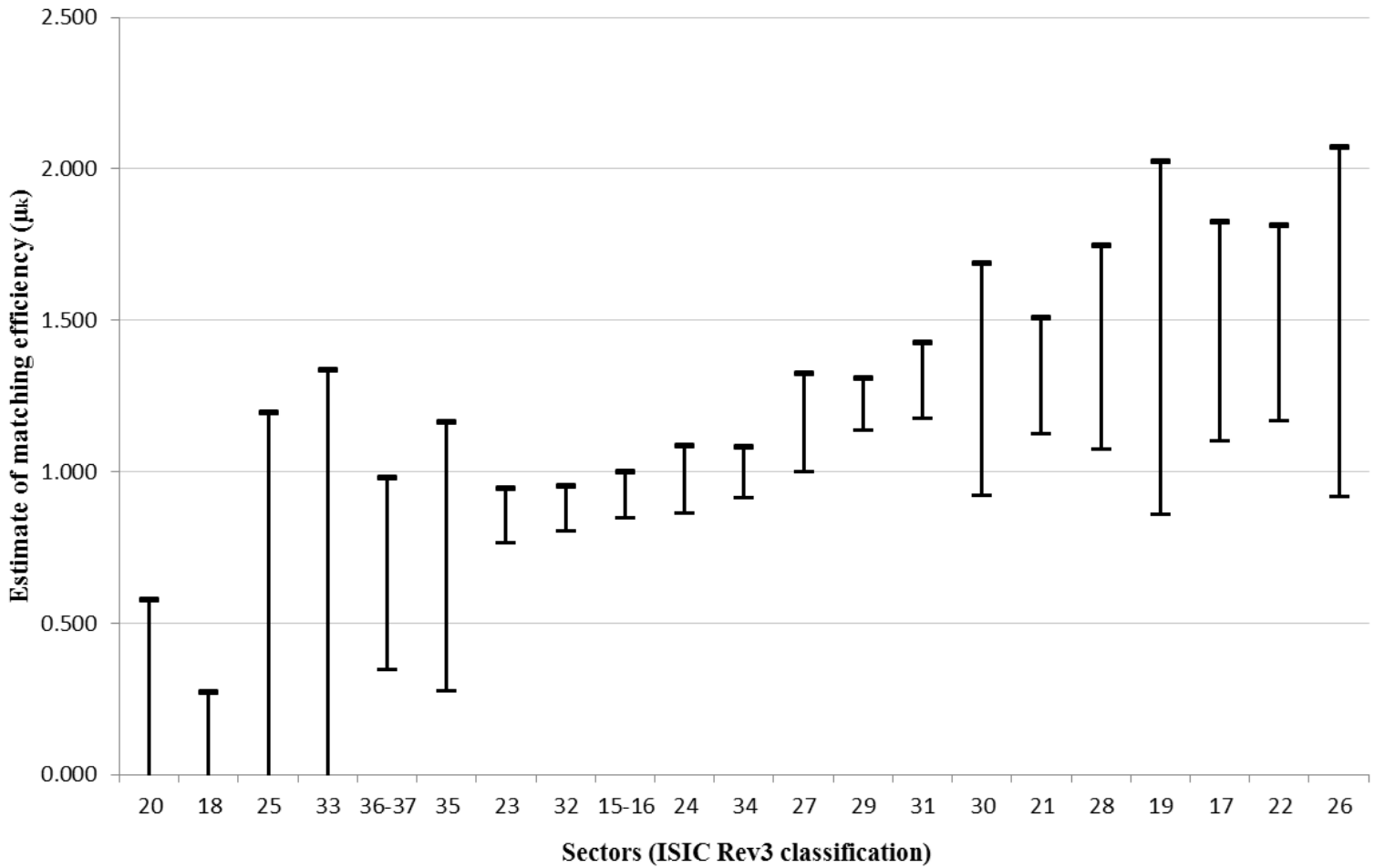
(15 aggregate sectors)



