Effects of Trade Barriers on Foreign Direct Investment: Evidence from Chinese Solar Panels

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Abstract

The recent comeback of protectionism and industrial policy will affect the international allocation of resources beyond the short run. Analyzing similar events from the past can help us envision their long-lasting effects. What are some unintended consequences of trade barriers in strategic economic sectors? I study the Anti-Dumping and Countervailing Duties (AD-CVD) implemented by the Obama Administration in 2012 against the imports of solar panels from China. Leveraging the variation given by the policy's discriminatory nature, I develop a difference-in-differences design. I estimate the effect on Foreign Direct Investment (FDI) decisions by Chinese firms using a Poisson Pseudo-Maximum Likelihood method and data on FDI announcements from 2009 to 2015. My findings show that in 2012, firms granted a specific AD-CVD rate increase FDI by 145 million dollars per year, from a previous average of 9 million dollars. These results for greenfield investment do not carry over to cross-border mergers and acquisitions. Firms also reduce their number of projects for two years after the policy. I use location choice models to test different hypotheses behind the FDI location decisions. I find evidence of production fragmentation in Asia after the imposition of the duties, mostly to countries that end up becoming exporters of solar panels to the US, showing support for the export-platform hypothesis. These results document FDI diversion that modifies investment patterns in the short run and eludes the trade barriers in the medium run, weakening the intended effects of the protectionist policy.

Keywords: Foreign Direct Investment, Anti-Dumping, Solar Panels, US, China.

JEL Codes: F13, F14, F21, F23

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1 Introduction

A return to protectionism involving large economies and important increases in tariffs and retaliations in a wide range of economic sectors has taken place since 2018 (Fajgelbaum et al. (2020)). On top of that, industrial policy is back on the scene (Aiginger and Rodrik (2020)). Many of the industrial policies implemented by developed nations are in the form of non-tariff barriers, which require granular evidence and a deep institutional context to have an adequate measurement of their effects (Lane (2020)). This paper uses the imposition of non-tariff barriers on Chinese solar panel producers in 2012 to examine the intended and unintended effects of trade barriers in the short and medium term.

Solar panels and washing machines, with the imposition of a 30% rate, were part of the first wave of tariffs imposed by the US and labeled the "Trade War" with China in 2018. However, it was not the first time the US solar panel industry received protection from its Chinese competitors. In 2012, the US imposed Anti-Dumping and Countervailing Duties (AD-CVDs) against the import of Chinese solar cells and modules (panels). This is known as one of the largest remedy cases in the US and the first involving the renewable energy sector.

In this paper, I document this previous US experience implementing non-tariff barriers in a strategic economic sector. I examine how these measures impact Foreign Direct Investment (FDI) decisions by multinational firms in a context where a nationalist industrial policy clashes with international climate change commitments. Specifically, I study how the AD-CVDs imposed by the US modified FDI decisions by targeted Chinese firms, and test some of the motives for firms' reactions.

AD-CVDs are frequently used forms of administered protection. The Anti-Dumping Agreement (Agreement on Implementation of Article VI of the GATT 1994), defines dumping as "the introduction of a product into the commerce of another country at less than its normal value" (World Trade Organization). Meanwhile, the Agreement on Subsidies and Countervailing Measures allows countries to launch their investigation and charge an extra duty (countervailing duty) if they find that subsidized imports are hurting domestic producers (World Trade Organization).[1] Both mechanisms aim at a particular product from a specific exporter. This characteristic makes them a "leaky form of protection" (Irwin (2019)), and creates an interesting setting to analyze differential effects on firms. Most of

[1] See more information for AD and CVD.

the literature focuses on the effect of these barriers on trade flows, but less is known about their impact on FDI.

I fill this gap by estimating the effect on FDI decisions by Chinese firms using a Poisson Pseudo-Maximum Likelihood (PPML) estimation method and data on greenfield FDI announcements from 2009 to 2015. This period considers three years before and after the policy change. Leveraging the variation given by the policy's discriminatory nature, I rely on firm-level data to develop a difference-in-differences design.

I devise a variety of tests for evaluating the hypotheses behind multinational firms' location choice decisions suggested by theory, such as tariff-jumping, horizontal, vertical, and export platform FDI. Although not mutually exclusive, each of them implies different location and industry choices for foreign investments. I use linear probability and probit models to test each of these motivations by estimating if the likelihood of investing in different regions changes by year as a reaction to the 2012 policy. To understand if this behavior is specific to firms granted a specific rate, I fit a model of location choice using McFadden's alternative-specific Conditional Logit model. Tariff-jumping FDI is described by Blonigen (2002) as multinational firms locating a manufacturing plant in the country that imposes a trade barrier to provide to the local market. In this case, this means increase FDI in the US by Chinese firms in the affected industry. The literature defines "horizontal" FDI as investments in production facilities to serve the consumers in the foreign market, while "vertical" FDI involves cross-country production fragmentation (Helpman et al. (2004)). I test these hypotheses for Europe and Asia respectively. Finally, export-platform FDI refers to multinational firms that use their foreign affiliates to export to markets outside the host country, as in Tintelnot (2017). I also apply this hypothesis to the location in Asia.

My results show that firms granted a specific rate increase FDI by 145 million dollars in 2012, the year the policy is implemented. This finding is statistically significant and economically relevant since the average before the policy for this group of firms is 9 million dollars per year. These results are robust to including the financial control variables in a yearly estimation for a sub-sample of publicly traded firms. Following this initial reaction to the policy, there is a decrease in the number of projects in the next two years. Specific-rate firms reduce their announcements by 53% in 2013 and 2014.

I do not find evidence to support the tariff-jumping hypothesis, meaning no increased FDI by affected firms in the US. I also do not find support for horizontal FDI, on the contrary, I find that these firms decrease their investment in Europe in 2015. I find evidence for vertical FDI in 2015 when specific-rate firms increase their investment in Asia. I then test if some industry activities impact the probability of investing in Asia, finding evidence of production fragmentation. Finally, a descriptive analysis of the data shows that Asian countries that received FDI after the policy end up becoming exporters of solar panels to the US, showing support for the export-platform hypothesis.

My paper contributes to the literature on the response of multinational firms to changes in bilateral trade conditions, specifically anti-dumping duties. I differentiate from previous work on trade diversion in that my focus is on FDI rather than trade flows. Flaaen et al. (2020) use ADDs against South Korea, Mexico, and China to estimate the price effect of US import restrictions on washing machines. Using country-level trade flows and firm-level import data, the authors find small changes in US prices explained by firms' production relocation strategies. They also show that firms' "country-hopping" behavior prevented the ADDs' objective of reducing imports. I depart from their approach in that I use an empirical strategy to test changes in FDI decisions by firms as a response to AD-CVDsand document large and significant increases in greenfield FDI by targeted firms, confirming there is a significant investment diversion.

I also contribute to the literature on the effects of temporary trade barriers implemented by the US. A study of US ADDs on Chinese imports by Bown et al. (2022) uses an instrumental variable approach to show the effects on supply chains. They find that this protection decreases imports and raises prices in targeted industries, harming domestic jobs due to the increasing costs for downstream producers. Bown and Crowley (2007) use theory and empirics to show that the US imposition of ADDs on Japanese imports deflects trade, while it depresses trade when imposed against a third country. Meanwhile, Bown and Crowley (2010) find that using the China safeguardby the US and the EU did not result in growing Chinese exports to third markets. Blonigen and Prusa (2015) provide a review of the effects of dumping and anti-dumping literature and find that trade diversion is the most common unintended effect of ADDs. A previous paper analyzing the effects of ADD on FDI is by Blonigen (2002). His results suggest that only multinational firms from industrialized countries engage in tariff-jumping FDI.

Similarly, my findings add to the studies of FDI location decisions by multinational firms, in this case as an unintended consequence of a trade barrier. Horizontal FDI is efficient for a multinational firm when the cost of installing and operating a new facility is lower than the trade costs (Helpman et al. (2004)). Meanwhile, vertical FDI is driven by differential factor prices between the home and the host country. The affiliate abroad assumes part of the production process and sells to the final market, instead of the parent company. Export-platform FDI is a decision that depends on the differential costs of exporting and establishing a plant in the desired market. In the context of this paper, exporting costs include the trade barrier. In Tintelnot (2017), the author develops a multicountry general equilibrium model of firms with export-platform affiliates facing fixed costs of foreign investment. The empirical results show the presence of large fixed costs to establish a foreign affiliate.

