

Import Protection, Business Cycles, and Exchange Rates:

Evidence from the Great Recession

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Preliminary, comments welcome

Any views expressed in this paper are personal and should not be attributed to the World Bank or the Federal Reserve Bank of Chicago.

Motivation

Conventional wisdom:

- **Import tariffs and other trade barriers rise during periods of macroeconomic weakness and crisis**
 - **Great Depression:** US Smoot-Hawley tariffs and the 1930s retaliatory response by US trading partners (Irwin 2011a,b)
- **During the Great Recession?**
 - Industrialized economies: no large scale tariff hikes or quantitative restrictions on the scale of the 1930s
 - Bown (2011a): substantial trade policy “churning” through antidumping, global safeguards, China-specific safeguards, and countervailing duties
 - E.g., United States: 23 percent increase in the stock of trade barriers by the end of 2010 relative to the pre-crisis (2007) level.
 - By 2010, over 5 percent of US 6-digit Harmonized System (HS) imported products were subject to these temporary trade barriers, so this is an economically important policy

Great Recession

However, given the severity of macroeconomic shocks that took place during the Great Recession, open research questions include

- (1) *What explains the import protection that did arise?*
- (2) *Why was the trade policy response to the Great Recession relatively mild?*

This paper's question

- What was the impact of macroeconomic fluctuations on import protection activity during the Great Recession for 5 industrialized economies?
 - United States, Canada, European Union, Korea, Australia

This paper's approach

1. We **estimate** models of import protection as a function of macroeconomic fluctuations **prior to** the crisis (1988:Q1-2008:Q3)
2. We use those models to **predict out-of-sample** import protection activity for 2008:Q4-2010:Q4, which we compared to realized import protection
3. We **re-estimate** the models on the **longer sample** (through 2010:Q4) and test for changes in the responsiveness of import protection to macroeconomic shocks across the two periods

Motivation based on the forms of Import Protection in use by Industrialized Economies under the WTO

