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## **Critical Assessment of Recent AGE Models**

**Katheryn Russ**

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# Critical Assessment of AGE Models: Lessons from recent trade policy debates

Katheryn N. Russ

UC Davis and NBER

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## Recent criticisms of the AGE class of models:

- Grown so complex that all transparency in its mechanisms is lost
- Bad at predicting changes in bilateral flows
- Missing the employment picture
  - Does not do a good job of capturing employment effects or dynamic effects more generally
  - Hard to fully capture disruptions in local labor markets, persistent unemployment
- Clunky in the way it deals with macro issues
  - Super-imposes aggregate trade balance
  - Restrictions on behavior of capital stock can amplify sectoral reallocation

And yet, the AGE class remains the field's workhorse for timely assessment of proposed changes in trade policy.

So rather than focus on caveats in AGE models, I will discuss how our common knowledge of their technical constraints have played out in the context of recent policy discourse.

- Highlighting particular frontiers that influence the interpretation of results for policymaking.

- Focusing on their role in debates over KORUS, TPP, China tariffs

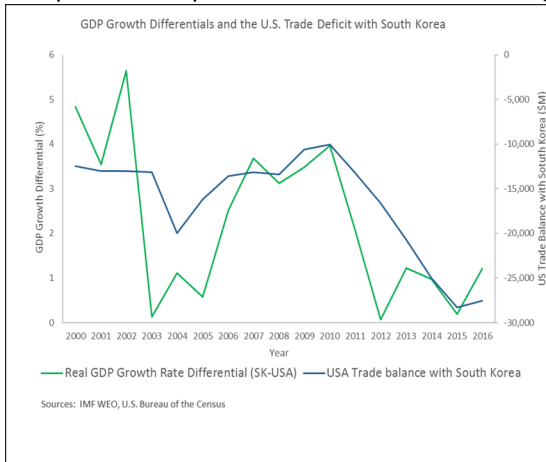
# Bilateral trade balances

- 2007 USITC assessment of Korea-U.S. Free Trade Agreement based on GTAP 6.1 predicted an increase in U.S. net exports to South Korea of more than \$3 billion (lowerbound).
- Actual U.S. net exports to South Korea declined by between \$10 billion and \$13 billion.

**Table 2.2** U.S.-Korea FTA: Simulated effects on U.S.-Korea bilateral trade from a projected 2008 baseline—*Continued*

GTAP sector	U.S. exports to Korea (f.o.b.) <sup>a</sup>						U.S. imports from Korea (LDP) <sup>a</sup>					
	Base before FTA		Benchmark Korean AVE		Change after FTA		Base before FTA		Benchmark U.S. AVE tariff		Change after FTA	
	Million dollars	Percent	Million dollars	Percent	Million dollars	Percent	Million dollars	Percent	Million dollars	Percent	Million dollars	Percent
			Low	High	Low	High			Low	High	Low	High
Transport equipment n.e.c.	2,582	0.9	140	167	5.4	6.5	1,439	0.1	-16	-11	-1.1	-0.7
Electronic equipment	5,529	0.6	212	231	3.8	4.2	17,900	0.2	182	229	1.0	1.3
Machinery and equipment n.e.c.	7,786	5.2	2,774	2,939	35.6	37.7	8,501	1.3	715	769	8.4	9.0
Manufactures n.e.c.	190	5.3	78	88	40.9	46.2	518	3.4	109	125	21.1	24.1
Other sectors	10,898	0.0	14	23	0.1	0.2	8,673	0.0	-86	-73	-1.0	-0.8
<b>Total<sup>b</sup></b>	<b>43,186</b>	<b>4.4</b>	<b>9,741</b>	<b>10,909</b>	<b>22.6</b>	<b>25.3</b>	<b>64,596</b>	<b>1.7</b>	<b>6,399</b>	<b>6,874</b>	<b>9.9</b>	<b>10.6</b>

One might say it isn't a fair comparison, since the goods deficit seems to track a macroeconomic slowdown in South Korea. GTAP setup is not responsible for macro forecasting errors.