90% confidence intervals for estimates of 15 μ_{ik}'s with available employment rate data

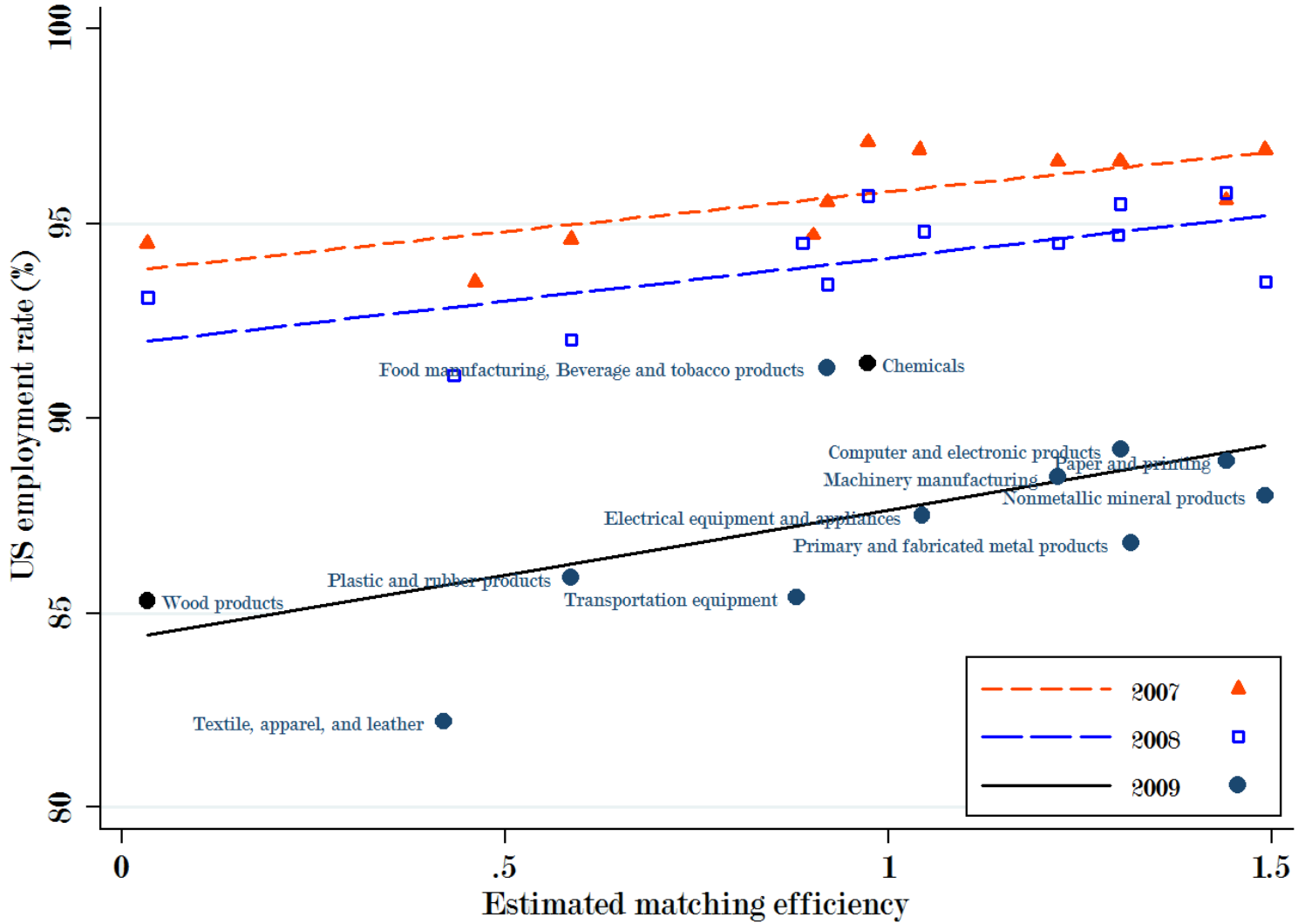
Estimation – Labor-market matching efficiencies, μ_m

