Trade Wars and Trade Disputes: the Role of Equity and Political Support

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Motivation

- US started increasing tariffs in early 2018
  - Several rounds of US announcements and retaliatory tariffs
  - We are not (yet) in a full-blown non-cooperative trade war, but closest in decades
- What can quantitative trade models say about the potential economic implications?
    - Several studies on effects of announced tariffs (see for example, Bollen & Rojas-Romagosa, 2018; Bekkers & Teh, 2019)
    - Optimal trade theory has been used to estimate effects of full-blown trade war (e.g. Ossa, 2014; Balistreri & Hillberry, 2017; Bouët & Laborde, 2018)
- This paper: we argue that optimal tariff theory provides little practical and empirical guidance

Broader research project

- Literature survey
  - Theory: classic, modern and contemporary interactive trade theory and optimal tariffs
  - Empirical applications and recent estimations: very wide optimal tariff estimations
  - Why different numerical results for Nash tariffs?
    - Part of a broader CGE/SG model comparison on model features (expanding TTIP survey, Bekkers & Rojas-Romagosa, 2018) and how they explain different results
- Stupid Trade Disputes (STDs): the role of rationality in optimal tariff theory
- This paper: what are we optimizing and how can that affect/inform actual policy?

Overview

- We argue that:
  - The theory of rational trade wars provides little help in understanding trade relations between US and China, which are as close to a real trade war as we've seen for quite some time.
    - We take it as axiomatic that trade economists should have something to say about this topic
    - However, we find that we can only provide very conditional and limited advice
    - In particular, the objective function to be optimized is hard to define and fully-informed rational players are required
  - Main numerical result: Nash equilibria change significantly when different objective functions are optimized
  - Rationality is another concern (STDs: not included in this paper)
  - Quantitative trade policy analysis should be based on case-by-case scenarios not on (normative) optimal tariff theory

What is a trade war?

- By “trade war”, we will mean: a breakdown in cooperative trading relations between countries, or coalitions of countries.
  - This will involve substantially increased protection across a range of products
  - Non-cooperative relations (e.g. US out of WTO)
  - Trade may be part of more generally hostile relations, making it important to be clear about the relationship between commercial and geo-strategic objectives in the objective function of the decision-maker.

The Economic Literature on Trade Wars

- The theory of trade wars is one end of a more general theory of *interactive trade theory*.
  - The idea is that the policy of one country has an effect on the policy choices of its trading partners.
  - This will usually mean that the countries in question are "large", in the usual sense that their policies affect the ToT, and thus the welfare of their trading partners.
- Interactive trade theory has evolved in four loosely construed periods:
  - The Mercantilist era
  - The Classical era
  - The Modern era
  - The Contemporary era

The Economic Literature on Trade Wars

- Modern era main papers: Scitovsky (1942) and Johnson (1953-4).
  - Johnson shows that, contra Scitovsky, one country *may* win a tariff war
  - Fundamental concern for agent heterogeneity and income distribution.
- Contemporary era begins with the boom in game theoretic research in the 1980s.
  - Non-cooperative Nash equilibrium
  - Aggregation using a representative agent usually with a Samuelsonian social welfare function.
  - But used to explain how countries move *away* from trade wars (i.e. explain cooperative policies and rationale for GATT/ WTO)

Some Empirics of Trade Wars

- Calculating Nash optimal tariffs
  - These have been calculated under a very wide variety of specifications
    - *Dimensionality of the models*: number of regions, production sectors and factors.
    - *Specific trade elasticities employed*: if calibrated, estimated and/or the assumed values used.
    - *Other model specification: trade model (HOS, Armington), market structure, intermediate inputs, factor mobility, etc.*
  - Conditional on the model characteristics and parameter values employed--in particular trade elasticity values--the Nash optimal tariff ranges from around 5 percent up to more than 100 percent.
  - Accordingly, the estimated "welfare" effects also vary broadly.

