Uncertainty Traps in International Trade *

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Abstract

This paper develops a theoretical framework to explain the sustained decline in export market participation induced by temporary trade policy shocks. Motivated by two empirical regularities—first, that non-affirmative anti-dumping (AD) investigations generate long-lasting declines in firm entry, and second, that exporters with an information advantage are shielded from this decline—we build a dynamic model of export entry under tariff uncertainty, featuring endogenous tariff information acquisition and social learning. In our framework, firms form and update their beliefs about future tariffs by observing incumbent exporters in the foreign market. Specifically, we show that temporary shocks reduce the number of incumbent exporters who supply tariff information, thereby decreasing the precision of firms' beliefs about future tariffs. In this framework, risk-averse firms incorporate their perceptions of future tariffs into export decisions, raising the productivity threshold required for new entrants. The consequent decline in entry further diminishes the precision of tariff information, leading to a persistent contraction in export participation and creating an uncertainty trap. Our model offers a new perspective on how temporary tariff shocks produce long-lasting declines through a self-reinforcing way, underscoring the critical role of information precision in facilitating efficient international market entry.

JEL Codes: F14; F17; D21

Keywords: Tariff uncertainty; imperfect information; social learning; non-affirmative AD investigations.

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1 Introduction

Despite rapid technological progress and effective global cooperation, uncertainties are far from disappearing and continue to pose significant challenges to economic development and policy debates.[1] Uncertainty shapes both aggregate economic outcomes and micro-level behaviors across various dimensions, including its effects on business cycles (Baqaee and Farhi, 2019; Dew-Becker and Giglio, 2023; Forni et al., 2025; Ludvigson et al., 2021), households (Bamieh et al., 2025; Coibion et al., 2024; Di Maggio et al., 2022), and firms (Favara et al., 2021; Guceri and Albinowski, 2021; Kumar et al., 2023). One notable form of uncertainty stems from temporary shocks, particularly one-time events, as these often entail long-lasting effects as well, but through mechanisms that differ fundamentally from those of recurrent fluctuations.

In international economics, the most fundamental source of uncertainty is tariff policy, which appears stochastic when viewed over a 150-year horizon (Barnichon and Singh, 2025). While an extensive literature evaluates the effect of trade policy uncertainty on trade,[2] less is known about the role of *expectation* concerning future tariffs, with the significant exception being Alessandria et al. (2024),Alessandria et al. (2025a) and Alessandria et al. (2025b). However, the *precision* of expectations—defined as the variance of beliefs about tariff—serves as another important but under-studied mechanism in shaping exporting decisions, as imperfect information is a key mechanism through which temporary shocks exert persistent effects. When tariff increase reduces the number of exporters, it diminishes available information sources, thereby increasing the variance of beliefs about future tariff movements and raising the cost of information acquisition. This, in turn, distorts the market-entry decisions of risk-averse firms and further amplifies the variance of potential exporters' beliefs regarding tariff evolution. To the best of our knowledge, there remains limited theoretical and empirical evidence on how learning and belief updating shape the exporter entry following a shock—and consequently, how this may generate self-reinforcing export contraction.[3] A central challenge in addressing this question lies in characterizing how firms update their beliefs about tariffs

[1] An extensive body of research has sought to measure uncertainty in diverse ways to capture its frequent fluctuations, including through financial market volatility (Bansal et al., 2014; Gao et al., 2022), dispersion in macroeconomic and microeconomic performance (Handley and Li, 2020; Lakdawala and Moreland, 2024), news-based indicators (Baker et al., 2016; Caldara and Iacoviello, 2022), and subjective beliefs (Atmaz and Basak, 2018; Bachmann et al., 2021; Krishnamurthy and Li, 2025).

[2] Handley and Limão (2017) establish a framework studying trade policy uncertainty and trade; Handley and Limão (2022) provide a detailed summary of this field.

[3] This channel is different from the well established literature on uncertainty and learning, such as demand learning (Sager and Timoshenko, 2024; Timoshenko, 2015).

and how *precision* of beliefs affect export decisions.[4]

We exploit a unique setting of non-affirmative AD investigations—those ultimately do not result in the imposition of duties—to isolate the effect of expectations about tariffs at the time an investigation is initiated.[5] Using Chinese exporters as an example, we first find a significant and growing negative effect on entry following investigations, suggesting that even transitory investigations nevertheless generate persistent real effects.[6] Second, firms with equity ties to superstar exporters—who possess clearer information and more precise expectation about tariff—do not exhibit the same decline in entry. The combination of one-time shocks and sustained export contraction motivates us to model the mechanism through which social learning among firms shapes their beliefs about tariff and ultimately their export decisions. We therefore extend the Melitz (2003) model by introducing an "uncertainty trap" mechanism following Fajgelbaum et al. (2017), which shows how heightened uncertainty creates a self-reinforcing trap by depressing firm investment through pessimistic beliefs about fundamentals.[7]

We model dynamic belief formation about tariffs under imperfect information to show how learning transients one-time shocks into persistent real effects. The framework illustrates the role of perceived uncertainty—defined as varying beliefs on tariff evolvement in shaping export decisions. Such uncertainty is generated through information acquisition and constitutes an entry cost. In our model, a temporary shock triggers an uncertainty trap: it induces the exit of incumbent firms in the initial period, depleting the information pool for predicting future tariffs. Amidst the evolving information set and belief updating, this process thereby undermines the *precision* of the tariff trend. This subjective uncertainty arising

[4] In the framework of Alessandria et al. (2025a), they introduce Bayesian agents with prior beliefs about the probability that China lose MFN status and discuss how the dispersion of beliefs would play a role.

[5] Based on our calculations, approximately 17.5% of cases targeting Chinese exports was issued as non-affirmative in preliminary determination, accounting for a significant proportion. These cases have been demonstrated to produce a "chilling effect" on the market, which is associated with observed long-term contraction, as discussed in Vandenbussche and Zanardi (2010) and Chen et al. (2025). However, we argue psychological chilling alone—without accompanying real costs—is not sufficient to explain the persistent long-term contraction observed.

[6] Industries affected by non-affirmative AD investigations exhibit a sustained contraction trend, as new exporter entry has become increasingly scarce and survival rates continue to decline. From 2000 to 2015, the average output and fixed assets in affected industries decreased by approximately 36% and 85%, respectively, while unaffected industries experienced growth of 11% in output and 18% in fixed assets. However, there was no significant difference in total factor productivity growth between the two groups, both of which saw an average increase of around 3%.

[7] Straub and Ulbricht (2024) study a similar feedback loop effect, in which a temporary shortage of funds leads to a long term funding problem for firms.Dong et al. (2025) discuss the effect of information acquisition in finance uncertainty-trap.

from dispersed information, raises information costs for potential entrants and progressively reduces entry.

By incorporating decision interdependence, our framework extends the theory of Melitz (2003) with imperfect information, linking heterogeneous—firm models with micro-level social learning behavior. Moreover, we model potential entrants as forward-looking decision-makers. These agents, when facing uncertainty from transitory shocks, incur additional utility losses due to high sensitivity to tariff, implying a higher productivity cutoff for exporting and reinforcing the self-selection effect. This characterization aligns with the framework of selection dynamics in export markets pioneered by Melitz (2003). Specifically, firms with heterogeneous unit costs decide whether to enter the foreign market or continue waiting while holding imperfect information about future tariff. This leads firms to rely on information to infer the tariff[8], which is acquired through both homogeneous public information and private information from former entrants as in Fajgelbaum et al. (2017). Potential exporters begin with a common prior belief about tariffs and update their beliefs regarding future tariffs in a Bayesian manner as new information arrives each period. This learning process involves observing the actions of former entrants to refine tariff expectations and sharpen belief precision, which in turn guides their sequential export decisions.

Our model is most notably characterized by highlighting the role of information and learning among firms in explaining the persistence of waiting outside the export market. Following tariff increases, incumbent exporters exit, which reduces the pool of information sources and the precision of their beliefs regarding tariffs, thereby increasing entry costs for potential exporters and raising their propensity to wait.[9] The laws of motion governing tariff belief variance depend on the rate of entry. Over periods of belief updating, the precision of beliefs continues to deteriorate. This dynamic increases the cost threshold required for firms to engage in exporting. This self-reinforcing process further amplifies the subjective uncertainty perceived by potential entrants, ultimately resulting in a persistent decline in exports. It validates a core macroeconomic proposition in the context of international economics, namely, the role of beliefs in shaping export decision.

We further establish the existence, uniqueness, and stability of the model's equilibrium.

[8]Without shocks and the abrupt exits of incumbent exporters, potential entrants are assumed to have perfect information about future tariffs. This is consistent with Chamley (2004), who argue that a large number of agents generates perfect information.

[9]The importance of information precision is widely established in the literature. For example, Dickstein and Morales (2018) demonstrate that the exporters' information set plays a vital role in quantifying export cost. Our argument also echos Van Nieuwerburgh and Veldkamp (2006), who find that noisy information generates slow and gradual economic responses because it impedes agents' learning and decision-making.

Specifically, we establish three necessary and sufficient conditions for the Banach fixed-point theorem. Under moderate parameter values, the competitive equilibrium characterized by persistent waiting emerges. Moreover, the proof excludes two types of special cases that could otherwise limit the generality of the results: first, the presence of risk-averse firms—those highly sensitive to tariff—does not affect the existence or stability of the equilibrium; second, the inclusion of initial conditions that account for factors such as destination-market risk ensures that the equilibrium is robust and not coincidental.

A well-established body of literature examines how uncertainty influences the economic activity of various agents. A central question in this strand of research concerns the role of uncertainty in driving business cycles and economic growth, which has been analyzed using diverse methodologies. For instance, Bloom (2009) develops and estimates a model with stochastic uncertainty to explain how firms' adjustment costs for labor and capital shape the dynamics of employment, investment, and productivity. Using a VAR approach, Baker et al. (2024) incorporate time-varying uncertainty—measured by disaster shocks—to assess its effect on economic growth. Baqaee and Farhi (2019) characterize the macroeconomic impact of microeconomic productivity shocks in a nonlinear framework, emphasizing how negative shocks are amplified through these nonlinearities. Forni et al. (2025) estimate the effects of downside and upside uncertainty shocks separately on business cycles. Second, a large body of empirical research examines the effects of uncertainty on firms and individuals, often leveraging exogenous uncertainty shocks to identify causal impacts on various aspects of firm decision-making and performance. See, for example, Gaba and Terlaak (2013), Ilut et al. (2018), Duval et al. (2020), Handley and Li (2020), Favara et al. (2021), Guceri and Albinowski (2021), and Kumar et al. (2023). Notably, Kumar et al. (2023) find randomized generated uncertainty reduces firms' prices, employment, investment, sales as well as new technology adoption. Regarding individuals, Bamieh et al. (2025) examine the effect of uncertainty on labor market outcomes, while Di Maggio et al. (2022) and Coibion et al. (2024) focus on household consumption and spending, demonstrating that macroeconomic uncertainty induces households to reduce spending.[10]