My paper also contributes to the growing empirical literature on US-China trade relations. By including non-tariff trade barriers, I show a broader picture of the US trade policy regarding China. As Bown (2021) describes, China has been a target for AD-CVDs from the US for a long time. Before the 2018 trade war, more than 7% of Chinese imports in the US were covered by AD-CVDs. Similar to Fajgelbaum et al. (2021), my findings show a global reallocation of resources and the creation of new investment patterns due to a US-China trade conflict.

Since these firms produce solar cells and modules, whether assembled on solar panels or not, my results show how a change in bilateral trade policy can reshape multinational production. Overall, my results document FDI diversion that modifies investment patterns in the short run and eludes the trade barriers in the medium run, weakening the intended effects of the protectionist policy.

The structure of this paper is the following: Section 2 provides background on the Chinese solar panel sector and the 2012 imposition of solar trade barriers by the United States. Section 3 describes the data and provides the summary statistics. Section 4 presents the empirical framework. Section 5 details the results. Section 6 provides the robustness checks. Section 7 concludes.

2 Background: Chinese Solar Panels & the 2012 US Trade Barriers

In this section, I describe the photovoltaic value chain, the main characteristics of China's solar manufacturing industry, and the US imports of solar cells and modules during the period under analysis. I also provide an overview of the trade barriers enacted by the

Obama Administration in 2012. I then argue that this setting presents several advantages for estimating the impact of trade barriers on FDI decisions by multinational firms.

2.1 The Photovoltaic Value Chain

Figure 1 shows the different stages of the Photovoltaic (PV) value chain. The primary raw material in the production process of solar panels is silica sand. This sand goes through a chemical process to obtain the high-purity silicon required for solar energy generation. The purified silicon is melted and formed into cylinders or bricks called ingots, which are then sliced into thin wafers. The process continues by adding metal conductors to the wafers' surface and creating the solar cell. Cells are soldered together and encapsulated in glass sheets to form a module. Combining the modules with equipment such as connectors and batteries constitutes a system.

The AD-CVDs under study apply to photovoltaic cells "whether or not assembled into modules." This implies that solar panels made by these cells are also subject to the duties

2.2 Solar Panel Manufacturing in China

Indicators in Figure 2 contextualize the evolution of the Chinese solar panel manufacturing industry. During the period under analysis, this industry had an overall positive economic performance shown by revenue and industry value added (IVA). The slump in these indicators in 2012, after the protectionist measures in the US, is followed by a recovery outperforming previous years. However, exports and imports failed to recover their pre-2012 performance.

2.3 Solar Imports in the US

To provide context to my findings, I present US imports of the targeted products during the period of analysis. The left-hand-side panel of Figure 3 shows the customs value (in million dollars) and on the right-hand side the quantities (in million units).

The value of US imports of solar cells increased by 260% during this period. Although there was a reduction from 2012 to 2013, values recovered and surpassed previous levels by 2015. Until 2011, the last year without the ADD and CVDs, imports from China increased in value but declined afterward.

Import quantities also increased during this period though by a smaller amount (112%), suggesting an increase in prices. After reaching its highest point in 2011, imported quantities of solar cells decreased and did not reach previous levels. The number of imports from China decreased by 50% from 2011 to 2012, the year the antidumping and countervailing duties were imposed. These quantities remained below half the 2011 peak for the rest of the period.

The increase in values and the smaller growth in quantity imports show that the duties had the effects the US policymakers intended.

2.4 The 2012 Solar Trade Barriers in the US

Figure 4 shows the timeline for the policy procedure. On October 19, 2011, SolarWorld Industries America (the petitioner) starts petitions on AD-CVDs on the import of crystalline silicon photovoltaic (CSPV) cells from China. Twenty days later, the US Department of Commerce (USDOC) initiates its investigations to determine the existence of dumping and subsidies (United States Department of Commerce, 2011). This is followed by an examination by the US International Trade Commission (USITC), an independent agency, of whether the domestic industry is materially injured. The results of the USITC's preliminary determination show "reasonable indication" of injury because of imports from China of CSPV cells and modules "that are alleged to be sold in the United States at less than fair value and subsidized by the Government of China" (United States International Trade Commission, 2011). This allows for the rest of the investigation to continue.

The scope of the investigation defined by Commerce, covers modules, laminates, and panels produced in a third country from solar cells made in China. However, it does not cover modules, laminates, and panels produced in China from solar cells made in a third country.

The USITC final determination finds that the US industry is "materially injured" because of imports of CSPV cells and modules from China that the USDOC determined are subsidized and sold in the United States at less than fair value. The results of the investigation show that the US domestic industry faced a decline in market share due to the increasing import competition from China sold at low prices. Furthermore, despite a growth in demand and reductions in costs the domestic industry still did not make a profit, showed a decline in many performance indicators, and reported, among other difficulties, the closure of production facilities. The investigation finds a "causal nexus" between subject imports and the poor condition of the domestic industry (United States International Trade Commission, 2012).

The preliminary determinations are issued on March 26, 2012, for the countervailing case, and on May 25, 2012, for the anti-dumping case (ADD CITATION). On December 7, 2012, the USDOC issued the final duty order on crystalline silicon photovoltaic cells whether or not assembled into modules imported from China (AD CITATION) (see the detail for HTSUS codes detail in Appendix Table 22).

For purposes of the US anti-dumping and countervailing duty laws, the USDOC defines China as a non-market economy (NME). This means that the country does not operate on market principles of cost or pricing structures (Section 771(18) of the Tariff Act of 1930). This has a direct impact on the dumping investigation process. In general, dumping is found when the price of the product in the importing country is less than the price of the same product in the exporting country. Because China is an NME, the US administration has to rely on information on cost and price structures from a third country instead. In the case studied in this paper, the surrogate country was Thailand, as proposed by the petitioners. Chinese firms argued in favor of India, which was the petitioner's initial proposal.

Another relevant implication of the NME status of China is the determination of the dumping duty rates. For these types of economies, the USDOC presumes that all companies within the country are subject to government control. Hence, they are all assigned a single rate unless they can demonstrate sufficient independence from the government. If that is the case, the firm can be granted a separate rate. In the case under study, 68 companies applied for a separate rate. The USDOC calculates this rate as an average of the dumping margins estimated for the individual exporters and producers. In this case, it is 24.48% for 94% of the firms.

Meanwhile, the "PRC-wide" rate applies to all other Chinese exporters and producers in this industry not specifically listed. The determination of the rate, in this case, was based on what is called "Adverse Facts Available" (AFA) because the PRC-wide entity did not respond to the USDOC requests for information. It is the policy of the Department in cases in which entities fail to cooperate, to establish a rate high enough "that the party does not obtain a more favorable result by failing to cooperate than if it had cooperated fully." The USDOC selected as AFA the highest margin alleged in the petition by Solar World Americas: 249.96% (See details on Final ADD Order AD CITATION).

The other investigation started by the petition resulted in the USDOC determining that countervailable subsidies were provided to Chinese producers and exporters of CSPV cells. The investigation covered 31 government programs during the year 2010. The results were CVD rates of 15.4% on average.

In summary, an average 40% AD-CVD rate was charged to firms granted a separate rate, while the PRC-Wide entity had a total of approximately 265%. This differential exposure to the policy is the basis of the research design in this paper.

AD-CVD orders are in place for five years after which Commerce conducts a sunset review to determine whether the order should remain in effect or not. In this case, the USDOC found that the revocation would lead to dumping margins of up to 249.96%, hence the orders remained in place (AD CITATION for sunset).

2.5 Advantages of this Policy Setting

This policy presents several advantages for the study of FDI decisions by multinational firms. First, the fact that there were specific duties for some firms makes this a very interesting setting. The discriminatory nature of the policy allows for analyzing the characteristics of the firms that, as a response, modify investment choices. It also helps identify how the geography of production fragmentation can restructure after a shock.

Second, changes in AD-CVDs can be interpreted as economically exogenous. These are determined by the US, and outside commercial relations between the Chinese firms and the FDI destination countries. Thus, this identification strategy helps overcome the endogeneity of trade policy, a key empirical challenge in estimating the causal impacts of trade barriers (Goldberg and Pavcnik (2016)).

Furthermore, the production process in the solar panel industry has differentiated stages that allow for analyzing cross-country production fragmentation as a response to an external shock.