## Trade diversion

However, the USITC assessment dramatically under-predicted trade diversion to South Korean suppliers, away from other U.S trading partners.

- USITC/GTAP6.1 assessment predicted \$5.7 billion (upperbound) in trade diversion, including autos
- Actual trade diversion was nearly \$14 billion by 2014, before the biggest auto tariff changes (Russ and Swenson 2018)

## Lesson for AGE practitioners and consumers

The missing trade diversion is big enough to account for at least half of the widening of the U.S. trade deficit with South Korea that the GTAP 6.1 model missed.

The missing trade diversion is too big to comfortably write off as mis-calibrated elasticity parameters, especially given the role of multinational activity in South Korea  $\Rightarrow$  some missing structural element likely.

Understanding (or at least anticipating) the missing structural element behind the observed excess trade diversion could help avoid later critiques and suspicion like those afflicting KORUS as bilateral deficits dramatically realigned.

# AGE and the Trans-Pacific Partnership (TPP)

The New York Times

## *Economists Sharply Split Over Trade Deal Effects*



Protestors waving placards at a rally opposing the Trans-Pacific Partnership in Kuala Lumpur, Malaysia, last month. Olivia Harris/Reuters

By Jackie Calmes

Feb. 1, 2016



Three GTAP-based studies predicted increases in U.S. GDP under TPP

- Petri, Plummer, and Zhai/Peterson Institute/World Bank (2016): 0.5 percent by 2030
- USITC (2016): 0.23 percent by 2032
- Li and Whalley (2012): 0.22 percent

About half of the discrepancy between the lower estimates and the upper one seemed to be attributable to assumptions about investment and calibration, half to inclusion of Melitz-style (2003) productivity effects in the Petri, Plummer, and Zhai model.

A Ricardian (Eaton-Kortum-type) structural model by Cheong and Takayama appeared in 2013, with an estimated gain from joining TPP of about 1.6 percent of U.S. real GDP.

Why so big? More scope for productivity effects and comparative advantage? Less home bias in the calibration?

Critics of TPP seized on the inability of the AGE models to capture labor market disruptions and related distributional issues—both in the aggregate and at the local level.

To fill the gap, many cited a study based on the United Nations Global Policy Model.

- This is a macro-forecasting framework from the 1970s designed to capture the impact of macroeconomic shocks. It contains no tariffs.
- The authors exogenously altered trade patterns by the amount predicted by other models and then backed out the changes in employment and real GDP that would, according to the mathematics of the model, accompany those exogenous changes in trade patterns.
- The exercise resulted in a drop in U.S. real GDP of 0.54 percent in 10 years, plus much bigger GDP losses in many other countries, and net employment losses in all countries.

## Lessons for AGE from TPP

1. It is important to include firm heterogeneity and its accompanying productivity effects.
2. It is becoming increasingly difficult to offer assessments to that do not try to account for the distributional effects and short- to medium-term unemployment from new import competition after liberalization.
3. Critics cited the widening U.S. bilateral trade deficit with South Korea that was not predicted by earlier AGE assessments as a reason to be skeptical of these AGE assessments of joining the TPP.

# Tariffs under the Trump Administration

Recently, tariffs have been imposed on a wide variety of goods under Sections 201 and 301 of the Trade Act of 1974 and Section 232 of the Trade Expansion Act of 1962.

Numerous estimates of the effects have emerged.



