US Exports and Employment

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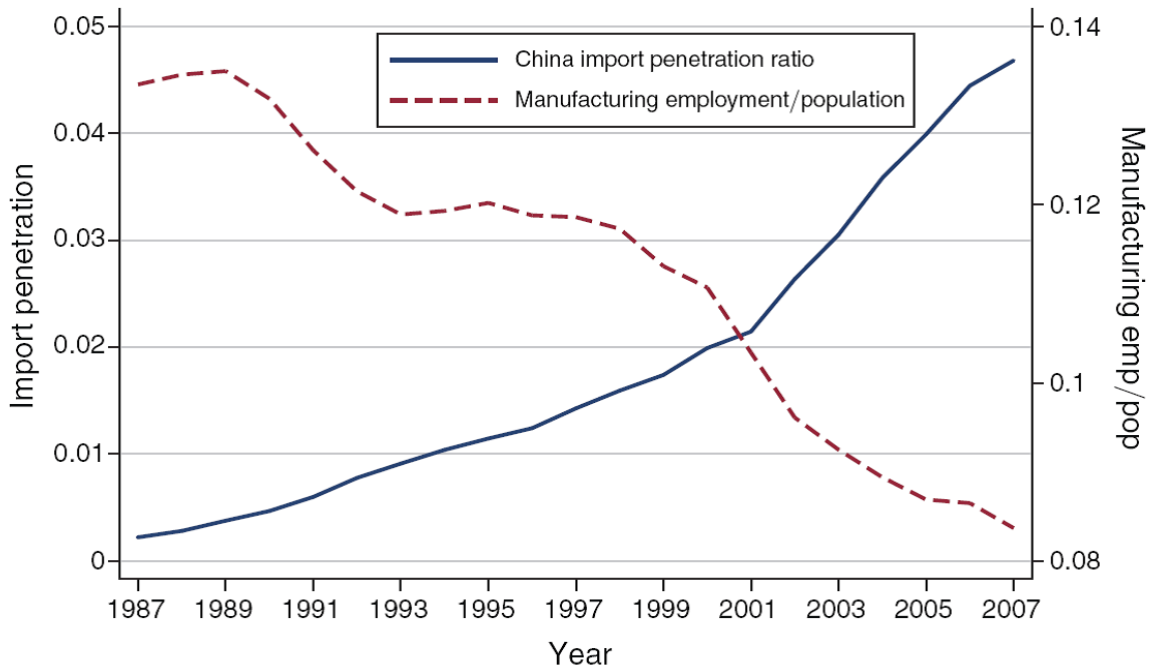
September 25, 2017

Motivation

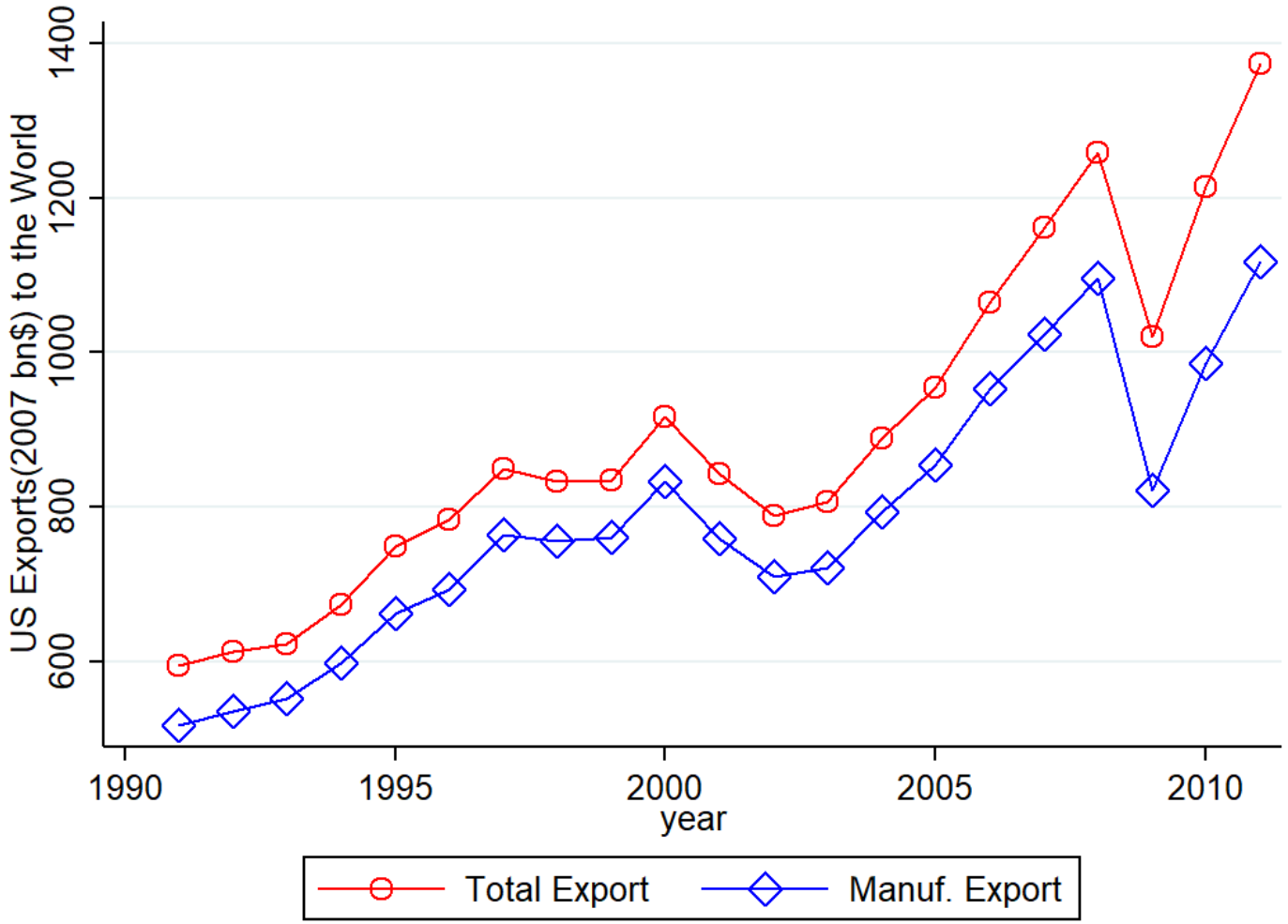
- The first decade in the 21st century is characterized by:
  - Rising emerging economies in the global trading system, particularly China.
  - Continuing drop in US manufacturing employment.
    - From the "roaring nineties" (Krueger and Solow, 2002) to the "great US employment sag" (Acemoglu et al, 2016) or the "surprisingly swift decline" in US manuf. employment (Pierce and Schott, 2016).