Our paper is further motivated by the growing literature on uncertainty in international economics. First, a series of studies by Blonigen and Park (2004), Handley (2014), Handley and Limão (2017), and Handley and Limão (2022) extensively examine both theoretical and empirical aspects of trade policy uncertainty. Numerous empirical works have further

[10]Some recent work specifically investigates the effect of COVID 19—an unexpected shock—on economics, such as Kozlowski et al. (2020), Miescu and Rossi (2021), and Bunn et al. (2021).

investigated the effects of such uncertainty. For instance, Vandenbussche and Zanardi (2010), Lu et al. (2013), Feng et al. (2017), Crowley et al. (2018), Jabbour et al. (2019), Sandkamp (2020), and Chen et al. (2025) specifically examine how AD investigations—a form of trade policy uncertainty—affect export behavior.[11] These studies generally find that this type of trade policy uncertainty reduces exports, in both the short and long run.[12] Recent work by Alessandria et al. (2024),Alessandria et al. (2025b), and Alessandria et al. (2025a) incorporate the expectation into analyzing trade policy uncertainty. For example, Alessandria et al. (2025a) particularly investigate the substantial uncertainty about the future path of tariffs, emphasizing the role of *expectation* on tariff. Moreover, a broader strand of research explores the impact of AD investigations on other types of firm responses.[13] The second series of studies examines the effects of broader economic uncertainty on firms operating in global markets. For example, Alfaro and Chen (2012), Bailey et al. (2024), Graziano et al. (2021), and Novy and Taylor (2020) study the performance of multinational subsidiaries and exporters under uncertain conditions. Novy and Taylor (2020) employ an uncertainty index to investigate the amplifying effect of uncertainty on international trade, finding that it leads firms to disproportionately reduce orders of foreign inputs due to higher fixed costs. Some recent work focuses specifically on supply chain-related uncertainty, such as Baldwin and Freeman (2022), Kopytov et al. (2024), and Liu et al. (2025).

Finally, our paper builds upon a broad literature on information and learning, particularly in environments characterized by uncertainty.[14] This connection can be structured into three main themes. First, theoretical and empirical contributions by Zeira (1994), Benhabib et al. (2016), Fajgelbaum et al. (2017), Ilut and Saijo (2021), Chousakos et al. (2023), and Alfaro et al. (2023) examine how information acquisition and learning shape business cycles, macroeconomic outcomes, and trade policy preferences. In particular, Benhabib et al. (2016) treat information as a productive input and link information acquisition to labor market dynamics. Their work illustrates how perfect and imperfect information influence business cycles in contrasting ways, underscoring the role of complete information in enabling efficient resource allocation. Meanwhile, Fajgelbaum et al. (2017) incorporate uncertainty into business

[11] There is also some work investigating the source of AD investigations and the investigation outcomes, such as Prusa et al. (2022) and Feng et al. (2025).

[12] Our work distinguishes itself from this literature by incorporating information costs and learning into the analysis of responding to non-affirmative AD investigations.

[13] For example, Ding et al. (2023), Crowley et al. (2018), and Huang et al. (2024) provide important empirical evidence on how AD investigations influence portfolio preferences, stimulate firm innovation, and reduce firm employment respectively.

[14] Bikhchandani et al. (1998) and Bikhchandani et al. (2024) provide a seminal review of the theory and evidence related to social learning.

cycle analysis and demonstrate how learning can contribute to self-reinforcing episodes of elevated uncertainty. Second, learning under imperfect information and its implications for firm dynamics have been widely studied, as exemplified by Tian (2022) and Frick and Ishii (2024). The latter examines how an economy's capacity for social learning influences the adoption of innovations. Third, the role of learning has been extensively explored across various economic domains. For instance, Benhabib et al. (2019) and Bustamante and Frésard (2021) investigate learning mechanisms in financial markets. Studies such as Ouimet and Tate (2020), Meinen et al. (2022), and Bailey et al. (2024) emphasize learning from peers or other individuals. In the field of international economics, Belderbos et al. (2011), Li et al. (2015), Wagner and Zahler (2015), and Bao and Chen (2018) analyze how information and learning affect exporters' behavior and how domestic firms respond to the threat of foreign multinational entry using information quantified from news.

Our study contributes to the existing literature in several meaningful ways. First, we provide novel empirical and theoretical insights into how social learning among exporters amplifies the persistent negative effects of temporary trade policy shocks. While prior research has extensively documented the chilling effects of AD investigations, few studies have explicitly modeled the role of information acquisition and social learning in shaping exporters' long-term responses. By constructing measures of social learning through equity-linked portfolio firms and incorporating Bayesian updating into a dynamic model of export decision-making, we offer a micro-founded mechanism that explains why even non-affirmative AD investigations lead to sustained declines in new market entry.

Second, our paper bridges several strands of literature—on trade policy uncertainty, imperfect information, and social learning—by developing a unified framework that highlights the endogenous decline in information precision following a shock. We show that the exit of incumbent firms reduces the availability of reliable information, raising the cost of entry and creating a self-reinforcing cycle of declining market participation. This approach not only complements existing work on uncertainty and firm dynamics but also extends the heterogeneous—firm model to include informational externalities and interdependent decision-making. We demonstrate how decreases in information precision propagate shocks and lead to persistent export contraction, thereby offering a more nuanced understanding of the long-term impacts of trade policy uncertainty.

The rest of the paper is organized as follows. Section 2 describes the institutional background about AD investigations and datasets. Section 3 presents the empirical evidence and Section 4 presents the formal theoretical framework, depicting how social learning

behavior among exporters leads to the long-term effects of AD investigations. Section 5 concludes.

2 Data

2.1 Data and Variables

The data of this article come from two sources: The *Global Anti-dumping Database* maintained by the World Bank, which documents AD investigations initiated by 52 countries between 1980 and 2015. From this comprehensive dataset, we extract specific information related to AD investigations targeting China. Second, the *China Customs Database* from 2000 to 2016. This database provides detailed export information on Chinese firms. We match the two datasets using HS-6 digit product codes. During the sample period, 26 countries initiated AD investigations against China at the HS-2 digit product level, impacting a total of 1,060,273 exporters. This process yielded 5,126,330 firm-level observations at the firm-HS-6 digit product-destination country-year level, covering the years 2000 to 2015. These observations were subsequently aggregated to the HS-6 digit product-destination country-year level for further analysis. Table 1 presents the variable definitions and data sources, and Appendix A outlines key stylized facts about AD investigations against Chinese exporters.

Table 1: Variable Definitions and Data Sources

Variable Name	Variable Definition	Data Source and Description
$\ln Entrants_{jkt}$	Number of entrants	CCD (2001-2016)
AD_{jkt}	$AD_{jkt} = 1$indicates the treatment group	Global AD Database
$Tariff_{jkt}$	Average tariff imposed by country k on product j in year t	WTO's Integrated Database
$\ln Exportvalue_{ijkt}$	Export value at firm-HS6-country level	CCD (2001-2016)

Notes: The subscripts i, j, k and t represent firm, HS-6 digit product, export destination country and year respectively.

We identify new entrants of a specific product to the same destination country in a given year. The 'entrant' is identified based on the export value of firm i exporting product j to country k in year t. If $Exportvalue_{jkt} > 0$ and $Exportvalue_{jkt-1} = 0$, firm i with product j choose to enter the market of country k in year t. Similarly, if $Exportvalue_{ijkt} > 0$ but $Exportvalue_{ijkt+1} = 0$, it indicates firm i exits from the destination country in the following year. AD_{jkt} measures whether product j faces AD investigation by country k in year t. $Tariff_{jkt}$ measures the regular tariff imposed by country k on product j in year t. The

summary statistics is shown in Table 2.

Table 2: Summary Statistics

	(1) Mean	(2) Std. Dev.	(3) 10%	(4) 25%	(5) Median	(6) 75%	(7) 90%
$\ln Entrants_{jkt}$	2.183	1.584	0	1.099	2.079	3.135	4.344
AD_{jkt}	0.161	0.368	0	0	0	0	1
$Tariff_{jkt}$	9.392	8.529	0	2.7	7.5	15	20
$\ln Exportvalue_{ijkt}$	9.322	2.676	5.935	7.624	9.374	11.12	12.67

3 Stylized Facts

In this section, we employ AD investigations as a representative case to empirically examine the long-term effects induced by transitory trade policy shocks, thereby providing facts and intuition for modeling. [15]

3.1 Model Specification

We start by examining the long term effect of AD investigations on the export decision of Chinese exporters. Drawing on Lu et al. (2013) and Jabbour et al. (2019), we follow Cengiz et al. (2019)'s methodology, which employ the stacked-data regressions with difference-in-differences (DiD) strategy. Specifically, we define a HS-6 digit product as treatment group, if this product has ever been investigated by an export destination country. The control group includes products that are under the same HS-4 digit category and export to the same destination country of the treatment group, and treated products in later period. We stack these late-treatment products data in relative time. The regression equation is as follows:

$$\begin{aligned}\ln Entrants_{jkt} = &\text{Cons.} + \sum_{\vartheta=-11,\vartheta\neq-1}^{12} \xi_{\vartheta} \times AD_{jk} \times T_{\vartheta} + X\gamma \\ &+ FE_{jk} + FE_{jt} + FE_{skt} + FE_{cohort} + \varepsilon_{jkt} \end{aligned} \tag{1}$$

where subscripts j, s, k, and t denote the HS-6 digit product, the HS-2 digit product, the export destination country and year, respectively. The dependent variable $\ln Entrants_{jkt}$ indicates

[15] On the contrast, long-term trade policy, such as China's accession to WTO, is always considered as permanent shock. Examples include China's accession to the WTO (Feng et al., 2017), the EU's eastward expansion (Sandkamp, 2020), and the UK's Brexit (Graziano et al., 2021).

the total number of new entrants exporting product j to country k in year t. Furthermore, in subsection 3.3, we will replace the dependent variable with the number of new entrants that have established equity linkages with superstar exporters to infer the effect of information. The dummy variable AD_{jk} is set to 1 if product j is subject to an AD investigation by country k during the overall sample period. T is a vector of dummy variables that equal to 1 when the time lag of a firm's exporting year to investigation year are equal to υ. It is important to note that we use the initiation year of the AD investigation as the treatment time, rather than the year when the investigation results are adjudicated, since our focus is on the period when uncertainty about the outcome of the AD investigation arises.

ξ is a set of parameters we need to estimate, which measure the difference of new exporters between the treatment and control group, compared to the previous year of investigation(t=-1) with time lag υ. A negative ξ indicates that fewer firms in the treatment group choose to enter the destination country compared to the reference period, and vise versa.

X is a vector of control variables, including average tariffs at the product-destination country level. FE denotes a list of fixed effects, including product-year fixed effects (FE_{jt}), destination country-year fixed effects (FE_{kt}), and product-destination country fixed effects (FE_{jk}). Specifically, FE_{jt} controls for product-year specific shocks, such as demand shocks, technology improvement and changes in industrial policies. FE_{kt} incorporates shocks related to export destination country, such as economic development, foreign exchange rate, trade policies, etc. FE_{jk} accounts for the inherent differences at the product-destination country dimension, such as unobserved demand preference. Standard errors are clustered by HS-6 digit product-destination country group.

