Dynamic Impact of Trade Liberalization: Evidence from U.S.-Korea FTA

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What are the distributional effects of the FTA?

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$\rightarrow$ **Use an improved measure to estimate dynamic effects**

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  - State level variation – geographic distributional effect
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- Estimates dynamic response in local outcomes
  - State level variation – geographic distributional effect
  - Local projection method (Jorda 2005)
- US-Korea Free Trade Agreement
  - Largest FTA for the US since NAFTA
  - Signed 2007; Effective 2012; Revised 2018

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- Dynamic effects of FTA on wages and consumption
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  - Lower input barrier has transitory positive impact (0.5%)
- Using the new measures yields much more precise results

Literature

- **Measure of trade barriers**
  Anderson and Neary 1994, 1996; Kee et al. 2008, 2009; Kovak 2013
  Contribution: More comprehensive measure that captures all channels of tariffs

- **Regional impact of trade**
  Autor et al. 2013; Waugh 2019; Benguria and Saffie 2020
  Contribution: More precise identification of dynamics along the transition

- **Impact of trade through global value chain**
  Amiti and Konings 2007; Kasahara and Rodrigue 2008; Topalova and Khandelwal 2011; Flaaen and Pierce 2019; Handley et al. 2020
  Contribution: New perspective on welfare of US households

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- Export from m to n:

$$X_{mn} = \left[\frac{p_m(1+\tau_n)}{P_n}\right]^{-\varepsilon_n} Y_n \qquad P_n = \left[\sum_L \left(p_L(1+\tau_n)\right)^{\varepsilon_n}\right]^{1/\varepsilon_n}$$

  - τ_n: Tariff rate in n, p_m: Price of m products, P_n: Aggregate price index in n, ε_n: Demand elasticity in n, Y_n: Total expenditure in n

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- Measure tariff impact on total exports?

Export Barrier

A measure of tariff impact on total exports from state S to Korea

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$$B^{Export}_S = \frac{\sum_i X^i_{SK}\left(1 - X^i_{SK}/Y^i_K\right)\ \varepsilon^i_K\ \tau^i_K}{\sum_i X^i_{SK}\left(1 - X^i_{SK}/Y^i_K\right)\ \varepsilon^i_K}$$

Measure of Trade Barriers

1. Export Barrier: Korean tariff impact on **total exports** from state S to Korea

2. Protective Barrier: US tariff impact on **domestic sales** from state S to US

3. Input Barrier: US tariff impact on **intermediate imports** from Korea to state S

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$$\sum_{i \in Intmd} X^i_{KS}(B^{Input}_S) = \sum_{i \in Intmd} X^i_{KS}(\tau^i_{US})$$

Measures of Trade Barriers

1. Export Barrier

$$B_S^{Export} = \frac{\sum_i X_{SK}^i \left(1 - X_{SK}^i / Y_K^i\right) \ \varepsilon_K^i \ \tau_K^i}{\sum_i X_{SK}^i \left(1 - X_{SK}^i / Y_K^i\right) \ \varepsilon_K^i}$$

2. Protective Barrier

$$B_S^{Prot} = \frac{\sum_i \left(X_{K,US}^i X_{S,US}^i / Y_{US}^i\right) \varepsilon_{US}^i \ \tau_{US}^i}{\sum_i \left(X_{K,US}^i X_{S,US}^i / Y_{US}^i\right) \varepsilon_{US}^i}$$

3. Input Barrier

$$B_S^{Input} = \frac{\sum_{i \in Intmd} X_{KS}^i \left(1 - X_{KS}^i / M_S^i\right) \ \varepsilon_{US}^i \ \tau_{US}^i}{\sum_{i \in Intmd} X_{KS}^i \left(1 - X_{KS}^i / M_S^i\right) \ \varepsilon_{US}^i}$$

Data

- Unit of analysis: state in the US
- Annual tariff schedule (USITC, Korea Ministry of Trade)
- Product classification: HS6 (5,087 Korean and 4,316 US tariff lines)
- Trade elasticity: Kee (2008)
- UN Comtrade, BEA, Census, Korea Statistics

