The Incidence of the U.S.-China Solar Trade War

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Table of Contents

Context

- In the late 2000s, Chinese solar manufacturers started to rapidly gain market shares.
- China industrial policy subsidized heavily solar manufacturers.
- In the early 2010s, German manufacturers (then market leaders) and others were not happy.
- U.S. Department of Commerce investigated and decided to impose anti-dumping and countervailing duties: first three waves in 2012, 2014, and 2018.

Motivation

The New York Times

Biden to Pause New Solar Tariffs as White House Aims to Encourage Adoption

Critics said the move would shortcut an investigation by the Commerce Department, which has been considering whether to impose the tariffs as part of a trade case against Chinese companies.

SEIA Solar Energy Industries Association

The High Cost of Tariffs

Download a PDF of this Factsheet (1.87 MB)

Read the Full Report

The Section 201 tariffs on solar cells and modules have caused great harm to the U.S. solar industry and the broader economy:

- 62,000 workers laid off or never hired
- 10.5 gigawatts of solar capacity lost
- $19 billion in private sector investment lost
- U.S. solar module prices now among the highest in the world

Our Goals

- Quantify the distributional welfare effects of the recent trade tariffs in the solar sector on:
  - U.S. consumers
  - U.S. manufacturers
  - Foreign/Chinese manufacturers
  - U.S. installers
  - The environment
- Pay particular attention to:
  - Imperfect competition & market structure
  - Vertical contractual relationship (manufacturers-installers)

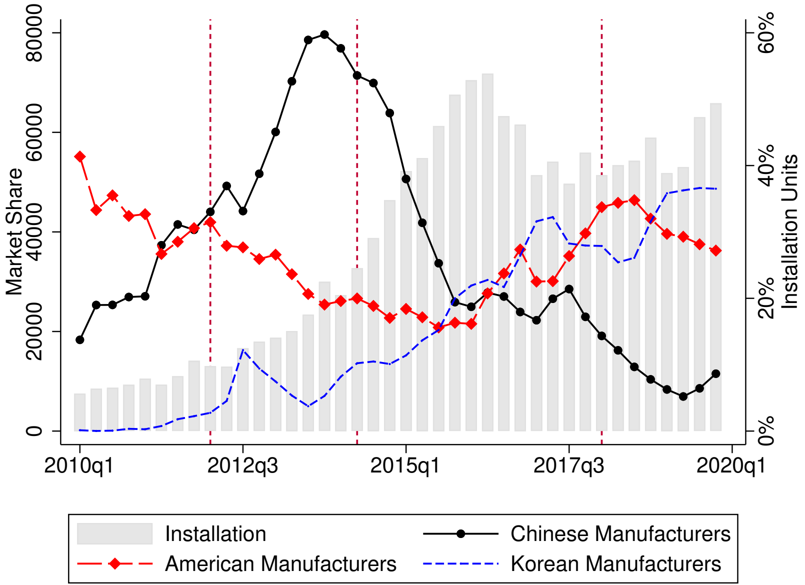
Methods

- Reduced-form evidence
  - Concentrated U.S. solar PV market
  - "Inertia" in the installer-manufacturer relationship
- Structural econometric model
  - Demand-side: static discrete choice model for differentiated goods
  - Supply-side: Berto Villas-Boas (2007)'s three-stage oligopoly model that captures the vertical contractual relationship between solar PV installers and manufacturers.
  - Frictions on the demand and supply-side model to capture installer-manufacturer's inertia

Data

- Lawrence Berkeley National Laboratory (LBNL)'s Tracking the Sun report series
  - 2012-2018 household-level installation, time and location.
  - Price, quantity and characteristics for the solar PV.
- 2010 U.S. Census Data
  - Demographic information on the MSA level.
  - Income, education, urbanization, race and political orientation.
- U.S. Bureau of Labor Statistics
  - Hourly wage rate for roofing across different states.
- Google Project Sunroof
  - The technical solar potential of all buildings in each U.S. county.