3.2 Persistent Effect of AD Investigations on New Entrants

The estimation results, as illustrated in Figure 1, show that before the AD investigation, there was no significant difference in the number of new entrants between the treatment and control groups relative to the base period, indicating parallel pre-trends. After the investigation, however, the number of new entrants exporting the investigated products to the investigating country declined significantly. This outcome confirms that our results are not driven by pre-existing trends.

Figure 1 highlights a significant increasing trend in the absolute value of the key parameter following the initiation of an investigation, suggesting a progressive decrease in the likelihood of firms entering into the investigated product-market relative to the control group. The one-time shock induced by possible AD tariff appears to have a lasting impact on the market

entry decisions of exporters, altering their trajectory over an extended period. Specifically, panel A shows the baseline estimation result. The estimated value and the upper bound of the 95% confidence interval are significantly less than 0 when t>0, which implies the number of new entrants in the treated sectors are significantly lower than that in control group following the investigation. Panel B shows estimates that exclude cases with affirmative preliminary dumping decisions, the estimated values in every period after the investigation are also significantly less than 0. Panel C displays estimates that exclude affirmative preliminary injury decisions, the estimated values are also significantly less than 0 from t=5, which implies information lagging in response to negative shock. Finally, Panel D incorporates both anti-dumping investigations and preliminary injury decisions. The results indicate that when t>5, the number of new entrants in the treated group shows a gradual decreasing trend compared with the control group.

To ensure robustness, we also used other methods with time varying treatments to examine the persistence effect of anti-dumping investigations on firm's exporting, including TWFE DiD specification and (Callaway and Sant'Anna, 2021). The detailed results are shown in Appendix A.

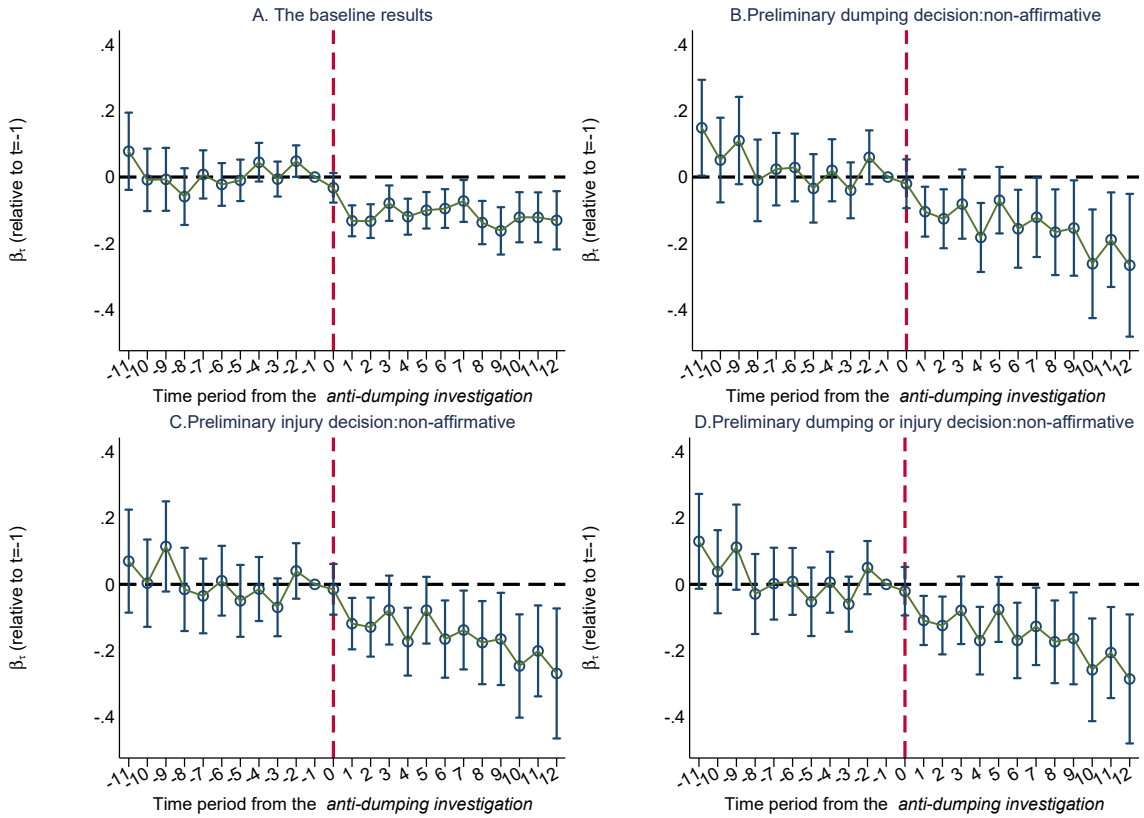


Figure 1: The Impact of AD Investigations on New Entrants

Notes: Figure 1 shows the effect of AD investigations on the number of new firms entering in the industry. The line segment perpendicular to the horizontal axis corresponds to the 95% confidence interval of the regression coefficients for each period, and the dots correspond to the regression coefficients for each period. Panel A,B,C,D reports the results under all AD investigation cases, only including cases of preliminary dumping decision with 'non-Affirmative', only including cases of preliminary injury decision with 'non-Affirmative', and only including cases of preliminary dumping or injury decision with 'non-Affirmative' Standard errors are clustered by HS-6 digit-destination country group. Detailed estimation results are presented in Appendix A.

In Appendix B, we complement the baseline findings with additional evidences. First, we use relative measure of export participation, which is the number of exporter entrants in t over that in t-1. The results in Table B.1 show that after the fourth period following AD investigations, the number of entrants reach a new equilibrium, which echoes the baseline. Second, we explore whether the AD investigations affect firms' export decisions along the extensive margin—specifically, whether firms shift exports to destination countries not subject to AD investigations or switch to non-investigated products to countries that initiated the investigations. As shown in Table B.2, following the investigations, affected Chinese exporters

strategically divert their exports to other countries and increase exporting non-investigated products to the investigating countries. Moreover, we find that these firms do not establish brand new export relationships in the aftermath of the investigations.

To address the potential concern that risks associated with AD investigations drive the sustained contraction, we construct a measure of one-off export over all export and the results are shown in Table B.3. We find that after being subjected to an AD investigation, the proportion of one-off exports to the investigated country and product briefly increased relative to total exports, with no significant difference observed thereafter. This indicates that market uncertainty/risk is insufficient to explain the sustained decline in exports. Specifically, the market risk triggered by the AD investigation leads to more firms engaging in one-time exports in the short run. However, over time, one-time exports—which are more representative of risk impact—do not exceed other types of exports, suggesting that there are other more profound reasons behind the sustained decline in this market, such as information and learning we explore in this paper.

We conduct a battery of robustness checks in the following ways: First, we examine whether the estimated effects of are attributable to particular industries, such as industries with less, more and the most investigated sectors, to ensure our results are not driven by these sectors. Second, we exclude industries which account for less or more export value, as well as products in which Chinese exporters have comparative advantage traditionally. Third, we exclude industries with the highest and lowest competition level. Fourth, we conduct placebo test by using randomly selected control groups. These analysis are also reported in Appendix B.

Overall, we conclude that there are increasingly less entrance into the destination country once the product is subject to AD investigations.

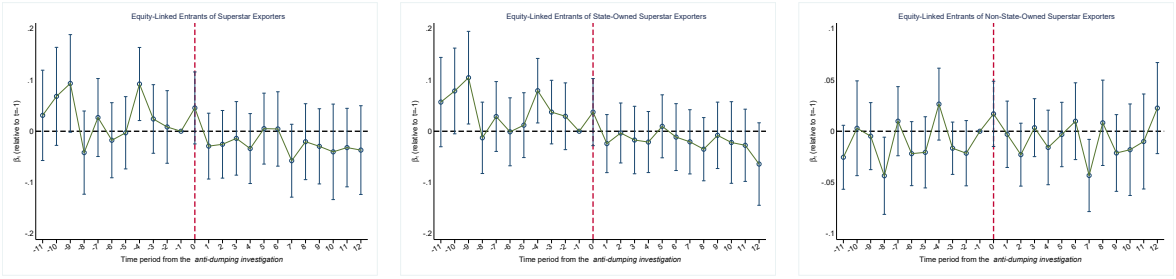
3.3 Superstars' Information Diffusion to Equity-Linked Entrants

Based on the fact above, a pivotal question arises: what mechanisms underlie the persistent negative effects of transitory AD investigations on firm export performance? Moreover, in cases where fewer new firms enter the affected industry following such trade policy shocks, do potential entrants—operating with imperfect information—react to the observed export behavior of incumbents in later periods, leading them to choose to stay out of the market instead of exporting?

Motivated by this conjecture regarding potential informational externalities among firms, we leverage variation in information linkages generated by equity ownership connections to

examine whether and how information transmission shapes market entry decisions in the presence of temporary shocks. Specifically, we identify superstar exporters and locate their equity-linked exporters, which allows us to explore the information sharing among firms. We formally examine this hypothesis by replacing the dependent variable with the number of new exporting firms within the same product category who have equity connections to superstar exporters, and re-estimating the Equation 1.

The results of (a) in Figure 2 indicate that there are no statistically significant differences between the treatment and control groups in the number of such new exporters either before or after the shock. This suggests that the export decisions of firms linked to superstar exporters are shielded from rising information costs, supporting a key argument we emphasize: the shock does not uniformly negatively affect export decisions. Thus, it is accurate information—rather than the shock itself—that shapes patterns of market entry.



(a) Equity-Linked Entrants of Superstars (b) Equity-Linked Entrants of SOE Superstars (c) Equity-Linked Entrants of non-SOE Superstars

Figure 2: The Impact of AD Investigations on Equity-Linked Entrants of Superstars

Notes: Figure 2 shows the effect of AD investigations on the number of new entrants which establish equity linkage with superstar exporters. The line segment perpendicular to the horizontal axis corresponds to the 95% confidence interval of the regression coefficients for each period, and the dots correspond to the regression coefficients for each period. (a),(b),(c) reports the results which the explained variable is equity-linked entrants of all superstars, equity-linked entrants of SOE superstars, and equity-linked entrants of non-SOE superstars, respectively. Standard errors are clustered by HS-6 digit-destination country group.

Given the heightened sensitivity of state-owned enterprises (SOEs) to policy signals in China—where expectations regarding public policies may also influence the decisions of firms with equity ties to SOEs.[16] We distinguish between state-owned and private superstar exporters. We then separately examine their influence by replacing the dependent variable with parallel measures: one for new entrants linked to SOE superstars, and another for

[16]The recent work by Luo et al. (2025) measure policy locality suitability based on SOE's revealed preference, suggesting the strong information advantage of SOE in China.

those linked to non-SOE superstars. We then re-estimate Equation 1, results of (b) and (c) in Figure 2 show that there is no significant difference in this two types of equity-linked entrants between treatment and control group. This reconfirms that it is the "private signal" conveyed by the actions of incumbents following the shock, rather than differential public policy perceptions, that drives firms' export decision.