Figure 1. Import Protection, Real Exchange Rates, and Recessions, 1988-2010

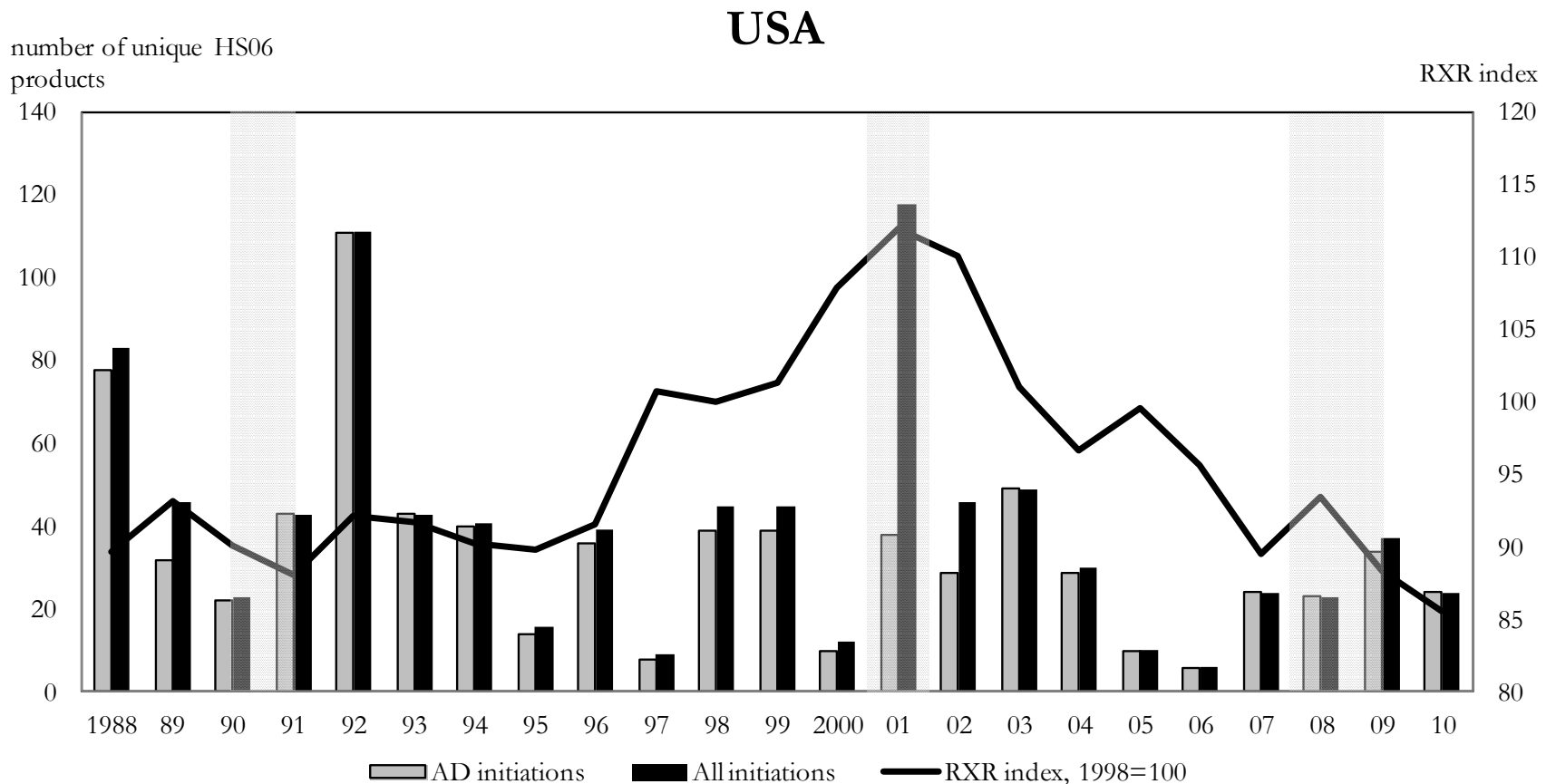


Figure 1. Import Protection, Real Exchange Rates, and Recessions, 1988-2010

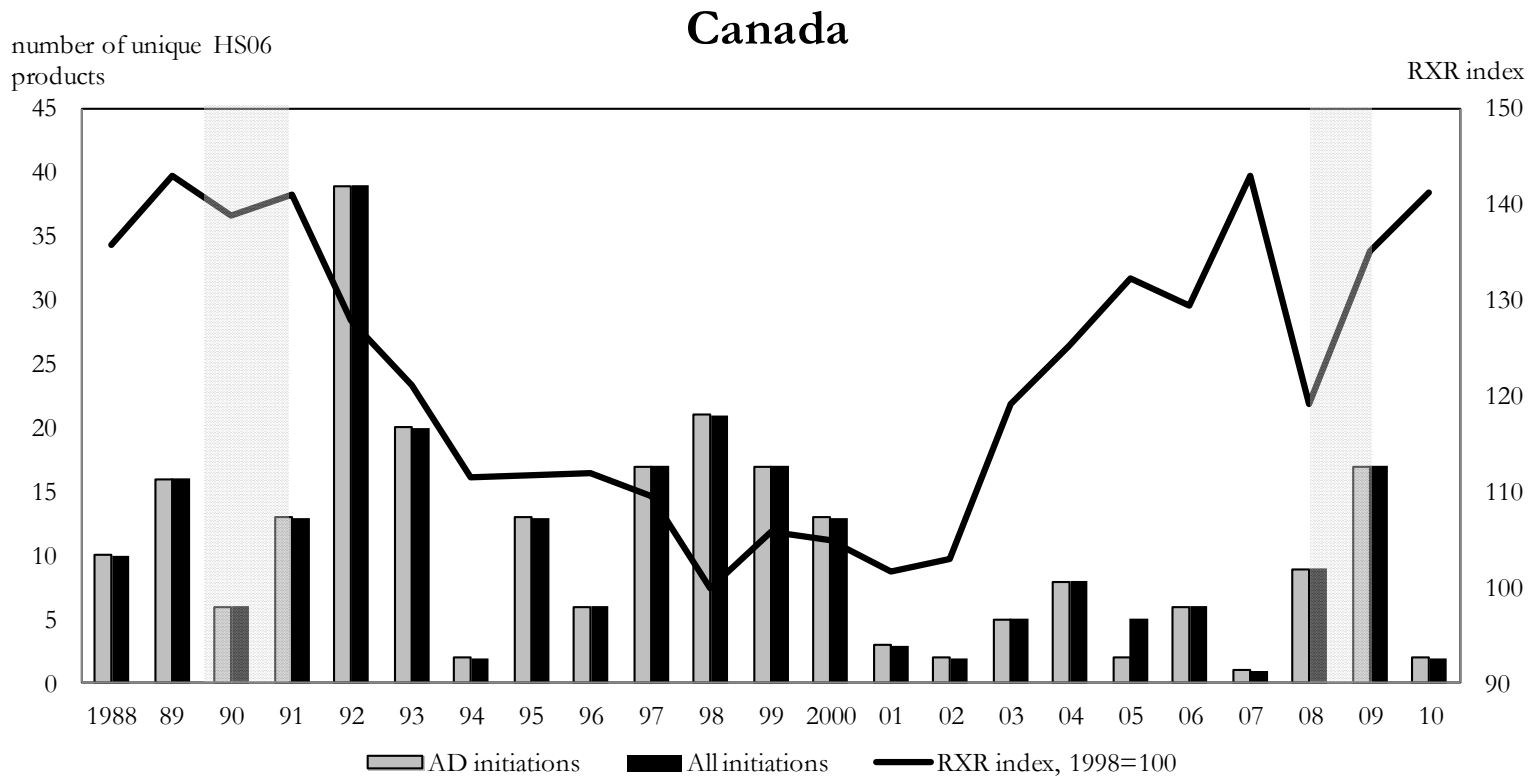


Figure 1. Import Protection, Real Exchange Rates, and Recessions, 1999-2010

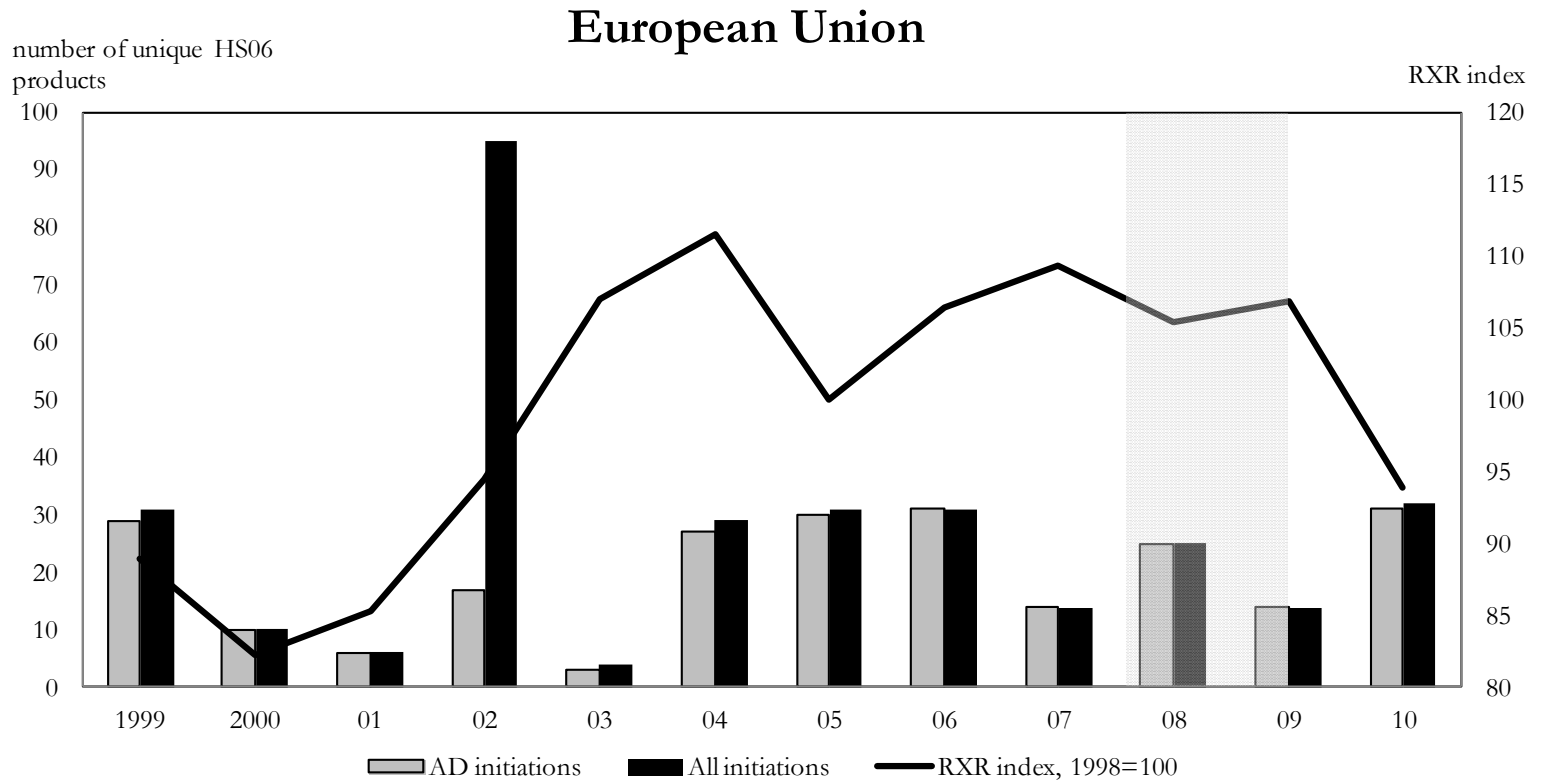


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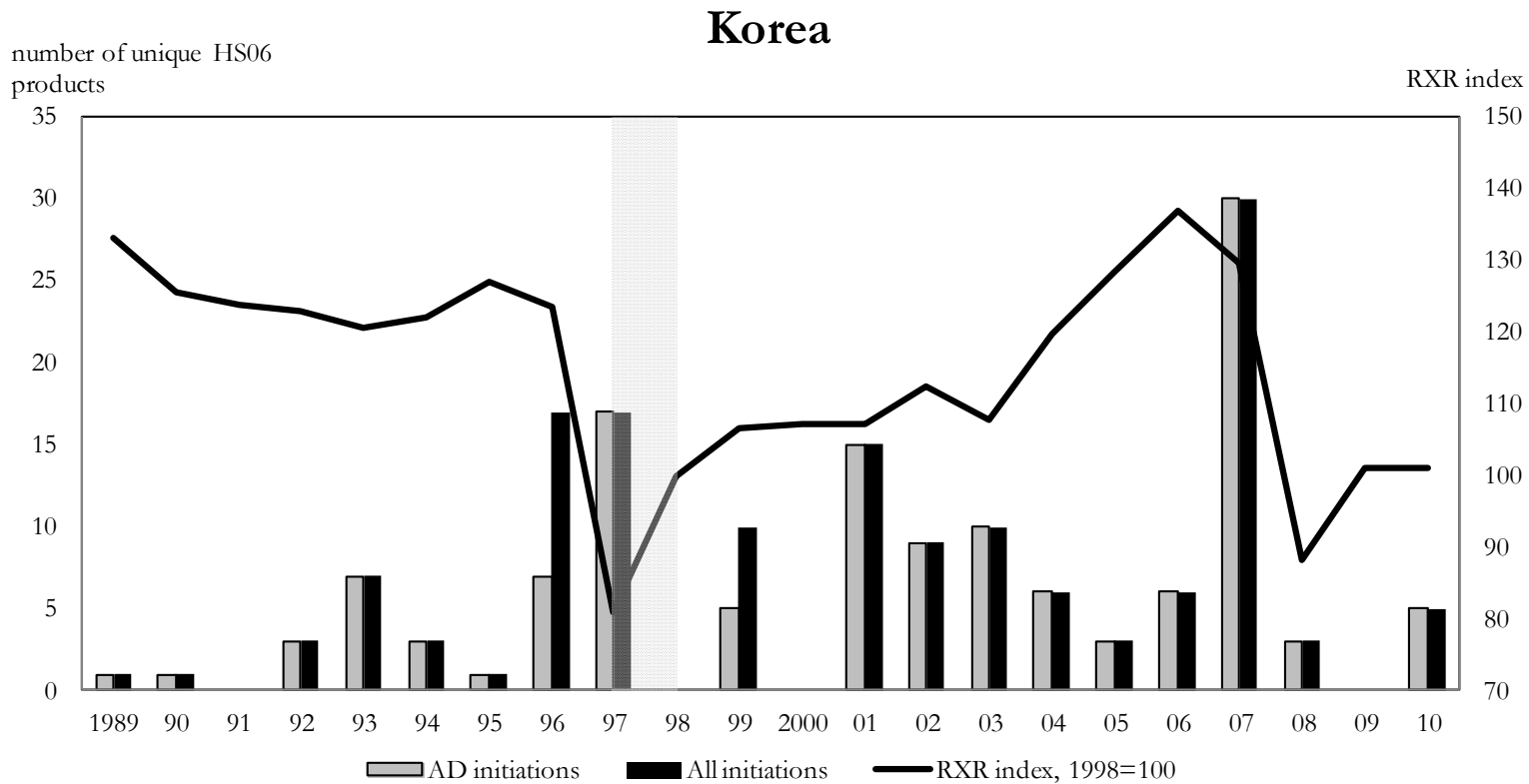
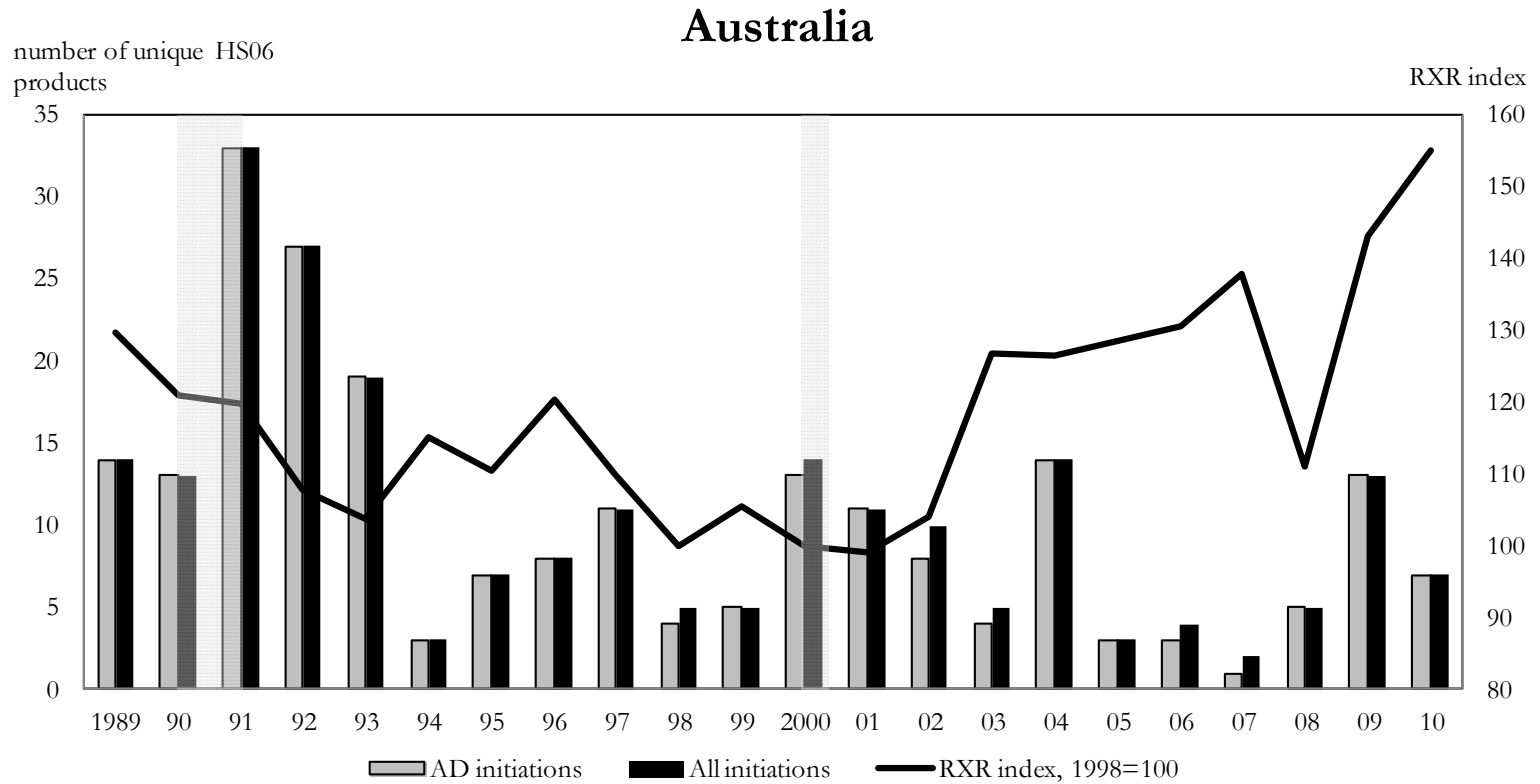