Note: Reproduced from ADH(2013).

Accounting for US global export expansion

- Prior to the global financial crisis, US exports grew strongly.



- Comparison:2007 US total imports: 2,017 Bn$; imports from China: 340 Bn$

Motivation

- Following ADH(2013)'s influential study, a growing body of literature has alerted us the negative impact of import penetration from China:
  - US employment (Acemoglu et al. 2016; Pierce and Schott, 2016)
  - Housing value and household debt (Feler and Senses, 2016; Barrot et al.2017)
  - marriage (ADH, 2017), politics (ADHM, 2016), and innovation (ADHPS, 2016), etc.
- These studies have important policy implications and challenge the benign view towards globalization.

- Our study argues that
  - A more balanced view towards trade effects should also consider the US export expansion.
    - At the industry level, the US manufacturing exports created enough jobs to offset all but 0.3-0.4 million of the jobs lost due to imports from China, over 1991-2011.
    - At the CZ level, 0.2 million net job loss over 1991-2007, but the job losses are just balanced with the job gains over 1991-2011.

Empirical Strategy for Industry Level Estimation

- Benchmark Estimation follows Acemoglu et al. (2016 JOLE)

$$\Delta ln(L_{st}) = \beta_t + \beta_1 \Delta IP_{st} + \beta_2 \Delta EP_{st} + \gamma X_{s0} + \epsilon_{st}, \quad (1)$$

- Changes in Import Exposure

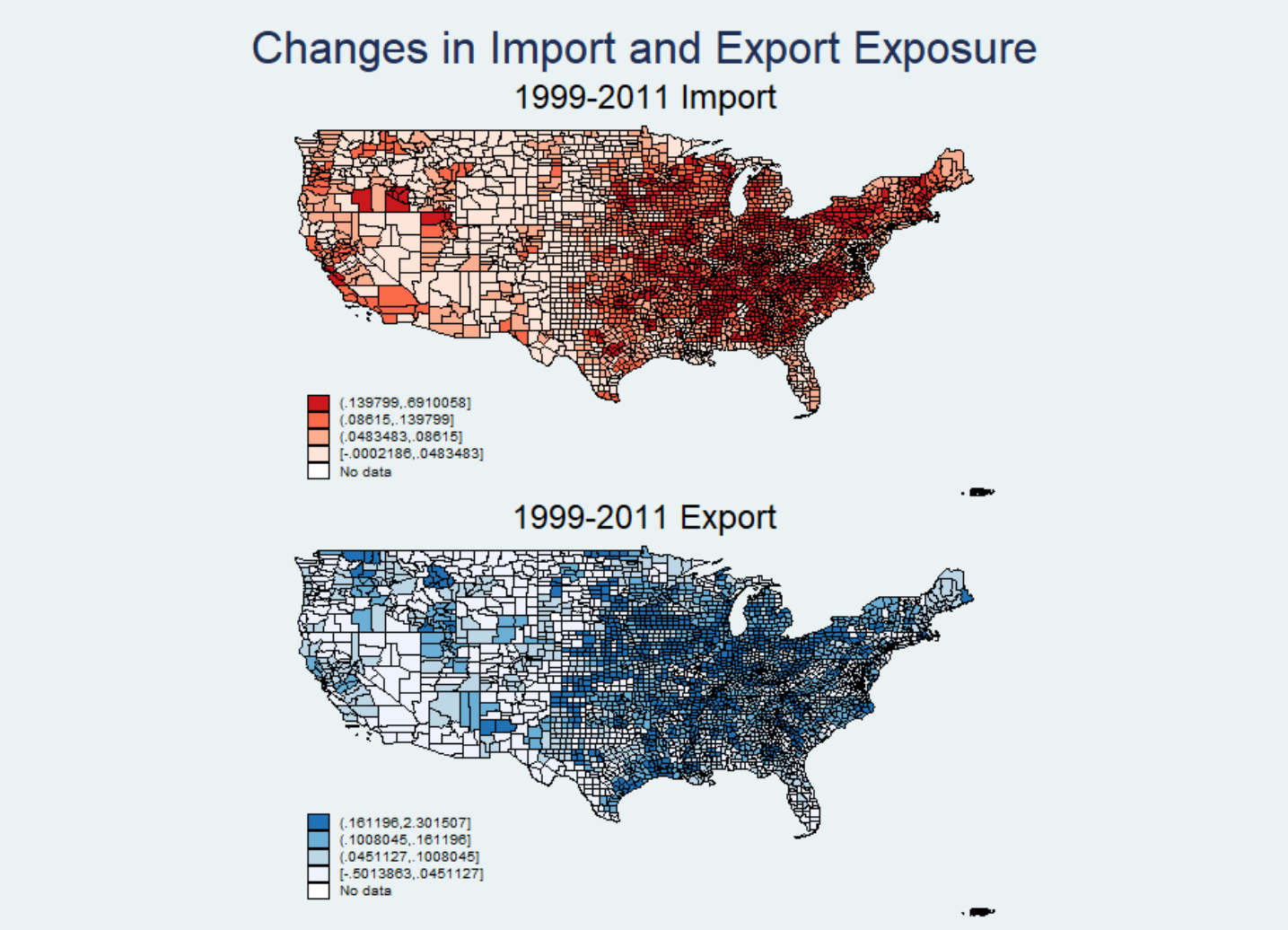
$$\Delta IP_{st} = \frac{\Delta M^{UC}_{s,t}}{Y_{s,t_0} + M_{s,t_0} - E_{s,t_0}}, \quad (2)$$

- Changes in Export Expansion

$$\Delta EP_{st} = \frac{\Delta X_{s,t}}{Y_{s,t_0}}, \quad (3)$$

  - Y_{s,t_0} is initial year shipments,
  - $(M_{s,t_0} - E_{s,t_0})$ is initial year net imports

Regions subject to import penetration also experienced export expansion



Instrumenting for US Trade Exposure

- Identification concerns for endogeneity of imports and exports
  - e.g.: Uncontrolled (often unobserved) domestic shocks, such as demand shocks, may affect imports and labor employment simultaneously.
- ADH and Acemoglu et al. suggest an IV for import penetration ΔIP_{st}
  - i.e., the contemporaneous changes in import from China by other eight high-income countries.