Barriers before and after the FTA

	B (%)	ΔB since FTA (%p)				
	2011	2012	2013	2014	2015	2016
Export Barrier B^{Export}						
25th percentile	4.73	-2.27	0.18	0.02	0.43	0.22
50th percentile	6.98	-3.76	-0.65	-0.58	0.17	-0.08
75th percentile	10.06	-5.58	-1.30	-1.35	-0.43	-0.55
Protective Barrier B^{Prot}						
25th percentile	1.74	0.04	-0.02	0.31	0.24	0.04
50th percentile	2.64	-0.72	-0.43	-0.09	-0.17	-0.18
75th percentile	4.11	-1.24	-0.80	-0.40	-0.51	-0.46
Input Barrier B^{Input}						
25th percentile	0.87	-0.05	0.19	0.17	0.07	0.15
50th percentile	2.03	-0.62	-0.03	-0.11	-0.01	-0.06
75th percentile	3.30	-1.89	-0.42	-0.45	-0.53	-0.41

Estimation

$$\Delta_h\, y_{s,t+h} = \mu_s^h + \mu_{t+h}^h + \beta_X^h \Delta_1 B_{st}^{Export} + \beta_P^h \Delta_1 B_{st}^{Prot} + \beta_I^h \Delta_1 B_{st}^{Input} + \sum_{k=1}^{2} \gamma_k^h \Delta_1\, y_{s,t-k} + \varepsilon_{t+h}$$

- Local projection (Direct multi-step sequential regressions)

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- $\Delta_h\, y_{s,t+h} = y_{s,t+h} - y_{s,t-1}$
- $\beta^h = \mathbb{E}(\Delta_h\, y_{s,t+h} | \Delta B_t = 1\%p, \mathcal{X}) - \mathbb{E}(\Delta_h\, y_{s,t+h} | \Delta B_t = 0, \mathcal{X})$

Estimation

$$\begin{aligned}\Delta_h\, y_{s,t+h} =& \mu_s^h + \mu_{t+h}^h + \beta_X^h \Delta_1 B_{st}^{Export} + \beta_P^h \Delta_1 B_{st}^{Prot} + \beta_I^h \Delta_1 B_{st}^{Input} \\ &+ \sum_{k=1}^{2} \gamma_k^h \Delta_1\, y_{s,t-k} + \varepsilon_{t+h}\end{aligned}$$

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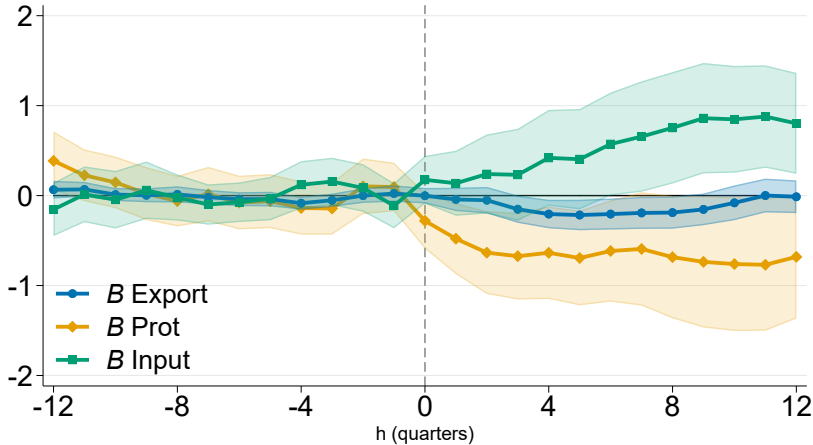
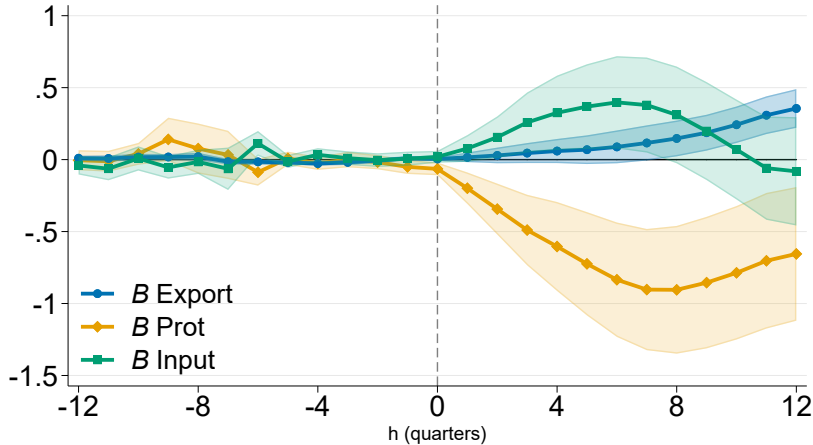
- All three barriers in one regression – identify each channel controlling for others
- ΔB_t not correlated, although at the product level tariff changes may be correlated