Figure 1. Import Protection, Real Exchange Rates, and Recessions, 1988-2010



This paper's results

Historical models

- **Bilateral real exchange rate appreciations** lead to more import protection
 - 4 percent appreciation in the bilateral real exchange rate relative to the mean level results in a policy-imposing country subjecting 60-90 percent more products to these forms of import protection
- Periods of **foreign** (trading partner) **macroeconomic weakness** lead to more import protection against them
 - One standard deviation fall in foreign real GDP growth results in a policy-imposing country subjecting greater than 100 percent more products to these forms of import protection

Great Recession

- **Out-of-sample** predictions: Historical models over-predict new import restrictions for 2008:Q4-2010:Q4 for US, Canada, and Korea and under-predict for EU and Australia
- Re-estimated models on data through 2010:Q4, testing for crisis-period changes to import protection responsiveness to macroeconomic shocks
 - While bilateral real **exchange rate appreciations** still lead to more import protection, the **estimated responsiveness is smaller** than historically
 - US and other economies “switched” from their historical behavior and shifted implementing new import protection **away from** those trading partners that were **contracting** and **toward** those experiencing economic **growth**

China-specific results

- A 9-20 percent appreciation of China's real bilateral exchange rate would provide it with **“equal treatment”** under US antidumping

Previous Literature

1. **Theoretical models** that include “exceptions” – e.g., antidumping, safeguards, countervailing duties – in trade agreements

- Bagwell and Staiger (1990, 2002, 2003) self-enforcing trade agreements in the presence of shocks
- Brander and Krugman (1983), Knetter and Prusa (2003), Crowley (2011)

2. **Empirical literature** estimates macroeconomic influence on antidumping filings using data from the 1980s and 1990s

- Feinberg (1989) – for 1982-87 US data, exchange rate depreciations lead to more AD
- Knetter and Prusa (2003) – for 1980-98, US, Canada, Australia, EU – exchange rate appreciations in general lead to more AD protection
- Irwin (2005) – for 1947-2002 for US, evidence consistent with Knetter and Prusa (2003)

Our approach – in addition to estimating on data extended through the 2000s, also includes advances, extensions and refinements to the previous literature

- Detailed **policy data** improves measurement; inclusion of **additional** policies
- **Higher frequency** macroeconomic data, better address timing issues of linkages
- Focus on **bilateral** (real exchange rate and foreign GDP growth) channels that are potentially import influences on bilateral, discriminatory policies such as antidumping

Estimation procedure and data

Estimate counts of products subject to new investigations under TTBs

- Negative binomial regression model
 - with trading partner fixed effects
- Panel data: For each policy-imposing economy, start with 1380 observations, panel (it) of policy-imposing economy trade policy actions against trading partner i (15 top countries) in quarter t (1988:Q1-2010:Q4)

Dependent variable:

- Count of 6-digit Harmonized System (HS) **products** subject to new TTB investigations per trading partner per quarter
- Common definition across investigations, countries, policies, time
- Trade policy data is carefully constructed from *Temporary Trade Barriers Database* (Bown, 2011)

Explanatory variables:

- Bilateral real exchange rate, end of period [USDA Economic Research Service]
- Domestic real GDP growth, annualized [IFS, OECD and national sources]
- Foreign real GDP growth, annualized [IFS, OECD and national sources]

Implementation of lag-structure for explanatory variables:

- Three lags ($t-1$, $t-2$, $t-3$) for each explanatory variable; AIC and BIC model selection tests most consistently prefer use of three lags (though not without exception) so we use three lags throughout for consistency

Results: “Historical” Model Estimates Prior to the Crisis

Table 2. Negative Binomial Model Estimates of Country Use of Import Protection, 1988:Q1-2008:Q3

Dependent variable:
Count of products initiated under either
all temporary trade barrier policies or AD
policy only

Explanatory variables	USA AD only	USA All policies
Bilateral real exchange rate	22.798*** (4.93)	34.556*** (5.64)
Domestic real GDP growth	0.985 (0.29)	0.921 (1.43)
Foreign real GDP growth	0.942** (2.12)	0.904*** (3.62)
Time trend	0.974*** (5.61)	0.972*** (6.09)
Foreign country effects	yes	yes
Observations	1092	1092
Number of trading partners	15	15

Interpretation

- As is conventional in these count models, we report **Incidence Rate Ratios (IRRs)** and **t-statistics** (in parentheses) of the test of no effect which corresponds to an IRR of 1.0
- IRR estimate > 1 is positive effect; IRR estimate < 1 is negative effect**

Notes: Distributed lag model with three lags of quarterly data for each of the explanatory variables of interest. Incidence Rate Ratios (IRRs) of long-run effects reported in lieu of coefficient estimates, with t-statistics in parentheses. Model includes a constant term whose estimate is suppressed. ***, **, and * indicate statistically significant at the 1 percent, 5 percent, and 10 percent levels, respectively

Historical Model:

How large (economically) are these effects?