Reduced-form Evidence



Market Structure: Vertical Relationship Installers-Manufacturers

Panel A: No. of Manuf. Each Installer Works With

Mean	Std.Dev.	Min	25%	Median	75%	90%
3.84	4.11	1	1	2	5	9

Panel B: Distribution of Installers across Years

Year	No. installers per state	CR1 (%)	Staying with Manufacturers (%)
2011	89	32.53	57.75
2012	99	29.33	57.14
2013	110	28.06	55.71
2014	119	30.39	62.62
2015	165	31.09	75.94
2016	229	23.96	64.42
2017	234	24.40	61.36
2018	247	26.48	54.74

Inertia: Vertical Relationship Installers-Manufacturers

$$StayWith_{rmt} = \alpha + \theta log(1 + InstallCap_{rmt}) + \beta Price_{rmt} + \rho Quality_{mt} + \lambda_{rm} + \eta_t + \nu_{rmt}$$

Where

- $StayWith_{rmt}$: 0-1 dummy that equals 1 if installer r works with manufacturer m at t and stays with m at t+1.
- $InstallCap_{rmt}$: joint total installed capacity
- $Price_{rmt}$: panel price (possibly endogeneous) in \$/W.
  - IV: U.S. trade tariffs
- $Quality_{mt}$: panel characteristics (averaged over different modules if m supplies more than one model to r)

Inertia: Vertical Relationship Installers-Manufacturers

Linear Prob.	OLS	OLS	2SLS
Model	StayWith	StayWith	StayWith
Variables	(1)	(2)	(3)
Ln(1+Capacity)	0.078***	0.041***	0.033***
	(0.001)	(0.004)	(0.008)
Installed Price		-0.010*	0.286
		(0.005)	(0.192)
Efficiency		12.042***	11.647***
		(0.616)	(0.792)
Technology		0.003	0.008
		(0.016)	(0.018)
Year F.E.	No	Yes	Yes
Manuf.-Inst. F.E.	No	Yes	Yes
Observations	27,423	20,379	20,379

Structural Econometric Model

Berto Villas-Boas (2007)'s three-stage game:

1. Manufacturers pick modules to offer
2. Manufacturers set wholesale price
3. Installers purchase modules and set final prices

*Installed capacity influences joint marginal costs

Solar PV Manufacturers (M=10)

- 3 China
- 2 US
- 3 South Korea
- 1 Japan
- 1 German

U.S. Installers (R=10+1)

- Market is MSA-Year

U.S. Consumers

- Single-unit family houses that are solar-viable (Google Sunroof Project)
- House value > $100k

Static demand model for differentiated goods in the spirit of BLP (1995)

Results: BLP Demand Estimation

	Variables	Estimates	S.E.
Demand side parameters			
Means, (α, β)	Price	-1.549***	(0.503)
	Efficiency	45.154***	(16.957)
	Technology	-0.458	(0.479)
Demographics, (θ)	Income	0.230**	(0.109)
	Education	-7.230***	(1.676)
	Urbanization	-0.226***	(0.026)
	Race	0.573	(0.393)
	Democrats	1.872***	(0.452)
Taste variation, (Σ)	Price	0.438**	(0.224)
	Efficiency	7.308	(5.824)
	Technology	0.320	(1.774)

Results: Supply Estimation contd.

	Variables	Estimates	S.E.
Cost side parameters			
	Efficiency	7.507***	(0.022)
	Wage Rate	0.105***	(0.0003)
	Friction Term	0.031***	(0.0002)
	Installer F.E.	Yes	
	Year F.E.	Yes	

Policy Analysis

- Remove all tariffs of waves 1 to 3 (2012, 2014, and 2018)
- Same as above without inertia in vertical contractual relationship
- Effective rates = 50% of statutory rates

Main Result I

$\$1.35$

Main Results

- Tariffs reduced overall demand for residential solar PV by 17.2%
- U.S. manufacturers gained: \$4.6MM
- U.S. installers lost: \$271.4MM
- U.S. consumers lost: \$369.6MM
- Tariff revenues were: \$366.0MM
- Chinese manufacturers lost: \$271.4MM
- CO2 externality: \$253.3MM

*All the welfare numbers are computed for our estimation sample, which corresponds to about 21% of the whole U.S. solar residential market for the period 2012-2018.