Finally, this setting permits estimating the long-term effects of trade barriers and FDI decisions, something that the studies of the recent US-China trade war are still unable to assess.

3 Data

In this section, I describe the data I use for my estimations.

3.1 FDI: Greenfield Investments

The source for Foreign Direct Investment information is fDi Markets. This dataset tracks announcements on cross-border greenfield investment, defined as a new physical project or expansion of an existing one that creates jobs and capital investment. It includes monthly data on projects' variables at the firm level across all sectors and countries. These variables are: Project Date, Investing Company, Parent Company, Source Country, Source State, Source City, Destination Country, Destination State, Administrative Region, Destination City, Industry Sector, Sub-Sector, Cluster, Industry Activity, Capital Investment, Capital Investment Estimated (Yes or No), Jobs Created, Jobs Created Estimated (Yes or No), Project Type (New or Expansion). The Capital Investment and Jobs Created variables are estimated when the information is not released by the investing company.

I use announcements from 2009 to 2015 by firms based in China in the solar cell industry as defined in section 3.4 and characterized by Cluster, Industry Sector, and Sub-Sector shown in Table 1. This table reflects that the vast majority of the projects are new, as opposed to expansions of existing plants. It also presents the activities that I use to test the production fragmentation hypothesis. As well as the region where the projects are located that I use in my location choice models.

The original dataset presents an observation for a firm when it makes an investment announcement. I modify this to organize the data as a panel where each firm appears every month of every year. If it does not make an announcement, the FDI variable is set to zero. This is because not making an FDI announcement is also economically relevant and gives information for the estimations. In Table 2 I present the summary statistics for this data arrangement for the variables used in my estimations. I create the variable projects by counting the number of announcements per firm per month.

Figure 5 shows the frequency of countries appearing in the dataset as investment destinations before and after the policy. Some patterns arise. First, firms are investing in a wider range of locations, as more countries appear on the map. Second, there seems to be a change in the location of FDI, with new world regions as destinations. I look into this by investigating firms' location choices. Motivated by these stylized facts, I test for changes in location patterns.

3.2 Mergers and Acquisitions

I use data from Thomson and Reuters covering the period from 2009 to 2014 to analyze the impact of the AD-CVDs on Mergers and Acquisitions. I identify in this dataset the specific-rate firms and the PRC-wide-rate firms as defined in the fDi markets dataset and construct a firm-year panel.

Table 3 shows that during this period, most of the M&A activity by these multinational firms is domestic, mainly China followed by Germany. When considering cross-country M&A activity, China becomes a relevant acquirer in the UK and the US.

To understand if this is horizontal or vertical M&A, table 4 shows the industry activities by target and acquirer company. The most frequent types of deals share the same activity, Electronic and Electrical Equipment, indicating a horizontal integration. The most common vertical integration is done by Investment and Commodity firms that target companies in Electronic and Electric Equipment activities.

3.3 Financial Statements

I use Refinitiv to find the financial summaries for the publicly traded firms in my FDI dataset. I collect variables such as Capital Expenditure (CapEx); Gross Profit Margin; Earnings before interest, taxes, depreciation, and amortization (EBITDA); Return on Average Total Assets (ROAA); Total Debt Percentage of Total Assets (DEBTA); Assets; and Revenue. I include a means test on these variables and include those that are different between groups before the policy as control variables in my robustness checks.

3.4 Firms: Specific-Rate and PRC-Wide-Rate

The final determinations issued by the Federal Register include the list of firms granted a specific rate by the anti-dumping and countervailing duties. These are exporters and producers, and the list includes subsidiaries. I identify 61 unique firms.

I call "specific-rate firms" those granted the separate rate that I identify in my dataset. I find 25 of them which represent 40% of the firms listed in the Federal Register. To define the control group, those affected by the PRC-wide rate, I select the firms that operate in the same economic activities as the specific-rate ones, that made FDI announcements between 2009 and 2015. I find 52 companies that were not listed by the Federal Register, ending up with 185 observations that represent monthly investment announcements by 77 unique firms. This means the total observations in my dataset is 6468 (77 firms x 12 months x 7 years).

In the Refinitiv data, I find 26 specific-rate and 14 PRC-wide-rate firms.

Table 5 shows the results for the means differences test in the FDI data, while table 6 does the same for the financial data. I include the financial variables that show statistical differences for the two groups before the policy as control variables in my robustness checks.

4 Empirical Framework

In this section, I discuss my empirical strategies to estimate the effect of trade barriers on FDI decisions by firms. I also analyze some threats to identification from this strategy.

4.1 Estimation Strategy: FDI

Using data on FDI announcements from 2009 to 2015, I leverage the variation given by policy's discriminatory nature to estimate their impact on firms. I develop a difference-in-differences design where the treatment is given by the AD-CVD rate the US imposed on the imports of Chinese solar cells and modules in 2012.

Since FDI data tends to be heteroskedastic and have a large presence of zeros, when these models are log-linearized and estimated by OLS the results are biased estimations of elasticities (Santos-Silva (2006)). To overcome this, my specification is a multiplicative model and I estimate the coefficients using a Poisson Pseudo-Maximum Likelihood (PPML) method.

$$Y_{it} = exp[\sum_{s=2009}^{2015} \delta_s (D_i \times 1[t = s]) + \beta \boldsymbol{X}_{it} + \gamma_i + \lambda_t]\eta_{it}. \tag{1}$$

Where Y_{it} is the outcome of interest: FDI in levels, aggregation is monthly or yearly; or the existence of a M&A acquisition deal, for a firm i in period t; D_i is the indicator for specific-rate firms; X_{it} are control variables such as the number of projects, jobs created, or financial variables; γ_i are firm fixed effects; λ_t are time fixed effects (month and year, or year, depending on the aggregation level); and η_{it} is the error term. Robust standard errors are clustered at the firm level.

To test for a change in announcements, I use the same specification as in equation **??** and modify the dependent variable for the number of projects per year per firm.

4.1.1 Threats to Identification

I analyze the parallel trends assumption, i.e. if the pre-treatment trajectories for the specific rate and PRC-wide rate firms are parallel. For this, I use an OLS estimation method in equation 2 using the Stata did-regress package. This allows for a graphical diagnosis in Figure 7. It also provides a test on the linear-trends model coefficient that captures the differences in the trends between both groups. If the coefficient is zero, there are no differences in the slopes. In Table 7 I show the results for this test and do not reject the hypothesis that the linear trends are parallel in the pre-treatment period.

$$Y_{it} = \delta d_{it} + \gamma_i + \lambda_t + \varepsilon_{it}. \tag{2}$$

Where Y_{it} is the outcome of interest (FDI amount, number of projects), for a firm i in year t; d_i is the indicator for treatment (equals to one after 2012 for firms granted a specific rate firms); γ_i are firm fixed effects; λ_t are year fixed effects; and ε_{it} is the error term. Robust standard errors are clustered at the firm level.

4.2 Estimation Strategy: Location Choice

Motivated by the changes in patterns shown in the data and figure 5, I estimate how each year affects the probability of investing in a particular region. I estimate equation 3 using linear probability and Probit models.

$$Y_{it} = \delta Year + \beta X_{it} + \gamma_i + \epsilon_{it}. \tag{3}$$

Where Y_{it} is the probability of investing in a particular region for a firm i in year t; $Year$ is a year dummy from 2009 to 2015; X_{it} controls for FDI amounts, number of projects, or jobs created; γ_i in the Probit model is firm control and a firm fixed effect in the linear probability specification; and ϵ_{it} is the error term. Robust standard errors are clustered at the firm level.

To understand if this behavior is specific to firms granted a specific rate, I estimate a location choice model using McFadden's alternative-specific Conditional Logit model (McFadden 1973). In this model, individuals choose the option with the greatest utility. I modify the original structure of the fDi markets data to fit this model. For each month-year, each firm has six options for where to invest: Asia, Europe, North America, Africa, Latin America, or Oceania. If a firm makes more than one investment per month, I order the projects by FDI amount and number of jobs created. The location choice is given by the region of the project of the larger magnitude. This creates a set of alternatives is J=1,...,6. An indicator y_{ijt} equals one if firm i chooses alternative j in period t, and zero otherwise. There are q case-specific variables (if the firm is granted a specific rate, year, FDI amount, and number of projects per month). The focus of my estimations is to identify location choices by the characteristics of the firms and projects (cases), rather than of the regions (alternatives). I aim to find if firms granted a specific rate make a different location choice than PRC-wide-rate firms. Hence, I do not include alternative-specific variables since all firms face the same region characteristics when they make their location choice and what is relevant in this case is the difference among the two groups of firms. The specification for this random utility is presented in equation 4.

$$u_{it} = (z_i A)' + \upsilon_{it}. \tag{4}$$

Where u_{it} is the utility for firm i in month-year t, $A = (\alpha 1, ..., \alpha 6)$ is a qxJ matrix of case-specific regression coefficients; the error term υ_{it} are independent random variables with a type I extreme-value Gumbel distribution (StataCorp. 2023).