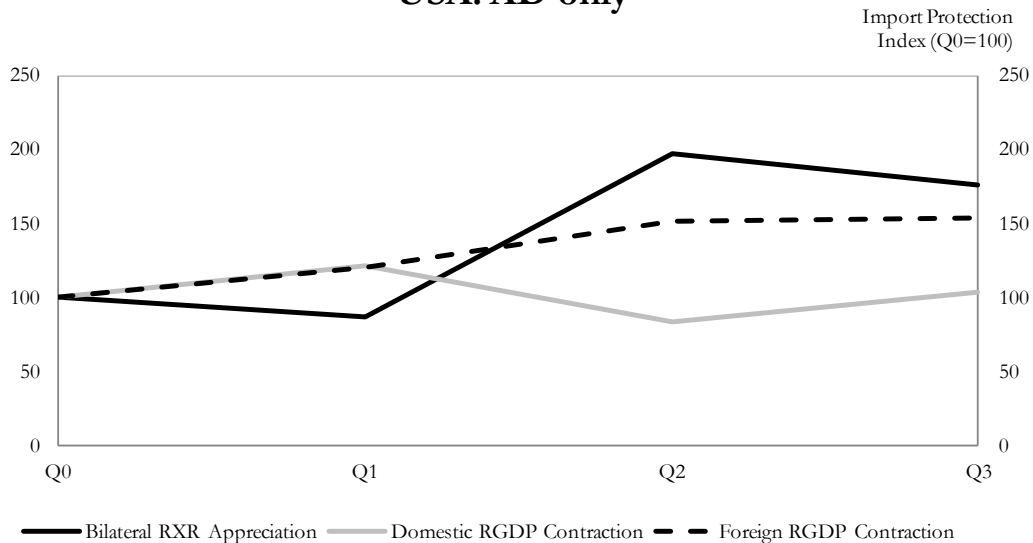
Exercise

1. Evaluate the model at the means of the data to establish the baseline
2. Ceteris paribus, document the impact on the import protection response for a one standard deviation shock to each explanatory variable, introduced quarter-by-quarter

Historical Model:

How large (economically) are these effects?

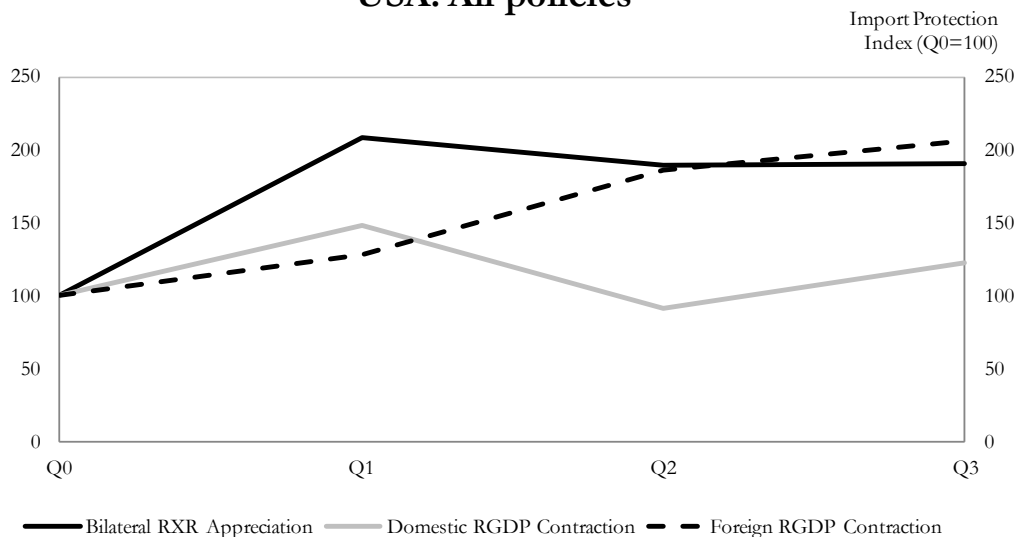
USA: AD only



USA

1. After 3 quarters, a 4% **real appreciation** of the US dollar is associated with
 - **76 percent** more products subject to AD (Table 2, first column)
 - **91 percent** more products subject to import protection overall (second column)
2. Negative Shock to **foreign GDP growth** is associated with **54-106** percent more import protection
3. Negative Shock to **US GDP growth** is associated with **4-22** percent more import protection *per partner*

USA: All policies



Results: “Historical” Model Estimates Prior to the Crisis

Table 2. Negative Binomial Model Estimates of Country Use of Import Protection, 1988:Q1-2008:Q3

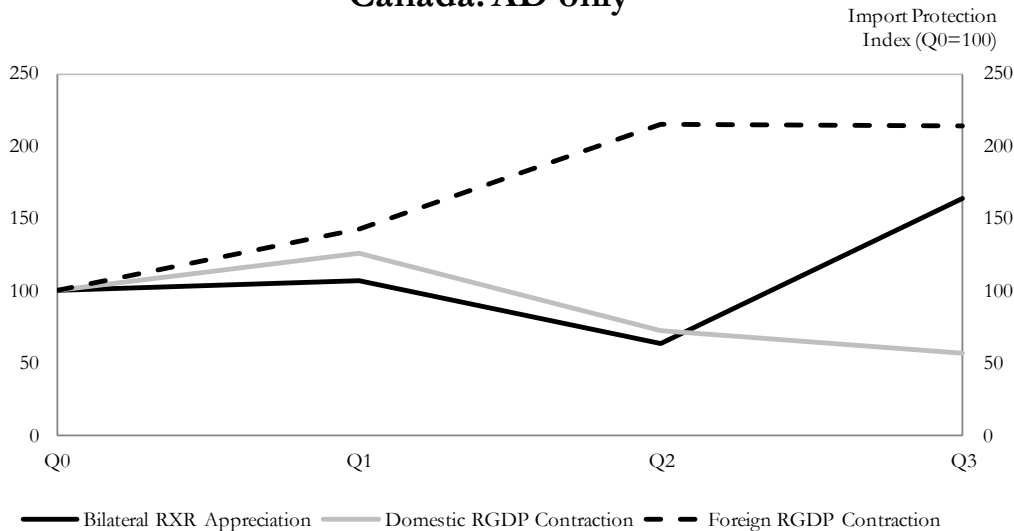
Explanatory variables	Dependent variable: Count of products initiated under either all temporary trade barrier policies or AD policy only									
	USA AD only	USA All policies	CAN AD only	CAN All policies	EU‡ AD only	EU‡ All policies	KOR AD only	KOR All policies	AUS AD only	AUS All policies
Bilateral real exchange rate	22.798*** (4.93)	34.556*** (5.64)	18.586* (1.82)	15.749* (1.92)	22.624*** (2.94)	1.070 (0.06)	21.768* (1.92)	32.158** (2.28)	0.902 (0.19)	0.885 (0.23)
Domestic real GDP growth	0.985 (0.29)	0.921 (1.43)	1.264** (2.34)	1.246** (2.42)	1.019 (0.13)	0.340*** (7.73)	0.992 (0.13)	1.084 (1.43)	0.868*** (3.74)	0.870*** (3.69)
Foreign real GDP growth	0.942** (2.12)	0.904*** (3.62)	0.899* (1.94)	0.917* (1.76)	1.014 (0.29)	1.022 (0.40)	0.905 (1.14)	0.890 (1.49)	0.976 (1.03)	0.983 (0.73)
Time trend	0.974*** (5.61)	0.972*** (6.09)	0.977*** (2.62)	0.991 (1.17)	0.959*** (3.26)	0.943*** (4.13)	1.040*** (4.16)	1.033*** (3.61)	0.977*** (6.55)	0.979*** (5.93)
Foreign country effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	1092	1092	1092	1092	585	585	852	852	1029	1029
Number of trading partners	15	15	15	15	15	15	12	12	15	15

Notes: Distributed lag model with three lags of quarterly data for each of the explanatory variables of interest. Incidence Rate Ratios (IRRs) of long-run effects reported in lieu of coefficient estimates, with t-statistics in parentheses. Model includes a constant term whose estimate is suppressed. ***, **, and * indicate statistically significant at the 1 percent, 5 percent, and 10 percent levels, respectively. ‡EU data for 1999:Q1-2008:Q3 only.

Historical Model:

How large (economically) are these effects?