In addition, we identify three-tiered hierarchy of equity linkages. We find that higher-level equity ties with superstars are associated with a weaker direct influence from the superstars' operational decisions, implying that the information transmission plays a more pronounced role in shaping the decision of linked exporters. These results consistently underscore the importance of information in the export decision-making of linked firms. Detailed results are provided in the Appendix C.

4 Model

In this section, we develop a theoretical framework to model export decision-making under unexpected shifts in the trade environment and potential tariff changes, incorporating endogenous information acquisition and dynamic learning. The model establishes a micro-founded link between firm's entry choices and observed industry-level export dynamics. Our analysis yields two key insights: First, it highlights the critical role of information in shaping export decisions under uncertainty. Second, it demonstrates that beyond the first-order effects of shocks, the persistent responses induced by endogenous learning constitute an equally important mechanism for understanding the stylized facts.

We start with the export decisions of firms under complete information facing tariff changes, aiming to demonstrate how firm make export decision based on profit with sensitivity to tariff variations. Furthermore, this paper investigates how transient trade policy shocks generate tariff uncertainty, prompting entrants to update their expectations and beliefs in each period by incorporating public signals from news media and private signals from peer firms. Through this iterative information acquisition and Bayesian learning process, firms make endogenous export decisions in each period, collectively generating industry-level equilibrium export dynamics.

4.1 Export Entry Setup

Regarding the basic settings of demand and supply, our paper draws on Handley (2014), as

specified below.

Consumer The consumer's utility is defined as:

$$U = q_0^{1-\alpha} \left[\int_{\omega \in \Omega} q(\omega)^{\frac{\sigma}{1-\sigma}} d\omega \right]^{\frac{1-\sigma}{\sigma}\alpha} \tag{2}$$

Consumption preferences over homogeneous products (q_0) and differentiated product (q(ω)) satisfy a Cobb-Douglas form. Consumers have a utility function with a CES ($\sigma > 1$) over a set of varieties Ω. q denotes the quantity of variety i consumed and α is the share of the expenditure. Y denotes the consumer's disposable income, p denotes product price, and P denotes price index. We derive the demand function for product i from utility maximization:

$$q_i = \frac{\alpha Y P^{\sigma-1}}{p_i^{\sigma}} \tag{3}$$

The price index is defined as $P = \left[\int_{\omega \in \Omega} p(\omega)^{1-\sigma} \right]^{\frac{1}{1-\sigma}}$.

Firm On the production side, following the setup of Fajgelbaum et al. (2017), we introduce an utility function to illustrate how perception of tariff affects exporter's entry decisions. The utility function consists of two parts: the first part is the firm's profit (π_i), labor is assumed to be the only production factor (Melitz, 2003). Firm with variety i needs to use w units of labor to produce one unit of product and the unit cost of labor is given by c_i. [17]

The second part is related to the impact of time-varying tariff. We assume that tariff variations not only affects the profit of an exporter within the framework of conventional trade theory, but also introduce additional risk exposure due to decision-makers' responsiveness to tariff variations. By doing so, our model not only allows for information acquisition in decision-making, but also possibly capture the entrant's dynamic learning process when responding to external environment. Specifically, exporter's utility is given by

$$\Psi_i (c_i, \tau) = \pi_i (c_i) (1 - ae^{a\tau}) = A c_i^{1-\sigma} (1 - ae^{a\tau}) \tag{4}$$

Where A is defined as $A = \frac{(\sigma-1)^{\sigma-1}\alpha}{\sigma^{\sigma}} \frac{Y}{P^{1-\sigma}} w^{1-\sigma}$. Specifically, τ is tariff and a denotes how sensitive the entrant is to tariff changes, $0 < a < 1$, and $ae^{a\tau}$ denote the loss of utility due to exposure of a exporter to tariff changes. For example, with a higher tariff, the export

[17] Equivalent to defining labor productivity in terms of cost, $1/wc_i$ can be equivalently viewed as labor productivity, i.e., firms with high productivity pay lower labor costs. The firm's marginal cost of production is then given by $MC_i = wc_i$.

value is smaller and a exporter values less of that market in her utility.

Entry Decision with Perfect Information We analyze firms' intertemporal export decision in a discrete-time dynamic framework with perfect information. Drawing on Melitz (2003), firms need to pay a certain amount of fixed costs f_e when entering a foreign market, which are mainly used for sunk cost such as market research and setting up sales channels in a particular destination country. Thus, a firm owner decides to export only if the present value of utility from multi-period exporting is greater than the sunk cost. In discrete time {1,2,...,T}, given the discount factor β, the present value of the entrant's utility is given by:

$$V^E(c_i, \tau) = \frac{1}{1-\beta}\Psi_i \tag{5}$$

The free entry condition is then:

$$c^{\text{cutoff}} = \left(\frac{A}{1-\beta}\frac{1}{f_e}\right)^{\frac{1}{\sigma-1}} (1 - ae^{a\tau})^{\frac{1}{\sigma-1}} \tag{6}$$

When $c_i < c^{\text{cutoff}}$, the firm owner decide to export to that market. From Equation 6, the critical value of unit labor costs of exporting firms is determined by both the responsiveness of entrant to tariff change and the tariff itself. On the one hand, the negative correlation between the cutoff cost and tariff rate implies that, an increase in the tariff rate forces less productive firms to exit an export market, on the other hand, the negative association between tariff sensitivity and the cutoff cost similarly indicates that more tariff-sensitive exporters need higher productivity to survive in foreign markets (in order to obtain a larger profit margin).

The Equation 6 may also implicitly suggests that potential exporters who are more sensitive to tariff changes need exert extra effort to cope with the tariff uncertainty induced by temporary shocks, motivated by survival concern. Thus, a self-selection of higher productive firms into the export market. This implies that our modeling of the firm owner's utility function is not only formalizes the behavioral incentive highlighted by Chen and Steinwender (2021), which documents owner-driven productivity enhancements to avoid bankruptcy, but also being grounded in the seminal framework of selection dynamics in export markets pioneered by Melitz (2003).

4.2 Decision-making with Imperfect Information: Navigating Tariff Uncertainty

4.2.1 Information Acquisition and Learning

Tariff Uncertainty Induced by Transitory Shock According to the existing studies, tariff uncertainty induced by transitory shocks, such as AD investigations, manifests itself in two ways: First, firms have difficulty in speculating on the extent to which the negative shock affects tariff changes (Handley, 2014); Second, firms are unable to ascertain whether similar negative shocks will reoccur (Crowley et al., 2018).Based on the above facts, we assume the changes in tariffs follow a random walk, i.e. $\tau' = \tau + \varepsilon^{\tau}$, where ε^{τ} represents the random term in which the shock occurs,and it follows a normal distribution $\varepsilon^{\tau} \sim \mathrm{N}\left(0, \sigma_{\tau}^{2}\right)$.

When facing uncertainty about tariff changes, firm's information sets shape its decisions. Based on Fajgelbaum et al. (2017), we hypothesize that information acquisition channels for potential entrants are principally divisible into two categories in belief updating regarding future tariffs: signals disseminated through public media and private signals inferred from the strategic actions of incumbent firms.

Information Acquisition First, potential entrants can infer signals from public news media to anticipate changes in the host country's trade policies and tariff movements, such as official statistics and media reports. Hence the public signal is defined as $\mathrm{Z}, \mathrm{Z} = \tau + \varepsilon^{\mathrm{z}}$, and there exists noise interference with signals released by public media $\varepsilon^{z}, \varepsilon^{z} \sim \mathrm{N}\left(0, \gamma_{z}^{-1}\right)$, where γ_z is the inverse of the public signal's variance and simultaneously captures the degree of information dispersion. A larger γ_z is associated with a more precise signal released by the public, as it corresponds to a smaller variance.

Second, by observing and learning the signals emitted through the actions of incumbent firms, potential entrants can update their prior beliefs and form revised expectations regarding future tariffs. Following Fajgelbaum et al. (2017), we assume that there exists a sufficiently large number of potential entrants in each industry $j \in \{1, 2, \ldots, \bar{N}\}$, and the information conveyed by each active firm is equally important, implying no information heterogeneity. Each active firm emits the information that satisfies the following equation,

$$x_j = \tau + \varepsilon^{x} \tag{7}$$

where ε^{x} denotes signal interference, $\varepsilon^{x} \sim \mathrm{N}\left(0, \bar{N}\gamma_{x}^{-1}\right)$ and γ_x represents the precision of private signals. The number of active firms in the industry is assumed to be N, which is endogenously determined by the firms' choice of export market entry. We then derive an average signal released by all active firms in the industry $\mathrm{X}, X = \frac{1}{N}\sum x_j = \tau + \varepsilon_N^x$, and $\varepsilon_N^x = \frac{1}{N}\sum \varepsilon_j^x, \varepsilon_N^x \sim \mathrm{N}\left(0, (n\gamma_x)^{-1}\right), n = \frac{N}{\bar{N}}$ denotes the number of active firms signaling tariff

changes as a proportion of all potential entrants.[18]

Firm's Belief and Learning Assume that potential entrants all have common prior beliefs about the tariff τ, and that the distribution of exporter's beliefs about is given by $\tau \mid \mathrm{I} \sim \mathrm{N}\left(\mu, \gamma^{-1}\right)$, where I is the information set. The entrants update their priors in a Bayesian manner conditional on the arrival of new information, the ex-post probability density function of τ is obtained according to Bayes'law, the updated beliefs can be obtained as follows:

$$\mu' = \frac{\mu\gamma + Z\gamma_z + n\gamma_x X}{\gamma + \gamma_z + n\gamma_x} \tag{8}$$

$$\gamma'^{-1} = \left(\frac{1}{\gamma + n\gamma_x + \gamma_z} + \sigma_\tau^2\right) \tag{9}$$

In Equation 8, μ' denotes the updated expectation of the tariff τ in current period. Upon receiving new information, the potential entrant's expectation of tariff τ is a weighted average about the prior beliefs μ, the public signals Z, and the average signals X released by the other active firms. The weight corresponds to the ratio of the precision of signals from each source to the sum of the precisions across all available information. Furthermore, substituting $X = \tau + \varepsilon_N^x$ and $Z = \tau + \varepsilon^z$ gives $E\left(\mu' \mid \mu, \gamma, n\right) = \mu$ (μ being the expected tariff in the previous period), it is clear that a smaller tariff expected beforehand when n and γ are given will be a smaller expectation of the updated expected tariff, which means that the tariff expectations of potential entrants—whether pessimistic or optimistic—demonstrate significant intertemporal persistence.

The variance of expected tariff is given by $D\left(\mu' \mid \mu, \gamma, n\right) = \frac{1}{\gamma} - \frac{1}{\gamma+\gamma_z+n\gamma_x}$. When γ is large, i.e., when the information available to potential entrants is more concentrated, the volatility of expected tariffs decreases, suggesting that potential entrants will rely more on current information than new information.

