Trade Deflection and Trade Depression

(Bown & Crowley, 2007)

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Introduction

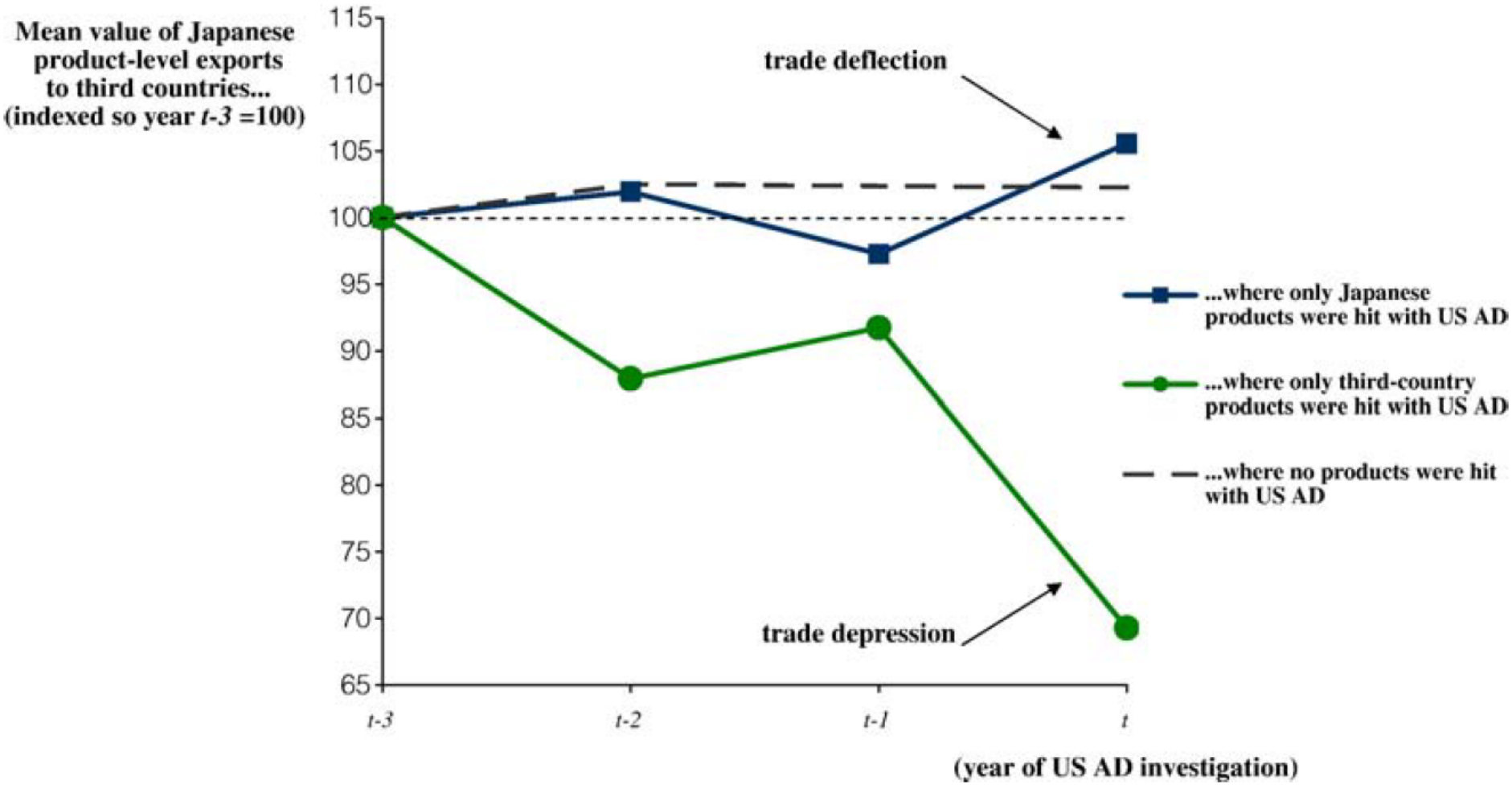
Bown and Crowley (2007) is the first paper to empirically examine **whether a country's use of an import restricting trade policy distorts a foreign country's exports to third markets**.