Robustness and Additional Results

- Non-linear vertical contracts reduce the pass-through from \$1.35 to \$1.17.
  - The markups are cut by half.
- Removing inertia increases the magnitude of the welfare effects.
  - Advantageous cost shock that increases overall market—thus, bigger effects in levels.
- Accounting for strategic avoidance of tariffs decreases the magnitude of the welfare effects proportionally.
  - We do not account for the fixed/sunk costs of manufacturing relocation.

Conclusion

- Tariffs had a negative impacts on the domestic economy even accounting for tariff revenues.
- Pass-through rate exceeds 100%.
- Tariffs reduced overall demand.
- Consistent with the overall narrative that tariffs slowed the expansion of the US solar market.

Table of Contents

Motivation


McKinsey Sustainability
How the European Union could achieve net-zero emissions at net-zero cost
December 3, 2020 | Report

Europe can reach net-zero emissions at net-zero cost.

Reducing GHG emissions would raise the cost of doing business in some sectors; savings in others would make up the difference. If these costs and savings were passed along to consumers, the average cost of living would decline slightly for low- and middle-income households.

More than half the emissions reductions could be achieved with mature and early-adoption technologies.

Energy security and competitiveness could increase.

Europe would become effectively energy independent, but could become more dependent on imports of climate-neutral technology components or materials. At the same time, the EU has a major opportunity to accelerate R&D, retain leadership, and penetrate new export segments.

Motivation

- Protectionism has reemerged in recent years and may even gain momentum in the post-pandemic world.
- The full welfare impacts of trade tariffs have remained underexplored, especially considering the market structure of certain industries.
- Each jurisdiction is looking for a win-win energy transition.
- Trade barriers could be one of the most important impediment to a collective action needed to address climate change.
- In a high-employment/high inflation environment, tariffs become increasingly difficult to justify.

Motivation: Empirical Strategy

- A large shock that affected the whole U.S. market: comparing equilibrium prices of PV systems with Chinese vs non-Chinese panels is problematic in a multiproduct oligopoly market.
- We do not observe the vertical contracts between downstream and upstream firms in the solar market.
- The potential endogeneity of solar PV prices with unobserved product attributes.

Table of Contents

Related Literature

- Incidence of recent trade wars:
  - Amiti, Redding, and Weinstein, 2019; Fajgelbaum et al., 2020; Cavallo et al., 2021 found tariff **pass-through rates between 0 and 100 percent** for the trade tariffs imposed in the context of the recent trade wars.
  - Flaaen, Hortaçsu, and Tintelnot, 2020's analysis of the 2018 U.S. tariff on clothes washers implies a **pass-through exceeding 100 percent**.
- Incidence of solar subsidies:
  - Pless and Van Benthem, 2019 found **pass-through rates exceeding 100 percent** for solar subsidies.
- Incidence of cost shocks in imperfectly competitive markets:
  - Bonnet et al., 2013 found cost **pass-through rates that increase with demand elasticity** in a structural oligopoly model of the German coffee market.
- Inertia in buyers-suppliers relationship
  - Monarch, 2018 found **large switching costs in international supply chains** involving U.S. buyers and Chinese sellers.

Table of Contents

Institutional Details

- Following German-based SolarWorld's petition, the U.S. Department of Commerce began an investigation.
- October 2012's announcement: anti-dumping duty rates ranging from 18.32% to 249.96% and countervailing duty rates ranging from 14.78% and 15.9% would be imposed on Chinese manufacturers.
- 2012's Loophole: panels assembled in Taiwan did not have to pay the tariffs.
- In 2014, loophole is closed and additional tariffs are imposed.
- In 2018, more tariffs are added in the context of Trump's trade war with China.
- In November 2021, U.S. court rejected some of Trump's tariffs.
- Holding constant behaviors (demand and supply), these tariffs added to about $3000 to the price of a U.S. solar system.