(21 manufacturing sectors)

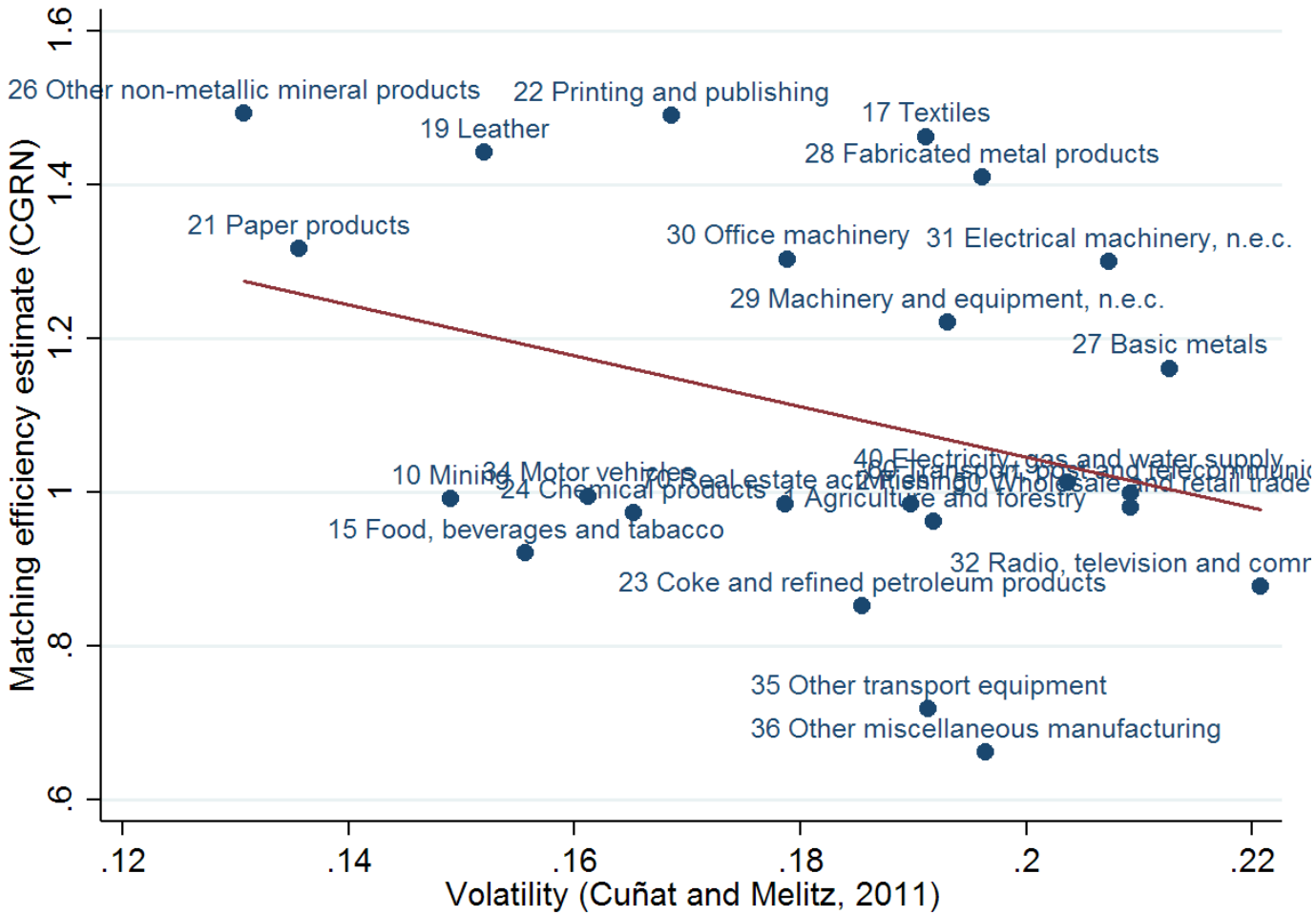


90% confidence intervals for estimates of 21 disaggregated manufacturing sectors

Correlation between μ_m and US employment rates (manufacturing sectors), $\rho \in (0.56, 0.74)$