Contemporary Theory of Trade War

	Study	Parties involved	time period of data	Calculated Nash tariffs	simple mean
1	Hamilton and Whalley (1983)	2 countries	analytical	5% to 78%	42
2	Whalley (1983)	2 countries	analytical	4% to 79%	42
3	Markusen and Wigle (1989)	US & Canada	1977	US=18% & CAN=6%	12
4	Lee and Roland-Holst (1999)	US & Japan	1985	US=50% & JPN=40%	45
5	Perroni and Whalley (2000)	7 OECD countries	1986	64% to 161%	113
6	Ossa (2011)	7 global regions	2004	10% to 29%	20
7	Whalley et al. (2012)	China and RoW	2005	0 to 33%	17
8	Ossa (2014)	7 global regions	2007	55% to 77%	66
9	Balistreri and Hillberry (2017)	US, Mexico & China	2011	US-MEX (12%/6%) & US-CHN (11%/-5%)	6
10	He et al. (2017)	US, EU, China & RoW	2013	68% to 104%	87
11	Bouët and Laborde (2018)	US, Mexico & China	2011	US-MEX-CHN (10%/10%/3%)	8
				average:	41

What are the policy makers actually optimizing?

- The "optimal" in "optimal tariff theory" refers to normative analysis.
  - Specifically, without an objective function there can be no optimum.
  - Heterogeneity in household factor-ownership will mean that any change in tariff policy will produce income distribution effects that need to be accounted for.
  - Using a Bergson-Samuelson social welfare function, as all papers have done so far, implicitly assumes that redistribution must actually be carried out to underwrite the representative agent.
- This *theoretically* underpins our main message: without income distribution considerations and/or political economy concerns, Nash tariffs provide very limited information

Main elements of the simulations

- We focus on numerical analysis of a US vs. rest of the world (RoW) trade war.
- We examine the implications of broadening our set of policy objective functions:
  - Move away from a single representative agent (i.e. including inequality effects)
  - Asymmetric political weights for capital lobbying
- We use a structurally estimated Eaton-Kortum quantitative general equilibrium model (similar to Caliendo & Parro, 2015) but with more labor detail (5 occupational-based types)

Main elements of the simulations (II)

- We incorporate trade policy effects on US household inequality:
  - Heterogeneity regarding factor ownership (Francois & Rojas-Romagosa, 2011).
  - We work with Sen-type social welfare (Sen, 1974, 1976):

    $$SW = Y(1-I)$$

    I = inequality, we can use several indices but here we use Gini

    Y = average welfare
- Comprehensive computational method for identification of the Nash equilibrium by identifying the optimal reaction functions of each country

US factor ownership and inequality

- Top down approach (cf. Bourguignon and Bussolo, 2013): Macro model on top and factor prices transmit to household income by source
- Usually done with micro-level household survey data, but we use a parsimonious approach by income quintile:
  - share of total households (aggregated by quintiles) in different occupations (US Census Bureau, 2015).
  - Aggregate to GTAP 5-labour types to get labor ownership matrix
  - Capital ownership matrix is indirectly obtained by using the GTAP total factor income,
  - Government net transfers is difference between total quintile net and gross income values (CBO, 2014)
- No equivalent data for RoW

Inequality changes for the US

- With quintile income we obtain the initial Gini coefficient for the US
- Tariff changes in the macro model are then mapped to inequality (Gini) changes in the US and these in turn provide changes in Sen-type social welfare
- We also use capital rents as an input when using a capital-lobbying political support objective function
- This is a stylized inequality analysis, but we have data on seven income sources that allows us to move beyond a purely representative-agent analysis

Quantitative GE model

- We use a trade GE quantitative model where we structurally estimate trade elasticities in line with "new" quantitative trade (NQT) literature (Costinot & Rodriguez-Clare, 2013) and assume *CD functions* otherwise (Caliendo & Parro, 2015)
- Underlying data are adjusted to set the trade balance at zero
- Trade is modelled according to the model of comparative advantage by Eaton and Kortum (2002)
- Our model is very similar to (Caliendo & Parro, 2015), but:
  - We have more agents (private, public)
  - Larger set of taxes (domestic, endowments, output)
  - Five labor types and capital (instead of only one factor)

Gravity estimations of trade elasticities

- We calibrate the baseline of our model to actual data from 2014 using the GTAP database version 10
- We use the gravity equation derived from the Eaton-Kortum model:

$$v_{ijk} = \left(\frac{(1+t_{ijk})\tau_{ijk}c_{ik}}{P_{jk}}\right)^{-\theta_k} = exp\{-\theta_k \ln(1 + t_{ijk}) + \beta' x_{ijk} + \mu_{ik} + \lambda_{jk} + \varepsilon_{ijk}\} \qquad (1)$$