To investigate if the type of industry activity developed by the project impacts the probability of investing in a particular region after the policy, I estimate the equation 5 using a Linear Probability Model.

$$Y_{it} = \delta Post * Activity_{it} + \alpha_1 Post + \alpha_2 Activity_{it} + \beta X_{it} + \gamma_i + \upsilon_{it}. \tag{5}$$

Where Y_{it} is the probability of investing in one of the six regions; *Post* equals to one if the year is after 2011; *Activity* is a dummy for the industry activities in the dataset; and X_{it} controls for FDI amounts or the number of projects; γ_i are firm fixed effects; υ_{it} is the error term. Robust standard errors are clustered at the firm level.

5 Results: Effects of Trade Barriers on FDI

In this section, I describe my empirical findings using a PPML method for estimating equation 1. In my specification of the exponential model, the dependent variable is measured in levels and the right-hand-side treatment variable D is an indicator taking the value zero or one. In the difference-in-differences interpretation, the first difference is between the two groups of firms in the setting: those granted a specific rate and those assigned the PRC-wide rate. The second difference is before and after the AD-CVDs are applied. Thus, variable D equals one for firms in the specific group in the year 2012 and after, and zero otherwise. The coefficients δ are the semi-elasticities estimated over time, given by 100*(exp(δ)-1)%. I normalize the results by excluding the year before the treatment, 2011, as is commonly done in the literature (Sun and Abraham (2021)).

5.1 Increase in FDI amounts

Table 8 presents my main results. The dependent variable is the monthly dollar amount of FDI projects by firm. The main explanatory variables are the interaction between the indicator for the specific-rate firms and the year. I present three specifications which all include firm, month, and year fixed effects. In Panel A I show the estimated coefficients using PPML, and in Panel B the economic valuation of the coefficients.

In column 1, I show the estimation of the model without control variables. The coefficient for the specific-rate firms in 2012 is 2.838 and it is statistically significant at the five percent level. Using the formula for the semi-elasticity, this converts into a 1608% increase in the dependent variable. To provide a more comprehensive meaning for this estimation, I show the dollar amounts in Panel B. I calculate this by multiplying the percentage change by the yearly average FDI in the pre-policy period. I use two benchmarks for this valuation. First, the average amount considering only the firms in the specific-rate group, which is 9 million dollars, and then considering all the firms, which is 13 million dollars. This translates into 145 and 208 million dollars per year respectively, of increase in FDI by firms in the specific-rate group with respect to the PRC-wide group in 2012.

In column 2, I show the estimation using as a control variable the number of jobs created by the project, as a way of considering the potential size and impact of the project. The coefficient for the specific-rate firms in 2012 is 2.464 and it is statistically significant at the five percent level. This semi-elasticity represents a 1075% increase in FDI, meaning 97 million dollars per year when the coefficient is evaluated at the pre-policy average for the specific-rate group, and 139 million dollars per year using the average for all firms. Hence, in this case, the economic value of the change in FDI is smaller than in the specification without any controls.

The third and final column in this table presents the estimations controlling by how many projects a firm announces per month. The objective is to take into consideration the frequency of the FDI activity by the firms. In this case, the coefficient for the year 2012 is statistically significant at the 10% level with a value of 2.352 representing an increase of 952%. This is equivalent to 86 or 123 million dollars per year, depending on which of the two benchmarks is used. In this specification, I also find a statistically significant effect for the year 2015. This means that after taking into account the number of projects, specific-rate firms increased FDI by 90 to 129 million dollars in 2015 with respect to the firms in the PRC-wide group. Thus, the quantity of project announcements also impacts the results, making them smaller in magnitude but introducing an effect in other years.

5.2 Decrease in the Number of Projects

Trade barriers might also affect the number of projects specific rate firms are willing to carry out. When considering firms that announce more than one investment per year, I find a statistically significant reduction in the number of projects two years after the policy was in place (2013 and 2014). This represents a reduction of 53% in the benchmark model. This might reflect firms being more cautious after being affected by the US trade barriers. I also find that specific rate firms had an average of 45% more projects than PRC-wide-rate firms in 2010 before the policy was implemented.

5.3 Change in Location Choice

Does the probability of investing in a specific region change after the policy? I first approach this question estimating equation 3 to find if there is a particular effect of each year in the probability of investing in the three relevant regions in the sample: the US, Europe, and Asia.

The estimations for the probit model are presented in Table 12, and for the linear probability models in Table 13. The results show that there is not a change in the probability of specific rate firms investing in the US by year, showing no evidence of tariff jumping behavior[2]. Meanwhile, investment in Europe decreases after the policy. There is no evidence to support a hypothesis of Chinese firms increasing their investment in Europe to substitute for the loss of the US market. Finally, the probability of investing in Asia rises after the policy and is statistically significant in 2015. This leaves space for vertical and export platform FDI.

Table 14 presents the marginal effects for the conditional logit model of location choice in 2015 controlling for FDI amounts, and Table 15 does the same controlling for the number of projects per month. In the first panel, we observe a positive and significant effect for Asia in both specifications and a negative effect for Europe. The second panel shows a statistically significant difference between the location choices of the two groups.

I move to the vertical FDI hypothesis and estimate equation 5 for Asia, the region where I find a significant effect. In Table **??** I find that manufacturing, and electricity affect the likelihood of investing in Asia after the policy. Hence pointing in the direction of a new structure of cross-border activities for specific rate firms.

To understand if the export platform hypothesis applies in this case, I take a deeper look into the data. Figure 17 depicts the number of FDI projects in Asia by all firms in the sample. The pattern shows an increase in the number of projects in this region in 2014 by PRC-wide-rate firms and in 2015 by specific-rate firms. Considering the destination countries in Figures 18 and 19 we can see the different countries where these two groups of firms choose to locate their new plants. I then look into the US imports of solar cells by source country in Figure 20. Interestingly, some Asian countries that received FDI from specific-rate firms became exporters of solar cells to the US a few years later, such as Japan, Thailand, and the Philippines. This shows initial support for the export platform hypothesis.

6 Robustness Checks

To include the financial controls, I estimate the same model as equation **??** with yearly variables. The results are in table 21. The change in the number of observations is due to the different availability for each variable. I still find a significant and positive effect in 2012 as in my benchmark model for all specifications except when controlling for ROAA.

[2]The year 2013 cannot be estimated due to lack of enough observations.

There are also significant effects in 2015 with CapEx as a control variable.

7 Summary and Concluding Remarks

Analyzing the case of the Anti-Dumping and Countervailing Duties implemented by the Obama administration in 2012 against imports of Chinese solar panels. Leveraging the variation given by the policy's discriminatory nature, I test for the change in Foreign Direct Investment decisions by firms granted a specific rate.

My findings show that in 2012, firms granted a specific rate increase FDI by 145 million dollars per year, from a previous average of 9 million dollars. These results are for greenfield investment and not mergers and acquisitions. Firms also reduce their number of projects for two years after the policy.

I use location choice models to test different hypotheses behind the location choice decisions. I show that the increase in FDI does not correspond to tariff-jumping or horizontal FDI. I find evidence of production fragmentation in Asia in 2015. I find support for the export platform FDI hypothesis in the medium run after countries that were FDI destinations for Chinese companies receiving a specific rate become exporters to the US a few years after the policy.

These results document FDI diversion that modifies investment patterns in the short run and eludes the trade barriers in the medium run, weakening the effects of the protectionist policy.