Correlation between μ_m and sector-specific volatility (Cuñat and Melitz, 2011), $\rho = -0.29$



Estimation – Labor-market matching efficiencies, μ_k (cont.)

Robustness checks

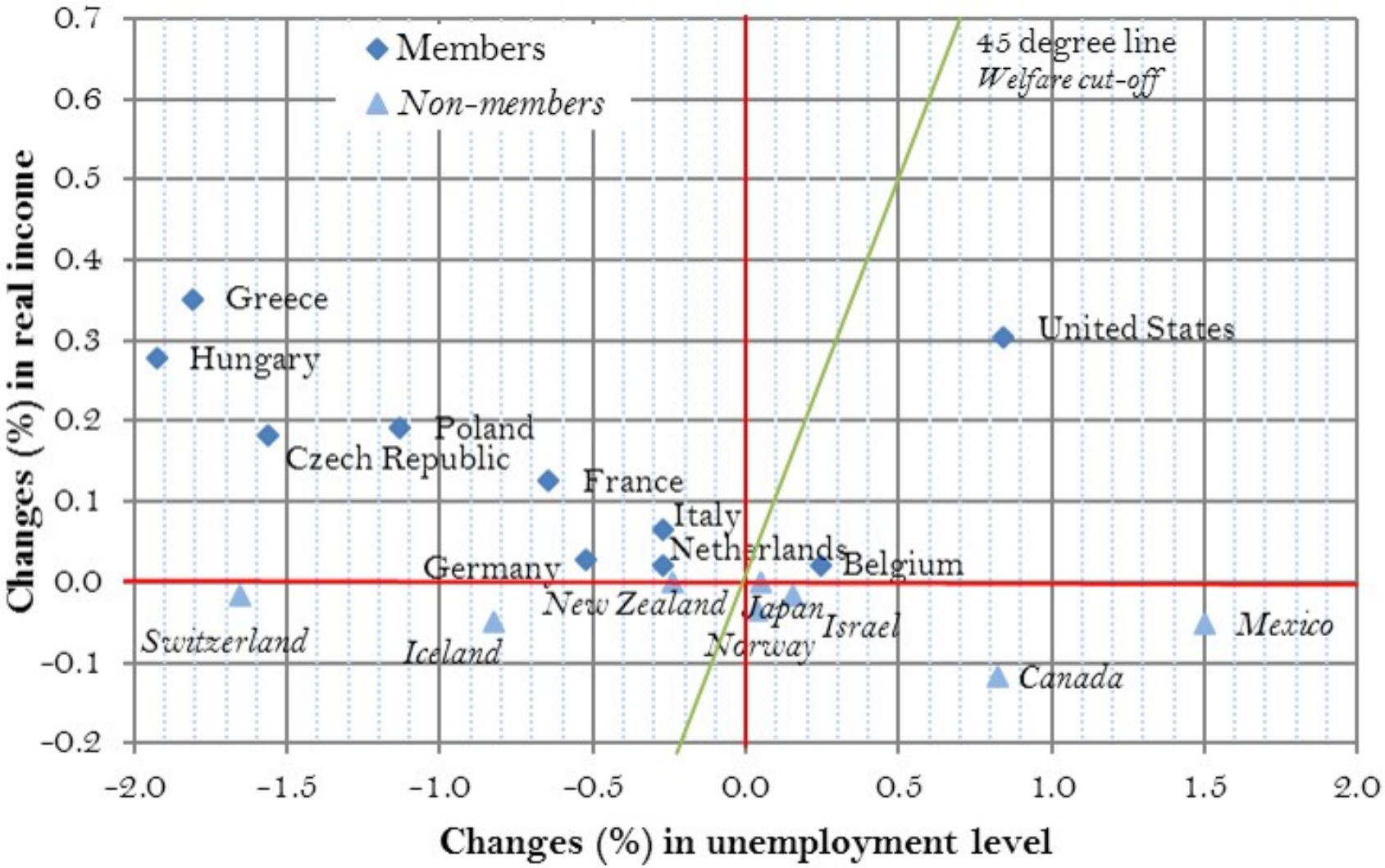
- Stability of μ_k estimates across countries and time μ_k
- Out-of-sample prediction of employment rates out