γ'^{-1} in Equation 9 represents the inverse of the new-period belief precision, which consists of two components, one is the inverse of the sum of the prior belief precision, and the other is the variance of the tariff change after the occurrence of an exogenous shock. The Equation 9 suggest that the precision of posterior beliefs depends not only on the precision of prior beliefs, but also on the number of active firms that are able to share or pass on information. It is noteworthy that these firms are simultaneously those that endogenously self-select into export markets. When n is larger, potential entrants are able to infer future tariff changes

[18] In reality, certain firms, such as state-owned enterprises or superstar exporters, often have privileged access to information, stemming from political ties and characterized by idiosyncratic, opaque information channels. Our model, however, concentrate on the broader set of remaining firms without such distinctive traits.

by observing action from more firms, suggesting that potential entrants are exposed to more concentrated information disseminated by incumbent firms.[19] For intuition, we plot the variation of γ' for different values of N according to Equation 9 by assigning random values, as shown in Figure 3.

First, it is clear that is positively correlated with prior belief γ, suggesting that there is 'temporal memory' of subjective uncertainty arising from dispersed information among potential entrants, given constant N. Second, the steady-state precision of aggregate beliefs is monotonically increasing in the number of active firms disseminating private signals, irrespective of the precision of public signal γ_z, i.e., when γ' meets the γ at a 45° diagonal, a larger N leads to a higher precision of posterior belief.

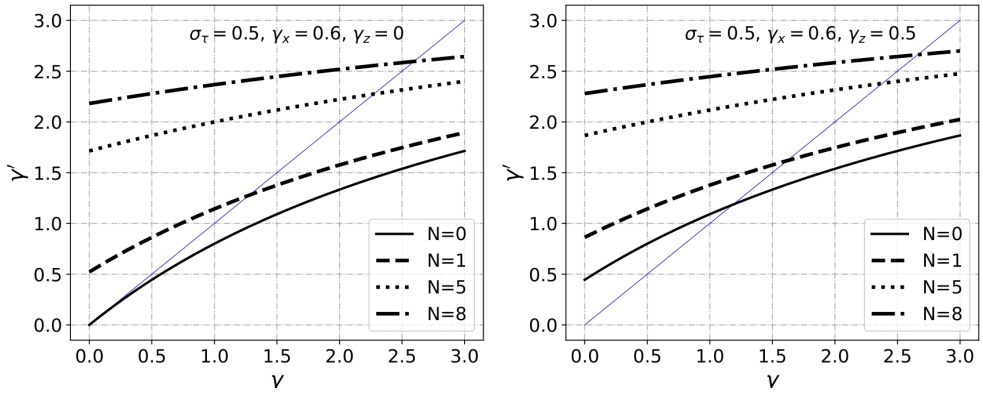


Figure 3: Number of Active Firms and Signal Precision

Notes: Figure 3 visualizes the relationship between the change in the updated belief precision and the number of new entrants, i.e., the relationship between the parameter γ' and N. The specific values of the other parameters do not affect the pattern.

4.2.2 Export Decisions with Imperfect Information

Dynamic Decision-making Process Within our model, potential entrant chooses whether to enter the destination market under imperfect information still based on her utility. However, it differs from the situation under perfect information, as belief updating driven by information acquisition and learning also enters the decision-making process of potential entrants when

[19] To validate the theory, we also provide relevant empirical evidence using anti-dumping investigation cases used in baseline. Specifically, we examine the relationship between belief precision γ and n from three following perspectives, the turnover rate of industry, the variance in firms' export values within the industry, and the impact of superstar exporter exits. Detailed results can be found in the Appendix C.

confronted with tariff uncertainty, thus, the expected utility value satisfies the following equation:

$$V^E(\mu,\gamma) = \frac{1}{1-\beta}E(\Psi(\mu,\gamma)) \tag{10}$$

where $E(\Psi(\mu,\gamma)) = Ac_i^{1-\sigma}\left(1-ae^{\frac{a^2}{2\gamma}+a\mu}\right)$, if the potential entrant does not export in the current period and chooses to continue waiting, the value function is:

$$V^W(\mu,\gamma) = 0 + \beta E\left(\Psi\left(\mu',\gamma' \mid \mu,\gamma\right)\right) \tag{11}$$

In this equation, $E\left(\Psi\left(\mu',\gamma' \mid \mu,\gamma\right)\right) = \max\left\{V^W\left(\mu',\gamma' \mid \mu,\gamma\right), V^E\left(\mu',\gamma' \mid \mu,\gamma\right) - f_e\right\}$, $V^W\left(\mu',\gamma' \mid \mu,\gamma\right)$ denotes the utility value of waiting in the next period, and $V^E\left(\mu',\gamma' \mid \mu,\gamma\right)$ is the utility value of exporting in the next period. It is worth noting that the present value of utility when entrant chooses to wait likewise depends on the maximization of value derived from the choice between exporting in the subsequent period or opting to wait.

Thus, if $V^E(\mu,\gamma) > V^W(\mu,\gamma)$, the entrant will choose to export in the current period, and the equilibrium is characterized by the following equation:

$$f_e = E(\Psi(\mu,\gamma)) - \beta E\left(\Psi\left(\mu',\gamma' \mid \mu,\gamma\right)\right) \tag{12}$$

The right-hand side of the Equation 12 represents the opportunity cost incurred by potential entrants for waiting, and the following equation can be obtained:

$$(1-\beta)f_e = \frac{Ac_i^{1-\sigma}}{1-\beta}\left[\int \frac{1}{\sqrt{2\pi\gamma^{-1}}}e^{-\frac{(\tau-\mu)^2}{2\gamma^{-1}}}\left(1-ae^{a\tau}\right)d\tau - \beta\int \frac{1}{\sqrt{2\pi\gamma'^{-1}}}e^{-\frac{(\tau-\mu')^2}{2\gamma'^{-1}}}\left(1-ae^{a\tau}\right)d\tau\right] \tag{13}$$

In the final simplification, the critical unit labor cost conditions of potential entrants that decide to export in the current period are as follows:

$$c'^{cutoff} = \left(\frac{A}{(1-\beta)^2 f_e}\right)^{\frac{1}{\sigma-1}}\left(1-\beta-ae^{\frac{a^2}{2\gamma}+a\mu}\left(1-\beta e^{\frac{a^2}{2}\sigma_\tau^2}\right)\right)^{\frac{1}{\sigma-1}} \tag{14}$$

Obviously, any firm with lower labor cost would choose to export. Further attention to the role of learning, firstly, the relationship between thresholds and tariff expectation yields:

$$\frac{\partial c'^{cutoff}}{\partial \mu} = \left(\frac{A}{(1-\beta)^2 f_e}\right)^{\frac{1}{\sigma-1}} \times \frac{\left(1-\beta-ae^{\frac{a^2}{2\gamma}+a\mu}\left(1-\beta e^{\frac{a^2}{2}\sigma_\tau^2}\right)\right)^{\frac{2-\sigma}{\sigma-1}}}{\sigma-1} \times \left[-a^2 e^{\frac{a^2}{2\gamma}+a\mu}\left(1-\beta e^{\frac{a^2}{2}\sigma_\tau^2}\right)\right] \tag{15}$$

Because $0 < \beta < 1$ and $\sigma > 1$, we can infer $\frac{\partial c'^{cutoff}}{\partial \mu} < 0$, i.e., c'^{cutoff} are decreasing with respect to prior beliefs μ, which suggests that when potential entrants' expectation of future tariff are relatively pessimistic, critical labor costs decrease and the threshold for firms to enter the destination market becomes higher. In addition, we also investigate the role of belief precision in firms' dynamic decision-making processes, the derivation of γ is carried out to obtain that the variation of the critical cost about the belief precision satisfies the following relation:

$$\frac{\partial c'^{cutoff}}{\partial \gamma} = \left(\frac{A}{(1-\beta)^2 f_e}\right)^{\frac{1}{\sigma-1}} \times \frac{\left(1-\beta-ae^{\frac{a^2}{2\gamma}+a\mu}\left(1-\beta e^{\frac{a^2}{2}\sigma_\tau^2}\right)\right)^{\frac{2-\sigma}{\sigma-1}}}{\sigma-1} \times \left[\frac{a^3}{2\gamma^2} e^{\frac{a^2}{2\gamma}+a\mu}\left(1-\beta e^{\frac{a^2}{2}\sigma_\tau^2}\right)\right] \tag{16}$$

Equation 16 shows that critical cost condition for entry into the destination market is looser when the belief precision is bigger, implying that more firms can enter the destination market. Since c'^{cutoff} is increasing with respect to γ, the more dispersed the information that potential entrants received and the lower precision of updated beliefs when there are fewer active firms due to a negative shock, this will induce potential entrants to choose waiting instead of exporting in the current period.

How γ Shapes Entry: Endogenous Information Frictions According to Equation 9, the derivation of γ' with respect to n yields $\frac{\partial \gamma'}{\partial n} > 0$, indicating that the updated belief precision γ' is increasing with respect to n. Since $n = \frac{N}{\bar{N}}$, the smaller the number of active firms N is, the less valid information the potential entrant can receive, and the less accurate the updated beliefs will be. In other words, a decline in belief precision raises the costs of entry by amplifying uncertainty regarding destination market conditions. Thus, sparse market participation endogenously heightens information frictions, manifesting as rising costs of market exploration and a decline in the availability of credible market signals, which ultimately translates into a more substantial deterrent to export.

The model establishes that in the face of tariff uncertainty, potential entrants update their beliefs to decide whether to export by learning from the information released by other firms,

and that their access to accurate information is positively correlated with the number of active firms in the industry that can release information on tariff changes. The following proposition encapsulates the intuitions underlying social learning and the persistent waiting outside foreign markets, which also implies that beyond the first-order effect of the negative shock, the second-order effects—manifested as informational ambiguity arising from inter-firm learning further amplify its impact. [20]

Proposition 1. *When transitory shocks introduce tariff uncertainty and initially induce incumbent firms to exit the destination market, due to* $n = \frac{N}{\bar{N}}$ *is decline and* $\frac{\partial \gamma'}{\partial n} > 0$*, the posterior belief precision* γ' *is reduced, which in turn leads to a decrease in the critical cost condition for entry* c'^{cutoff} *according to* $\frac{\partial c'^{cutoff}}{\partial \gamma} > 0$*. As a result, potential entrants choose to wait outside the market instead of exporting with dynamic learning.*

4.3 Equilibrium Characterization

Existence and Uniqueness of Equilibrium In this part, we prove the existence and uniqueness of equilibrium and analyze the parameter conditions required when reaching the equilibrium to elucidate the equilibrium properties. The proof follows the logical structure based on the application of Banach Fixed-Point Theorem:

1) Firstly, we need to prove whether the mapping $(\mu, \gamma) \rightarrow c^{\text{cutoff}}(\mu, \gamma)$ is a self-mapping defined on a set of (μ, γ) and satisfy certain value conditions;

2) Secondly, we argue that the set about (u, y) satisfying the value condition belong to the Banach space [21];

3) Third, we provide further proof that satisfying the self-mapping mentioned in the first step is a contraction mapping, i.e., Lipschitz constant $K < 1$.

Before proceeding with the equilibrium proof, it is necessary to enumerate some useful assumptions, lemmas and definitions that will be utilized.