Canada: AD only

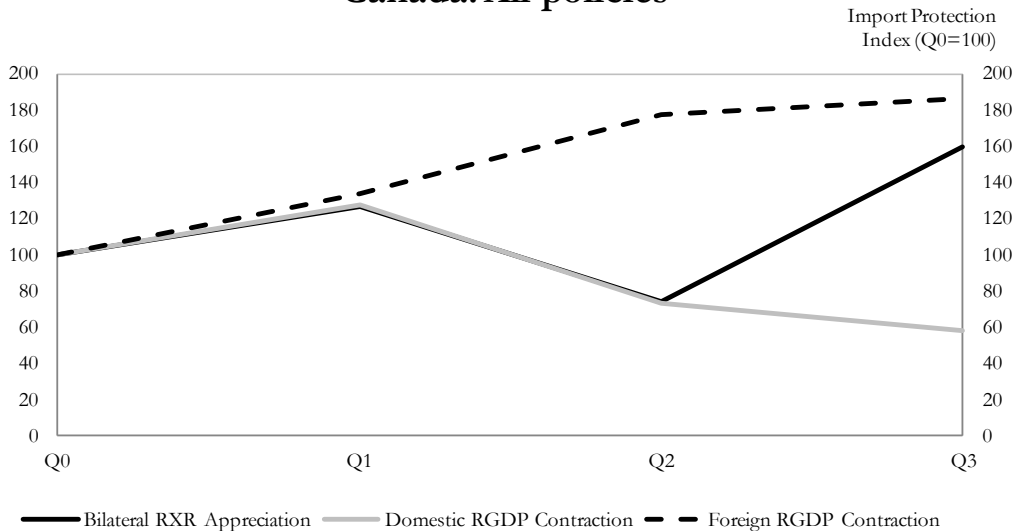


Canada

1. After 3 quarters, a 4% **real appreciation** of the Canadian dollar is associated with

- **64 percent** more products subject to AD (Table 2, first column)
- **59 percent** more products subject to import protection overall (second column)

Canada: All policies

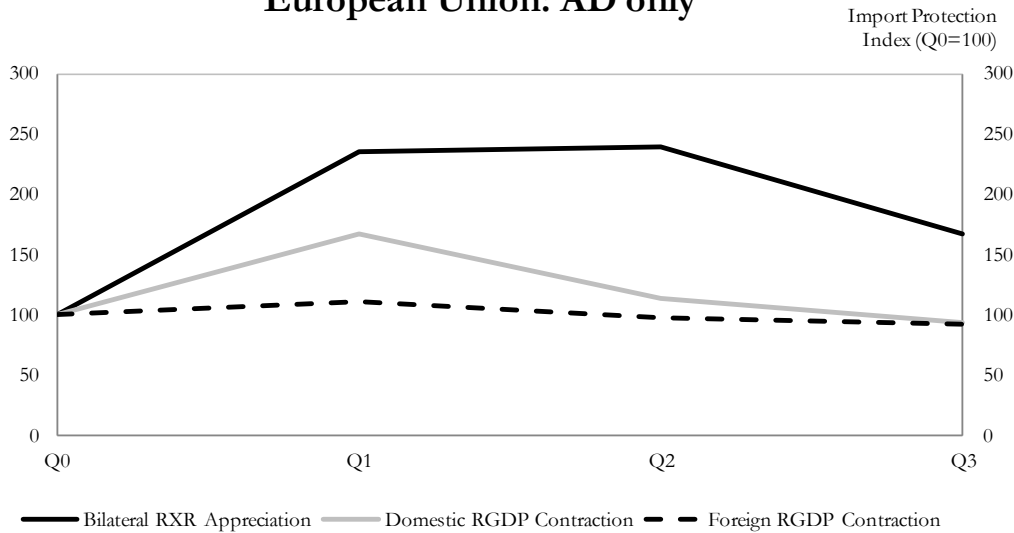


2. Negative Shock to **foreign GDP growth** is associated with **87-114** percent **more** import protection

Historical Model:

How large (economically) are these effects?

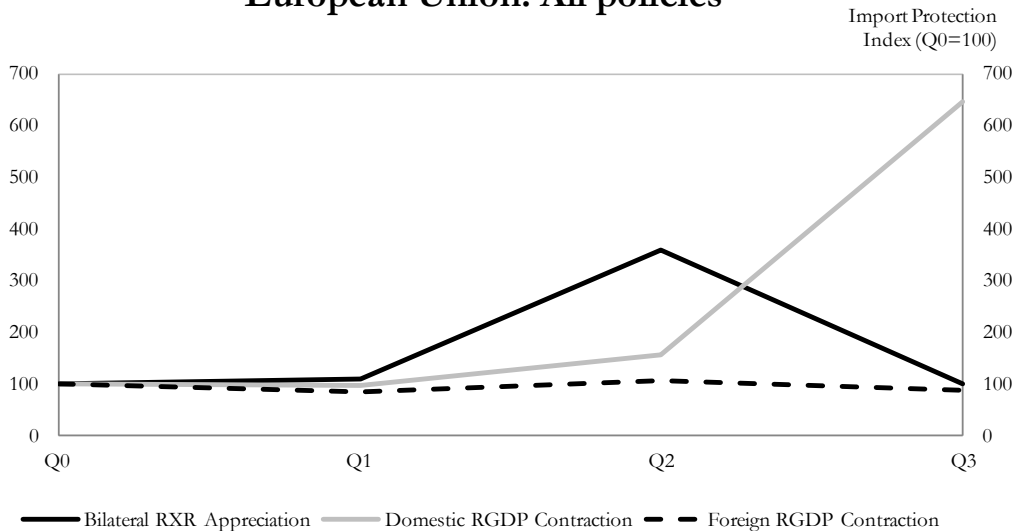
European Union: AD only



European Union

1. After 3 quarters, a 4% **real appreciation** of the Euro is associated with
 - **67 percent** more products subject to AD (Table 2, first column)

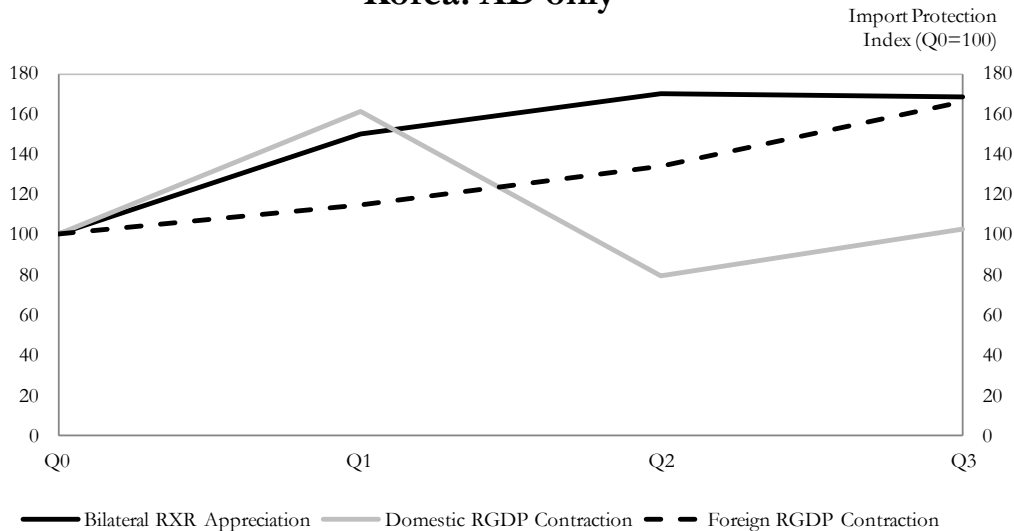
European Union: All policies



Historical Model:

How large (economically) are these effects?

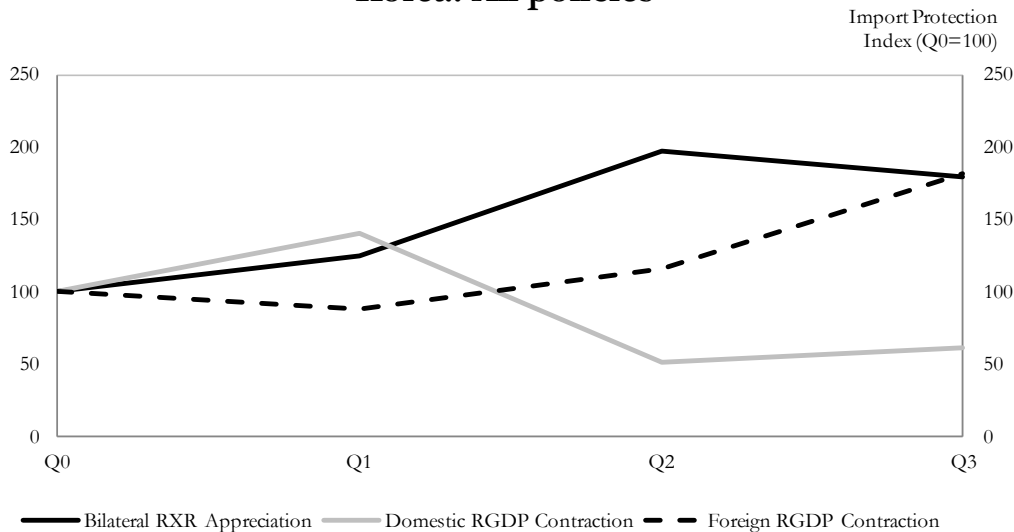
Korea: AD only



Korea

1. After 3 quarters, a 4% **real appreciation** of the South Korean won is associated with
 - **68 percent** more products subject to AD (Table 2, first column)
 - **79 percent** more products subject to import protection overall (second column)
2. Negative Shock to **foreign GDP growth** is associated with **66-82 percent more** import protection