Their research steps are:

1. They develop a theoretical model of worldwide trade in which the imposition of antidumping and safeguard tariffs by one country causes significant distortions in world trade flows.
2. They empirically test the theoretical model by investigating the effect of the United States' use of such import restrictions on Japanese exports into 37 countries between 1992 and 2001.

Motivation

Figure 1: Trade deflection and trade depression associated with US antidumping



Qualitative Findings

- US AD against Japan $\Rightarrow$ Japan's export to third countries $\uparrow$ (**Trade Deflection**)
- US AD against a third country $\Rightarrow$ Japan's export (of same product) to average third country's market $\downarrow$ (**Trade Depression**)

Quantitative Findings

- The median antidumping duty against Japan leads to a 5–7% average increase in Japanese exports to a non-US trading partner. (**Trade Deflection**)
- When the median US antidumping duty is imposed against a third country's exporters, Japanese exports in the same product to that third country decrease by an average of 5–19%. (**Trade Depression**)
- When faced with a US safeguard measure, Japanese exports to third countries fall by somewhere between 55% and 70%.
- The results on the "deflection" and "depression" of Japanese exports vary substantially across importing countries, and the estimated impact appears stronger for non-steel relative to steel products.

Theoretical Model: Assumptions

- **Three countries**: $i, j \in \{A, B, C\}$. Each country has one firm.
- m_{ij} denotes a good produced in country i and exported to country j.
- The good produced for domestic consumption and the imported goods are **strategic substitutes**.
- The marginal cost of production is **increasing**: the cost function is $c(x_i)$ where $c'(x_i) > 0$ and $c''(x_i) > 0$. x_i is firm i's total output.
- The inverse demand in all countries is denoted $p(Q_j, Y_j)$, where Q_j is the total output sold in country j (domestic sales plus imports from two other countries) and Y_j is national income.

Theoretical Model: Firm's Problem

- The objective of the firm in i is to chose a total output level and a level of sales for each market in order to maximize profits:

$$\max_{m_{ij}} \pi_i = \sum_j [p(Q_j, Y_j) m_{ij} - \tau_{ij} m_{ij}] - c(x_i)$$

  where τ_{ij} represents country j's tariff on imports from i.

- Solving the nine best response functions (by FOC) simultaneously yields the Cournot Nash equilibrium quantities sold by each firm in each country:

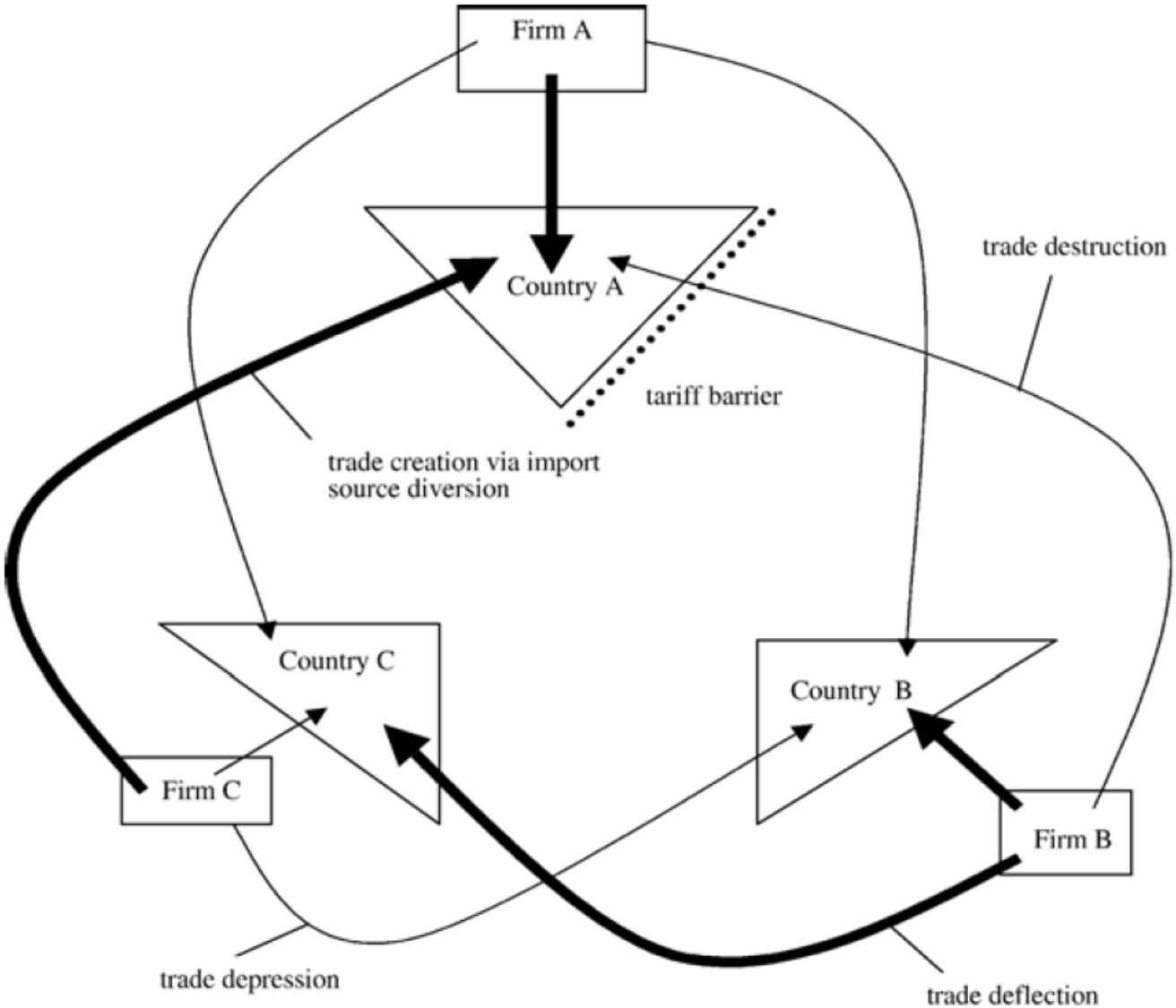
$$m_{ij} = f\Big(p(Q_j, Y_j), c(x_i), \tau_{i,j}\Big) \quad \forall i, j \in \{A, B, C\} \tag{1}$$

Theoretical Model: Proposition 1

For the three country Cournot model in which goods are strategic substitutes and firms face increasing marginal costs in production, a tariff by country A against country B causes, relative to the free trade equilibrium: figure

- **Trade destruction:** $\frac{dm_{ba}}{d\tau_{ba}} < 0$.
- **Trade creation via import source diversion:** $\frac{dm_{ca}}{d\tau_{ba}} > 0$.
- **Trade deflection:** $\frac{dm_{bc}}{d\tau_{ba}} > 0$.
- **Trade depression:** $\frac{dm_{cb}}{d\tau_{ba}} < 0$.

Theoretical Model: Trade Flows under an AD



Theoretical Model: Proposition 2

For the three country Cournot model in which goods are strategic substitutes and firms face increasing marginal costs in production, a tariff by country A against all other countries (B and C, assuming $\tau_{ba} = \tau_{ca} = \tau$) causes, relative to the free trade equilibrium:

- **Trade destruction:** $\frac{dm_{ba}}{d\tau} < 0$, $\frac{dm_{ca}}{d\tau} < 0$.
- **Two-way trade deflection:** $\frac{dm_{bc}}{d\tau} > 0$ and $\frac{dm_{cb}}{d\tau} > 0$.

Difference from Proposition 1:

- No trade creation.
- No trade depression (assumption: each firm has a strong desire to export).

Empirical Model: Basic

Bown and Crowley develop the following reduced-form specification for the value of Japanese exports to country i based on Eq (1):

$$\ln(vm_{iht}) = \alpha_i + \gamma_h + \beta_1' \ln(Y_t) + \beta_2' \ln(Y_{it}) + \beta_3' \ln(e_{it}) + \beta_4' \tau_{ht} + \beta_5' \tau_{iht} + \beta_6' \tau_t^{*i} + \beta_7' \ln(c_{kt}) + \beta_8' \ln(vm_{ih,t-1}) + \epsilon_{iht} \quad (2)$$

where i denotes an importing country, h denotes a 6-digit product, t denotes time in years, and k denotes an industry aggregate at the 3-digit ISIC level. β_4 and β_5 are coefficients of interest, estimating the trade deflection and depressing effects, respectively.