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Figure 1. Photo Voltaic Value Chain

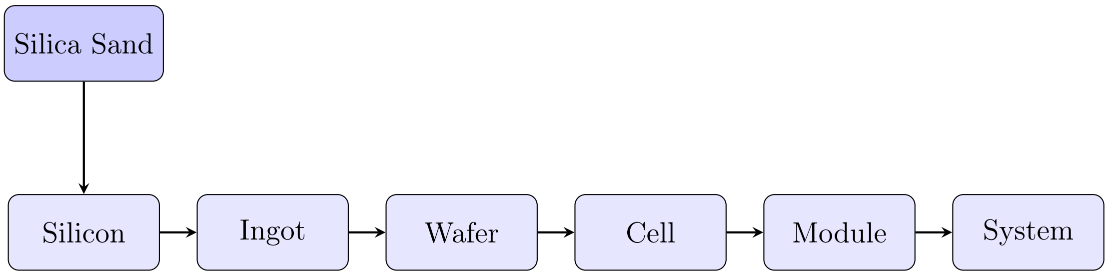
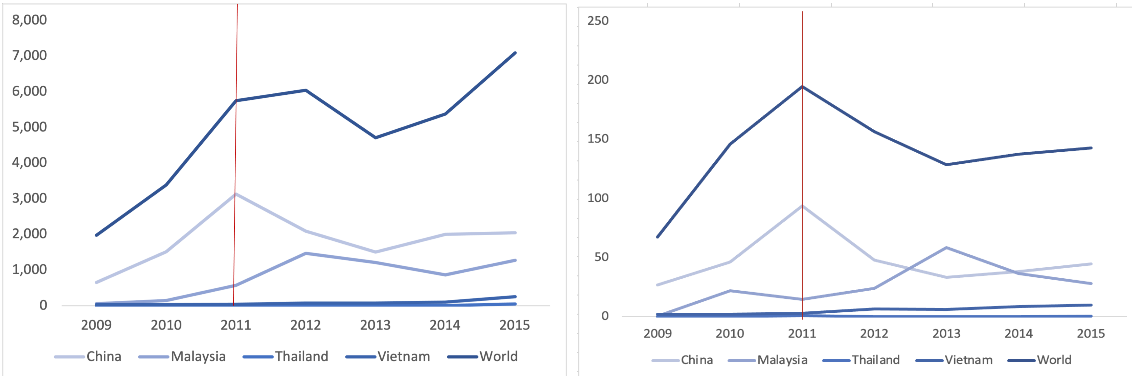


Figure 2. Economic Performance of the Chinese Solar Industry

Source: IBISWorld

Figure 3. US Imports of Solar Cells
Value & Quantity



Source: USITC

Figure 4. Timeline

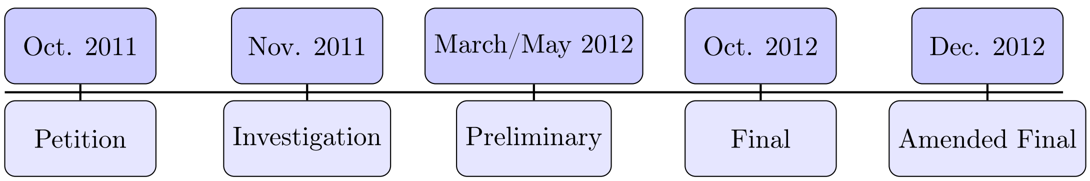


Figure 5. Frequency of Destination Countries pre and post-policy

Table 1. Sample Description

Variable	Percent
Cluster	
Environmental Technology	100
Industry Sector	
Electronic components	75.14
Renewable energy	23.78
Other	1.08
Sub-Sector	
All other electrical equipment & comp..	75.14
Solar electric power	23.78
Other	1.08
Industry Activity	
Sales, Marketing & Support	42.70
Electricity	20.54
Manufacturing	15.14
Headquarters	14.05
Design, Development & Testing	3.78
Logistics, Distribution & Transportat..	3.78
ProjectType	
New	95.68
Expansion	4.32
Location	
Europe	42.70
Asia	30.81
North America	11.35
Africa	7.57
Oceania	4.32
Latin America & Caribbean	3.24
Capital Investment Estimated	
Yes	77.30
No	22.70
Jobs Created Estimated	
Yes	81.08
No	18.92
Source State	
Jiangsu	40.54
Shanghai Municipality	12.43
Zhejiang	12.43
Hebei	7.03
Beijing Municipality	6.49
Fujian	4.32
Guangdong	4.32
Shandong	3.78
Other	8.64

Table 2. Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
FDI	6,468	3.15	49.4	0	2,000
Jobs	6,468	3.91	71.0	0	3,000
Projects	6,468	0.03	0.2	0	4

Table 3. M&A country-pairs

Target	**Acquiror**	**Percent**
China	China	27
Germany	Germany	10
United Kingdom	China	10
Germany	Unknown	7
Hong Kong	Hong Kong	7
United States	China	7
Germany	China	3
United Kingdom	Germany	3
Romania	China	3
Romania	Luxembourg	3
South Korea	South Korea	3
Italy	Germany	3
Italy	China	3
Italy	Italy	3
Liechtenstein	Hong Kong	3
Singapore	Singapore	3

Table 4. M&A Industry Activities

Target	**Acquiror**	**% of deals**
Electronic and Electrical Equipment	Electronic and Electrical Equipment	40
Electronic and Electrical Equipment	Investment & Commodity Firms,Dealers,Exchanges	20
Electronic and Electrical Equipment	Electric, Gas, and Water Distribution	7
Investment & Commodity Firms,Dealers,Exc.	Electronic and Electrical Equipment	7
Electric, Gas, and Water Distribution	Electronic and Electrical Equipment	7
Electric, Gas, and Water Distribution	Investment & Commodity Firms,Dealers,Exchanges	3
Electric, Gas, and Water Distribution	Electric, Gas, and Water Distribution	3
Machinery	Electronic and Electrical Equipment	3
Construction Firms	Electric, Gas, and Water Distribution	3
Wholesale Trade-Durable Goods	Electronic and Electrical Equipment	3
Metal and Metal Products	Metal and Metal Products	3

Table 5. Mean Differences Test: FDI data

		PRE-POLICY				POST-POLICY			
		control	*specific-rate*	*diff*	*t-stat*	*control*	*specific-rate*	*diff*	*t-stat*
	obs.	1,872	900			2,496	1,200		
fdi (mill.USD)	mean	1.23	0.75	0.48	0.54	3.75	6.72	-2.97	-1.35
	std. dev.	26.12	8.36			58.07	70.79		
jobs	mean	2.32	2.10	0.22	0.10	2.35	11.01	-8.66	-3.00
	std. dev.	62.03	18.07			30.45	137.55		
projects	mean	0.02	0.05	-0.03	-3.70	0.03	0.05	-0.02	-3.14
	std. dev.	0.18	0.25			0.21	0.26		

Table 6. Mean Difference Test: Financial Data

		PRE-POLICY				**POST-POLICY**			
		control	*specific-rate*	*diff*	*t-stat*	*control*	*specific-rate*	*diff*	*t-stat*
CapEx	mean	115.87	200.15	-84.27	-1.50	79.5	70.5	9.0	0.4
	std. dev.	136.02	282.94			95.2	113.4		
	obs	32	33			49	32		
Profit Mg	mean	27.65	25.20	2.46	0.41	7.9	17.3	-9.4	-0.8
	std. dev.	17.11	29.95			57.9	36.6		
	obs	32	34			50	33		
EBITDA/Assets	mean	0.09	0.05	0.03	0.99	0.05	0.003	0.04	2.2
	std. dev.	0.17	0.07			0.1	0.1		
	obs	33	31			50	32		
ROAA	mean	8.99	0.76	8.23	1.76	-2.0	-40.4	38.4	1.1
	std. dev.	25.20	16.06			14.8	252.9		
	obs	32	46			48	51		
DEBT/Assets	mean	25.35	31.98	-6.64	-1.32	25.5	44.0	-18.6	-3.4
	std. dev.	22.01	16.96			18.2	29.7		
	obs	31	30			47	29		
Log Assets	mean	6.32	6.07	0.25	0.69	6.73	6.57	0.16	0.53
	std. dev.	1.87	1.52			1.66	1.39		
	obs	34	54			50	50		