Plan

Calibration results: TTIP

		u_i^{2008}	$\left(\frac{\sum_k s_{ik}^{TTIP}\mu_k}{\sum_k s_{ik}^{2008}\mu_k} - 1\right)$	$\left(\frac{u_i^{TTIP}}{u_i^{2008}} - 1\right)$	$\left(\frac{\omega^{TTIP}}{\omega^{2008}} - 1\right)$	$\left(\frac{\mathbb{W}^{TTIP}}{\mathbb{W}^{2008}} - 1\right)$
TTIP	Austria	3.8	0.049	-2.391	0.114	2.566
members	Belgium	7.0	-0.027	0.249	0.022	-0.227
	Czech Republic	4.4	-0.001	-1.561	0.182	1.770
	Denmark	3.4	0.057	-3.035	0.126	3.259
	Estonia	5.5	-0.004	-2.393	0.359	2.819
	Finland	6.3	0.003	-2.205	0.364	2.627
	France	7.4	0.001	-0.644	0.125	0.774
	Germany	7.5	0.031	-0.522	0.028	0.554
	Greece	7.7	0.011	-1.810	0.351	2.201
	Hungary	7.8	0.052	-1.926	0.278	2.247
	Ireland	4.6	-0.284	2.401	0.423	-1.932
	Italy	6.7	-0.007	-0.268	0.065	0.333
	Netherlands	2.8	-0.001	-0.270	0.022	0.293
	Poland	7.1	0.010	-1.130	0.191	1.336
	Portugal	7.7	0.037	-2.453	0.419	2.944
	Slovenia	4.4	-0.009	-2.060	0.259	2.368
	Spain	8.4	-0.146	-1.834	0.789	2.672
	Sweden	6.3	0.030	-2.265	0.307	2.631
	United Kingdom	5.4	-0.019	-2.656	0.426	3.167
EU-19	**Average**	**6.7**	**-0.010**	**-1.180**	**0.233**	**1.430**
	United States	**5.9**	**-0.175**	**0.846**	**0.304**	**-0.537**
Other	Canada	6.3	-0.008	0.827	-0.118	-0.938
OECD	Iceland	3.0	0.045	-0.825	-0.050	0.782
	Israel	6.1	-0.003	0.154	-0.017	-0.170
	Japan	4.0	-0.003	0.052	0.001	-0.051
	Mexico	3.5	-0.033	1.502	-0.053	-1.532
	New Zealand	3.9	0.009	-0.239	0.001	0.240
	Norway	2.6	0.013	0.037	-0.035	-0.071
	Switzerland	3.4	0.065	-1.654	-0.017	1.664