Empirical Model: Problems in Basic Model

$$\ln(vm_{iht}) = \alpha_i + \gamma_h + \beta_1' \ln(Y_t) + \beta_2' \ln(Y_{it}) + \beta_3' \ln(e_{it}) + \beta_4' \tau_{ht} + \beta_5' \tau_{iht} + \beta_6' \tau_t^{*i} + \beta_7' \ln(c_{kt}) + \beta_8' \ln(vm_{ih,t-1}) + \epsilon_{iht} \quad (2)$$

Two problems in estimating Eq (2):

- The autocorrelation of $vm_{iht} \Rightarrow$ bias!
- In a short panel, the number of parameters to be estimated (α_i and γ_h) increases with the number of countries and products $\Rightarrow$ inconsistently estimated.

Empirical Model: GMM

To address both problems, they use the **first difference** and the **optimal GMM estimator** proposed by Arellano and Bond (1991), in which multiple lags of the level of the dependent variable, i.e., $\ln(vm_{ih,1})$, ..., $\ln(vm_{ih,t-2})$, are used as IV for $\Delta \ln(vm_{ih,t-1})$. note

$$\begin{aligned}\Delta \ln(vm_{iht}) = \beta_1' \Delta \ln(Y_t) + \beta_2' \Delta \ln(Y_{it}) + \beta_3' \Delta \ln(e_{it}) + \beta_4' \Delta \tau_{ht} + \beta_5' \Delta \tau_{iht} \\ + \beta_6' \Delta \tau_t^{*i} + \beta_7' \Delta \ln(c_{kt}) + \beta_8' \Delta \ln(vm_{ih,t-1}) + \Delta \epsilon_{iht} \qquad (3)\end{aligned}$$

Empirical Model: Problem in GMM

$$\Delta \ln(vm_{iht}) = \beta_1' \Delta \ln(Y_t) + \beta_2' \Delta \ln(Y_{it}) + \beta_3' \Delta \ln(e_{it}) + \beta_4' \Delta \tau_{ht} + \beta_5' \Delta \tau_{iht} + \beta_6' \Delta \tau_t^{*i} + \beta_7' \Delta \ln(c_{kt}) + \beta_8' \Delta \ln(vm_{ih,t-1}) + \Delta \epsilon_{iht} \quad (3)$$

One potential problem in basic empirical model, i.e., Eq (3): The industry cost variables, c_{kt}, are only available at a 3-digit industry level whereas the trade data and policy changes are measured at a 6-digit product level. Thus, the basic model does not adequately control for product-level variation in production costs.

Empirical Model: FE I

To address this problem, they use a **fixed effects model** as robustness check:

$$\Delta \ln(vm_{iht}) = \mu_h + \chi_{it} + \eta_1' \Delta\tau_{ht} + \eta_2' \Delta\tau_{iht} + \eta_3' \Delta \ln(vm_{ih,t-1}) + \Delta\epsilon_{iht} \quad (4)$$

where μ_h are 6-digit HS product-specific fixed effects and χ_{it} represents a full set of country-year dummies. note

They estimate Eq (4) using the IV approach of Anderson and Hsiao (1982) in which they instrument for $\Delta \ln(vm_{ih,t-1})$ using the second lag of the log level of the value of imports, i.e., $\ln(vm_{ih,t-2})$.