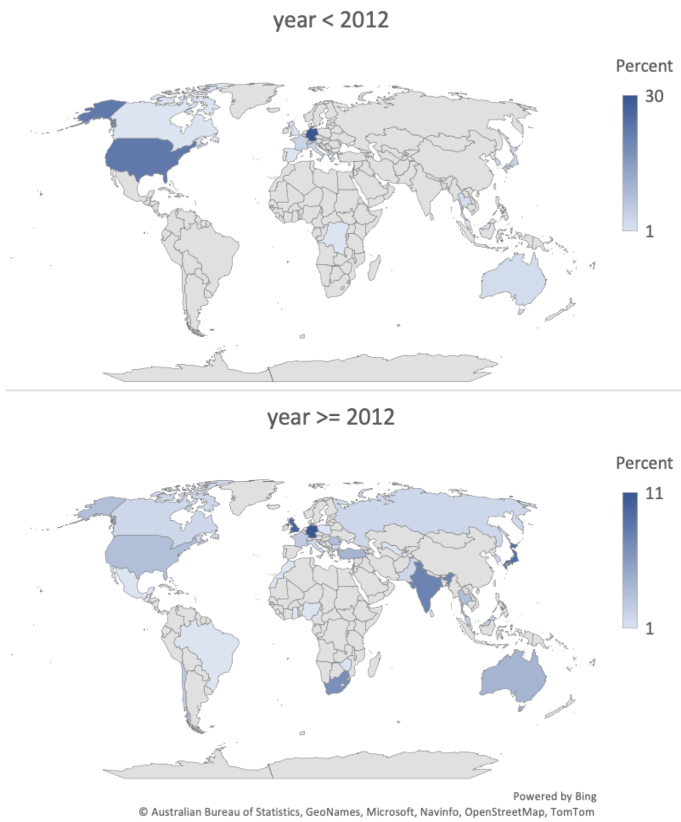


Figure 6. Pre-trends: fdi, projects

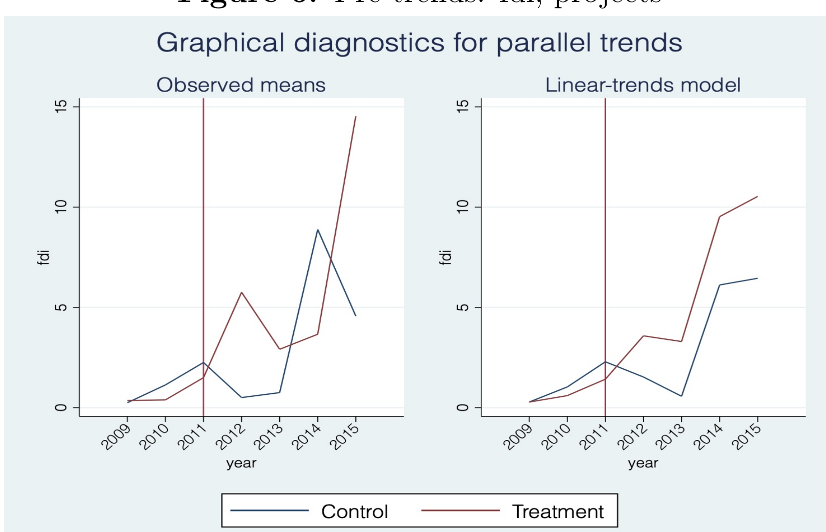


Table 7. Parallel-trends test (pre-treatment period)

H0: Linear trends are parallel		
	fdi	projects
F(1, 77) =	0.25	0.09
Prob>F	0.62	0.76

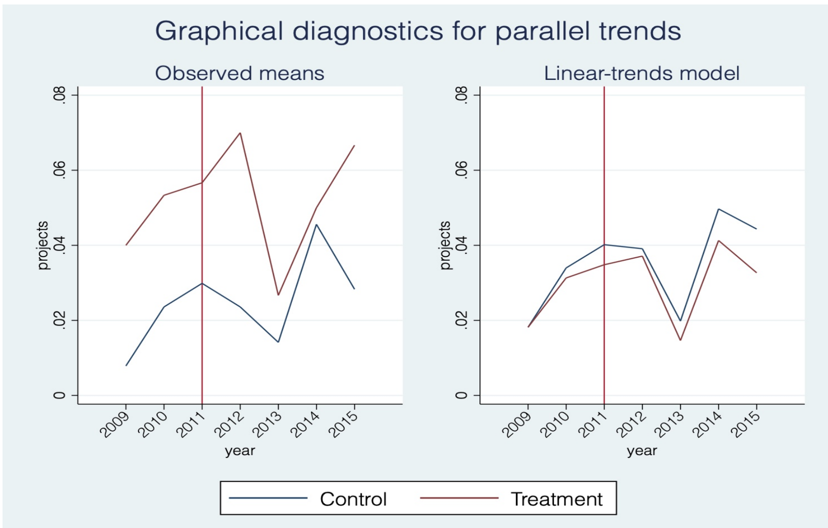


Figure 7. Probability of Investing in the US, Europe, and Asia.

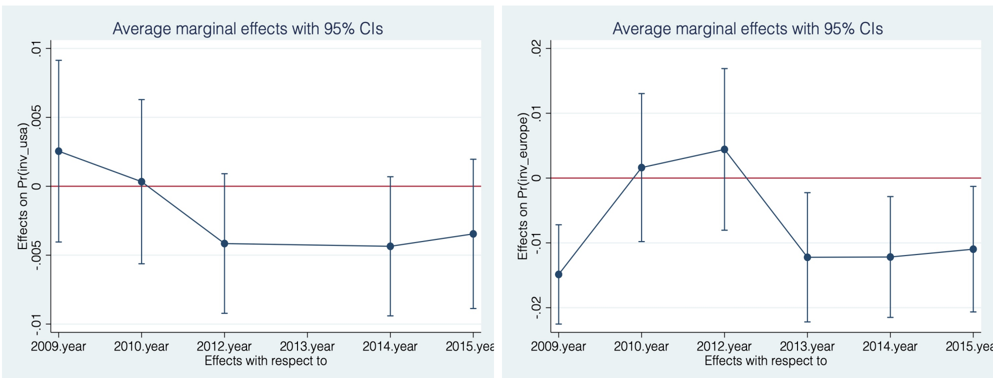


Table 8. Effects of Trade Barriers on FDI

Panel A: Estimation of coefficients (PPML)			
	(1) FDI	(2) FDI	(3) FDI
Specific-rate*2009	0.810	0.826	-0.321
	(1.267)	(1.258)	(1.249)
Specific-rate*2010	-0.662	0.223	-0.224
	(1.238)	(1.780)	(1.221)
post-policy			
Specific-rate*2012	2.838**	2.464**	2.352*
	(1.197)	(1.034)	(1.243)
Specific-rate*2013	1.762	1.795	2.281
	(1.209)	(1.177)	(1.639)
Specific-rate*2014	-0.478	-0.303	0.985
	(1.156)	(1.173)	(1.221)
Specific-rate*2015	1.566	0.983	2.392*
	(1.078)	(1.417)	(1.301)
Fixed effects			
Firm	✓	✓	✓
Month	✓	✓	✓
Year	✓	✓	✓
Controls			
Jobs		✓	
Projects			✓
Observations	6468	6468	6468
PseudoR^2	0.372	0.475	0.762
Panel B: Economic valuation of coefficients (mill. USD)			
Specific-rate*2012	145	97	86
Specific-rate*2015			90
Mean FDI pre-policy for specific-rate firms:			9
Specific-rate*2012	208	139	123
Specific-rate*2015			129
Mean FDI pre-policy for all firms:			13

NOTE: Panel A of this table presents the results of the PPML estimations for equation 1. The coefficients represent semi-elasticities. The dependent variable is FDI in million dollars per month per project. Standard errors clustered at the firm level are shown in parentheses. Statistical significance levels are given by: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Panel B presents the economic valuation. For each coefficient δ, I first compute the semi-elasticity as=100*(exp(δ)-1)%. I then multiply it by the yearly values in the pre-policy period of the mean dependent variable for the specific-rate firms and for all the firms.