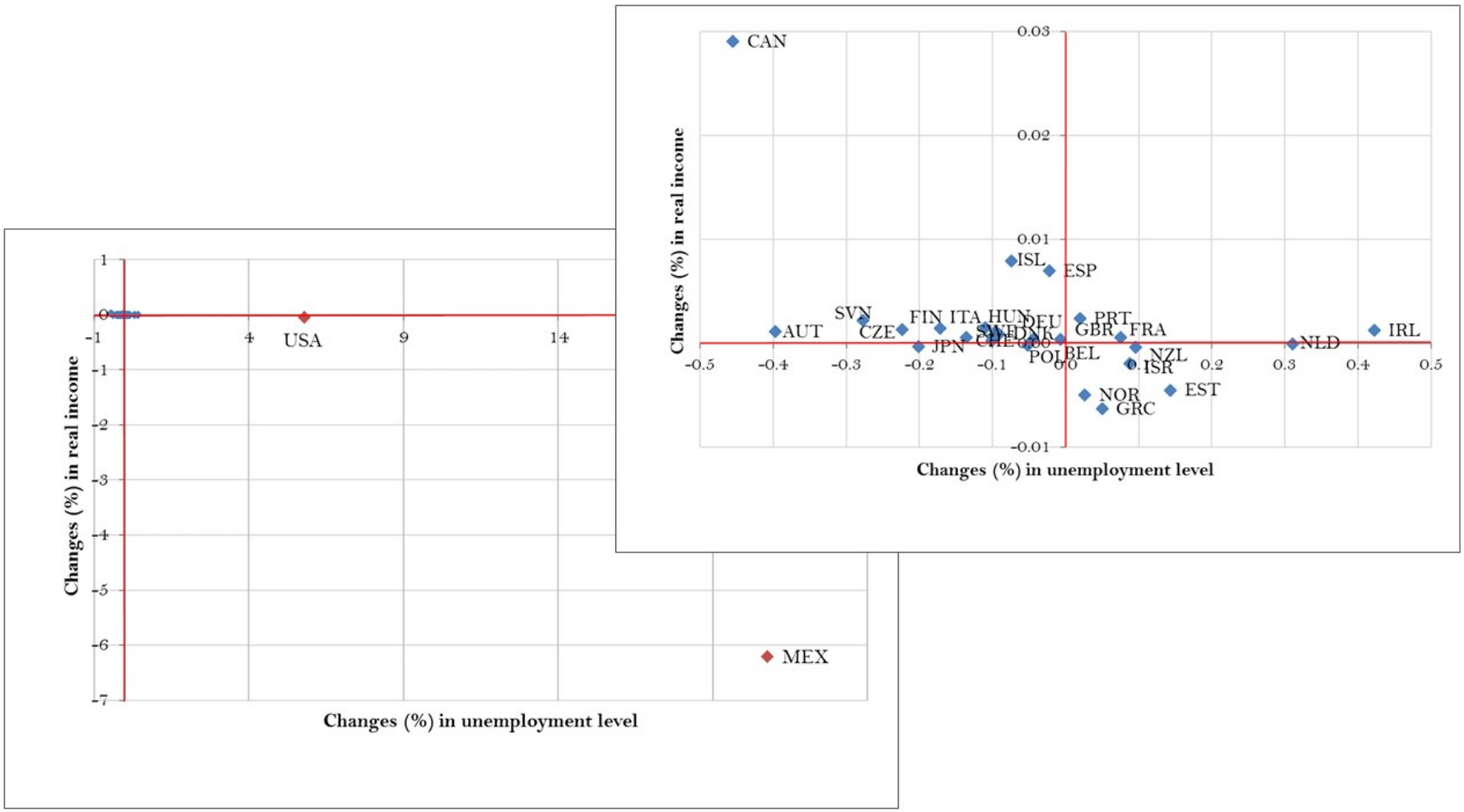
Calibration results: TTIP (cont.)