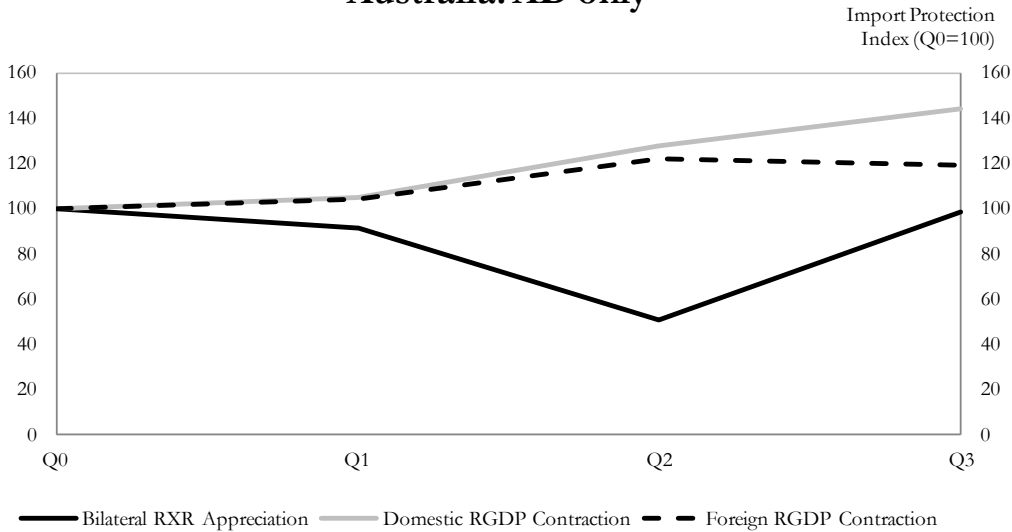
Korea: All policies



Historical Model:

How large (economically) are these effects?

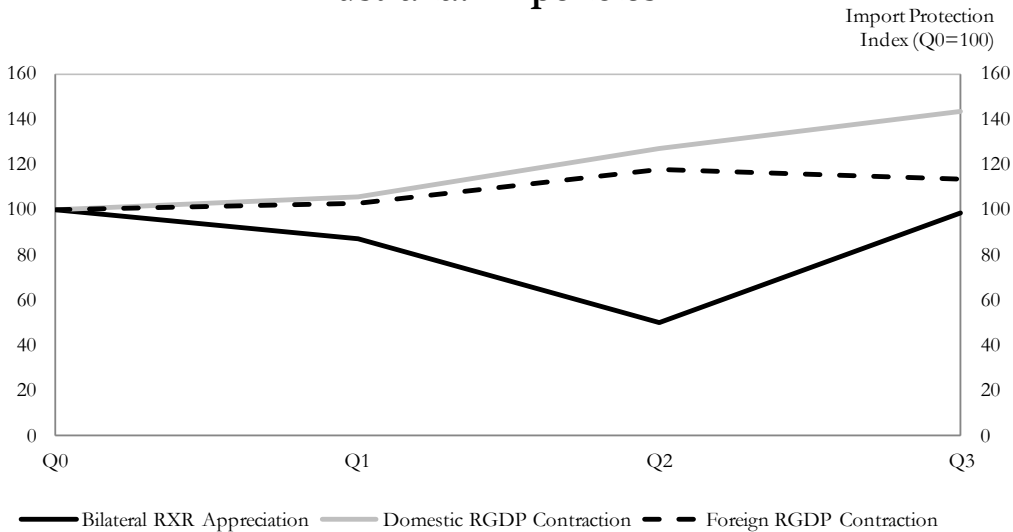
Australia: AD only



Australia

1. Negative Shock to **Australia's GDP growth** is associated with **43-44** percent **more** import protection *per partner*

Australia: All policies



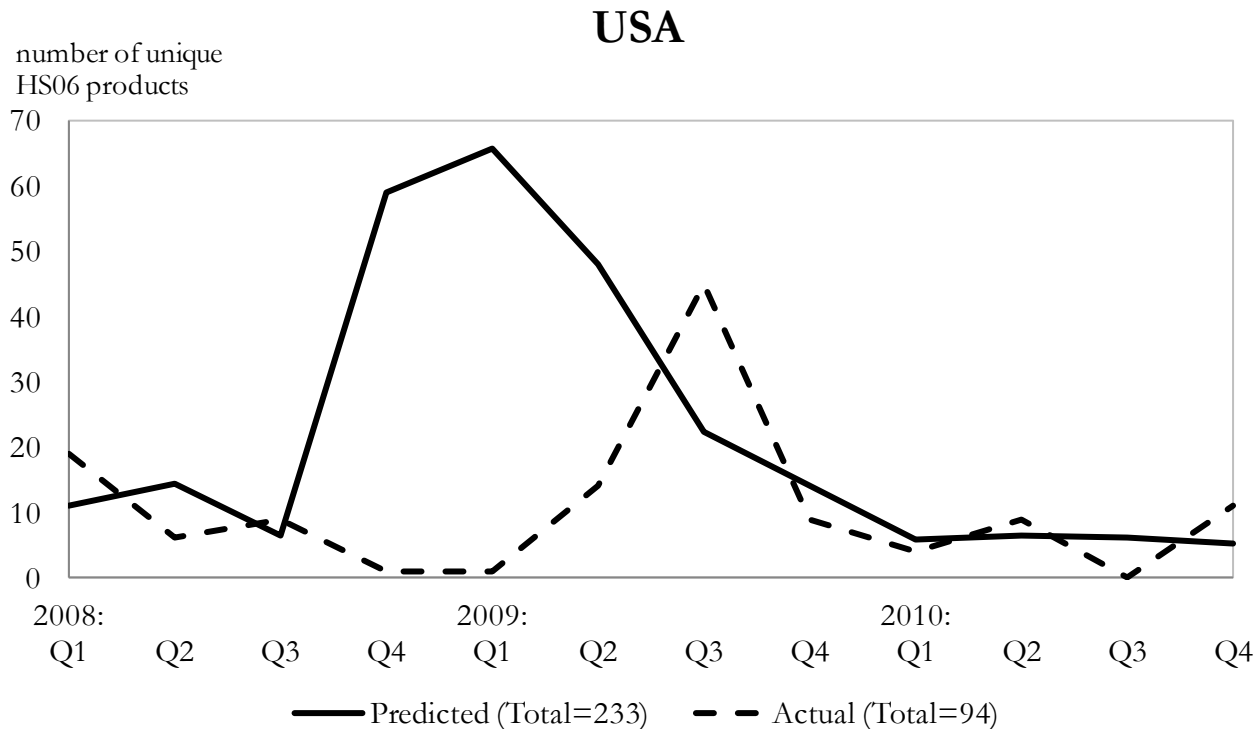
Out of Sample Prediction based on the Historical Model:

How much import protection was expected to arise and how does it compare to the realized response?

Exercise

1. Take the historical model estimates of Table 2/Table 4
2. Predict out-of-sample import protection response for 2008:Q4-2010:Q4 based on realized shocks to bilateral real exchange rates, domestic GDP growth, foreign GDP growth taking place during the Great Recession
3. Compare this to actual, realized import protection taking place during 2008:Q4-2010:Q4

Great Recession: Out-of-Sample Prediction and Comparison



1. Historical model over-predicts import protection by 150 percent more products overall for 2008:Q4-2010:Q4.
2. “Delay”/ “Shifting” of import protection response from expected 2008:Q4-2009:Q1 surge to realized 2009:Q3 spike
3. How did the import protection responsiveness of policymakers to macroeconomic shocks *change* during the crisis?
 - **Next: Re-estimate the model** on longer time series of data (through 2010:Q4) and test for differential effects across periods

Results: “Historical” vs. Crisis Estimates

Table 4. Differential Impacts on Policy Response during the Great Recession

Dependent variable:	
Count of products initiated under all temporary trade barrier policies	
Explanatory Variables	USA
Bilateral real exchange rate, 1988:Q1-2008:Q3	32.046*** (5.63)
Bilateral real exchange rate, 2008:Q4-2010:Q4	15.439*** (4.17)
[Test statistic]	[20.31]***
Domestic real GDP growth, 1988:Q1-2008:Q3	0.924 (1.38)
Domestic real GDP growth, 2008:Q4-2010:Q4	0.727** (1.96)
[Test statistic]	[1.92]
Foreign real GDP growth, 1988:Q1-2008:Q3	0.892*** (4.10)
Foreign real GDP growth, 2008:Q4-2010:Q4	1.187** (2.10)
[Test statistic]	[11.81]***
Time trend	0.971*** (6.25)
Foreign country effects	yes
Observations	1224
Number of trading partners	15