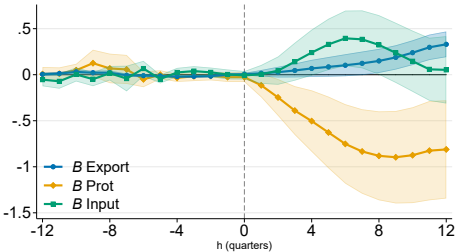
Cumulative Response to Lower Barriers: GDP



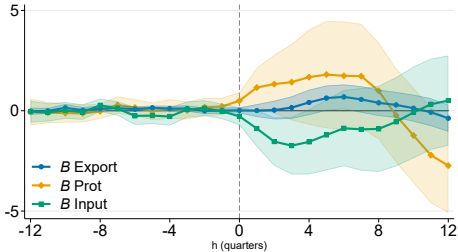
Labor Market Response: Employment



Employment Driven by Changes in Labor Force

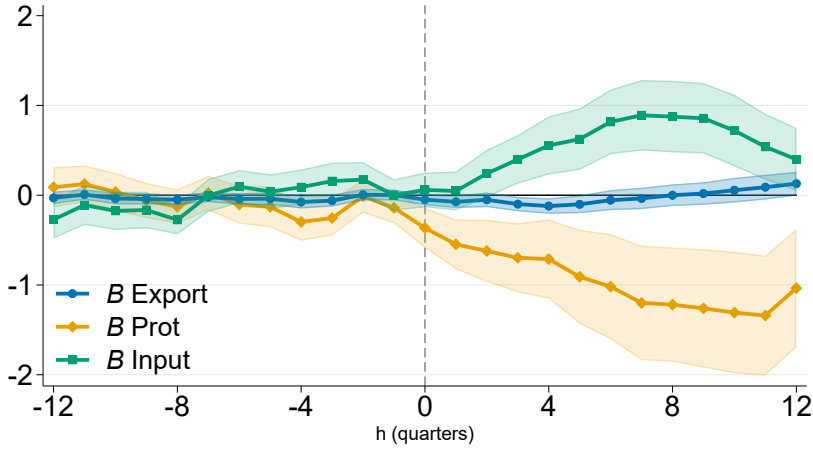


(a) Labor Force Participation

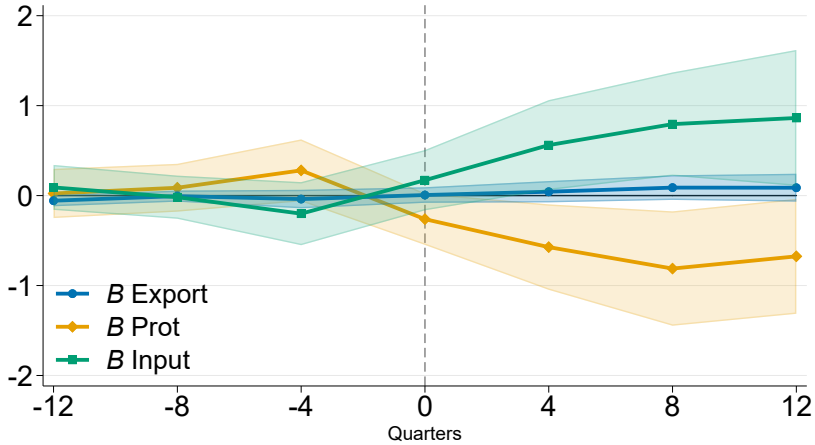


(b) Unemployment

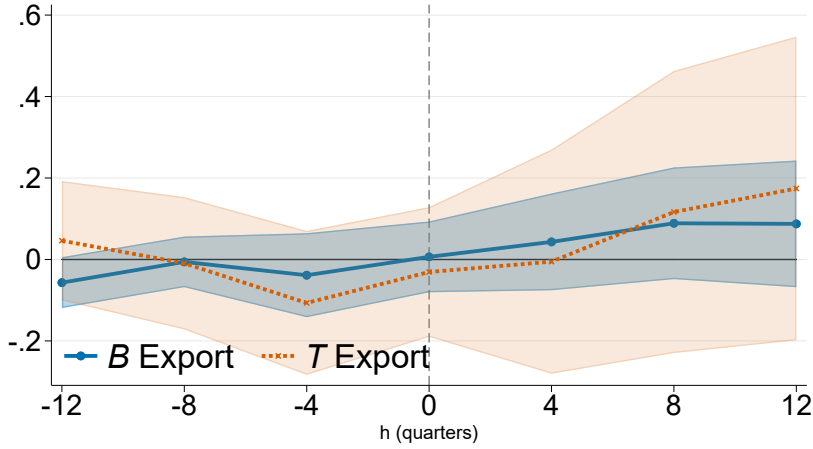
Similar Responses in Wages



Implications for Welfare: Consumption



Export Barrier vs. Average Export Tariff



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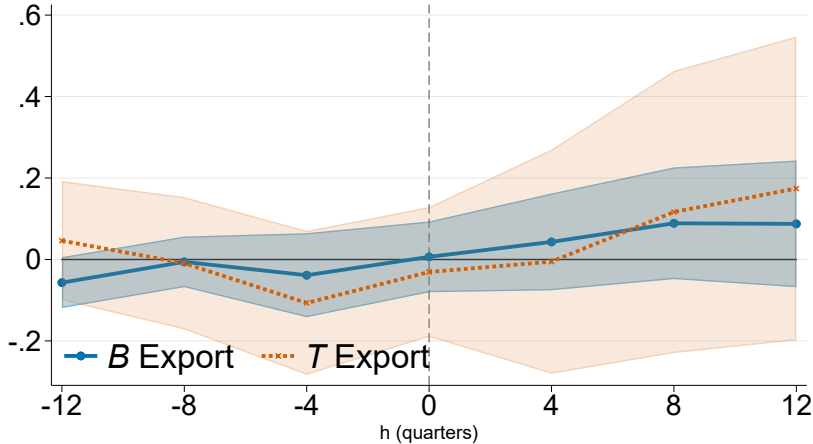
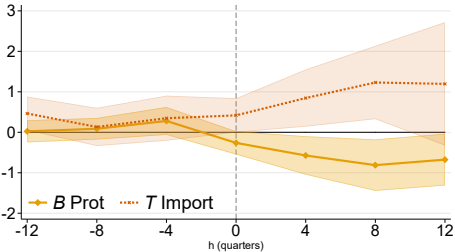
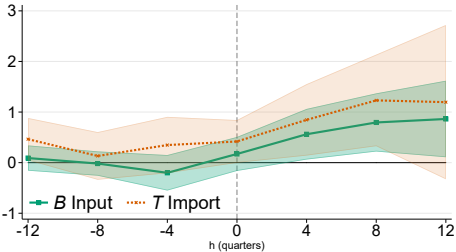


- Enables much more precise estimation with smaller standard errors

Protective/Input Barrier vs. Average Import Tariff