$$\Delta IP_{st}^{OTH} = \frac{\Delta M_{s,t}^{OC}}{Y_{s,t_0} + M_{s,t_0} - E_{s,t_0}},$$

Instrumenting for US Trade Exposure

- Sources of endogeneity for exports
  - Unobserved demand shocks may reduce exports and increase labor employment simultaneously, OLS estimates biased down.
  - A labor-saving supply shocks may increase exports and reduce labor employment simultaneously, OLS estimates biased down.
  - An expansion in product variety may increase exports and increase labor employment simultaneously, OLS estimates biased up.
- Two Instruments for export expansion ΔEP_{st}
  1. **the export expansion of other high-income countries**, assuming that these high-income countries face similar import demand shocks from other countries as does the US. - similar to the AADHP instrument for ΔIP_{st}.
  2. **the predicted US exports**, determined by the tariffs that US exporters face, the tariffs that other competing countries face, and the rising *multilateral* foreign demand for merchandise imports (except from the US).

Empirical Strategy - Instruments

- IV1 for ΔEP_{st}: export expansion by other high-income economies

$$\Delta EP_{st}^{OTH} = \frac{\Delta X_{s,t}^{OTH}}{Y_{s,t_0}}.$$

- IV2 for ΔEP_{st}: Predicting US Exports

$$\ln X_{st}^{us,j} = \beta_{st}^{us} + \beta_1 \ln(\tau_{st}^{us,j}) + \beta_2 \ln\left(\sum_{k \neq US} X_{st}^{k,j}\right) + \beta_3 \ln(T_{st}^{j}) + \beta_4 \ln\left(d^{us,j}\right) + \epsilon_{st}^{j}$$

- $\left(\sum_{k \neq US} X_{st}^{k,j}\right)$ captures country j's *multilateral* import demand from the rest of world.
- $\ln(T_{st}^{j})$ measures *multilateral* tariffs imposed by j on all other exporters.
- β_{st}^{us} reflects a US supply shock and can be captured by a set of sector and year fixed effects or their interactions.

Predicting US Exports -1

1. Similar to Romalis (2007), we start from a simple symmetric CES equation:

$$\frac{X_{svt}^{us,j}}{X_{svt}^{i,j}} = \left(\frac{w_{st}^{us} d^{us,j} \tau_{st}^{us,j}}{w_{st}^{i} d^{i,j} \tau_{st}^{i,j}} \right)^{1-\sigma},$$

2. M_{st}^{i} identical product varieties in sector s. Multiply both sides by M_{st}^{i} and summing over all countries $i \neq us$:

$$X_{svt}^{us,j} \sum_{i \neq us} M_{st}^{i} \left(w_{st}^{i} d^{i,j} \right)^{1-\sigma} = \left(w_{st}^{us} d^{us,j} \tau_{st}^{us,j} \right)^{1-\sigma} \sum_{i \neq us} M_{st}^{i} X_{svt}^{i,j} \left(\tau_{st}^{i,j} \right)^{\sigma-1}.$$

Predicting US Exports -2

3. Denote sectoral exports from the US and country i to country j as $X_{st}^{us,j} = M_{st}^{us} X_{svt}^{us,j}$ and $X_{st}^{i,j} = M_{st}^{i} X_{svt}^{i,j}$, respectively, then:

$$X_{st}^{us,j} = \frac{M_{st}^{us}\left(w_{st}^{us} d^{us,j} \tau_{st}^{us,j}\right)^{1-\sigma}}{\sum_{k\neq us} M_{st}^{k}\left(w_{st}^{k} d^{k,j}\right)^{1-\sigma}} \left(\sum_{k\neq us} X_{st}^{k,j}\right) \sum_{i\neq us} \frac{X_{st}^{i,j}}{\sum_{k\neq us} X_{st}^{k,j}} \left(\tau_{st}^{i,j}\right)^{\sigma-1},$$

4. Taking logs of the above equation, we obtain:

$$\ln X_{st}^{us,j} = \beta_{st}^{us} + \ln(\tau_{st}^{us,j})^{1-\sigma} + \ln\left(\sum_{k\neq US} X_{st}^{k,j}\right) + \ln\left[\sum_{i\neq us} \frac{X_{st}^{i,j}}{\sum_{k\neq us} X_{st}^{k,j}} \left(\tau_{st}^{i,j}\right)^{\sigma-1}\right] + \ln\left(d^{us,j}\right)^{1-\sigma} + \epsilon_{st}^{j},$$

where $\beta_{st}^{us} = ln\left(M_{st}^{us}\left(w_{st}^{us}\right)^{1-\sigma}\right)$, and

$\epsilon_{st}^{j} = -ln\left(\sum_{k\neq us} M_{st}^{k}\left(w_{st}^{k} d^{k,j}\right)^{1-\sigma}\right)$

Predicting US Exports

Table 1: Predicting US Exports: 1990-2011

	(1)	(2)	(3)
$\ln(1+\tau_{st}^{us,j})$	-6.780***	-7.058***	-7.124***
	(0.044)	(0.044)	(0.044)
$\ln(\sum_{k\neq US} X_{s,t-1}^{k,j})$	0.752***	0.759***	0.763***
	(0.001)	(0.001)	(0.001)
$\ln(T_{st}^{j})$	7.063***	6.899***	6.953***
	(0.044)	(0.043)	(0.043)
$\ln Dist$	-1.951***	-1.944***	-1.951***
	(0.004)	(0.004)	(0.004)
Observations	1,256,201	1,256,201	1,255,646
R-squared	0.560	0.565	0.574
SITC FE	YES	YES	
YEAR FE		YES	
SITC-YEAR FE			YES

- We use column (3) to predict US exports, but we omit the FE from that prediction to obtain the instrument.

Steps to obtain IV2

Convert US exports at 5-digit SITC products to measuring export exposure at the revised SIC poduct level.

(1) Estimate eq(9) at SITC 5-digit product g across importing countries j. (Col.(3))

(2) Aggregate across destinations to get the US industrial exports, denoted as $\hat{X}_{gt}^{SITC}$.

(3) Match between SITC to SIC, following Feenstra,et al (2002).

(4) Use the crosswalk from Acemoglu et al (2016) to convert the 1987 SIC industry code to the revised SIC code, ending up with export values for 392 revised 4-digit SIC codes, denoted as $\hat{X}_{st}^{SIC} = \sum_{g \in s} \omega_{gs,t_0} \hat{X}_{gt}^{SITC}$, where s denotes the SIC sector, while ω_{gs,t_0} is the start-of-period weights used in matching SITC product g to SIC .