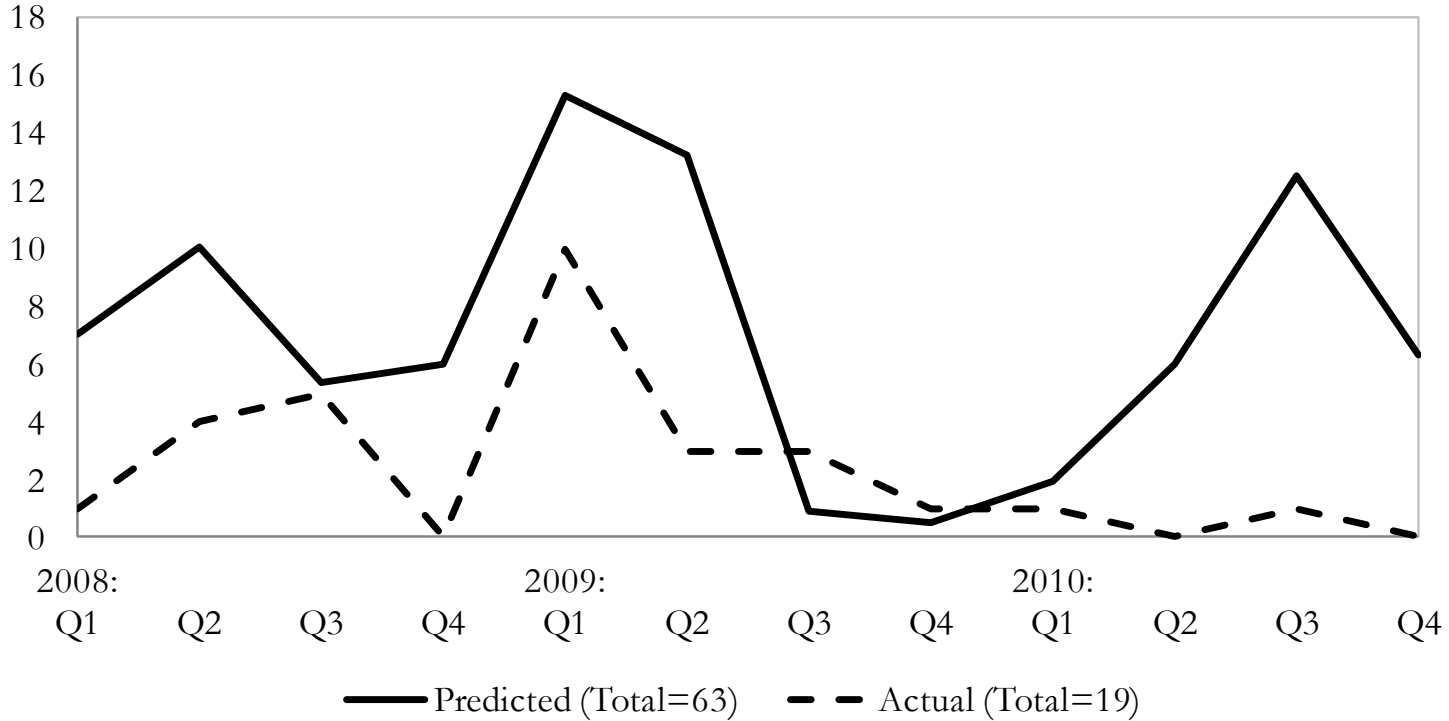
Interpretation: USA

- Even during the crisis a **real appreciation** of the US dollar is associated with **more** import protection
 - However, the smaller IRR indicates the US was **less responsive** to appreciations relative to historical period
 - Foreign GDP growth**: a “switch” in behavior – more import protection likely against trading partners that **are growing** is different from historically, when import protection was more likely against those with macroeconomic weakness
 - During the crisis, very **few partners were growing** so there was less US import protection overall
- Similar patterns for *Canada* and the *European Union***