- Trade elasticity is the tariff coefficient and iceberg trade costs are partially proxied by depth of PTA (DESTA)
- We use a two-stage estimation methodology to account for the endogeneity of PTAs (Egger et al. 2011 and 2015)

Dimensionality

- Dimensionality problem: the main practical constraint in the literature has been to deal with multiple sectors in complex (enough) models:
  - With N countries, S sectors and T possible tariff levels, then ST^N simulations are required
  - It can easily become unfeasible (running into the millions) if this set is not constrained
  - Importantly all numerical applications use a single-sector (or one-sector at a time)
- We have complex model but need to assume a flat (overall) tariff level

Experiment design and grid search

- We are first to use a comprehensive tariff space to generate optimal reaction curves
  - Before: convergence grid search (starts with factual tariffs, obtain optimal responses, until a convergence criterion is satisfied)
  - No need for full tariff space (but problem if multiple equilibria!)
  - Used by Perroni and Whalley (2000), Ossa (2011, 2014) and Bouët and Laborde (2018)
- Use GE model to obtain welfare impact of different tariff combinations (three-dimensional space)
- 22 tariff levels (0 to 120%, mostly 5pp intervals): 484 sims
- Use polynomial regressions to smooth them and obtain a continuous reaction curve
- Intersection of reaction curves provides the non-cooperative Nash tariffs

Three different objective functions

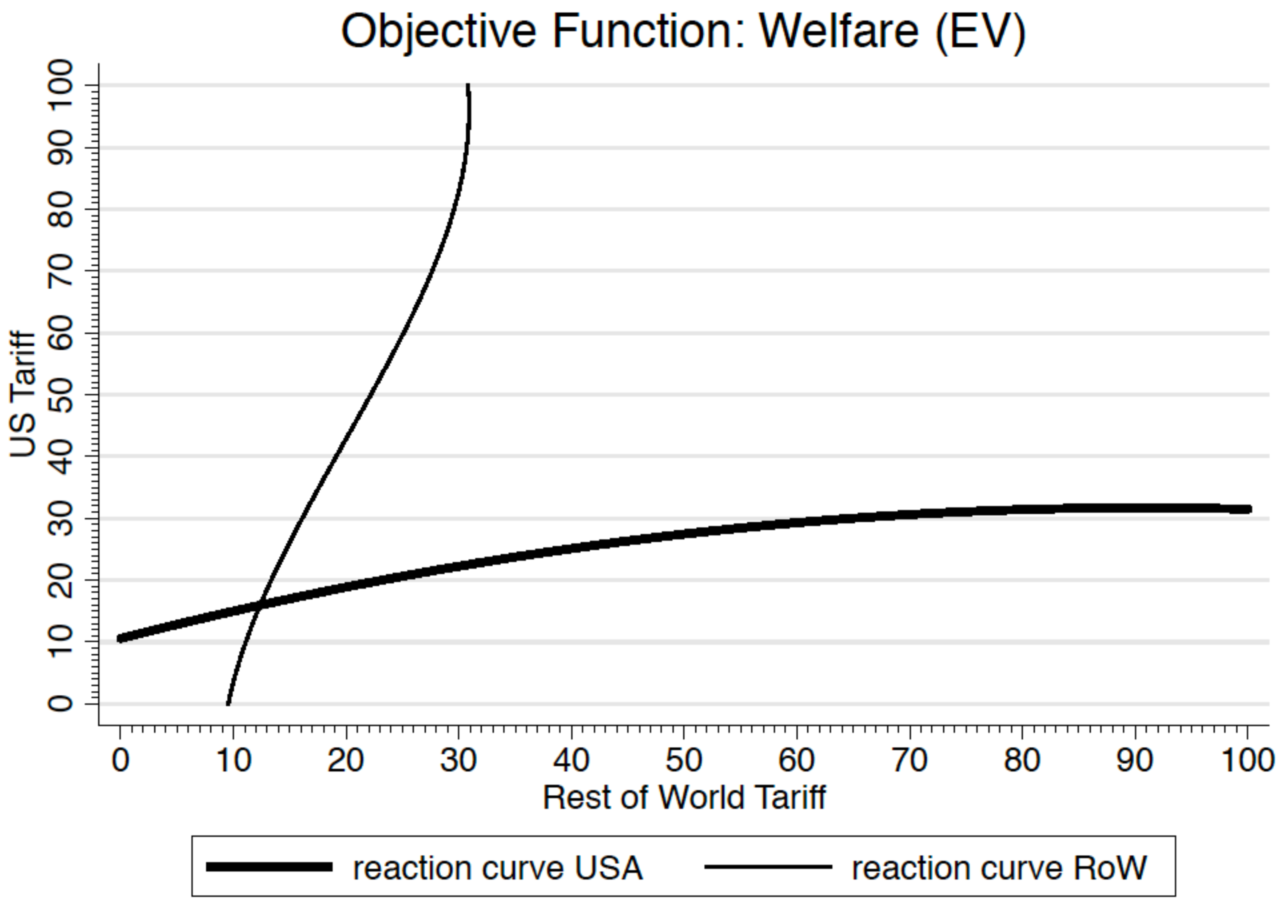
- Standard welfare (EV)