Market Structure

- 270 different solar manufacturers operating in the U.S. market from 2012 to 2018.
  - The ten largest manufacturers accounted for approximately 80% of the solar module sales.
- 4,990 different firms that have installed at least one residential PV system in the U.S. during the sample period.
  - 50% of these installers installed no more than five systems.
  - The 15 highest-volume installers accounted for approximately 50% of U.S. solar PV installations during the 2012-2018 period.
  - In each state, the largest installer has between 30-54% of the total market share (CR1).

Table of Contents

Estimation Details: Demand

The conditional indirect utility of consumer i in MSA w from purchasing and installing solar PV j, (manufacturer (m)-installer (r) pair technology), during year t is given by

$$U_{ijwt} = X_j\beta_i + \alpha_i p_{jwt} + Z_w\theta + \lambda_{j(mr)} + \eta_t + \zeta_{jt} + \epsilon_{ijt}$$

- X_{jt}: product characteristics
- p_{jwt}: the average consumer purchase price
- Z_w: demographic variables (income, education, urbanization, race, and political orientation).
- $\lambda_{j(mr)}$: manufacturer-installer fixed effect
- η_t: year fixed effect
- ζ_{jt}: the unobserved product characteristics
- ϵ_{ijt} iid idiosyncratic preferences/attributes (logit)

Estimation Details: Demand

The heterogeneous taste parameters for product characteristics are modeled as

$$\begin{pmatrix} \alpha_i \\ \beta_i \end{pmatrix} = \begin{pmatrix} \alpha \\ \beta \end{pmatrix} + \Sigma v_i \tag{1}$$

The trans-log version of the predicted market share of solar PV/installer pair j in MSA w during year t is

$$\ln s_{jwt} - \ln s_{0wt} = X_j \beta_i + \alpha_i p_{jwt} + Z_w \theta + \lambda_{mr} + \eta_t + \zeta_{jt} \tag{2}$$

- s_{0wt}: the market share of the outside good.
- Market size: For each MSA-year we define, $M_w \times A \times V$, where M_w is the number of single-unit house in MSA w; A is the proportion of single-unit houses with value greater than 100K US dollars; and V is the percentage of buildings which are solar-viable.

Estimation Details: Demand

Instrumental variables

- Installed PV prices might be correlated with ζ_{jt}, the unobserved product characteristics.
- Exploit variation in prices induced by product differentiation (the so-called BLP instruments, Berry et al. 1995)
- BLP instruments: $BLP\_efficiency_{jt}$, $BLP\_technology_{jt}$

  i.e., added up the values of a product characteristic for other products owned by the same manufacturer and products owned by other manufacturers.

First-stage Regression with Market Shares and Logit Model

Table 4: Results for the first-stage regression

VARIABLES	Model 1	Model 2	Model 3
BLP_eff	0.024***	0.059***	0.045**
	(0.008)	(0.017)	(0.019)
BLP_tech	0.002	0.007	0.009
	0.003	(0.006)	(0.006)
$(\text{BLP\_eff})^2$		-0.002***	0.002
		(0.001)	(0.002)
$(\text{BLP\_tech})^2$		-0.0001	0.0005
		(0.0001)	(0.0003)
BLP_eff $\times BLP\_tech$			-0.003**
			(0.0015)
Control Variables	Yes	Yes	Yes
Manufacturer-Installer FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	6,653	6,653	6,653
F-statistics	30.32	21.19	17.83
R-squared	0.44	0.44	0.44