(5) Measure predicted US export expansion as,

$$\Delta EP_{st}^{PRE} = \frac{(\hat{X}_{st}^{SIC} - \hat{X}_{st_0}^{SIC})}{Y_{s,t_0}},$$

Benchmark Results for Export Expansion

$$\Delta ln(L_{st}) = \beta_t + \beta_1 \Delta IP_{st} + \beta_2 \Delta EP_{st} + \gamma X_{s0} + \epsilon_{st},$$

Dep var: 100 × annualized log change in industrial employment					
	(1)	(2)	(3)	(4)	(5)
	1991-2007	1991-2007	1991-2011	1991-2007	1991-2011
	OLS	2SLS	2SLS	2SLS	2SLS
Δ Imports	-0.74***	-1.30***	-1.41***	-1.30***	-1.41***
	(0.16)	(0.31)	(0.40)	(0.32)	(0.41)
Δ Exports	0.39**	0.83***	0.79***	0.69***	0.65***
	(0.15)	(0.22)	(0.17)	(0.17)	(0.17)

	First Stage Results			
	(2)	(3)	(4)	(5)
Dep. var: Δ Imports				
Δ $Imports^{OTH}$	1.215***	1.008***	1.215***	0.992***
	(0.146)	(0.148)	(0.147)	(0.140)
Δ $Exports^{OTH}$	-0.016	-0.022	-0.016	-0.026
	(0.015)	(0.015)	(0.020)	(0.016)
Δ $Exports^{PRE}$			-0.000	0.028
			(0.068)	(0.041)
F-test	41.91	30.17	28.00	23.04
Dep. var: Δ Exports				
Δ $Imports^{OTH}$	-0.293***	-0.064	-0.633***	-0.417*
	(0.110)	(0.120)	(0.239)	(0.239)
Δ $Exports^{OTH}$	0.287***	0.249***	0.212***	0.169***
	(0.041)	(0.047)	(0.048)	(0.053)
Δ $Exports^{PRE}$			0.534***	0.622***
			(0.203)	(0.212)
F-test	36.22	20.97	27.06	15.56

Quantify the results

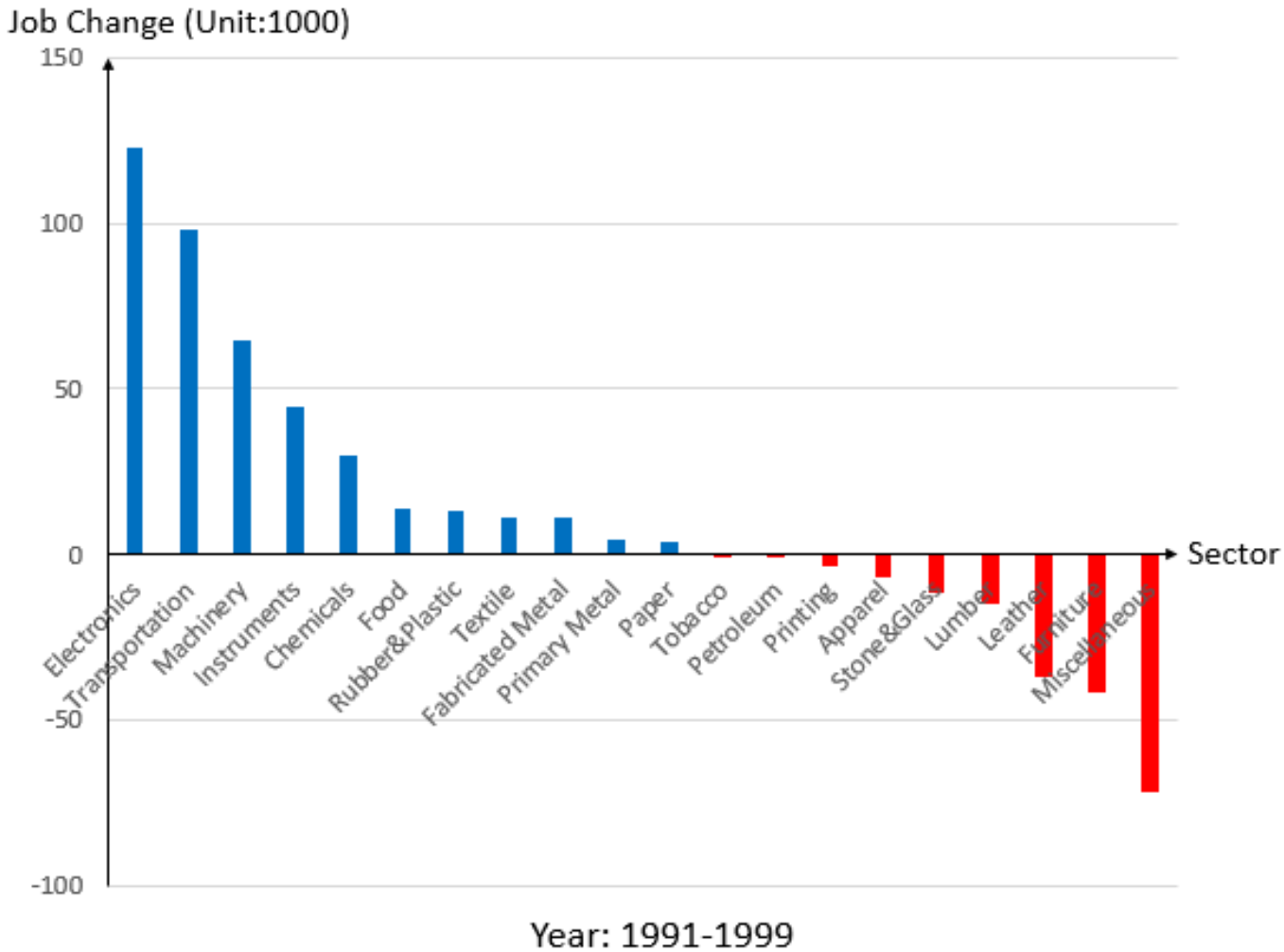
- Col.(4) & (5) are our benchmark, with stacked long differences b/w 1991-1999 & 1999-2007 or 1999-2011.
  1. a 1 ppt rise in industry import penetration reduces domestic industry employment by 1.3 ppt.
  2. a 1 ppt rise in industry export expansion increases industrial employment by 0.69 ppt (or 0.65 for 1991-2011).
- Quantitative Results:

$$\Delta L_t = \sum_s \left(L_{s,t}(1 - e^{(\hat{\beta}_1 \Delta IP_{st} + \hat{\beta}_2 \Delta EP_{st})}) \right),$$

  - Export expansion *net of* China import penetration actually led to a net gain of 324,000 jobs in the first period 1991-1999, while it led to a net loss of 642,000 jobs for the second period 1999-2007 (or 697,000 job losses for 1999-2011).
  - Therefore, job gains due to changes in US global exports largely offset job losses due to China's imports, resulting in about 0.3-0.4 million job losses in net.