Great Recession: Out-of-Sample Prediction and Comparison

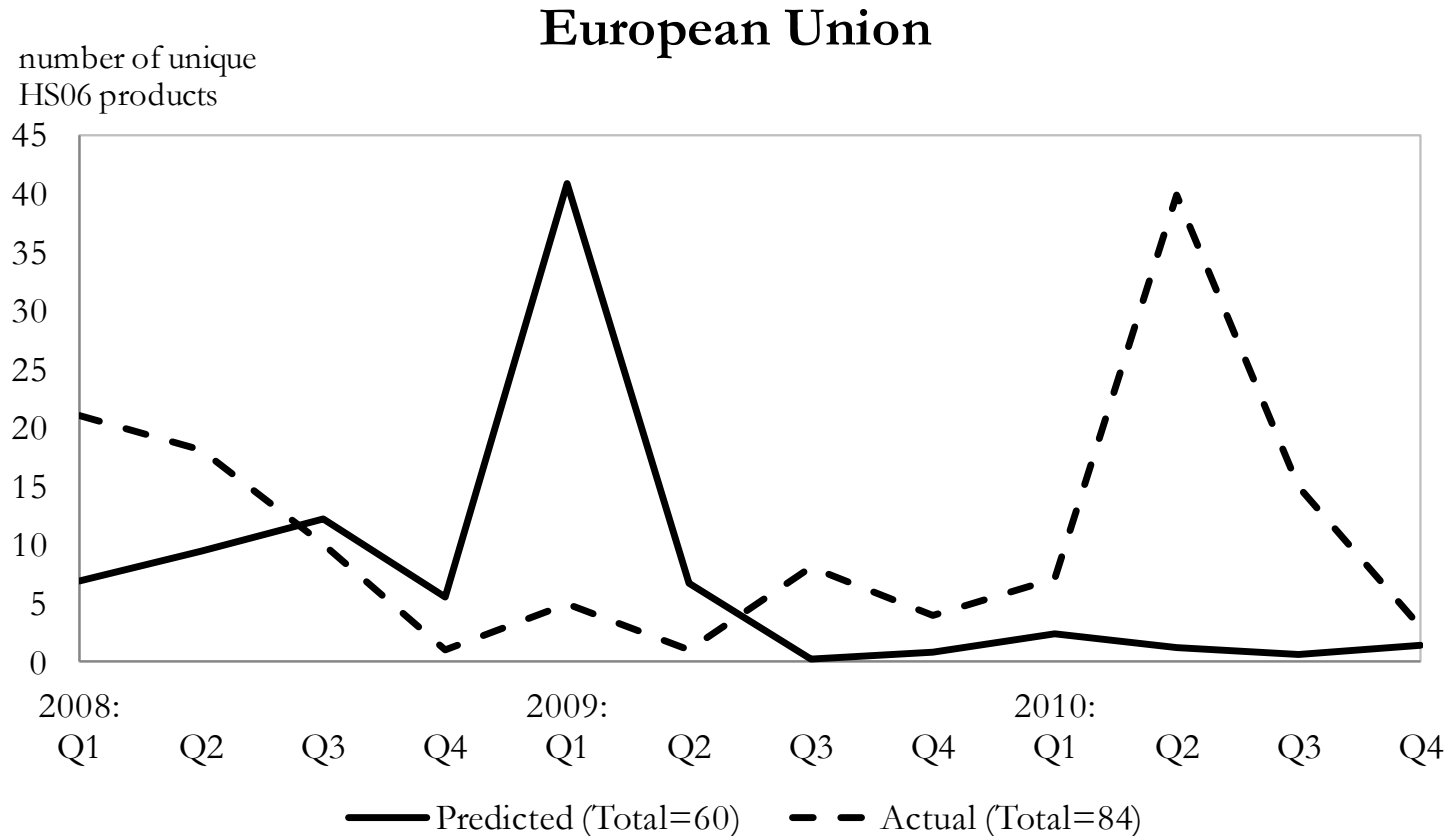
Canada

number of unique
HS06 products



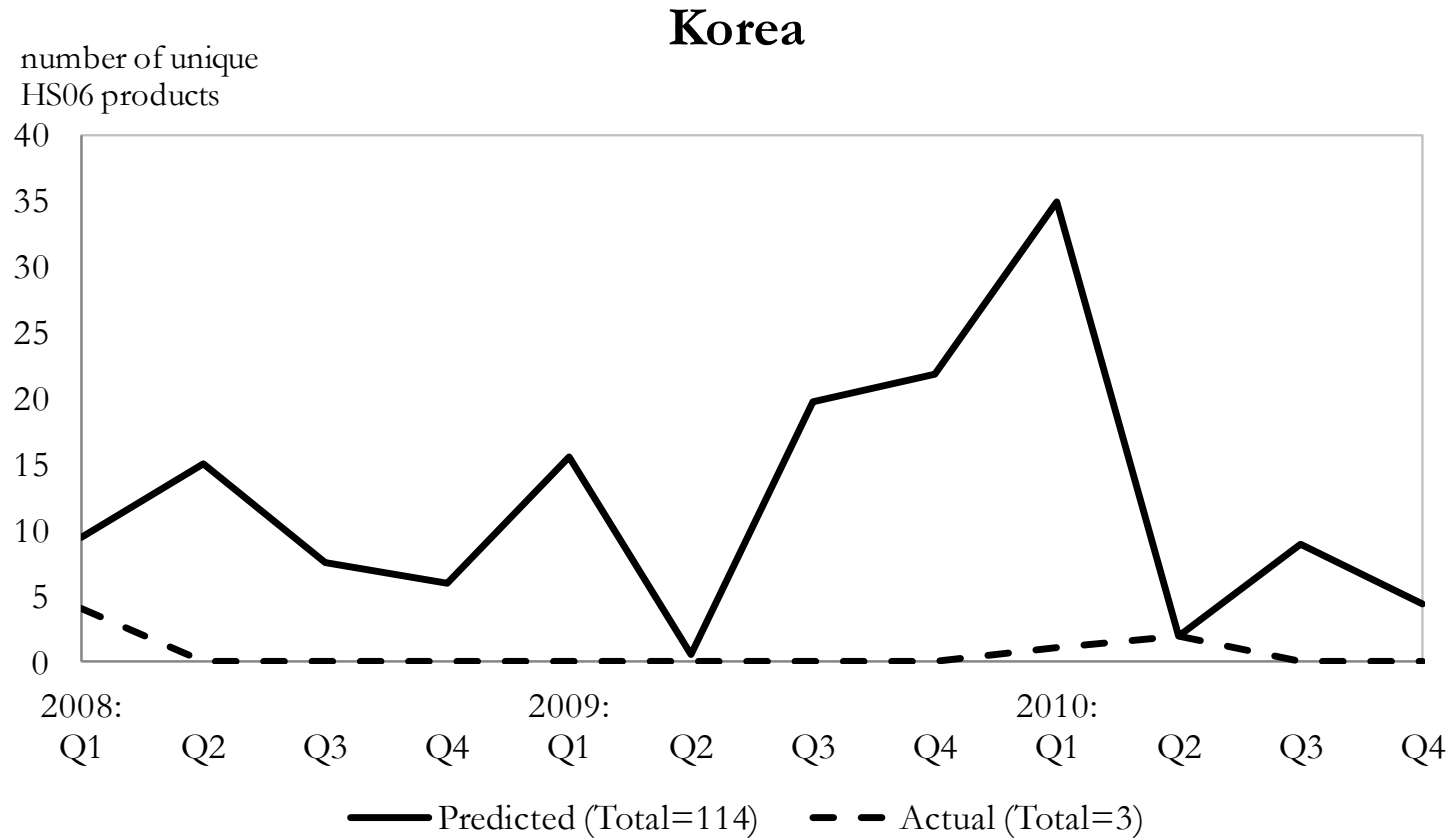
- Historical model over-predicts import protection by 230 percent more products overall for 2008:Q4-2010:Q4.

Great Recession: Out-of-Sample Prediction and Comparison



1. Historical model under-predicts import protection by 29 percent fewer products overall for 2008:Q4-2010:Q4.
2. “Delay”/ “Shifting” of import protection response from expected 2009:Q1 surge to realized 2010:Q2 spike

Great Recession: Out-of-Sample Prediction and Comparison



- Historical model over-predicts import protection by 3698 percent more products overall for 2008:Q4-2010:Q4.

Table 4. Differential Impacts on Policy Response during the Great Recession

Dependent variable: Count of products initiated under all temporary trade barrier policies†					
Explanatory Variables	USA	CAN	EU†‡	KOR	AUS†
Bilateral real exchange rate, 1988:Q1-2008:Q3	32.046*** (5.63)	10.900* (1.74)	8.964** (2.21)	37.033** (2.40)	0.603 (0.94)
Bilateral real exchange rate, 2008:Q4-2010:Q4	15.439*** (4.17)	5.502 (1.22)	6.653* (1.87)	1.083 (0.02)	0.568 (1.01)
[Test statistic]	[20.31]***	[7.18]***	[2.32]	[0.80]	[0.13]
Domestic real GDP growth, 1988:Q1-2008:Q3	0.924 (1.38)	1.242** (2.43)	1.036 (0.25)	1.084 (1.44)	0.866*** (3.63)
Domestic real GDP growth, 2008:Q4-2010:Q4	0.727** (1.96)	0.577 (1.48)	1.038 (0.34)	1.980 (0.50)	1.173 (0.46)
[Test statistic]	[1.92]	[3.96]**	[0.00]	[0.20]	[0.75]
Foreign real GDP growth, 1988:Q1-2008:Q3	0.892*** (4.10)	0.913** (1.91)	0.985 (0.35)	0.893 (1.47)	0.985 (0.63)
Foreign real GDP growth, 2008:Q4-2010:Q4	1.187** (2.10)	1.265 (1.56)	1.164 (1.62)	0.630 (0.55)	1.021 (0.44)
[Test statistic]	[11.81]***	[4.64]**	[3.18]*	[0.17]	[0.55]
Time trend	0.971*** (6.25)	0.990 (1.25)	0.964*** (2.94)	1.033*** (3.68)	0.977*** (6.29)
Foreign country effects	yes	yes	yes	yes	yes
Observations	1224	1224	717	957	1161
Number of trading partners	15	15	15	12	15

Notes: Distributed lag model with three lags of quarterly data for each of the explanatory variables of interest. Incidence Rate Ratios (IRRs) of long-run effects reported in lieu of coefficient estimates, with t-statistics in parentheses. Model includes a constant term whose estimate is suppressed. ***, **, and * indicate statistically significant at the 1 percent, 5 percent, and 10 percent levels, respectively. †AUS and EU estimates based on dependent variable of antidumping policy only. ‡EU pre-crisis data for 1999:Q1-2008:Q3 only.

China-specific Concerns, Controls, and Exercise

Potential Estimation Concerns

- Since 2001, these forms of import protection are disproportionately applied to imports from China (see Bown, 2010, for an explanation)
 - Bown (2011): for the entire “stock” of all accumulated barriers in place, those against China ranged from a low of 21 percent (United States) to a high of 44 percent (Australia) in 2009, up from a range of only 8 percent (United States) to 20 percent (Korea) in 1997

Exercise

1. Interact explanatory variables with China or non-China interaction terms to test for a differential impact of China
2. We can also use this to examine the relationship between US-China real exchange rates and import protection

Data for China/non-China:

- China’s products face three times as many new trade barriers per quarter relative to the sample average for non-China
- US-China bilateral real exchange rate is only half as volatile as US-“non-China” bilateral real exchange rate in the data
 - Challenge for identification
 - Careful interpreting “size” and magnitude of IRRs

Table 6. China versus Other Targets, 1988:Q1-2010:Q4

Interpretation: USA

Explanatory Variables	Dependent variable: Count of products initiated under all temporary trade barrier policies	
	USA	USA
Bilateral real exchange rate, non-China	45.706*** (6.93)	77.130*** (7.18)
Bilateral real exchange rate, China	13.673*** (2.78)	4.672 (0.33)
[Test statistic]	[2.20]	[0.35]
Domestic real GDP growth, non-China	0.939 (1.40)	0.934 (1.51)
Domestic real GDP growth, China	0.863 (0.87)	0.863 (0.92)
[Test statistic]	[0.23]	[0.22]
Foreign real GDP growth, non-China	0.955** (1.96)	0.926*** (2.79)
Foreign real GDP growth, China	0.878 (0.92)	0.882 (0.93)
[Test statistic]	[0.34]	[0.12]
Time trend, non-China	0.963*** (8.67)	0.962*** (8.55)
Time trend, China	1.009 (0.51)	1.007 (0.38)
[Test statistic]	[6.41]**	[5.78]**
Foreign country effects	no	yes
Observations	1224	1224
Trading partners	15	15

Note: Even though point estimates not statistically different from one another, interpret magnitudes as if they were

1. IRR of 46 for “non-China” is evidence that a 4 percent appreciation of the dollar (a one standard deviation shock on the non-China sample) is a 50 percent increase in protection
2. IRR of 14 for China is evidence that a 1.9 percent appreciation of the dollar (a one standard deviation shock on the China sample) is a 28 percent increase in protection
 - However, a 4 percent appreciation in the US bilateral real exchange rate with respect to China would lead to a 72 percent more protection

Final Thought Experiment: *What would it take for China to have received “normal” treatment?*

- Model implies that a 9-20 percent appreciation of the Chinese real exchange rate against the dollar during this period would reduce the new import protection against China (from the prediction at the means of the data) to the prediction for the “other” countries at the means of that subsample of data

Conclusions

Historical models

- **Bilateral real exchange rate appreciations** lead to more import protection
 - 4 percent appreciation in the bilateral real exchange rate relative to the mean level results in a policy-imposing country subjecting 60-90 percent more products to these forms of import protection
- Periods of **foreign** (trading partner) **macroeconomic weakness** lead to more import protection against them
 - One standard deviation fall in foreign real GDP growth results in a policy-imposing country subjecting greater than 100 percent more products to these forms of import protection

Great Recession

- **Out-of-sample** predictions: Historical models over-predict new import restrictions for 2008:Q4-2010:Q4 for US, Canada, and Korea and under-predict for EU and Australia
- Re-estimated models on data through 2010:Q4, testing for crisis-period changes to import protection responsiveness to macroeconomic shocks
 - While bilateral real **exchange rate appreciations** still lead to more import protection, the **estimated responsiveness is smaller** than historically
 - US and other economies “switched” from their historical behavior and shifted implementing new import protection **away from** those trading partners that were **contracting** and **toward** those experiencing economic **growth**

China-specific results

- A 9-20 percent appreciation of China’s real bilateral exchange rate would provide it with **“equal treatment”** under US antidumping