Second-stage with Market Shares and Logit Model

Table 5: Results for the second-stage regression

VARIABLES	Model 1	Model 2	Model 3
Price	-2.011***	-1.263***	-1.559***
	(0.394)	(0.289)	(0.298)
Efficiency	63.38***	54.87***	58.24***
	(6.480)	(5.219)	(5.453)
Technology	-0.265*	-0.398***	-0.345***
	(0.146)	(0.122)	(0.129)
Income	0.404***	0.284***	0.332***
	(0.0685)	(0.0516)	(0.0534)
Education	-9.710***	-7.788***	-8.549***
	(1.241)	(0.969)	(1.008)
Urbanization	-0.221***	-0.234***	-0.229***
	(0.0234)	(0.0200)	(0.0211)
Race	0.933***	0.858***	0.888***
	(0.259)	(0.223)	(0.235)
Democrats	2.271***	1.892***	2.043***
	(0.476)	(0.401)	(0.422)
Constant	-11.31***	-13.02***	-12.34***
	(1.205)	(0.958)	(0.999)
Observations	6,653	6,653	6,653

Table of Contents

Estimation Details: Supply

We model the supply side as a three-stage game.

- In the first stage, the solar manufacturers choose their products.
- In the second stage, they set the upstream price charged to the solar installers given the demand shock.
- In the third stage, the solar installers choose the final price charged to the consumers.

We use backward induction to solve this subgame perfect Nash equilibrium (Berto Villas-Boas, 2007).

Estimation Details: Supply

Each installer r's profit function in period t is given by

$$\max_{p_{jt}\ \forall j} \pi_{rt} = \sum_{j \in F_{rt}} \left[p_{jt} - p_{jt}^m - c_{jt}^r\right] M s_{jt}(p)$$

FOC:

$$p_t - p_t^m - c_t^r = -(T_{rwt} * \Delta_{rt})^{-1} s_t(p)$$

The solar manufacturer m's profit-maximizing problem is

$$\max_{p_{jt}^m} \pi_{mt} = \sum_{j \in F_{mt}} \left[p_{jt}^m - c_{jt}^m\right] M s_{jt}(p)$$

FOC:

$$p_t^m - c_t^m = -(T_{mt} * \Delta_{mt})^{-1} s_t(p)$$

Estimation Details: Supply

The solar manufacturer and installer's joint marginal cost MC_t,

$$MC_t = c_t^m + c_t^r = p_t + (T_{rwt} * \Delta_{rt})^{-1} s_t(p) + (T_{mt} * \Delta_{mt})^{-1} s_t(p)$$

Assuming joint marginal cost depends on a vector of cost characteristics, each element of the vector MC_t is:

$$mc_{rmt} = \gamma Y_{rmt} + \pi F_{rmt} + \kappa_r + \varphi_t + \varepsilon_{rmt}$$

- Y_{rmt}: including energy conversion efficiency and wage rate in roofing associated with installer r's region.
- F_{rmt}: friction term, capturing various phenomena that induce inertia in a manufacturer-installer contracting relationship.
- κ_r: installer fixed effect.
- φ_t: year fixed effect.

Estimation Details: Supply

Ownership matrices determine the products offered by each firm:

- Installer ownership matrix T_{rwt}: Modules that installer r bought in MSA w and year t.
  - Consideration set of an installer varies exogenously across regions and years.
  - We do not endogenize (yet) the decision to select new suppliers.
- Manufacturer ownership matrix T_{mt}: Modules that manufacturers m sold nationally in year t.

Table of Contents

Policy Analysis: Details & Additional Results

- Baseline scenario: with tariffs for all three waves (statutory rates = effective rates).
- Counterfactual scenario: remove all tariffs.
- Change in welfare for manufacturers, installers, and consumers.
- Quantify CO2 externality using the average emission rate for the whole U.S.