Empirical Model: FE II

$$\Delta \ln(vm_{iht}) = \beta_1' \Delta \ln(Y_t) + \beta_2' \Delta \ln(Y_{it}) + \beta_3' \Delta \ln(e_{it}) + \beta_4' \Delta \tau_{ht} + \beta_5' \Delta \tau_{iht} + \beta_6' \Delta \tau_t^{*i} + \beta_7' \Delta \ln(c_{kt}) + \beta_8' \Delta \ln(vm_{ih,t-1}) + \Delta \epsilon_{iht} \quad (3)$$

$$\Delta \ln(vm_{iht}) = \mu_h + \chi_{it} + \eta_1' \Delta \tau_{ht} + \eta_2' \Delta \tau_{iht} + \eta_3' \Delta \ln(vm_{ih,t-1}) + \Delta \epsilon_{iht} \quad (4)$$

Because the product fixed effects and the country-year dummies absorb product-level and macroeconomic variation over time, this approach requires **fewer control variables** than Eq (3). Thus, we are able to utilize a much **larger sample** of trade and trade remedy data for many additional countries.

Data on Trade

Trade data: Annual data on the nominal value of imports into 37 non-US countries for roughly 4800 6-digit Harmonized System (HS) products for the years 1992 to 2001 come from **UNCTAD's TRAINS data base**. Import data for these 37 countries was reformatted into a dataset of Japanese exports to these countries.

- In basic specification (3), they use a smaller set of **28 importing third countries** due to the limited availability of some of the macroeconomic data.
- The alternative fixed effects model (4) requires no macroeconomic data and utilizes a larger sample of **37 importing countries**.

Data on Policy

Policy data: We collected data on the US imposition of country-specific antidumping duties and safeguard measures at the 6-digit HS level over the 1992 through 2001 period from a variety of US government publications, most notably the **Federal Register**.

For the **antidumping policies**, we interact a variable indicating that the policy was imposed in year t with the level of the antidumping duty that is imposed, to help control for the heterogeneity in duties imposed across exporters and across investigations. On the other hand, we use a simple indicator variable to examine the **safeguard policies**, due to the fact that sometimes the safeguard measure is imposed as a quantitative restriction or a tariff-rate quota, as opposed to a simple ad valorem duty.

Data on Macroeconomic and Industrial-Level Variables I

Variable	Description	Source
$\Delta \ln(\text{realGDP}_{it})$	Growth of country i's GDP.	**OECD data** and IMF's **International Financial Statistics (IFS)**.
$\Delta \ln(\text{realGDP}_{\text{jpn},t})$	Growth of Japan's GDP.	
$\Delta \ln(\text{open}_{it})$	Growth of country i's openness to world.	
$\Delta \ln(\text{yen/curr}_{i})_t$	Growth of bilateral real Japanese yen/country i's currency rate.	**USDA Economic Research Service** (for 20 countries) and **IFS** (for Norway and Switzerland).
$\Delta \ln(\text{avg.wage}_{\text{jpn},kt})$	Growth of Japan's industry k's average wage.	**UNIDO's Industrial Statistics Database** (2002).
$\Delta \ln(\text{v.add/worker}_{\text{jpn},kt})$	Growth of Japan's industry k average value-added per worker.	

Data on Macroeconomic and Industrial-Level Variables II

To proxy for changes to an importing country's overall trade policy that they cannot observe, they control for changes in an importing country's "**openness**," which is defined as the sum of real aggregate imports and exports divided by real GDP.

Results from GMM I

	Dependent variable: $\Delta \ln(vm_{iht})$				
	(1) mag	(2)	(3)	(4)	(5)
ΔAD duty$_{\text{jpn},ht}$	0.141*	0.148*	0.156*	0.168*	0.167*
ΔAD duty$_{iht}$	-1.269***	-1.207***	-1.292***	-1.262***	-1.265***
ΔSG policy$_{ht}$	-1.012*	-0.981*	-1.023	-1.102	-1.018
IV for $\Delta \ln(vm_{ih,t-1})$	✓	✓	✓	✓	✓
IV for $\Delta \ln(vm_{ih,t-2})$	✓	✓	✓	✓	✓
$\Delta \ln(\text{realGDP}_{it})$	✓	✓	✓	✓	✓
$\Delta \ln(\text{realGDP}_{\text{jpn},t})$	✓	✓	✓	✓	✓
$\Delta \ln(\text{open}_{it})$	✓	✓	✓	✓	✓
$\Delta \ln(\text{yen}/\text{curr}_i)_t$		✓	✓	✓	✓
$\Delta \ln(\text{avg.wage}_{\text{jpn},kt})$			✓		
$\Delta \ln(\text{v.add}/\text{worker}_{\text{jpn},kt})$				✓	
Observations	141,164	136,583	113,393	113,393	113,393