Table 9. Effects of Trade Barriers on M&A

	(1) m_a	(2) m_a
specific-rate*2009	-1.179*	-1.766**
	(0.674)	(0.803)
specific-rate*2010	1.371	1.147
	(0.996)	(1.014)
specific-rate*2012	-1.412**	-1.248
	(0.707)	(0.896)
specific-rate*2013	-0.750	-0.778
	(0.726)	(0.823)
specific-rate*2014	-0.129	0.133
	(0.706)	(0.869)
N	1440	1440
PseudoR^2	0.309	0.338
Fixed Effects		
Firm	✓	✓
Month	✓	✓
Year	✓	✓
Controls		
Complete	✓	✓
Cross Border		✓

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 10. Effects of Trade Barriers on Number of Projects (>1)

	(1) sum projects	(2) sum projects	(3) sum projects
specific-rate*2010	0.371***	0.346**	0.394**
	(0.142)	(0.163)	(0.158)
specific-rate*2012	-0.0118	-0.0153	0.0215
	(0.208)	(0.210)	(0.205)
specific-rate*2013	-0.755***	-0.720***	-0.839**
	(0.205)	(0.162)	(0.356)
specific-rate*2014	-0.753***	-0.756***	-0.795***
	(0.239)	(0.234)	(0.175)
specific-rate*2015	-0.159	-0.195	-0.198
	(0.335)	(0.353)	(0.357)
N	540	540	540
PseudoR^2	0.103	0.103	0.105
Fixed Effects			
Firm	✓	✓	✓
Year	✓	✓	✓
Controls			
Jobs		✓	
FDI			✓

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 11. Number of projects (%)

	(1)	(2)	(3)
specific-rate*2010	45	41	48
specific-rate*2013	-53	-51	-57
specific-rate*2014	-53	-53	-55
mean annual projects treated firms (>1)			2.57

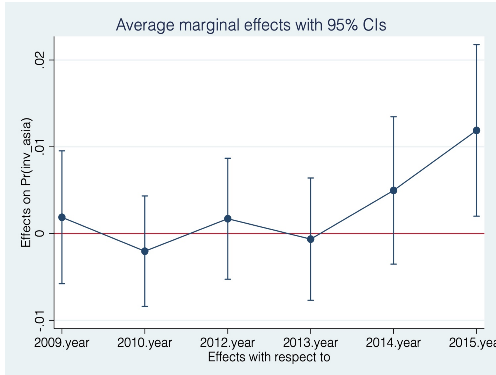


Table 12. (Probit) Probability of Investing in

	(1) USA	(2) USA	(3) USA	(4) Europe	(5) Europe	(6) Europe	(7) Asia	(8) Asia	(9) Asia
year=2009	0.086	0.235	0.066	-0.619***	-0.637***	-0.634***	0.116	0.654	0.146
	(0.190)	(0.231)	(0.193)	(0.187)	(0.241)	(0.190)	(0.242)	(0.563)	(0.246)
year=2010	-0.056	-0.108	-0.094	0.035	0.113	0.008	-0.179	-0.188	-0.474
	(0.202)	(0.277)	(0.208)	(0.125)	(0.150)	(0.128)	(0.275)	(0.759)	(0.411)
year=2012	-0.497	-0.547	-0.515	0.091	0.188	0.085	0.107	0.534	0.0822
	(0.339)	(0.432)	(0.339)	(0.128)	(0.151)	(0.129)	(0.229)	(0.555)	(0.238)
year=2013				-0.421**	-0.427	-0.398**	-0.0479	0.437	-0.193
				(0.198)	(0.318)	(0.196)	(0.268)	(0.588)	(0.311)
year=2014	-0.552	-1.314	-0.518	-0.419**	-0.603*	-0.319**	0.255	0.751	0.306
	(0.374)	(1.120)	(0.338)	(0.165)	(0.332)	(0.162)	(0.230)	(0.545)	(0.240)
year=2015	-0.350	-0.414	-0.367	-0.353**	-0.448	-0.335**	0.437**	1.047**	0.405*
	(0.293)	(0.430)	(0.300)	(0.172)	(0.282)	(0.165)	(0.211)	(0.493)	(0.215)
N	5616	5616	5616	6552	6552	6552	6552	6552	6552
PseudoR^2	0.053	0.416	0.047	0.074	0.526	0.046	0.169	0.548	0.284
Controls	fdi	projects	jobs	fdi	projects	jobs	fdi	projects	jobs
Firm ID	✓	✓	✓	✓	✓	✓	✓	✓	✓

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

NOTE: This table shows the results for the Probit estimations based on equation 3. Coefficients show the marginal effects for treated firms. Robust standard errors are clustered at the firm level.

Table 17. FDI in Asia by All Firms in the Sample

Table 13. (LPM) Probability of Investing in

	(1) USA	(2) USA	(3) USA	(4) Europe	(5) Europe	(6) Europe	(7) Asia	(8) Asia	(9) Asia
year=2009	0.003	0.004	0.003	-0.009	-0.006	-0.010	-0.002	0.000	-0.003
	(0.007)	(0.007)	(0.007)	(0.007)	(0.006)	(0.007)	(0.011)	(0.009)	(0.011)
year=2010	0.003	0.004	0.003	0.007	0.007	0.006	-0.012	-0.012*	-0.013
	(0.007)	(0.007)	(0.007)	(0.011)	(0.009)	(0.011)	(0.009)	(0.006)	(0.009)
year=2012	-0.007	-0.008	-0.007	0.011	0.009	0.013	-0.004	-0.003	-0.002
	(0.006)	(0.006)	(0.007)	(0.012)	(0.009)	(0.012)	(0.009)	(0.010)	(0.010)
year=2013	-0.010*	-0.007	-0.010*	-0.007	0.002	-0.006	-0.011	-0.002	-0.010
	(0.005)	(0.005)	(0.005)	(0.011)	(0.009)	(0.011)	(0.010)	(0.007)	(0.009)
year=2014	-0.010*	-0.009*	-0.010*	-0.010	-0.008	-0.010	-0.008	-0.005	-0.006
	(0.005)	(0.005)	(0.005)	(0.009)	(0.008)	(0.010)	(0.008)	(0.007)	(0.009)
year=2015	-0.010*	-0.011*	-0.011*	-0.020***	-0.019***	-0.017***	0.014	0.023**	0.012
	(0.005)	(0.005)	(0.006)	(0.007)	(0.006)	(0.007)	(0.013)	(0.010)	(0.013)
N	2184	2184	2184	2184	2184	2184	2184	2184	2184
WithinR^2	0.006	0.113	0.008	0.024	0.311	0.006	0.169	0.312	0.187
Firm fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓
Controls	fdi	projects	jobs	fdi	projects	jobs	fdi	projects	jobs

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

NOTE: This table shows the results for the Linear Probability Model estimations based on equation 3. The sample is restricted to treated firms. Robust standard errors are clustered at the firm level.

Table 14. Location Choice in 2015: Conditional Marginal Effects

0.specific-rate	(base outcome)					
1.specific-rate _outcome	dy/dx	std. err.	z	P>z	[95% conf. interval]	
Asia	0.398	0.150	2.650	0.008	0.104	0.692
Europe	-0.404	0.118	-3.430	0.001	-0.635	-0.174
North America	-0.117	0.078	-1.490	0.135	-0.270	0.036
Africa	0.058	0.097	0.600	0.549	-0.132	0.248
Latin America & Caribbean	0.065	0.064	1.020	0.309	-0.060	0.190
Oceania	0.000	0.000	0.000	1.000	0.000	0.000
	Delta-method Contrast	std. err.	z	P>z	[95% conf. interval]	
Outcome: Asia specific-rate (1 vs 0)	0.348	0.150	2.320	0.020	0.054	0.641
Outcome: Europe specific-rate (1 vs 0)	-0.405	0.115	-3.520	0.000	-0.630	-0.179
Control variable: FDI amounts						

Table 15. Location Choice in 2015: Conditional Marginal Effects

0.specific-rate	(base outcome)					
1.specific-rate _outcome	dy/dx	std. err.	z	P>z	[95% conf. interval]	
Asia	0.367	0.150	2.440	0.015	0.073	0.661
Europe	-0.405	0.117	-3.460	0.001	-0.635	-0.175
North America	-0.119	0.079	-1.510	0.130	-0.274	0.035
Africa	0.050	0.092	0.540	0.586	-0.130	0.230
Latin America & Caribbean	0.107	0.072	1.480	0.138	-0.035	0.249
Oceania	0.000	0.000	0.000	1.000	0.000	0.000
	Delta-method					
	Contrast	std. err.	z	P>z	[95% conf. interval]	
Outcome: Asia specific-rate (1 vs 0)	0.361	0.148	2.440	0.015	0.071	0.650
Outcome: Europe specific-rate (1 vs 0)	-0.406	0.114	-3.560	0.000	-0.630	-0.182
Control variable: number of projects per month						