Calibration results: WALL scenario

		$\left(\frac{\sum_k s_{ik}^{WALL}\mu_k}{\sum_k s_{ik}^{2008}\mu_k} - 1\right)$	$\left(\frac{u_i^{WALL}}{u_i^{2008}} - 1\right)$	$\left(\frac{\omega^{WALL}}{\omega^{2008}} - 1\right)$	$\left(\frac{\mathbb{W}^{WALL}}{\mathbb{W}^{2008}} - 1\right)$
NAFTA	United States	-0.343	5.796	-0.050	-5.526
members	Mexico	1.827	20.756	-6.213	-22.333
	Canada	0.019	-0.455	0.029	0.487
EU-19	Austria	0.015	-0.397	0.001	0.400
	Belgium	0.004	-0.052	0.000	0.052
	Czech Republic	0.010	-0.224	0.001	0.226
	Denmark	0.003	-0.091	0.001	0.092
	Estonia	-0.007	0.143	-0.004	-0.148
	Finland	0.011	-0.171	0.001	0.173
	France	-0.006	0.075	0.001	-0.075
	Germany	0.008	-0.101	0.000	0.102
	Greece	-0.002	0.050	-0.006	-0.057
	Hungary	0.008	-0.096	0.001	0.097
	Ireland	-0.021	0.422	0.001	-0.419
	Italy	0.010	-0.136	0.001	0.136
	Netherlands	-0.009	0.311	0.000	-0.310
	Poland	0.003	-0.044	0.000	0.045
	Portugal	-0.003	0.019	0.002	-0.017
	Slovenia	0.012	-0.277	0.002	0.280
	Spain	-0.001	-0.022	0.007	0.029
	Sweden	0.007	-0.110	0.002	0.111
	United Kingdom	0.000	-0.007	0.000	0.007
EU-19	**Average**	**0.003**	**-0.038**	**0.001**	**0.039**
Other	Iceland	-0.001	-0.074	0.008	0.082
OECD	Israel	-0.005	0.088	-0.002	-0.090
	Japan	0.009	-0.202	0.000	0.202
	New Zealand	-0.004	0.095	0.000	-0.096
	Norway	0.001	0.026	-0.005	-0.031
	Switzerland	0.003	-0.100	0.001	0.101

Calibration results: WALL scenario (cont.)



Plan

Summary and Conclusion

- A multi-country, multi-sector Ricardian/Gravity trade model
- Labour market frictions and equilibrium unemployment
- Inequality or risk aversion $\Rightarrow$ Unemployment matters
- Comparative advantage matters for unemployment
- Estimate sector-specific labour-market frictions
- Counterfactual exercises
  - Repeal of NAFTA $\rightarrow$ increase in unemployment: 21% in Mexico and 6% in US
  - TTIP $\rightarrow$ increase in real wages (0.2% in EU, 0.3% in US)
  - TTIP $\rightarrow$ unemployment: 0.85%-increase in US, 1.2%-reduction in EU

Appendix

Estimates of sector-specific matching efficiencies

High matching efficiencies

ISIC Rev 3	Sector description	Matching eff.
26	Other non-metallic mineral products	1.492
22	Printing and publishing	1.490
17	Textiles	1.462
19	Leather, leather products and footwear	1.442
28	Fabricated metal products, except machinery and equipment	1.409
21	Pulp, paper and paper products	1.316

Low matching efficiencies

ISIC Rev 3	Sector description	Matching eff.
55	Hotels and restaurants	0.942
15-16	Food, beverages and tobacco products	0.921
32	Radio, television and communication equipment	0.877
23	Coke, refined petroleum products and nuclear fuel	0.852
35	Other transport equipment	0.719
36-37	Other miscellaneous manufacturing	0.662