Parameter Used in Simulations

Panel A: Anti-dumping and Countervailing Duty Rates (%)						
	Anti-dumping			Countervailing		
	2012	2014	2018	2012	2014	2018
Trina Solar	18.32	26.71	81.71	15.97	49.79	49.79
Canadian Solar	25.96	52.13	107.13	15.24	38.72	38.72
Yingli Energy	25.96	52.13	107.13	15.24	38.72	38.72

Panel B: Breakdown of Total Installed Price				
Year	Total Price	Module Price	Non-Module	% Module Price
2012	5.71	1.02	4.7	17.91%
2013	4.91	0.98	3.9	20.04%
2014	4.51	0.85	3.7	18.92%
2015	4.42	0.76	3.7	17.16%
2016	4.23	0.56	3.7	13.33%
2017	3.99	0.48	3.5	12.09%
2018	3.78	0.59	3.2	15.48%

Simulation: Removing Anti-dumping Policies

Table 5: Simulation Results for Main Scenarios: Removing All Tariffs

Panel A: Demand Response				
Origin Country	Manufacturer	Model 1	Model 2	Model 3
China	Canadian Solar	72.8%	77.5%	79.6%
	Trina Solar	66.1%	68.4%	68.5%
	Yingli Energy	80.2%	85.9%	85.8%
USA	SunPower	-0.7%	-0.7%	-0.6%
South Korea	Hanwha	-0.6%	-1.0%	-0.8%
	Hyundai	-0.6%	-0.9%	-0.7%
	LG	-0.7%	-0.7%	-0.5%
Japan	Kyocera	-0.8%	-1.8%	-1.7%
German	Solar World	-0.8%	-0.8%	-0.7%
Norway	REC Solar	-0.5%	-1.2%	-1.0%
Total		17.2%	18.0%	18.1%

B: Welfare Distribution (in 2015$ million)			
	Model 1	Model 2	Model 3
Δ Consumer Surplus	369.6	331.7	331.0
Δ U.S. Manufacturers	-4.6	0	-3.8
Δ Chinese Manufacturers	271.4	0	279.3
Δ Korean Manufacturers	-2.9	0	-2.7
Δ Other Manufacturers	-5.8	0	-9.1
Δ Installers	291.8	266.1	0
Δ U.S. Tariff Revenue	-366.0	-382.9	-382.8
Total	553.5	214.9	211.9

Panel C: Environmental Benefit			
	Model 1	Model 2	Model 3
Δ Reduced CO_2 (million tons)	7.0	7.4	7.4
Δ Reduced Cost (2015$ million)	253.3	265.6	266.2

Tariff Pass-through

Table 8: Tariff Pass-through

	Without Equilibrium Response		With Equilibrium Response		Pass-through
	Percent (%)	Level ($)	Percent (%)	Level ($)	
Model 1	(1)	(2)	(3)	(4)	(5)
With Inertia Term	12.69	2,911	17.05	3,765	1.35
Without Inertia Term	12.69	2,598	16.70	3,323	1.32
50% × Statutory Rates	6.34	1,549	8.60	2,063	1.37
Model 2					
With Inertia Term	12.69	2,911	14.81	3,315	1.17
Without Inertia Term	12.69	2,599	14.47	2,922	1.15
50% × Statutory Rates	6.34	1,549	7.36	1,775	1.16
Model 3					
With Inertia Term	12.69	2,911	14.68	3,292	1.16
Without Inertia Term	12.69	2,544	14.34	2,832	1.13
50% × Statutory Rates	6.34	1,549	7.41	1,778	1.17

- Tariff over-shifting: a $1 dollar increase in tariff leads to a $1.35 increase in the final price of an installed solar PV system.
- Consistent with Pless and Van Benthem (2019), in which they also find pass-through rates exceeding 100 percent.
- Tariff over-shifting can be attributed to the presence of market power.

Sensitivity Test

Table 9: Sensitivity Test

Average Tariff Pass-through for All PV Systems			
Demand Elasticity	Consumer's Final Price	Manufacturer's Markup	Installer's Markup
-1	1.16	0.13	0.20
-2	1.20	0.23	0.30
-3	1.25	0.36	0.46
-3.64	1.30	0.47	0.65
-4	1.35	0.60	0.85

- Pass-through rate increases with the elasticity of the demand.
- Bonnet et al. (2013) find similar results using a structural oligopoly model of the German coffee market.
- Consistent with the theoretical evidence in Bettendorf and Verboven (2000), in which they argue that markup absorption is more important in oligopolies than competitive markets.