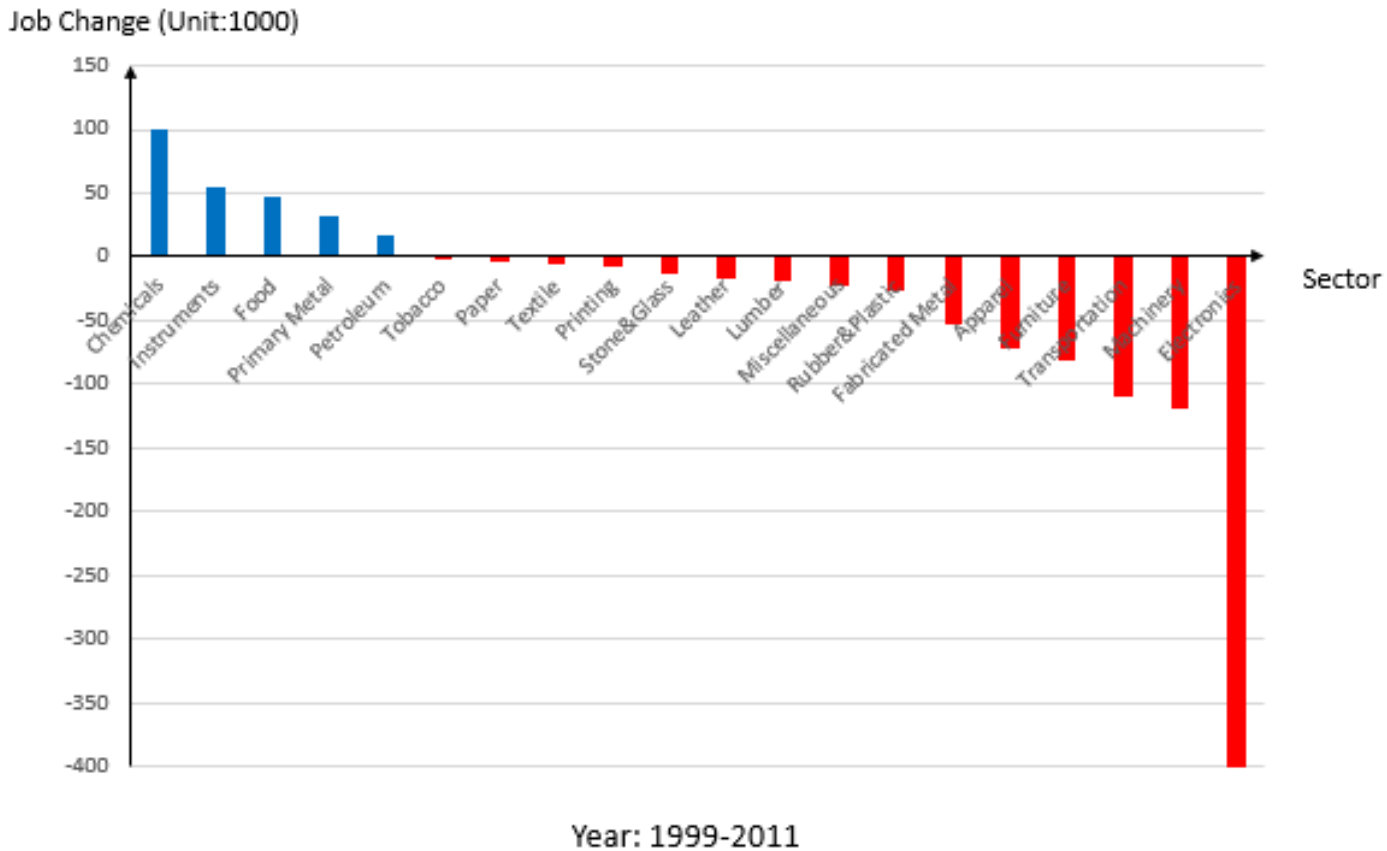
Quantify the results

- Industry employment changes due to trade shocks (1991-1999).



Quantify the results

- Industry employment changes due to trade shocks (1999-2011).



Robustness Checks

- Adding various controls.

Dep var: 100 × annualized log change in industrial employment							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
			1991-2007			1991-2011	
Δ Imports	-0.83***	-1.16***	-1.31***	-0.81***	-0.68***	-0.77***	-0.41
	(0.20)	(0.30)	(0.33)	(0.20)	(0.24)	(0.23)	(0.28)
Δ Exports	0.60***	0.61***	0.82***	0.63***	0.44***	0.57***	0.48**
	(0.11)	(0.16)	(0.18)	(0.11)	(0.14)	(0.13)	(0.19)
Sector controls	Yes	No	No	Yes	No	Yes	No
Production controls	No	Yes	No	Yes	No	Yes	No
Pretrend controls	No	No	Yes	Yes	No	Yes	No
Industry fixed effects	No	No	NO	No	Yes	No	Yes
Observations	784	784	784	784	784	784	784
First-stage F for Δ Imports	25.17	28.01	28.79	25.74	41.58	22.99	14.19
First-stage F for Δ Exports	18.83	20.73	25.22	18.79	6.40	12.13	4.65

- With a full set of controls (col.4), the coefficient of import penetration is reduced to 0.81, while the coefficient of export expansion is more stable, at 0.63.

Robustness Checks

- Considering the Impact of Export Expansion on Other Industry Outcomes
  - Export expansion substantially increases employment, no. establishment, employment per establishment, real wage bill; it also increases employment of both production workers and non-production workers, real wage of production workers, and the real shipments.