BACK

Robustness tests

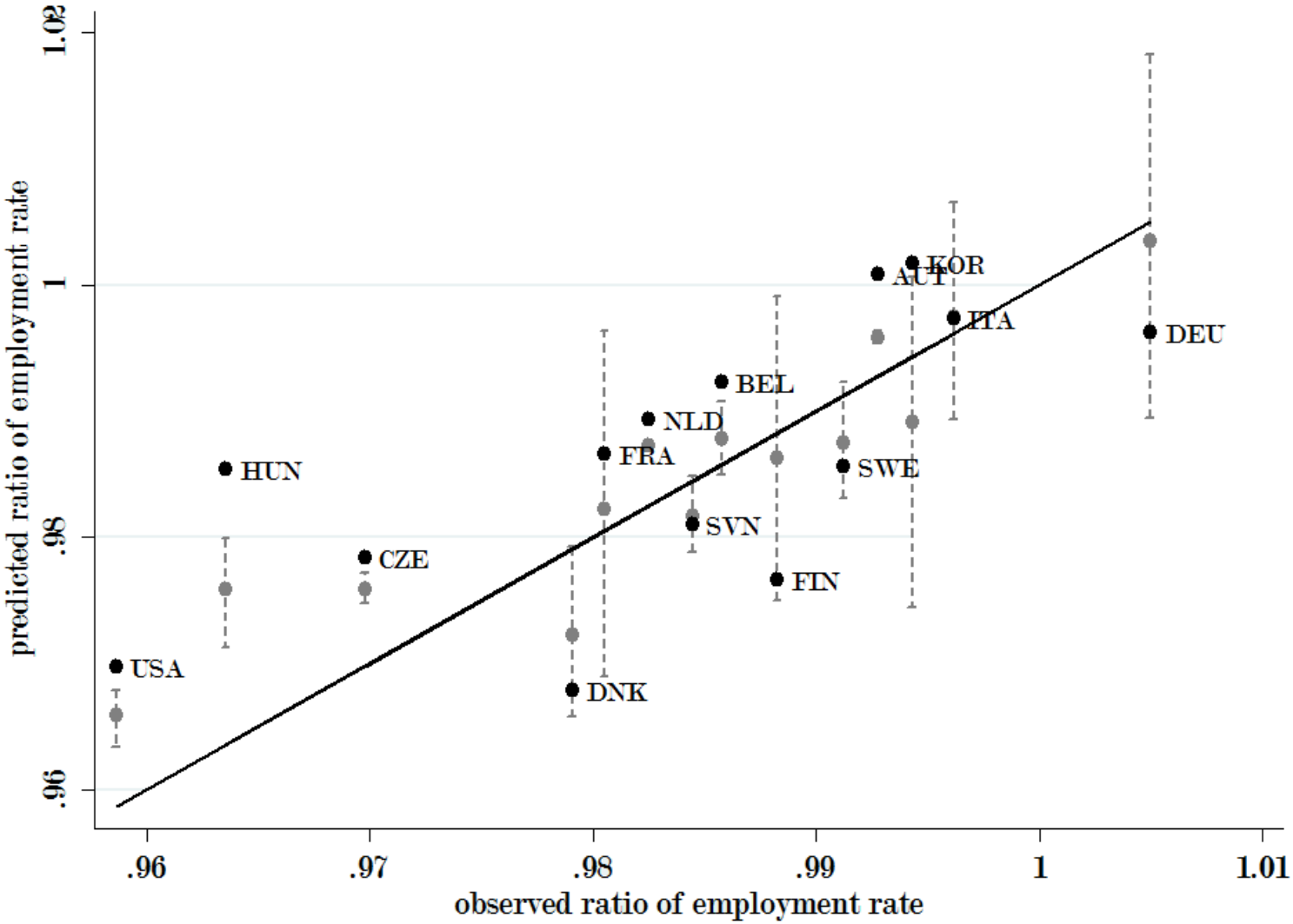
- Stability of μ_k estimates across OECD countries and time
  - Correlation between 'lower' and 'higher' income OECD countries: 0.8
  - Correlation between 'pre-2005' and 'post-2005' income OECD countries: 0.7

- Out-of-sample validity check

$$\frac{\ell_{i,2011}}{\ell_{i,2008}} = \frac{\ell_{ik',2011}}{\ell_{ik',2008}} \frac{\sum_k s_{ik,2011}\mu_k}{\sum_k s_{ik,2008}\mu_k} \qquad \forall\, k'.$$

BACK

Robustness test: Out-of-sample prediction for year 2011



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