- Sen-type SW = y (1-G)

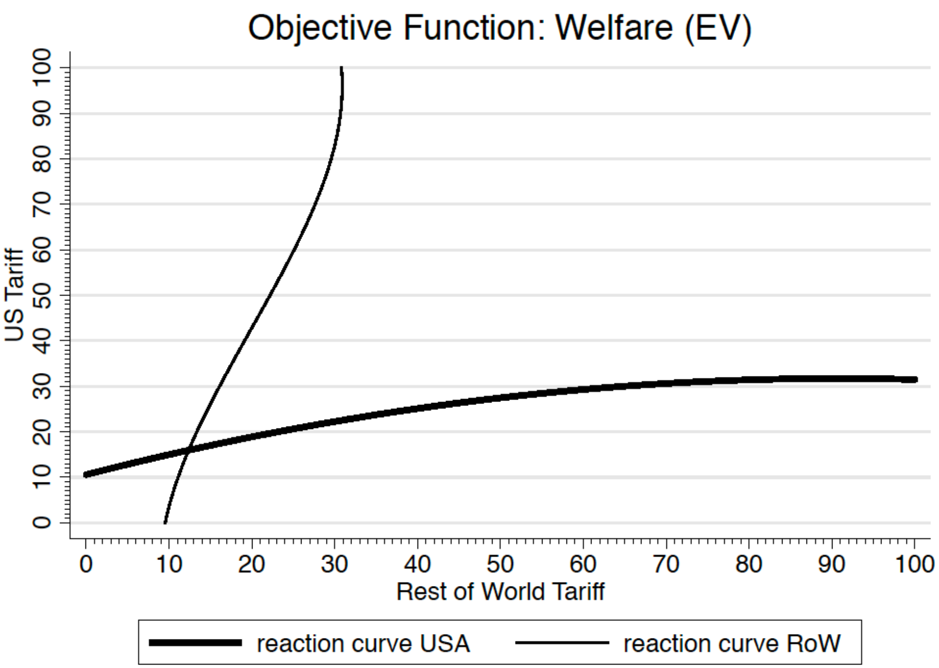
- Political support function with capital lobbying
  - Obj = *a** K_rents + (1-*a*) * SW

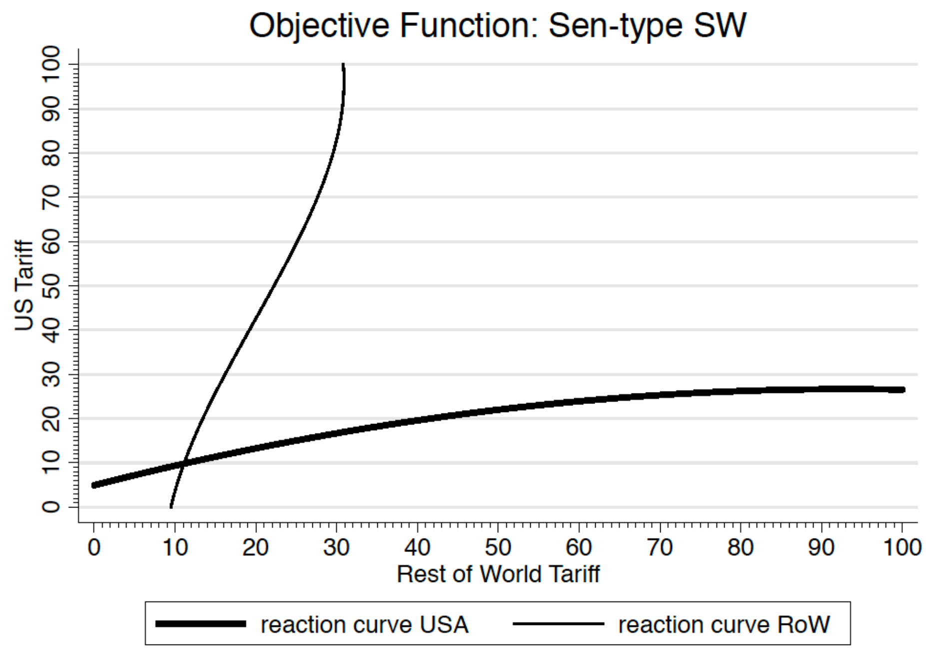
  - We use *a=0.75* (from Francois and Nelson, 2014)