Results from GMM II

Notes:

- Specifications (1) and (2) present estimates on the full set of industries (agricultural and manufacturing) over the 1992–2001 period thus leaving out the industry-level controls.
- Specifications (3) through (5) present estimates for all manufacturing industries from 1992–1999, all years for which the ISIC industry variables are available.
- Specification (5) shows that the small changes to the estimates for the policy variables of interest (the slight increase in the size of the AD duty imposition variables and decrease in the statistical significance of the SG policy imposition variable) are most likely due to the loss of observations from years 2000 and 2001.

Results from IV Using FE and an Expanded Sample I

	Dependent variable: $\Delta \ln(vm_{iht})$			
	(6) IV	(7) IV	(8) IV	(10) OLS
ΔAD duty$_{jpn,ht}$	0.127	0.190***	–	0.105*
ΔAD duty$_{jpn,ht}$ for exports to EU	–	–	0.390*	–
ΔAD duty$_{jpn,ht}$ for exports to KOR	–	–	0.578**	–
ΔAD duty$_{jpn,ht}$ for exports to CHN	–	–	-0.326	–
ΔAD duty$_{jpn,ht}$ for exports to IND	–	–	0.238	–
ΔAD duty$_{jpn,ht}$ for exports to OTH	–	–	0.198***	–
..... continue mag				
IV for $\Delta \ln(vm_{ih,t-1})$	✓	✓	✓	
6-digit HS product FE	✓	✓	✓	✓
Country i-year dummies	✓	✓	✓	✓
Observations	141,164	254,074	254,074	254,074

Results from IV Using FE and an Expanded Sample II

Notes:

- Specifications (7), (8), and (10) use data on Japanese exports to **37 non-US countries**. This adds to the estimation sizable import markets (e.g., China), in addition to requiring one fewer lag of the dependant variable in the estimation, providing effectively another year (1994) of trade remedy data.
- In column (8) they present estimates where they interact the AD variables of interest with a number of importing country indicators, examining the variation across some of Japan's important export markets. This approach yields strong evidence of trade deflection associated with Japan's exports to both the **EU and Korea** (the two largest destination markets for Japanese exports in the sample).

Results from IV Using FE and an Expanded Sample III

	Dependent variable: $\Delta \ln(vm_{iht})$			
	(6) IV	(7) IV	(8) IV	(10) OLS
..... unhide mag				
ΔAD duty$_{iht}$	-0.870***	-0.281***	–	-0.242**
ΔAD duty$_{iht}$ for exports to EU	–	–	0.812	–
ΔAD duty$_{iht}$ for exports to KOR	–	–	-1.000	–
ΔAD duty$_{iht}$ for exports to CHN	–	–	-0.249**	–
ΔAD duty$_{iht}$ for exports to IND	–	–	-1.118***	–
ΔAD duty$_{iht}$ for exports to OTH	–	–	0.145	–
ΔSG policy$_{ht}$ for exports to OTH	-1.189***	-0.807***	0.805***	-0.547***
IV for $\Delta \ln(vm_{ih,t-1})$	✓	✓	✓	
6-digit HS product FE	✓	✓	✓	✓
Country i-year dummies	✓	✓	✓	✓
Observations	141,164	254,074	254,074	254,074

Results from IV Using FE and an Expanded Sample IV

Note:

- Specification (8) indicates that US antidumping duties on third countries are associated with statistically significant reduction in Japanese exports to China and India.