Go to Czone Effect

Export Expansion on Other Industry Outcomes

	Dep var: 100 × annualized log change in industrial outcome									
	County Business Patterns Dataset			NBER-CES Dataset						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Emp.	Num Estabs.	Emp Per Estab.	Real Wage Bill	Real Wage	Prod. Emp.	Non-Prod. Emp.	Real Prod. Wage	Real Non-Prod. Wage	Real shipments
Δ Imports	-0.83***	-0.24***	-0.59***	-0.69***	0.13**	-0.93***	-0.72***	0.11	-0.07	-0.24
	(0.20)	(0.08)	(0.18)	(0.18)	(0.07)	(0.22)	(0.19)	(0.11)	(0.08)	(0.35)
Δ Exports	0.60***	0.34***	0.25**	0.67***	0.07	0.63***	0.57***	0.13**	0.12	1.07**
	(0.11)	(0.11)	(0.11)	(0.12)	(0.05)	(0.13)	(0.17)	(0.06)	(0.08)	(0.52)
11991-1999	-0.61*	0.17	-0.78***	0.94***	1.55***	-0.26	-0.72**	1.04***	1.71***	3.04***
	(0.34)	(0.20)	(0.28)	(0.32)	(0.09)	(0.39)	(0.34)	(0.06)	(0.11)	(0.57)
11999-2007	-3.30***	-1.21***	-2.08***	-2.92***	0.37***	-3.54***	-2.52***	0.37***	0.08	-0.87**
	(0.30)	(0.22)	(0.24)	(0.31)	(0.12)	(0.33)	(0.33)	(0.08)	(0.12)	(0.35)
Observations	784	784	784	784	784	768	768	768	768	768
R^2	0.545	0.198	0.406	0.508	0.628	0.558	0.385	0.436	0.437	0.408
First-stage F for Δ Imports	27.62									
First-stage F for Δ Exports	17.40									

Robustness Checks

- Accounting for inter-sectoral linkages
  1. Trade shocks to downsteam buyers may affect upstream suppliers, and vice versa.
  2. Using Input-Output table, we could measure the inter-sectoral trade exposure.
  3. We find: besides the positive direct within-sector effect of export exposure, buyers' export exposure also creates significant and positive effect on the employment of upstream suppliers, while the effect of downstream export exposure is not significant.
- the *upstream effect* of export and import exposure:

$$\Delta IP_{st}^{up} = \sum_{g} \omega_{gs}^{u} \Delta IP_{gt}, \qquad \textit{and} \qquad \Delta EP_{st}^{up} = \sum_{g} \omega_{gs}^{u} \Delta EP_{gt},$$

  - where ω_{gs} is the use coefficient which tells the share of product s used as input in industry g.