Assumption 1. *To ensure that the domain of* μ *encompasses all possible values for belief updating, we assume that the expectation* μ *follows a truncated Markov process over* $[\underline{\mu}, \bar{\mu}]$*,*

[20] As illustrated in the benchmark stylized facts, when the negative shock of antidumping investigations leads to the exit of incumbent firms in the current period, potential entrants have difficulty in obtaining more accurate information on tariff changes, prompting them to choose to wait outside the market, and the posterior belief precision is further reduced due to the reduction in the number of active firms. And potential entrants still will not choose to export, the updating of the beliefs will therefore continue to tend to be negative. As a result, the observational learning among firms further enhances the negative impact of tariff uncertainty caused by investigation, leading firms avoid entering the destination market.

[21] A Banach space is a vector space that has a paradigm and is complete about that paradigm.

as formalized below:

$$\mu' = min\{max[\mu + s(n,\gamma)\varepsilon, \underline{\mu}], \bar{\mu}\}$$

The above equation indicates that when the interval range is sufficiently large, the truncated Markov process obeyed in converges to the first-order stochastic process described in the text.

Lemma 1. *The potential entrant's belief expectation μ obeys the following first-order stochastic process :*

$$\mu' = \mu + s(n,\gamma)\varepsilon, \quad \varepsilon \sim \mathcal{N}(0,1) s(n,\gamma) = \sqrt{D\left(\mu' \mid \mu, \gamma, n\right)} = \left(\frac{1}{\gamma} - \frac{1}{\gamma + \gamma_z + n\gamma_x}\right)^{\frac{1}{2}}$$

$$E\left(\mu' \mid \mu, \gamma, n\right) = \mu,\ s(n,\gamma) = \sqrt{D\left(\mu' \mid \mu, \gamma, n\right)} = \left(\frac{1}{\gamma} - \frac{1}{\gamma + \gamma_z + n\gamma_x}\right)^{\frac{1}{2}}$$

and :

$$s_n(n,\gamma) = \frac{\gamma_x \gamma^{\frac{1}{2}}}{2\left(\gamma_z + n\gamma_x\right)^{\frac{1}{2}}\left(\gamma + \gamma_z + n\gamma_x\right)^{\frac{3}{2}}} \geq 0,\ s_\gamma(n,\gamma) = -\frac{\left(\gamma_z + n\gamma_x\right)^{\frac{1}{2}}\left(2\gamma + \gamma_z + n\gamma_x\right)}{2\gamma^{\frac{3}{2}}\left(\gamma + \gamma_z + n\gamma_x\right)^{\frac{3}{2}}} \leq 0$$

The lemma 1 shows that the fluctuation of μ is monotonically increasing in γ and monotonically decreasing in prior belief precision, which is consistent with the previous analysis.

To facilitate the later proof, we also derive the supremum and infimum of s_n and s_γ, i.e., the number of consistent paradigms as follows:

$$\|s_n\| = \sup_{n\in[0,1],\gamma\in[\underline{\gamma},\bar{\gamma}]} \mid s_n(n,\gamma) \mid = s_n\left(0, \frac{\gamma_z}{2}\right) = \frac{\gamma_x}{\left(3\gamma_z\right)^{\frac{3}{2}}}$$

$$\left\|s_\gamma\right\| = \sup_{n\in[0,1],\gamma\in[\underline{\gamma},\bar{\gamma}]} \left|s_\gamma(n,\gamma)\right| = s_\gamma\left(\gamma_x^{-1}\left(2\underline{\gamma} - \gamma_z\right), \underline{\gamma}\right) = \left(\frac{2}{3\underline{\gamma}}\right)^{\frac{3}{2}}$$

Proof. see Appendix E for more details to prove lemma 1. □

Lemma 2. *The precision of potential entrants' updated belief can be defined as:*

$$\gamma'(n) = \left(\frac{1}{\gamma + n\gamma_x + \gamma_z} + \sigma_\tau^2\right)^{-1} = \Gamma(n,\gamma)$$

$\Gamma(n,\gamma)$ is an increasing function about prior beliefs, so we can further get supremum and

infimum of Γ_n and Γ_γ :

$$\bar{\Gamma}_\gamma = \sup_{n\in[0,1],\gamma\in[\underline{\gamma},\bar{\gamma}]} \Gamma_\gamma(n,\gamma) = \left(\frac{\underline{\gamma}}{\underline{\gamma}+\gamma_z}\right)^2, \quad \underline{\Gamma}_\gamma = inf_{n\in[0,1],\gamma\in[\underline{\gamma},\bar{\gamma}]}\Gamma_\gamma(n,\gamma) = \left(\frac{\bar{\gamma}}{\bar{\gamma}+\gamma_z+\gamma_x}\right)^2$$

$$\bar{\Gamma}_n = \sup_{n\in[0,1],\gamma\in[\underline{\gamma},\bar{\gamma}]} \Gamma_\gamma(n,\gamma) = \gamma_x\bar{\Gamma}_\gamma, \quad \underline{\Gamma}_n = inf_{n\in[0,1],\gamma\in[\underline{\gamma},\bar{\gamma}]}\Gamma_\gamma(n,\gamma) = \gamma_x\underline{\Gamma}_\gamma$$

Proof. see Appendix E for proving lemma 2. □

Definition 1. *Define an assignment vector space $B(C), B(C)$ is a set containing a series of consecutive bounded functions., function $g : C \subseteq \mathbb{R}^l \to \mathbb{R}, l \in \mathbb{N}$, i.e. g is a mapping from a multidimensional vector space to a real number space, The consistent paradigm of g is expressed as $\|g\| = \sup_{x\in C}|g(x)| = \bar{g}$, and $\bar{g}$ is the supremum of g, $\underline{g}$ denotes infimum.*

Definition 2. *According to $\mu \in [\underline{\mu},\bar{\mu}]$ and $\gamma \in [\underline{\gamma},\bar{\gamma}], \mathcal{S} = [\underline{\mu},\bar{\mu}]\times[\underline{\gamma},\bar{\gamma}]$ is defined as a space where all (μ,γ) locate, In order to minimize the inconvenience caused by cumbersome formulas in the later analysis, $R : g \in B(\mathcal{S}) \to B(\mathbb{R}\times[\underline{\gamma},\bar{\gamma}])$ is defined as a an extended function of g, i.e. definition domain $\mathcal{S} \to \mathbb{R}\times[\underline{\gamma},\bar{\gamma}]$, the details are as follows:*

$$R(g)(\mu,\gamma) = \begin{cases} g(\bar{\mu},\gamma) & if\ \mu > \bar{\mu} \\ g(\mu,\gamma) & if\ \bar{\mu} \geq \mu \geq \underline{\mu} \\ g(\mu,\gamma) & if\ \mu < \mu \end{cases}$$

And, according to the expectation of g and $R(g)$ can be computed as:

$$\begin{aligned} E[g \mid \mu,\gamma,n] &= \int_{(\underline{\mu}-\mu)/s(n,\gamma)}^{(\bar{\mu}-\mu)/s(n,\gamma)} g(\mu+s(n,\gamma)\varepsilon,\Gamma(n,\gamma))\Phi(d\varepsilon) \\ &\quad + \Phi\left(\frac{\underline{\mu}-\mu}{s(n,\gamma)}\right)g(\underline{\mu},\Gamma(n,\gamma)) + \left(1-\Phi\left(\frac{\bar{\mu}-\mu}{s(n,\gamma)}\right)\right)g(\bar{\mu},\Gamma(n,\gamma)) \\ &= \int_{-\infty}^{\infty} R(g)(\mu+s(n,\gamma)\varepsilon,\Gamma(n,\gamma))\Phi(d\varepsilon) \end{aligned}$$

Φ is the probability distribution function of the standard normal distribution.

Assumption 2. *Labor cost, denoted as c_i, defines firm heterogeneity. We assume that c_i follows a probability distribution F, and cumulative distribution function F is first-order differentiable. $F' = f > 0$ and $\int |f|dF < \infty$. Entrants with labor costs below the critical threshold will self-select into foreign market, so $N(\mu,\gamma,c_{i\,1\leq i\leq\tilde{N}}) = \sum_{i=1}^{\tilde{N}}\Phi(c_i \leq$*

c'^{cutoff}), *when the total number of potential entrants in each period* $\bar{N} \to \infty$, $n(\mu,\gamma) = F(c^{cutoff}(\mu,\gamma))$.

Definition 3. *Define a self-mapping* $\mathcal{T} : c^{cutoff} \in B(\mathcal{S}) \to B(\mathcal{S})$, *to make* $\forall(\mu,\gamma) \in \mathcal{S}$, *we can always get:*

$$\left[\mathcal{T}c^{cutoff}\right](\mu,\gamma) = \left(\frac{A}{1-\beta}\right)^{\frac{1}{\sigma-1}} \underbrace{\left(1-\beta-ae^{\frac{a^2}{2\gamma}+a\mu}\left(1-\beta e^{\frac{a^2}{2}\sigma_\tau^2}\right)\right)^{\frac{1}{\sigma-1}}}_{S(\mu,\gamma)}$$

$$\cdot \underbrace{\left\{(1-\beta)f_e+\beta\iint \max\left[c_i - R\left(c^{cutoff}\right)(\mu+s(n(\mu,\gamma),\gamma)\varepsilon),\Gamma(n(\mu,\gamma),\gamma)\right),0\right]F(dc_i)\,\Phi(d\varepsilon)\right\}^{\frac{1}{1-\sigma}}}_{P}$$

Definition 4. *Define* $\mathcal{F}_0$ *is a continuous bounded function,* c^{cutoff} *is monotonically decreasing about* μ *and monotonically increasing about* γ., $\mathcal{F}_0 \subset B(\mathcal{S})$. *The supremum of function* c^{cutoff} *is* $\overline{c^{cutoff}}$, $\overline{c^{cutoff}}$ *is Lipschitz continuous about* $\mu_{and}\,\gamma$, *and the formula of* $\overline{c^{cutoff}}$ *is:*

$$\overline{c^{cutoff}} = \left|\frac{A}{1-\beta}\right|^{\frac{1}{\sigma-1}} \cdot \underbrace{|1-\beta+ae^{\frac{a^2}{2\underline{\gamma}}+a\bar{\mu}}\left(1-\beta e^{\frac{a^2}{2}\sigma_\tau^2}\right)|^{\frac{1}{\sigma-1}}}_{H(H>0)} \cdot \underbrace{\left|(1-\beta)f_e+\beta\int\left|c\left|dF-\beta\overline{c^{cutoff}}\right|^{\frac{1}{1-\sigma}}\right.\right.}_{Q(Q>0)}$$

In fact, $\overline{c^{cutoff}}$ *is not a global Lipschitz continuum under arbitrary conditions about* μ *and* γ, *We need to show that the condition of Lipschitz continuity is satisfied in order to clarify the basic premise when proving equilibrium later. Combining lemma 1 and lemma 2, the conditions further satisfied can be obtained by simplification as:*

$$\frac{\beta H\left(\frac{2}{3\underline{\gamma}}\right)^{\frac{3}{2}}\frac{c^{cutoff}}{c^c}\left[\left(\frac{\bar{\gamma}^2+\gamma_z\bar{\gamma}}{\gamma_z}\right)^{\frac{1}{2}}+\left(\frac{\bar{\gamma}^2+\gamma_z\bar{\gamma}}{\gamma_z}\right)^{\frac{3}{2}}\right]}{a^2e^{\frac{a^2}{2\underline{\gamma}}+a\bar{x}}\left(1-\beta e^{\frac{a^2}{2}\sigma_\tau^2}\right)Q} < \frac{a}{2\underline{\gamma^2}} - \frac{(\bar{\gamma}+\gamma_z+\gamma_x)^2}{(3\gamma_z)^{\frac{3}{2}}\bar{\gamma}^2}$$

Proof. see Appendix E for proving the above conditions in definition 4. □

According to the three necessary and sufficient conditions for satisfying Banach's fixed-point theorem, we prove each of them as follows.