Simulation results



Simulation results





Inequality changes

Figure 2 Gini coefficient level by USA tariff at different RoW tariff leve

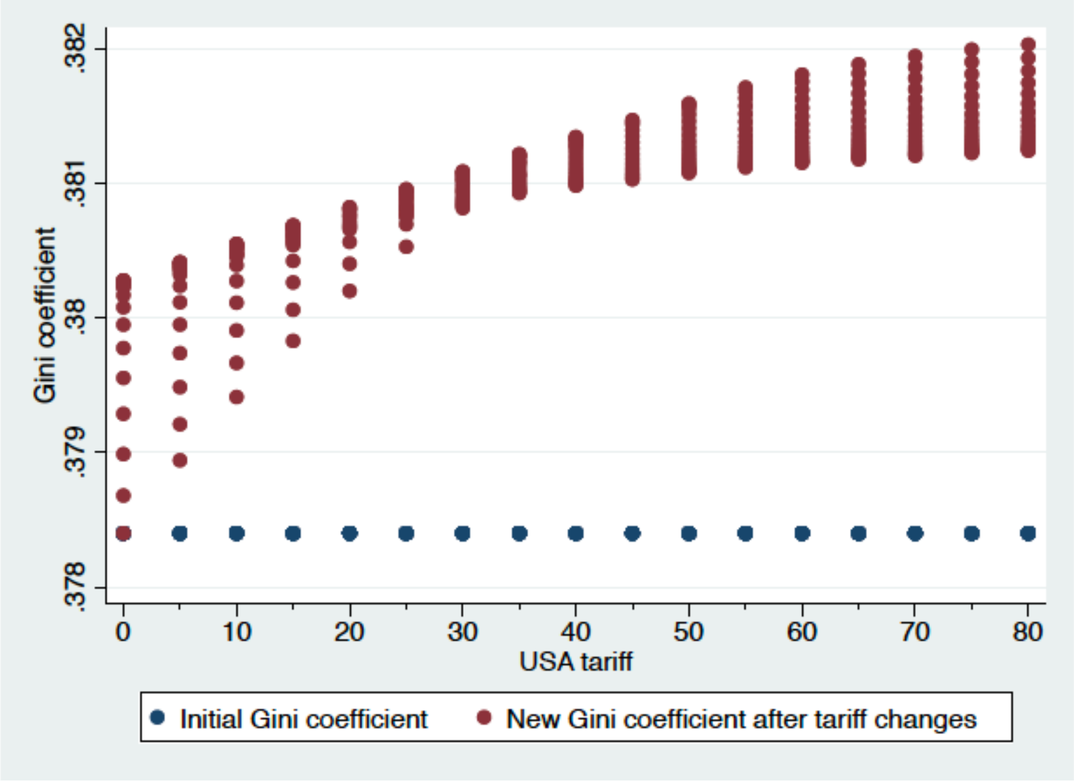


Figure 4 Real factor price changes by USA tariff at different RoW tariff levels, percentage changes with respect to free trade baseline