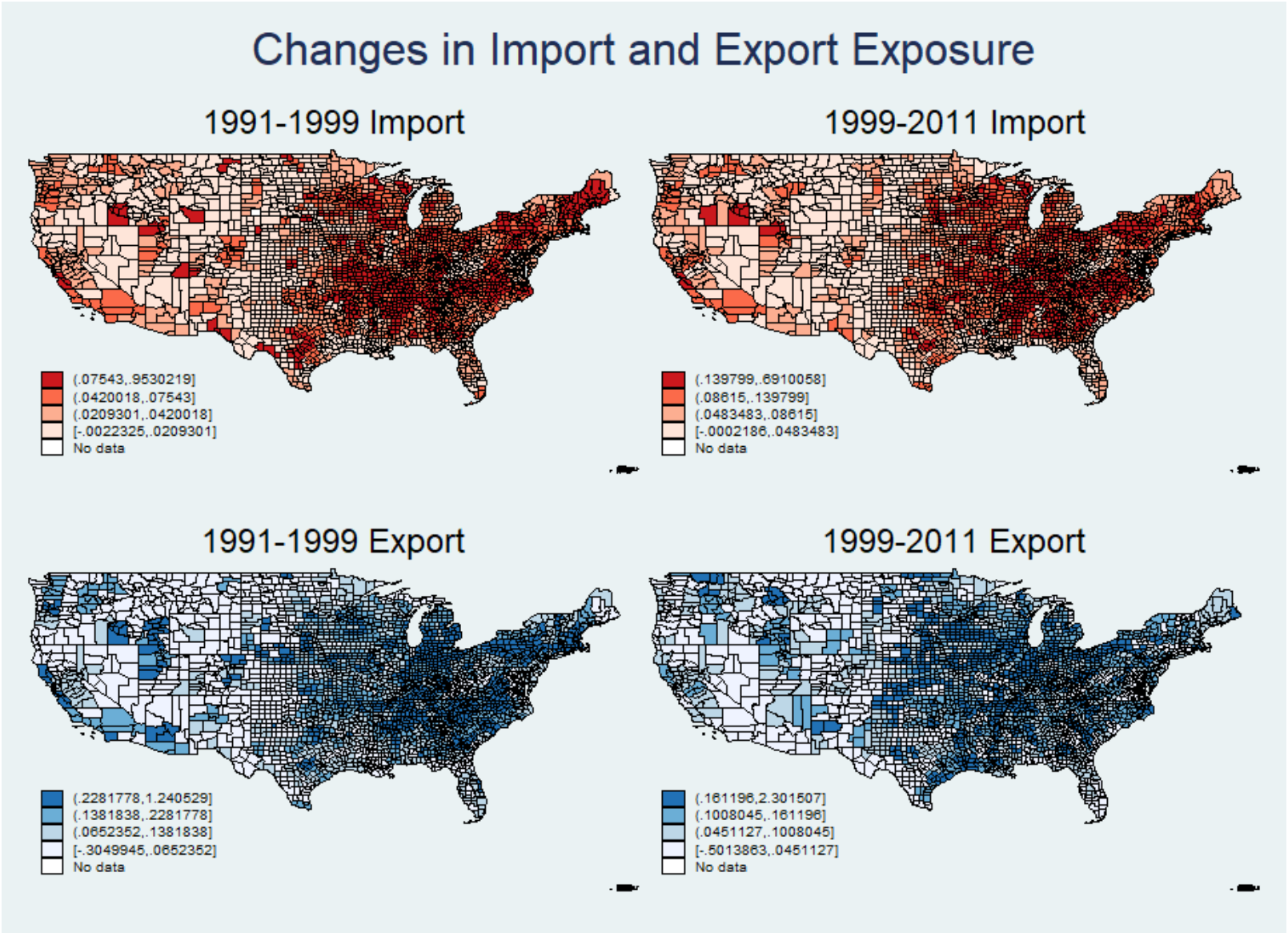
Go to Czone Effect

Accounting for Inter-sectoral Linkages

Dep var: 100 × annualized log change in industrial employment						
	(1)	(2)	(3)	(4)	(5)	(6)
	manufacturing		non-manuf	all sectors		manufacturing
Direct Import Exposure	-1.15**	-1.14***		-1.13***		
	(0.45)	(0.37)		(0.34)		
First-Order Upstream Import Exposure	-2.63***	-2.86**	-13.84**	-3.34**		
	(0.96)	(1.21)	(5.60)	(1.40)		
First-Order Downstream Import Exposure	0.97	0.96	0.26	1.53		
	(2.94)	(2.57)	(3.41)	(1.89)		
Direct Export Exposure		0.42***		0.39***		
		(0.15)		(0.15)		
First-Order Upstream Export Exposure		1.97**	5.55	1.27		
		(0.89)	(4.69)	(0.98)		
First-Order Downstream Export Exposure		-0.00	4.09	1.13		
		(1.16)	(2.71)	(1.14)		
Combined Direct/Upstream Import Exposure					-1.32***	-1.37***
					(0.30)	(0.38)
Combined Direct/Upstream Export Exposure					0.74***	0.43**
					(0.22)	(0.21)
Observations	784	784	174	958	958	784

- Here we use direct Input-Output table from the 1992 BEA input-output matrix, using Leontif IO matrix obtains similar results.

Export Expansion on Local Employment



Export Expansion on Local Employment

- First constructing the Bartik measures of CZ level import and export exposure as:

$$\Delta IP_{it}^{CZ} = \sum_s \frac{L_{is,t_0}}{L_{i,t_0}} \Delta IP_{st}, \qquad \textit{and} \qquad \Delta EP_{it}^{CZ} = \sum_s \frac{L_{is,t_0}}{L_{i,t_0}} \Delta EP_{st}, \tag{4}$$

- We specify the estimation as:

$$\Delta L_{it}^{m} = \beta_t + \beta_1 \Delta IP_{it}^{CZ} + \beta_2 \Delta EP_{it}^{CZ} + \gamma X_{it_0}^{CZ} + \gamma_r + e_{it}, \tag{5}$$

where ΔL_{st}^{m} is the annual change in *manufacturing employment share of the working age population* in commuting zone i over time period t.

Export Expansion on Local Manufacturing Employment

$$\Delta L_{it}^{m} = \beta_t + \beta_1 \Delta IP_{it}^{CZ} + \beta_2 \Delta EP_{it}^{CZ} + \gamma X_{it_0}^{CZ} + \gamma_r + e_{it},$$

Dep. var: changes in mfg employment-workingage population ratio				
	(1)	(2)	(3)	(4)
	1991-2007		1991-2011	
Δ Imports	-1.955***	-1.243***	-2.270***	-1.292***
	(0.172)	(0.208)	(0.255)	(0.267)
Δ Exports	0.313*	0.790***	0.333*	0.916***
	(0.180)	(0.279)	(0.193)	(0.275)
share of mfg employment t-1		-1.130***		-1.218***
		(0.287)		(0.235)
Observations	1444	1444	1444	1444
Kleibergen-Paap rk Wald F stat	24.03	13.25	17.06	10.57

- Also control for *start of period* commuting zone level demographic and economic conditions.

Export Expansion on Local Employment

- the impact of CZ level import exposure on the local manufacturing employment share is negative and significant.
- export exposure has a significant positive effect on local employment in manufacturing.
- *start-of-period* manufacturing employment share plays a substantial role:

$$\Delta IP_{it}^{CZ} = \frac{L_{i,t_0}^{mfg}}{L_{i,t_0}} \sum_s \frac{L_{is,t_0}}{L_{i,t_0}^{mfg}} \Delta IP_{st}, \qquad \Delta EP_{it}^{CZ} = \frac{L_{i,t_0}^{mfg}}{L_{i,t_0}} \sum_s \frac{L_{is,t_0}}{L_{i,t_0}^{mfg}} \Delta EP_{st},$$

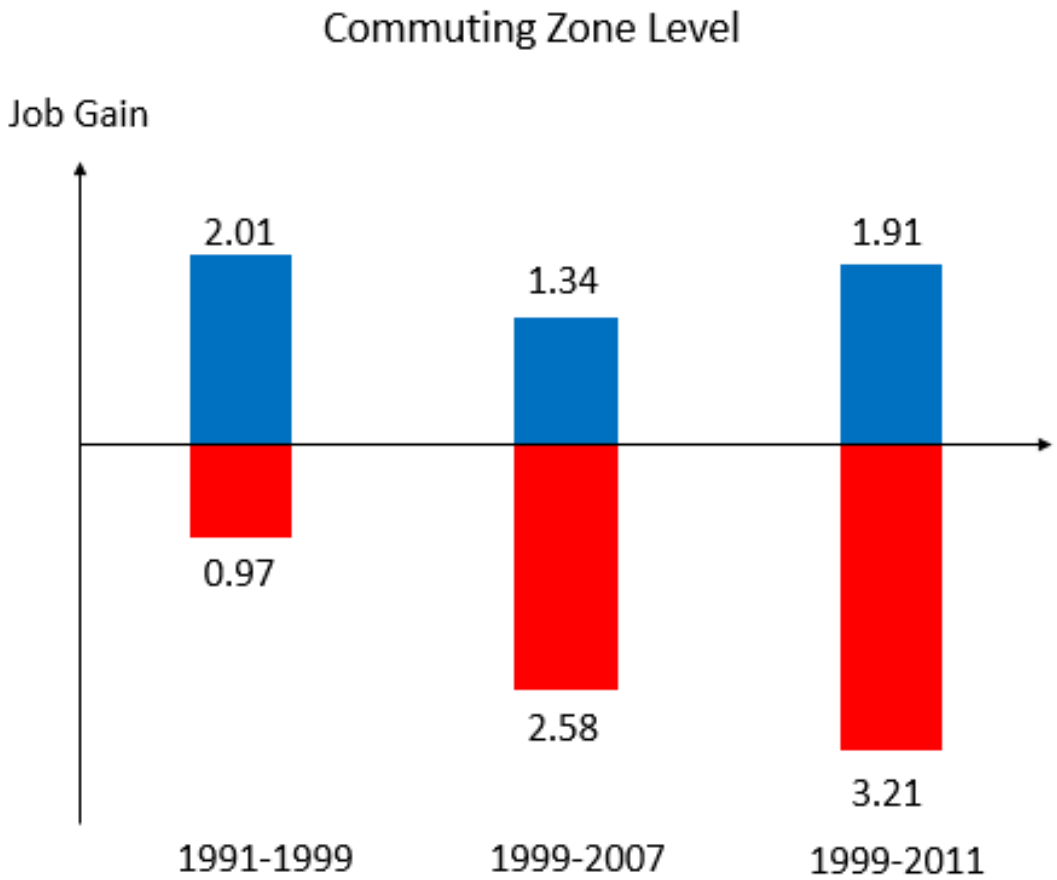
- Bernard and Jensen (2000) noticed that manufacturing-intensive states saw disproportionate rises in wage inequality.
  - falling the durable manufacturing employment share to total employment resulted into rising state residual wage inequality.