(1) **The mapping** $\mathcal{T}c^{\mathbf{cutoff}}$ **is a self-mapping on** $\mathcal{F}_0$**.**

Proof. First, we argue that the supremum of the mapping $\mathcal{T}c^{\text{cutoff}}$ is $\overline{c^{\text{cutoff}}}$. Second, we also

need prove that $\mathcal{T}c^{\text{cutoff}}$ is Lipschitz continuous on $\left(\overline{c^{\text{cutoff}}}_{\mu}, \overline{c^{\text{cutoff}}}_{\gamma}\right)$. Because $\left|\mathcal{T}c^{\text{cutoff}}\right|$ satisfies $\left|\mathcal{T}c^{\text{cutoff}}\right| \leq \overline{c^{\text{cutoff}}}$, the boundary of the mapping $\mathcal{T}c^{\text{cutoff}}$ in the normed space is consistent with the function c^{cutoff}, combining definition 3 and definition 4, $\left|\frac{\partial \mathcal{T}_{c^{\text{cutoff}}}}{\partial\gamma}\right| \leq \left|\frac{\partial \overline{c^{\text{cutoff}}}}{\partial\gamma}\right|$, therefore, $\left|\frac{\partial \overline{c^{\text{cutoff}}}}{\partial\mu}\right|$ and $\left|\frac{\partial \overline{c^{\text{cutoff}}}}{\partial\gamma}\right|$ get maximum values on the set $\mathcal{F}_0$, indicating $\forall\mu \in [\underline{\mu}, \bar{\mu}]$ or $\forall\gamma \in [\underline{\gamma}, \bar{\gamma}], \mathcal{T}c^{\text{cutoff}}$ corresponding partial derivatives are bounded, i.e., the Lipschitz continuity condition is satisfied on $\mathcal{F}_0$. □

(2) **The space in which $\mathcal{F}_0$ is located is Banach space.**

Proof. In definition 1, $B(\mathcal{S})$ is a normed vector space composed of continuous bounded functions, and is complete with the defined paradigm $\|\cdot\|$, so $B(\mathcal{S})$ is Banach space. In definition 4, $\mathcal{F}_0$ is a subset of $B(\mathcal{S})$, and for the functions $c^{\text{cutoff}} \in \mathcal{F}_0$, we can construct an arbitrary Cauchy sequence in $\mathcal{F}_0$, $\left\{c_k^{\text{cutoff}}\right\}_{k\in\mathbb{N}} \in \prod_{k\in\mathbb{N}} \mathcal{F}_0$, from definition 4 and Lipschitz continuity, it follows that, $\forall\mu_1, \mu_2 \in [\underline{\mu}, \bar{\mu}]$ and $k \in \mathbb{N}$, $\left|c_k^{\text{cutoff}}(\mu_2) - c_k^{\text{cutoff}}(\mu_1)\right| \leq \left|\overline{c^{\text{cutoff}}}_{\mu}\right| \cdot |\mu_2 - \mu_1|$, and when $k \to \infty$, $\left|c^{\text{cutoff}}(\mu_2) - c^{\text{cutoff}}(\mu_1)\right| \leq \left|\overline{c^{\text{cutoff}}}_{\mu}\right| \cdot |\mu_2 - \mu_1|$.

Similarly, we can also know $\forall\gamma_1, \gamma_2 \in [\underline{\gamma}, \bar{\gamma}]$, when $k \to \infty$, $\left|c^{\text{cutoff}}(\gamma_2) - c^{\text{cutoff}}(\gamma_1)\right| \leq \left|\overline{c^{\text{cutoff}}}\gamma\right| \cdot |\gamma_2 - \gamma_1|$, revealing that the above Cauchy sequence is convergent on both about μ and γ. Thus, it follows that c^{cutoff} defined on a space $\mathcal{F}_0$ about μ and γ is Lipschitz continuous, and it is also proved that $\mathcal{F}_0$ is a closed set belonging to a Banach space, and so is likewise a Banach space. □

(3) **The mapping $\mathcal{T}c^{\text{cutoff}}$ is a contraction mapping on $\mathcal{F}_0$.**

Proof. $\mathcal{T}c^{\text{cutoff}}$ is continuous derivative on $\mathcal{F}_0$, to show that $\mathcal{T}c^{\text{cutoff}}$ is a contraction mapping, follows from lemma 1, lemma 2, and definition 1, must hold under the space $\mathcal{F}_0$ it is necessary to show that the derivative of $\mathcal{T}c^{\text{cutoff}}$ about c^{cutoff} is less than 1, i.e., $\frac{\partial T_{c^{\text{cutoff}}(\mu,\gamma)}}{\partial c^{\text{cutoff}}} < 1$:

In summary, we can conclude that the self mapping $\mathcal{T}c^{\text{cutoff}}$ defined on the space of $\mathcal{F}_0$ is a contraction mapping, and according to the principle of contraction mapping or Banach's immovable point theorem, it can be shown that there exists and only exists a unique equilibrium point $c^{\text{cutoff}} \in \mathcal{F}_0$ on $\mathcal{F}_0$. □

Overall, our model formally prove the existence and uniqueness of equilibrium characterized by persistent waiting outside export market through verifying the completeness, contraction, and self-mapping conditions required by the Banach Fixed-Point Theorem, thereby providing a micro-founded theoretical explanation for sustained export inertia resulting from

information externalities across firms. Appendix E shows the full statements and proofs of equilibrium.

Further Discussion Based on the proof of equilibrium, this model finds that in order to achieve the self-reinforcing belief updating described above, the equilibrium in which entrant's choose to persistently stay out of the export market needs to satisfy the following conditions:

$$\frac{\beta H\left(\frac{2}{3\underline{\gamma}}\right)^{\frac{3}{2}} c^{\text{cutoff}}\left[\left(\frac{\bar{\gamma}^2+\gamma_z\bar{\gamma}}{\gamma_z}\right)^{\frac{1}{2}}+\left(\frac{\bar{\gamma}^2+\gamma_z\bar{\gamma}}{\gamma_z}\right)^{\frac{3}{2}}\right]}{a^2 e^{\frac{a^2}{2\underline{\gamma}}+a\bar{\mu}}\left(1-\beta e^{\frac{a^2}{2}\sigma_\tau^2}\right)Q} < \frac{a}{2\underline{\gamma}^2}-\frac{(\bar{\gamma}+\gamma_z+\gamma_x)^2}{(3\gamma_z)^{\frac{3}{2}}\bar{\gamma}^2} \tag{17}$$

Equation 17 mainly ensures that the critical unit labor cost at reaching equilibrium varies monotonically with respect to the belief expectation μ and the belief precision γ. The right part of the inequality sign mainly embodies the feedback of information, indicating that the information precision γ_x that a potential entrant receives by learning from other firms should not be too large when other parameters are held constant.

The interpretation of the above condition is as follows, if the external information available to potential entrants is more precise when equilibrium is reached, it implies that entrant's expectations are more volatile in belief-updating, furthermore, it demonstrates that the critical unit labor cost may no longer vary monotonically with tariff expectations and belief precision, may even exhibiting oppositely correlated, and that then persistent waiting outside the destination country will not occur.

In addition, it is necessary to ensure that the critical unit labor cost is a positive number, i.e., $c^{\text{cutoff}} > 0$, Although this is a weak assumption that is intuitively obvious, theoretically we still need to give parametric conditions that satisfy that the equation holds, i.e., equivalently, the following equation holds:

$$\frac{1-\beta}{1-\beta e^{\frac{a^2}{2}\sigma_\tau^2}} > a e^{\frac{a^2}{2\gamma}+a\mu} \tag{18}$$

Since $e^{\frac{a^2}{2\gamma}\sigma_\tau^2} > 1$, if $1-\beta e^{\frac{a^2}{2}\sigma_r^2} > 0$, this implies that for the above equation to hold, the parameters $a(0 < \text{a} < 1)$, μ , σ_τ^2, need to be sufficiently small, or the prior belief precision γ sufficiently large. A sufficiently small a implies that potential entrants are not overly sensitive to changes in tariff τ^D. Sufficiently small μ and sufficiently large belief precision γ ensure that firms have relatively optimistic expectations before entering the destination country market

and have access to external information with a certain degree of accuracy, so that they have sufficient incentives to choose to enter the destination country market rather than waiting from the beginning.

A sufficiently small σ_τ^2 ensures that the impact of tariff uncertainty on potential entrants does not cause them to simply drop out of the waiting queue when negative shocks are large or venture into the industry when positive shocks are large, thus making the aforementioned steady state of entry into the destination market unattainable.

Proposition 2. *Under the moderate conditions, an equilibrium characterized by persistent waiting outside the export market—induced by social learning—exists and is unique. Furthermore, these conditions preclude two situations that would otherwise distort equilibrium generality: 1) the influence of risk-averse entrants exhibiting heightened sensitivity to tariff fluctuations within the waiting queue (i.e., sufficiently small a); 2) the absence of potential entrants resulting from severe negative shocks or adverse initial export conditions (i.e., sufficiently small μ, σ_τ^2 and sufficiently large belief precision γ).*

Overall, we develop a model of firms' dynamic export decision-making under imperfect information, incorporating a social learning mechanism. *It reveals that informational interactions and dynamic learning among firms amplify the perceived subjective uncertainty, which constitutes a primary reason for firms to persistently wait outside the export market.* This finding also aligns with the established stylized facts. Furthermore, the existence and uniqueness of the equilibrium are formally demonstrated. And our further discussion on equilibrium shows that the persistent waiting outside export market under social learning portrayed is neither a fortuitous situation due to the special setting of initial conditions nor a localized result of extremely risk averse entrants in the industry.

5 Conclusions and Policy Implications

In this paper, we develop a general theory explaining how temporary trade policy shocks can generate persistent effects through learning in the presence of imperfect information. The key insight is that such shocks affect firms not only directly through tariffs, but also indirectly by reducing the precision of information available to potential entrants, thus raising the entry threshold. When part of incumbent exporters exit in response to temporary shocks, the resulting decline in information precision amplifies the initial shock by raising entry costs and deterring new participation.

This mechanism helps rationalize two motivating empirical regularities: that non-affirmative AD investigations produce long-term effects, and that the amount of information available systematically influences firms' entry decisions. Our model highlights that these patterns are not specific to the Chinese exporters but reflect general features of trade under uncertainty.