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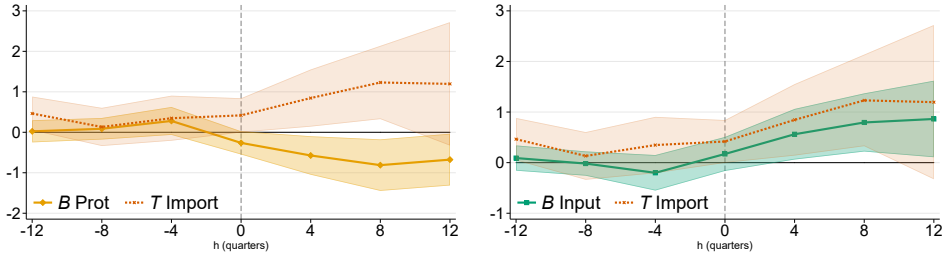

- Separate out positive/negative impact of import tariff

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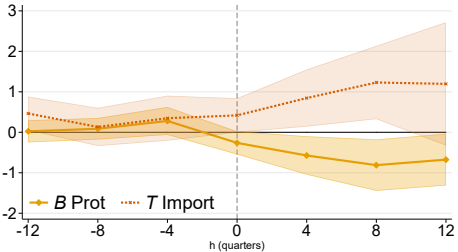

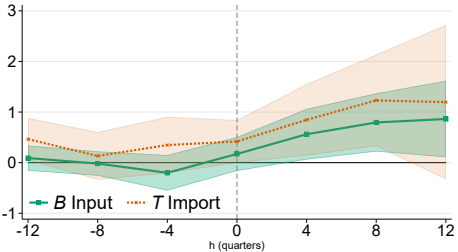

- Separate out positive/negative impact of import tariff
- Smaller standard errors

Robustness checks

- Number of lags
- Control future/past shocks
- Quarterly frequency
- Sample period
- Wage/earnings from other data sources (QCEW, BEA SAGDP)

Conclusion

- FTA reduced trade barriers on exports (7%), domestic protection (2.6%), intermediate imports (2%)
- FTA effect takes time to realize
  - Lower protective barrier has largest persistent negative impact
  - Lower input barrier has transitory positive impact
- Identification requires theoretically sound quantification of trade barriers