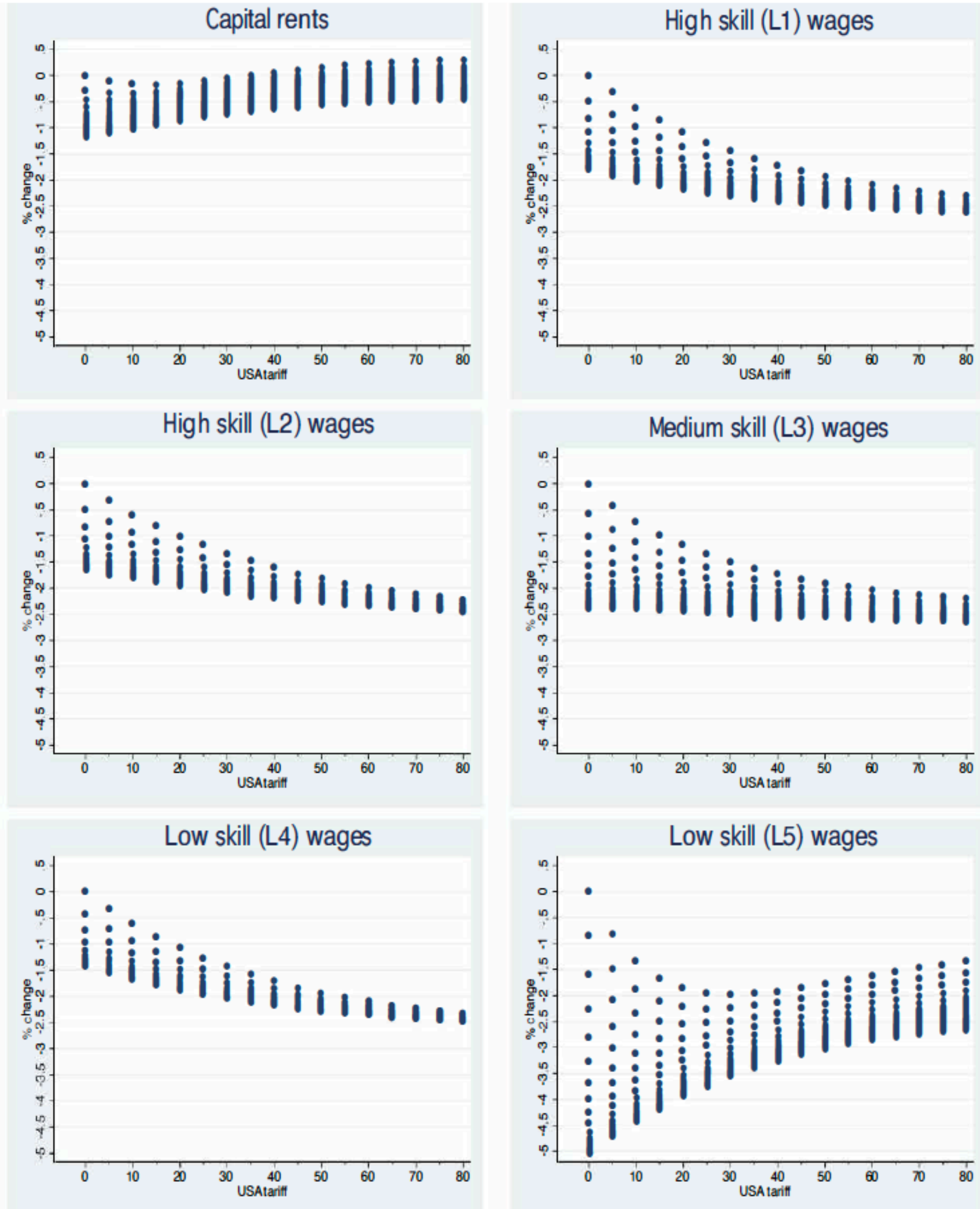
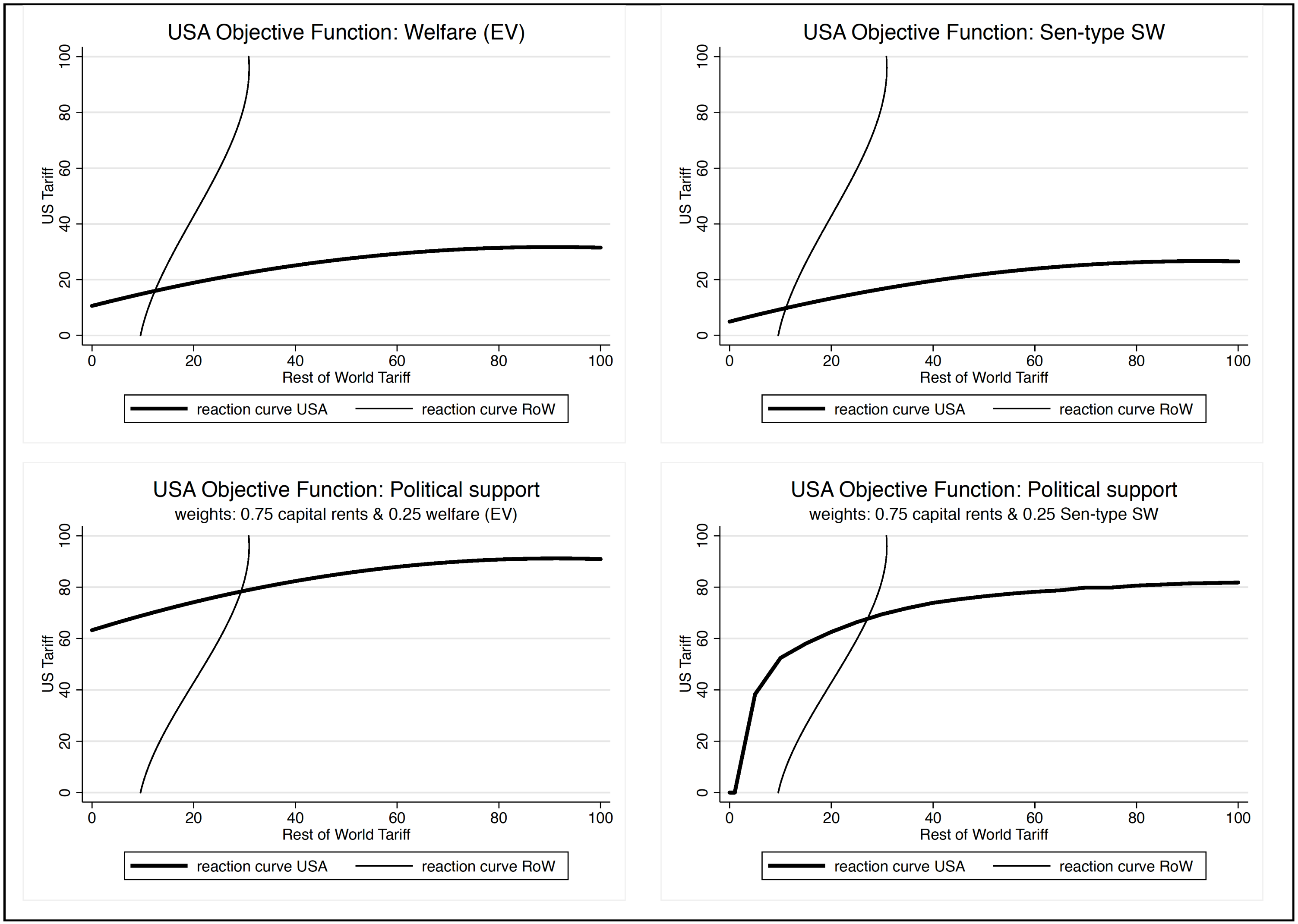