	Tariffs covered	Costs considered	Average annual cost* per household
<a href="#">Tax Foundation</a>	25 percent tariff on \$150B of U.S. imports from China	Tax burden, deadweight loss	\$161 net
<a href="#">Amiti, Redding, and Weinstein (2019)</a>	Tariffs imposed in 2018	Tax burden, deadweight loss	\$414 gross
<a href="#">Fajgelbaum, Goldberg, Kennedy, and Khandelwal (2019)</a>	Tariffs imposed in 2018	Tax burden, deadweight loss, retaliatory tariffs	\$539 gross; \$61 net
<a href="#">Borusyak and Jaravel in Bui and Irwin (2019)</a>	Tariffs imposed in 2018 and through May 2019	Tax burden	\$247 gross
<a href="#">Amiti, Redding, and Weinstein (2019)</a>	Tariffs imposed in 2018 and through May 2019	Tax burden, deadweight loss	\$831 gross
<a href="#">Trade Partnership</a>	Tariffs on aluminum and steel plus tariffs imposed on Chinese goods in 2018 through May 2019	Tax burden, deadweight loss, retaliatory tariffs	\$767 gross; \$488 net
<a href="#">Congressional Budget Office</a>	Tariffs imposed 2018 through July 2019, increased policy uncertainty	Tax burden, deadweight loss, uncertainty, retaliatory tariffs	\$519 net in 2020
<a href="#">Board of Governors of the Federal Reserve</a>	Increase in measured trade policy uncertainty Jan 2018-June 2019	Statistical (VAR) estimate of impact of uncertainty on Industrial	\$1730 net in 2020

## Comparison of AGE with other estimates

The Trade Partnership estimated the costs of tariffs imposed in 2018 and the first half of 2019 using a standard AGE framework.

- Trade Partnership estimate: \$767 per household on average
- Includes similar set of tariffs to that in partial equilibrium analysis of Amiti, Redding, and Weinstein (2019): \$831
- Trade Partnership AGE estimate includes costs from retaliatory tariffs, while ARW do not, so the ARW estimate is a bit higher in comparison than the headline numbers suggest.
- If we double the result from the structural estimate of Fajgelbaum, Goldberg, Kennedy, and Khandelwal (2019) to scale to approximate a similar set of tariffs, the resulting \$1000 per household in costs is again noticeably higher than the Trade Partnership AGE estimate.

# Uncertainty

Research from the Board of Governors finds that uncertainty about the future path of tariffs is dampening investment, generating additional economic costs.

- Including uncertainty in its SVAR framework raises the average cost per household to \$1700, roughly double the ARW and Trade Partnership estimates without uncertainty.
- The recent USITC assessment of USMCA also shows that AGE results are also highly sensitive to including the impact of the agreement on uncertainty.

**Table 2.6** Impact of modeled provisions that reduce policy uncertainty on the economy-wide effects of USMCA (percent changes relative to the baseline)

<b>Impact of provisions reducing policy uncertainty</b>	<b>None</b>	<b>Moderate</b>	<b>High</b>
U.S. real GDP	-0.12	0.35	1.21
U.S. real output			
Agriculture	-0.22	0.18	0.88
Manufacturing and mining	0.37	0.57	0.88
Services	-0.13	0.17	0.71
U.S. employment	-0.04	0.12	0.40
Agriculture	-0.15	0.12	0.58
Manufacturing and mining	0.28	0.37	0.51
Services	-0.07	0.09	0.38
U.S. wages	-0.06	0.27	0.86
Agriculture	-0.18	0.23	0.94
Manufacturing and mining	0.25	0.50	0.94
Services	-0.10	0.23	0.84

Source: USITC estimates.

# Pass-through

Most model-based analyses assume full pass-through of tariff changes.

Recent estimates of the impact of tariffs show that they do filter through virtually completely into unit values as goods cross the border, so

- this is not a bad assumption for short- to medium-term aggregate assessments, but
- not great for retail-level analysis.

## Lessons for AGE from assessments of recent tariffs

1. AGE estimates may be lower than other model-based estimates
2. AGE estimates, like other approaches, are highly sensitive to inclusion of uncertainty
3. Assumption of full pass-through is plausible in the short- to medium-term for large tariffs applied broadly from a major import source (Section 301 tariffs), or across many suppliers of a specific good (Section 201 tariffs)

## Summary of Key Points

1. AGE models produce results comparable to other methods and can be augmented to include effects from changes in productivity and uncertainty related to trade policy shifts
2. Including changes in productivity and uncertainty is nontrivial
3. Capturing trade diversion and unemployment may require further structural development within the AGE framework.
4. Models that do not capture the tendency of trade diversion to widen bilateral trade imbalances and characterize the disruption of labor markets in a richer setting may soon lose relevance in policy debates.