Quantify the results

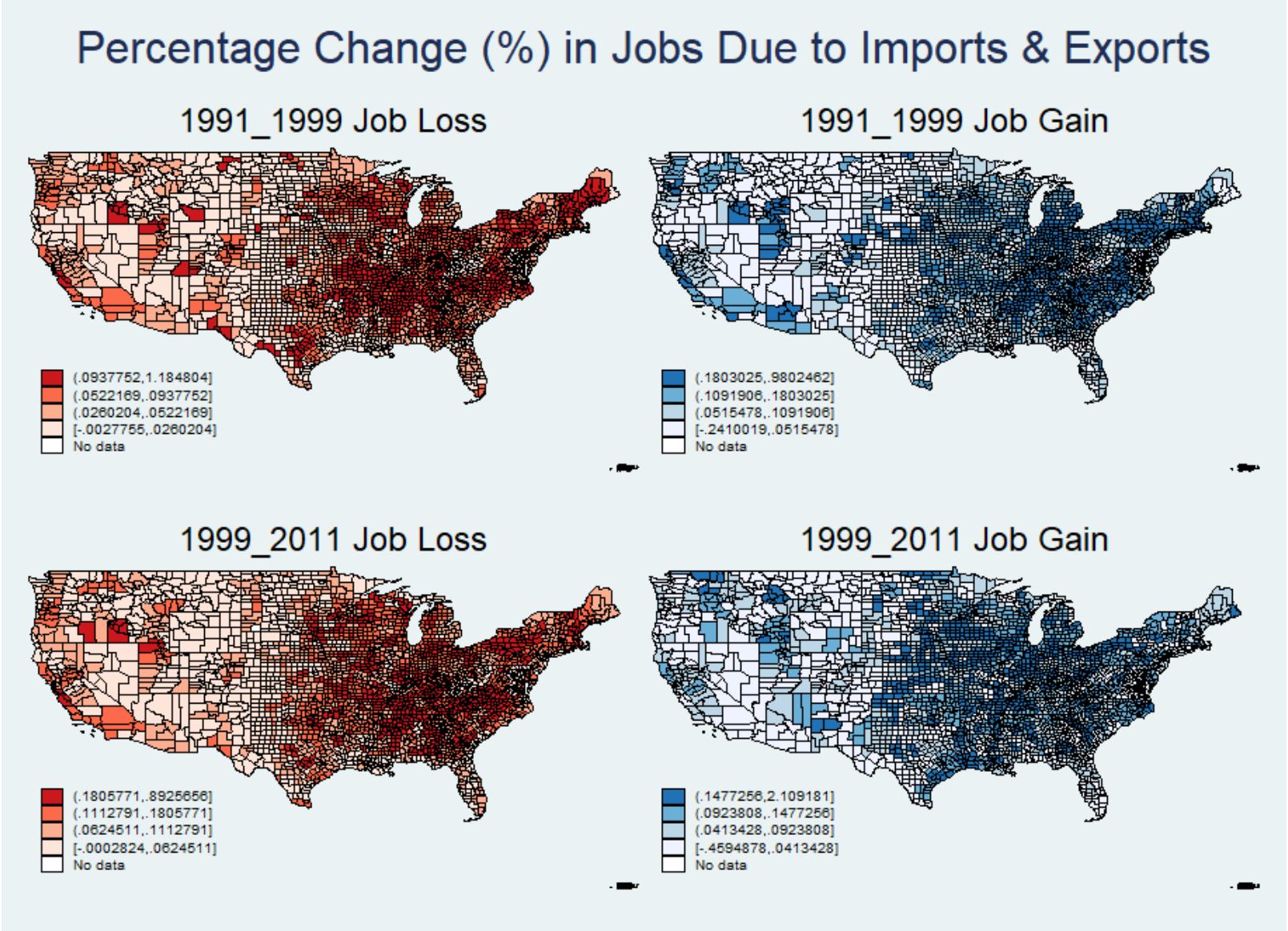
- Col.(2) & (4) are our benchmark, with stacked long differences b/w 1991-1999 & 1999-2007 (or 1999-2011).
  1. a 1 ppt rise in czone import penetration reduces domestic industry employment by 1.24 ppt.
  2. a 1 ppt rise in czone export expansion increases industrial employment by 0.79 ppt (or 0.92 for 1991-2011).
- Quantitative results: accounting for local market effects, export exposure substantially offsets the reduction in jobs caused by import penetration, leaving about only 0.2 million net job losses for 1991-2007 and roughly balanced for 1991-2011.
  - increased import exposure led to a loss of 0.97 million manufacturing job 1991 to 1999, and about 2.58 million from 1999 to 2007 (and 3.21 million from 1999-2011).
  - increased export exposure implies a gain of 2.01 million manufacturing jobs from 1991 to 1999 and 1.34 million from 1999 to 2007 (and 1.91 million from 1999-2011).

Quantify the results

- illustate the quantitative results:



Quantify the results



Export Expansion on Local Employment

- There is an apparent correlation in Figure 4 between job losses and job gains across CZ's:

	% Job Change			# of Jobs		
year	1991-1999	1999-2007	1999-2011	1991-1999	1999-2007	1999-2011
correlation	0.49	0.20	.20	0.93	0.84	0.63

Concluding Remarks

- Prior literature has shown that rising import competition from China reduces job opportunities for US manufacturing workers
- In this paper we extend the analysis to investigate US exports to the world:
  - At the industry level, the US manufacturing exports created enough jobs to offset all but 0.3-0.4 million of the jobs lost due to imports from China, over 1991-2011.
  - At the CZ level, 0.2 million net job loss over 1991-2007, but the job losses are just balanced with the job gains over 1991-2011.

- Unanswered questions:
  - Job losses and gains from US trade in agriculture, mining and services
  - The extent to which within-regional losses and gains balance out.