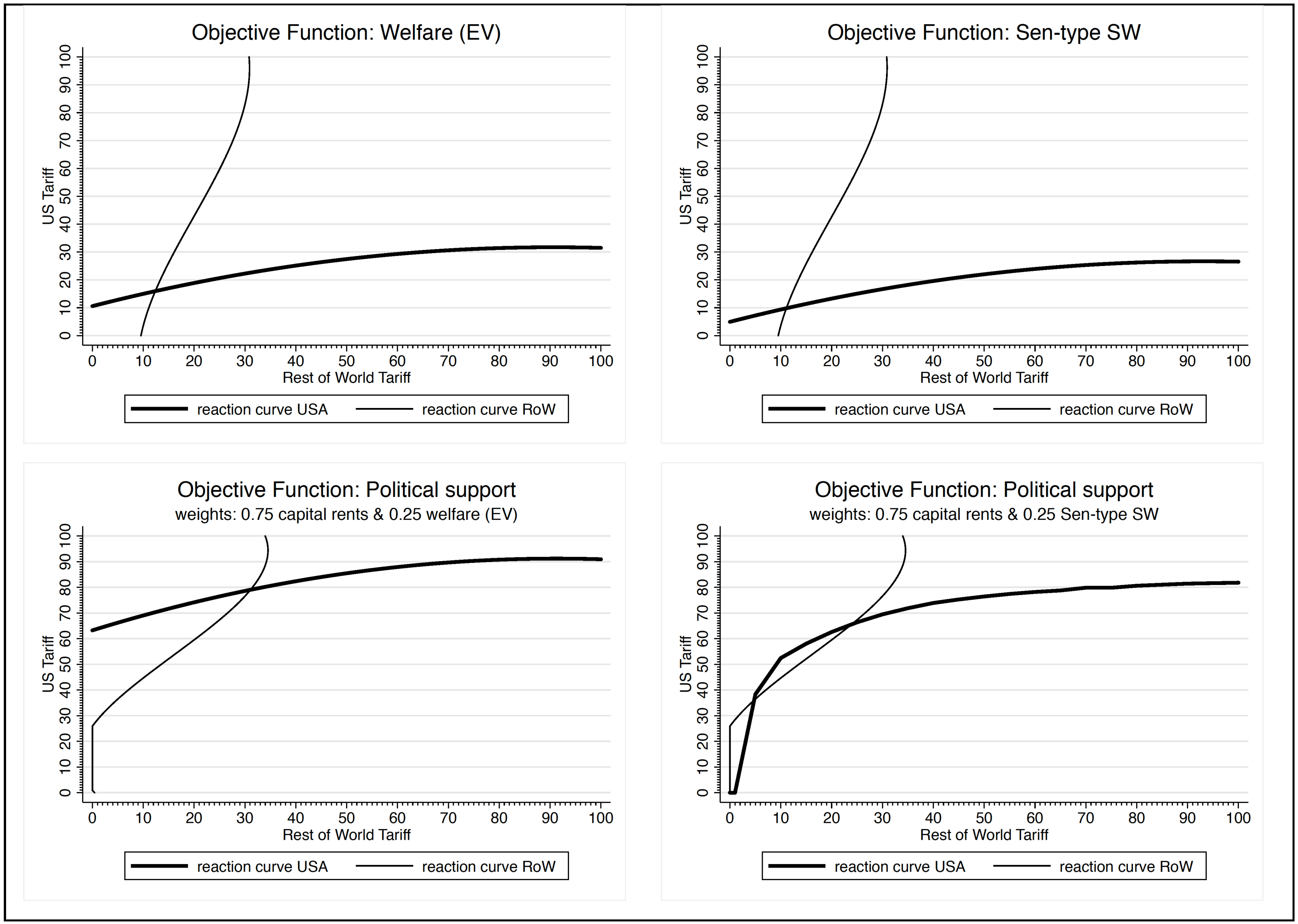