Table 16. Vertical FDI

	(1) inv_asia	(2) inv_asia
Design, Dev. & Testing	0.308***	0.218
	(0.009)	(0.177)
Electricity	0.978***	0.903***
	(0.007)	(0.135)
Headquarters	0.238**	0.134
	(0.109)	(0.240)
Logistics, Dist. & Transp.	0.325	0.209
	(0.277)	(0.173)
Manufacturing	-0.010***	-0.090
	(0.004)	(0.132)
Sales, Marketing & Supp.	0.233**	0.130
	(0.101)	(0.203)
post*Electricity	-0.713***	-0.575***
	(0.123)	(0.101)
post*Headquarters	0.063	0.108
	(0.148)	(0.166)
post*Logistics, Dist.& Transp.	-0.332	-0.349
	(0.277)	(0.281)
post*Manufacturing	0.650***	0.708***
	(0.122)	(0.138)
post*Sales, Marketing & Supp.	0.044	0.047
	(0.132)	(0.128)
N	2100	2100
R^2	0.444	0.424
Firm FE	✓	✓
Controls		
FDI	✓	
Projects		✓

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

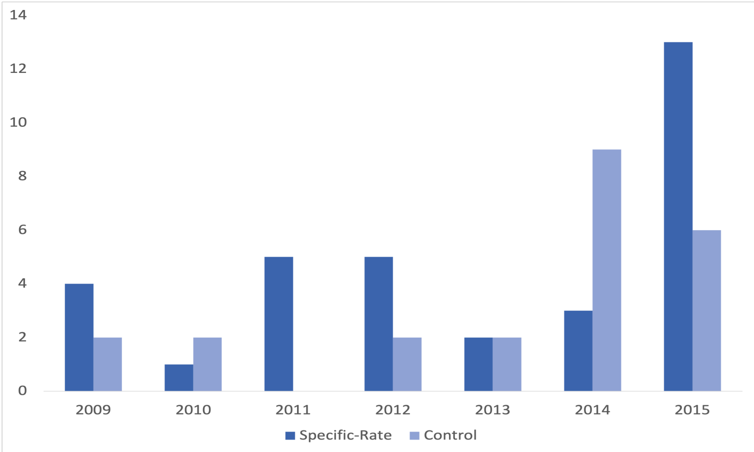


Table 18. FDI in Asia by Specific Rate Firms

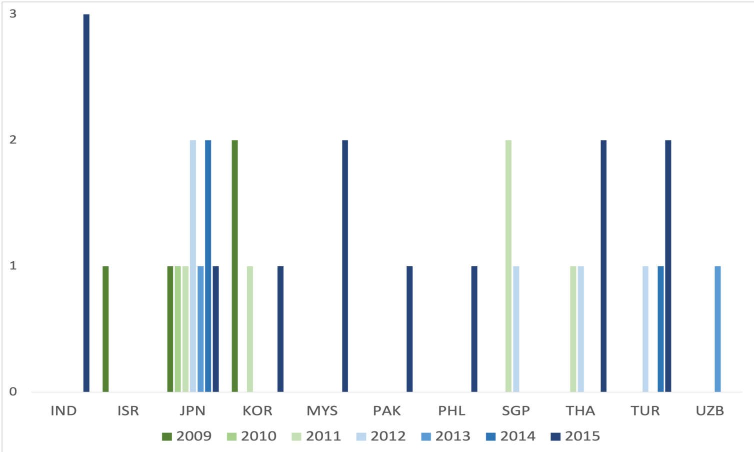


Table 19. FDI in Asia by PRC-wide-rate Firms

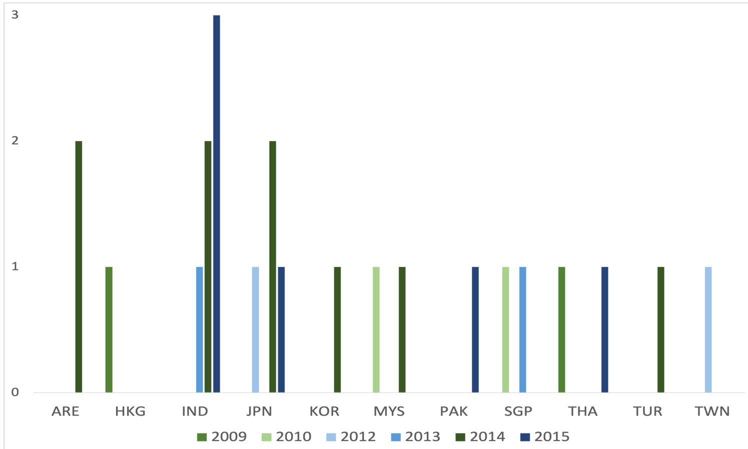


Table 20. US Imports of solar cells by Country 2012-2018

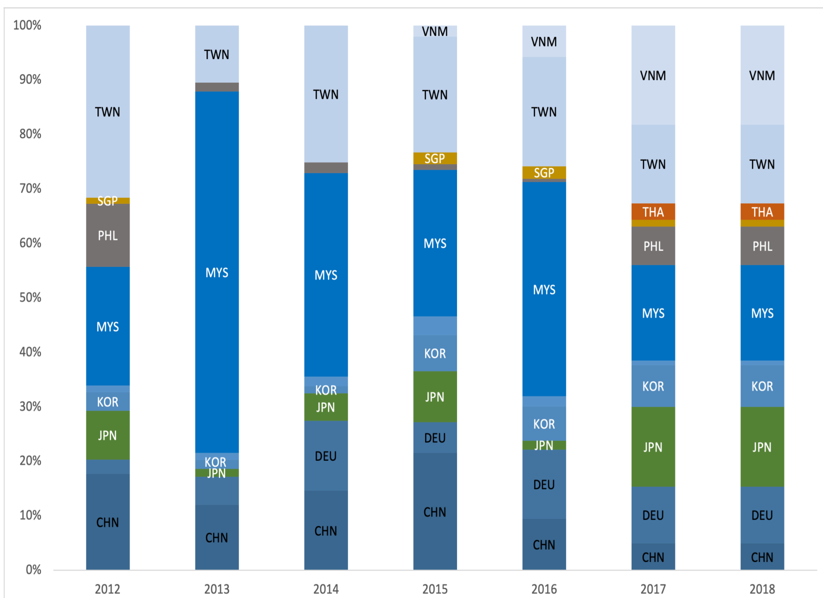


Table 21. Effects of Trade Barriers on FDI w/financials

	(1) FDI	(2) FDI	(3) FDI	(4) FDI
specific-rate*2009	-0.379	-3.915**	-0.227	-2.400
	(-0.20)	(-2.38)	(-0.11)	(-1.30)
specific-rate*2012	4.629**	-0.475	5.285***	6.609***
	(2.54)	(-0.28)	(3.17)	(3.26)
specific-rate*2013	1.667	-3.990**	1.892	2.378
	(0.87)	(-2.04)	(1.03)	(1.11)
specific-rate*2014	1.624	-7.307***	0.812	-1.851
	(0.87)	(-3.92)	(0.41)	(-1.04)
specific-rate*2015	3.999**	-2.078	2.982	3.826**
	(2.15)	(-1.30)	(1.50)	(2.00)
N	96	105	89	82
PseudoR^2	0.780	0.784	0.783	0.864
Fixed Effects				
Firms	✓	✓	✓	✓
Year	✓	✓	✓	✓
Controls				
CapEx	✓			✓
ROAA		✓		✓
DEBTA			✓	✓

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 22. HTS Codes and Description

HTSUS	Description
8501.61.0000	AC generators (alternators) of an output not exceeding 75 kVA
8507.20.20	Other
8541.40.6020	Solar cells assembled into modules or panels
8541.40.6030	Solar cells, not assembled into modules or made up into panels
8501.31.8000	Generators

Table 23. Weight of imports by HTS Code (%)

HTSUS	8501.31.8000	8501.61.0000	8507.20.80	8541.40.6020	8541.40.6030
2008	0.2	7.5	48.4	42.9	0.9
2009	0.9	5.2	28.5	63.8	1.7
2010	0.5	1.9	18.3	76.9	2.3
2011	0.2	1.2	8.1	86.4	4.1
2012	0.2	1.5	11.2	85.9	1.2
2013	0.6	1.6	13.1	84.5	0.2
2014	0.7	1.3	14.1	82.0	1.9
2015	0.5	0.9	10.5	87.7	0.4
2016	0.3	0.5	6.5	92.1	0.6

8 Appendix

The most important product treated by the ADD is 8541.40.6020: Solar cells assembled into modules or panels. It represents the majority of the treated imports and experienced important growth during the period (from 43% to more than 90%)