Simulation: Removing Inertia in Vertical Contracting

Table 6: Simulation Results: Removing All Tariffs and No Inertia

Panel A: Demand Response				
Origin Country	Manufacturer	Model 1	Model 2	Model 3
China	Canadian Solar	60.6%	66.1%	64.1%
	Trina Solar	62.3%	66.4%	65.9%
	Yingli Energy	73.7%	76.6%	75.1%
USA	SunPower	-0.9%	-0.8%	-0.7%
South Korea	Hanwha	-0.7%	-1.1%	-0.9%
	Hyundai	-0.6%	-1.1%	-0.9%
	LG	-0.9%	-0.8%	-0.7%
Japan	Kyocera	-0.6%	-1.9%	-1.9%
German	Solar World	-0.8%	-0.9%	-0.7%
Norway	REC Solar	-0.0%	-1.2%	-1.1%
Total		13.2%	14.3%	13.9%

Panel B: Welfare Distribution (in 2015$ million)			
	Model 1	Model 2	Model 3
Δ Consumer Surplus	524.1	539.9	565.0
Δ U.S. Manufacturers	-8.7	0	-10.1
Δ Chinese Manufacturers	407.1	0	501.5
Δ Korean Manufacturers	-5.1	0	-6.0
Δ Other Manufacturers	-1.7	0	-20.9
Δ Installers	426.6	446.1	0
Δ U.S. Tariff Revenue	-534.9	-639.6	-669.2
Total	807.4	346.4	360.3

Panel C: Environmental Benefit			
	Model 1	Model 2	Model 3
Δ Reduced CO2 (million tons)	11.1	13.3	14.1
Δ Reduced Cost (2015$ million)	399.2	478.8	506.0

Statutory versus Effective Rates

Table 7: Simulation Results: Effective Tariffs = 50%× Statutory Tariffs

Panel A: Demand Response				
Origin Country	Manufacturer	Model 1	Model 2	Model 3
China	Canadian Solar	33.7%	35.2%	35.0%
	Trina Solar	30.5%	31.0%	31.0%
	Yingli Energy	36.6%	38.4%	38.4%
USA	SunPower	-0.3%	-0.3%	-0.3%
South Korea	Hanwha	-0.3%	-0.5%	-0.4%
	Hyundai	-0.3%	-0.4%	-0.3%
	LG	-0.3%	-0.3%	-0.2%
Japan	Kyocera	-0.4%	-0.9%	-0.8%
German	Solar World	-0.4%	-0.4%	-0.3%
Norway	REC Solar	-0.2%	-0.5%	-0.4%
Total		7.9%	8.1%	8.1%

Panel B: Welfare Distribution (in 2015$ million)	Model 1	Model 2	Model 3
Δ Consumer Surplus	174.7	152.3	152.5
Δ U.S. Manufacturers	-2.2	0	-1.9
Δ Chinese Manufacturers	126.8	0	128.4
Δ Korean Manufacturers	-1.4	0	-1.3
Δ Other Manufacturers	-2.8	0	-4.3
Δ Installers	136.4	122.2	0
Δ U.S. Tariff Revenue	-149.9	-153.1	-153.1
Total	281.6	121.5	120.4

Panel C: Environmental Benefit	Model 1	Model 2	Model 3
Δ Reduced CO2 (million tons)	3.2	3.3	3.3
Δ Reduced Cost (2015$ million)	116.5	119.6	120.0

Table of Contents

Extensions & Wishful Thinking

- Account for dynamics in the installers' choice of suppliers.
- Quantify environmental externalities using information about marginal power producers.
- Perform merger simulations within the downstream market and across the vertical structure.

Table of Contents

Thank You!

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