Figure 1: Reaction curves and non-cooperative Nash equilibria, RoW always optimises welfare (EV) while the USA optimises different objective functions



Source: Own estimations.

Figure 2: Reaction curves and non-cooperative Nash equilibria when each region optimises the same objective function



Source: Own estimations.

Nash tariffs

Nash equilibrium when RoW optimise EV		
Objetive function:	**USA**	**RoW**
Welfare (EV)	16.0	12.4
Sen-type social welfare	9.8	11.1
Political support:		
weights: capital 0.75 & welfare (EV) 0.25	78.3	29.3
weights: capital 0.25 & Sen-type SW 0.75	67.7	27.1

Nash equilibrium when both optimise same objective function		
Objetive function:	**USA**	**RoW**
Welfare (EV)	16.0	12.4
Sen-type social welfare	9.8	11.1
Political support:		
weights: capital 0.75 & welfare (EV) 0.25	79.0	31.1
weights: capital 0.25 & Sen-type SW 0.75	0 / 49 / 67	0 / 9 / 24

Conclusions

- Core of optimal tariff theory relies on rationality and a well-defined objective function
- Both assumptions are debatable
- We show that using different objective functions substantially influences the calculated Nash tariffs
- Thus optimal tariff theory provides little practical political guidance
- Trade policy analysis can provide case by case evaluations (e.g. Brexit), but limited value to analyze post trade war equilibrium