Comparison of the Methods

Long-Run Diff-in-Diff

$$\Delta_h\, y_{st} = \gamma_X^h \Delta_h B_{st}^X + \gamma_P^h \Delta_h B_{st}^P + \gamma_I^h \Delta_h B_{st}^I + \epsilon_{st}$$

	Personal Income		Wages and Salaries	
	LR DD	Local projection	LR DD	Local projection
Export Barrier	0.20	0.20**	0.28**	0.26***
	(0.15)	(0.09)	(0.11)	(0.06)
Protective Barrier	-0.13	-0.17***	-0.03	-0.34***
	(0.16)	(0.06)	(0.22)	(0.08)
Input Barrier	-0.04	-0.29*	0.21	-0.25
	(0.36)	(0.15)	(0.38)	(0.24)

Comparison of the Results

- Autor et al, (2013)
  - With Chinese import penetration, -4.5% fall in manufacturing employees, 0.8% larger decline in mean log weekly earnings
- Waugh (2020)
  - 1%p higher Chinese retaliatory tariff: -1%p consumption growth
- Amiti and Konings (2007)
  - 1%p lower input tariff leads to 1.2% productivity gain
- Trefler (2003)
  - smaller export tariff impact than import tariff impact with U.S.-Canada FTA

Measure of Trade Barriers

- Export Barrier

$$B_S^{Export} = \frac{\sum_i w_S^i \, \varepsilon_K^i \, \tau_K^i}{\sum_i w_S^i \, \varepsilon_K^i} \qquad w_S^i = X_{SK}^i \left(1 - X_{SK}^i / Y_K^i\right)$$

- Protective Barrier

$$B_S^{Prot} = \frac{\sum_i w_S^i \, \varepsilon_{US}^i \, \tau_{US}^i}{\sum_i w_S^i \, \varepsilon_{US}^i} \qquad w_S^i = (X_{K,US}^i X_{S,US}^i / Y_{US}^i)$$

- Input Barrier

$$B_S^{Input} = \frac{\sum_{i \in Intmd} w_S^i \, \varepsilon_{US}^i \, \tau_{US}^i}{\sum_{i \in Intmd} w_S^i \, \varepsilon_{US}^i} \qquad w_S^i = X_{KS}^i \left(1 - X_{KS}^i / M_S^i\right)$$

Decomposition of Trade Barriers

$$
\begin{aligned}
B_S &= \frac{\sum_i w_S^i \ \varepsilon^i \ \tau^i}{\sum_i w_S^i \ \varepsilon^i} \\
&= \sum_i w_S^i \ \widehat{\varepsilon}_S^i \ \tau^i \\
&= \underbrace{\sum_i w_S^i \ \tau^i}_{\bar{\tau}_S} + \underbrace{\sum_i w_S^i (\tau^i - \bar{\tau}_S)(\widehat{\varepsilon}^i - \bar{\varepsilon}_S)}_{cov_S(\tau^i, \widehat{\varepsilon}^i)}
\end{aligned}
$$

$$
\bar{\tau}_S = \sum_i w_S^i \tau^i, \quad \bar{\varepsilon}_S = \sum_i w_S^i \varepsilon^i, \quad \widehat{\varepsilon}_S^i = \varepsilon_S^i / \bar{\varepsilon}_S
$$

- Different weights w^i reflect three different channels of tariff impact
- Covariance term reflects prohibitive power of tariffs

Table: Point estimates of cumulative response

	Wage and Salary			Consumption		
	Quarter 4	Quarter 8	Quarter 12	Year 1	Year 2	Year 3
ΔB^{Export}	-0.12**	0.00	0.13	0.04	0.09	0.09
	(0.05)	(0.07)	(0.08)	(0.07)	(0.08)	(0.09)
ΔB^{Prot}	-0.71***	-1.22***	-1.03***	-0.57**	-0.81**	-0.68*
	(0.27)	(0.39)	(0.40)	(0.29)	(0.39)	(0.39)
ΔB^{Input}	0.55***	0.88***	0.40*	0.56*	0.79**	0.86*
	(0.20)	(0.24)	(0.21)	(0.30)	(0.35)	(0.46)
Time FE	YES	YES	YES	YES	YES	YES
State FE	YES	YES	YES	YES	YES	YES
R^2	0.654	0.717	0.870	0.747	0.795	0.861
Observations	969	969	918	254	254	204