Results: Effect of Imposing a Conditional Median Duty I

	Percent increase in affected JPN exports		
	(1) GMM	(7) IV,FE	(8) IV,FE
ΔAD $\text{duty}_{\text{jpn},ht}$	5.24*	7.05***	–
ΔAD $\text{duty}_{\text{jpn},ht}$ for exports to EU	–	–	16.27*
ΔAD $\text{duty}_{\text{jpn},ht}$ for exports to KOR	–	–	20.13**
ΔAD $\text{duty}_{\text{jpn},ht}$ for exports to CHN	–	–	-12.10
ΔAD $\text{duty}_{\text{jpn},ht}$ for exports to IND	–	–	7.74
ΔAD $\text{duty}_{\text{jpn},ht}$ for exports to OTH	–	–	7.35***
ΔAD duty_{iht}	-18.83***	-4.57***	–
ΔAD duty_{iht} for exports to EU	–	–	-8.45
ΔAD duty_{iht} for exports to KOR	–	–	-3.08
ΔAD duty_{iht} for exports to CHN	–	–	-30.24**
ΔAD duty_{iht} for exports to IND	–	–	-81.04***
ΔAD duty_{iht} for exports to OTH	–	–	2.94

Results: Effect of Imposing a Conditional Median Duty II

Notes:

- Comparing the estimates from specifications (1) and (7), they see that the magnitudes of the trade deflection effect are similar. There is, however, a noticeable difference in the magnitude of the trade depression effect. They believe this difference in the magnitude of trade depression is likely due to differences in the underlying sample of data.
- There is an 81% decrease in Japanese exports to India and a 30% decrease in Japanese exports to China associated with the imposition of median US AD duties against each of these two countries.

Results: Steel versus Non-Steel Products I

Another question to consider is whether the AD or SG measures associated with the US steel industry are particularly important in our results, given that this industry is the most frequent user of US trade remedies.

In the following specification they separate out the estimated policy effects for steel and non-steel products by interacting each policy variable of interest with an indicator for whether the underlying 6-digit HS product was a steel (**HS chapter 72 or 73**) or non-steel product.

Results: Steel versus Non-Steel Products II

	(9)
ΔAD duty$_{\text{jpn},ht}$ for exports of steel	0.157
ΔAD duty$_{\text{jpn},ht}$ for exports of non-steel	0.204***
ΔAD duty$_{iht}$ for exports of steel	-0.077
ΔAD duty$_{iht}$ for exports of non-steel	-0.413***
ΔSG policy$_{ht}$ for exports of steel	-0.868***
ΔSG policy$_{ht}$ for exports of non-steel	-0.621
IV for $\Delta \ln(vm_{ih,t-1})$	✓
6-digit HS product FE	✓
Country i-year dummies	✓
Observations	254,074

Thank You !

Appendix: Variable Construction 1

Table 1: Description of Dependent and Independent Variables

Variable	**Notation**	**Description**
Dependent variable		
$\Delta \ln(vm_{imt})$	$\Delta \ln(vm_{imt})$	Annual growth of third country i's imports of product h from Japan.
Independent variable of interest		
ΔAD duty$_{\text{jpn},ht}$	$\Delta\tau_{ht}$	US AD duty against Japan on product h.
ΔAD duty$_{iht}$	$\Delta\tau_{iht}$	US AD duty against country i on product h.
SG policy$_{ht}$	$\Delta\tau_{ht}$	US SG policy on product h in year t.

GMM FE

Appendix: Variable Construction 2

Table 2: Description of Control Variables

Variable	**Notation**	**Description**
$\Delta \ln(\text{realGDP}_{it})$	$\Delta \ln(Y_{it})$	Growth of country i's GDP.
$\Delta \ln(\text{realGDP}_{\text{jpn},t})$	$\Delta \ln(Y_t)$	Growth of Japan's GDP.
$\Delta \ln(\text{open}_{it})$	τ_t^{*i}	Growth of country i's openness to world.
$\Delta \ln(\text{yen/curr}_i)_t$	$\Delta \ln(e_{it})$	Growth of bilateral real Japanese yen/country i's currency rate.
$\Delta \ln(\text{avg.wage}_{\text{jpn},kt})$	$\Delta \ln(c_{kt})$	Growth of Japan's industry k's average wage.
$\Delta \ln(\text{v.add/worker}_{\text{jpn},kt})$	$\Delta \ln(c_{kt})$	Growth of Japan's industry k average value-added per worker.

GMM FE

Reference

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