The findings of this paper convey important implications for the role of learning under imperfect information and how temporary uncertainty shocks shape export participation. While temporary trade policy shocks cause only part of exporters to exit, they trigger significant implicit entry barriers as a result of imperfect information. The deteriorating information environment about the destination market serves as an impediment for potential exporters, underscoring the need for governments to provide public information on market condition—such as tariff trends in countries that have previously initiated AD investigations. This type of information would lower the cost of information acquisition for potential exporters who might otherwise never get a chance to export, remaining overshadowed by superstar exporters with information advantage. Such policy interventions are especially important in the era of frequent geopolitical tensions.

References

Alessandria, George, Shafaat Yar Khan, and Armen Khederlarian, "Taking stock of trade policy uncertainty: Evidence from China's pre-WTO accession," *Journal of International Economics*, 2024, *150*, 103938.

_ , _ , _ , Kim J Ruhl, and Joseph B Steinberg, "Trade Policy Dynamics: Evidence from 60 Years of US-China Trade," *Journal of Political Economy*, 2025, *133* (3), 713–749.

_ , _ , _ , _ , and _ , "Trade war and peace: US-China trade and tariff risk from 2015–2050," *Journal of International Economics*, 2025, *155*, 104066.

Alfaro, Laura and Maggie Xiaoyang Chen, "Surviving the Global Financial Crisis: Foreign Ownership and Establishment Performance," *American Economic Journal: Economic Policy*, 2012, *4* (3), 30–55.

_ , Maggie Chen, and Davin Chor, "Can Evidence-based Information Shift Preferences Towards Trade Policy?," Technical Report, National Bureau of Economic Research 2023.

Atmaz, Adem and Suleyman Basak, "Belief dispersion in the stock market," *The Journal of Finance*, 2018, *73* (3), 1225–1279.

Bachmann, Rüdiger, Kai Carstensen, Stefan Lautenbacher, and Martin Schneider, "Uncertainty and Change: Survey Evidence of Firms' Subjective Beliefs," Technical Report, National Bureau of Economic Research 2021.

Bailey, Warren B, Xiaping Cao, Zhenyi Yang, and Sili Zhou, "Who Leads and Who Follows? The Cross-border Peer Effect in Investment by Chinese and US Firms," *Journal of International Economics*, 2024, *147*, 103875.

Baker, Scott R, Nicholas Bloom, and Stephen J Terry, "Using Disasters to Estimate the Impact of Uncertainty," *Review of Economic Studies*, 2024, *91* (2), 720–747.

_ , _ , and Steven J Davis, "Measuring Economic Policy Uncertainty," *The Quarterly Journal of Economics*, 2016, *131* (4), 1593–1636.

Baldwin, Richard and Rebecca Freeman, "Risks and Global Supply Chains: What We Know and What We Need to Know," *Annual Review of Economics*, 2022, *14* (1), 153–180.

Bamieh, Omar, Decio Coviello, Andrea Ichino, and Nicola Persico, "Effect of Business Uncertainty on Turnover," *Journal of Labor Economics*, 2025, *43* (2), 319–348.

Bansal, Ravi, Dana Kiku, Ivan Shaliastovich, and Amir Yaron, "Volatility, the Macroeconomy, and Asset Prices," *Journal of Finance*, 2014, *69* (6), 2471–2511.

Bao, Cathy Ge and Maggie Xiaoyang Chen, "Foreign Rivals are Coming to Town: Responding to the Threat of Foreign Multinational Entry," *American Economic Journal: Applied Economics*, 2018, *10* (4), 120–157.

Baqaee, David Rezza and Emmanuel Farhi, "The Macroeconomic Impact of Microeconomic Shocks: Beyond Hulten's Theorem," *Econometrica*, 2019, *87* (4), 1155–1203.

Barnichon, Régis and Aayush Singh, "What Is a Tariff Shock? Insights from 150 years of Tariff Policy," Technical Report 2025.

Belderbos, René, Woody Van Olffen, and Jianglei Zou, "Generic and Specific Social Learning Mechanisms in Foreign Entry Location Choice," *Strategic Management Journal*, 2011, *32* (12), 1309–1330.

Benhabib, Jess, Xuewen Liu, and Pengfei Wang, "Endogenous Information Acquisition and Countercyclical Uncertainty," *Journal of Economic Theory*, 2016, *165*, 601–642.

_ , _ , and _ , "Financial Markets, the Real Economy, and Self-fulfilling Uncertainties," *Journal of Finance*, 2019, *74* (3), 1503–1557.

Bikhchandani, Sushil, David Hirshleifer, and Ivo Welch, "Learning from the Behavior of Others: Conformity, Fads, and Informational Cascades," *Journal of Economic Perspectives*, 1998, *12* (3), 151–170.

_ , _ , Omer Tamuz, and Ivo Welch, "Information Cascades and Social Learning," *Journal of Economic Literature*, 2024, *62* (3), 1040–1093.

Blonigen, Bruce A. and Jee-Hyeong Park, "Dynamic Pricing in the Presence of Antidumping Policy: Theory and Evidence," *American Economic Review*, 2004, *94* (1), 134–154.

Bloom, Nicholas, "The Impact of Uncertainty Shocks," *Econometrica*, 2009, *77* (3), 623–685.

Bunn, Philip, David Altig, Lena Anayi, Jose Maria Barrero, Nicholas Bloom, Steven J Davis, Brent Meyer, Emil Mihaylov, Paul Mizen, and Greg Thwaites, "COVID-19 Uncertainty: A Tale of Two Tails," *University of Chicago, Becker Friedman Institute for Economics Working Paper*, 2021, (2021-135).

Bustamante, M. Cecilia and Laurent Frésard, "Does Firm Investment Respond to Peers' Investment?," *Management Science*, 2021, *67* (8), 4703–4724.

Caldara, Dario and Matteo Iacoviello, "Measuring Geopolitical Risk," *American Economic Review*, 2022, *112* (4), 1194–1225.

Callaway, Brantly and Pedro H.C. Sant'Anna, "Difference-in-differences with Multiple Time Periods," *Journal of Econometrics*, 2021, *225* (2), 200–230.

Cengiz, Doruk, A. Dube, A. Lindner, and Ben Zipperer, "The Effect of Minimum Wages on Low-wage Jobs," *Quarterly Journal of Economics*, 2019, *134* (3), 1405–1454.

Chamley, Christophe, "Delays and Equilibria with Large and Small Information in Social Learning," *European Economic Review*, 2004, *48* (3), 477–501.

Chen, Cheng and Claudia Steinwender, "Import competition, Heterogeneous Preferences of Managers, and Productivity," *Journal of International Economics*, 2021, *133*, 103533.

Chen, Ming, Wen Chen, Ling Feng, Zhiyuan Li, and Deborah Swenson, "The Chilling Effects of Unsuccessful Antidumping Investigations on Firm Export Dynamics," *Journal of Development Economics*, 2025, p. 103610.

Chousakos, Kyriakos, Gary Gorton, and Guillermo Ordoñez, "Information Dynamics and Macro Fluctuations," *American Economic Journal: Macroeconomics*, 2023, *15* (4), 372–400.

Ciliberto, Federico and Ina C. Jäkel, "Superstar Exporters: An Empirical Investigation of Strategic Interactions in Danish Export Markets," *Journal of International Economics*, 2021, *129*, 103405.

Coibion, Olivier, Dimitris Georgarakos, Yuriy Gorodnichenko, Geoff Kenny, and Michael Weber, "The Effect of Macroeconomic Uncertainty on Household Spending," *American Economic Review*, 2024, *114* (3), 645–677.

Crowley, Meredith, Ning Meng, and Huasheng Song, "Tariff Scares: Trade Policy Uncertainty and Foreign Market Entry by Chinese Firms," *Journal of International Economics*, 2018, *114*, 96–115.

Dew-Becker, Ian and Stefano Giglio, "Cross-sectional Uncertainty and the Business Cycle: Evidence from 40 Years of Options Data," *American Economic Journal: Macroeconomics*, 2023, *15* (2), 65–96.

Dickstein, Michael J and Eduardo Morales, "What Do Exporters Know?," *Quarterly Journal of Economics*, 2018, *133* (4), 1753–1801.

Ding, Haoyuan, Xiao Li, and Jiezhou Ying, "Anti-dumping Policies and International Portfolio Allocation: The View from the Global Funds," *China & World Economy*, 2023, *31* (2), 58–83.

Dong, Ding, Allen Hu, Zhaorui Li, and Zheng Liu, "Information Acquisition and the Finance-Uncertainty Trap," *Available at SSRN 5343049*, 2025.

Duval, Romain, Gee Hee Hong, and Yannick Timmer, "Financial Frictions and the Great Productivity Slowdown," *Review of Financial Studies*, 2020, *33* (2), 475–503.

Fajgelbaum, Pablo D., Edouard Schaal, and Mathieu Taschereau-Dumouchel, "Uncertainty Traps," *Quarterly Journal of Economics*, 2017, *132* (4), 1641–1692.

Favara, Giovanni, Janet Gao, and Mariassunta Giannetti, "Uncertainty, Access to Debt, and Firm Precautionary Behavior," *Journal of Financial Economics*, 2021, *141* (2), 436–453.

Feng, Ling, Zhiyuan Li, and Deborah L. Swenson, "Trade Policy Uncertainty and Exports: Evidence from China's WTO Accession," *Journal of International Economics*, 2017, *106*, 20–36.

Feng, Yusheng, Haishi Li, Siwei Wang, and Min Zhu, "Industrial Policy and Retaliatory Protection under the WTO: Lessons from China," Technical Report, CESifo Working Paper 2025.

Forni, Mario, Luca Gambetti, and Luca Sala, "Downside and Upside Uncertainty Shocks," *Journal of the European Economic Association*, 2025, *23* (1), 159–189.

Frick, Mira and Yuhta Ishii, "Innovation Adoption by Forward-looking Social Learners," *Theoretical Economics*, 2024, *19* (4), 1505–1541.

Gaba, Vibha and Ann Terlaak, "Decomposing Uncertainty and Its Effects on Imitation in Firm Exit Decisions," *Organization Science*, 2013, *24* (6), 1847–1869.

Gao, Lin, Steffen Hitzemann, Ivan Shaliastovich, and Lai Xu, "Oil Volatility Risk," *Journal of Financial Economics*, 2022, *144* (2), 456–491.

Graziano, Alejandro G., Kyle Handley, and Nuno Limão, "Brexit Uncertainty and Trade Disintegration," *The Economic Journal*, 2021, *131* (635), 1150–1185.

Guceri, Irem and Maciej Albinowski, "Investment Responses to Tax Policy under Uncertainty," *Journal of Financial Economics*, 2021, *141* (3), 1147–1170.

Handley, Kyle, "Exporting under Trade Policy Uncertainty: Theory and Evidence," *Journal of International Economics*, 2014, *94* (1), 50–66.

_ and J Frank Li, "Measuring the Effects of Firm Uncertainty on Economic Activity: New Evidence from One Million Documents," Technical Report, National Bureau of Economic Research 2020.

_ and Nuno Limão, "Policy Uncertainty, Trade, and Welfare: Theory and Evidence for China and the United States," *American Economic Review*, 2017, *107* (9), 2731–2783.

_ and _ , "Trade Policy Uncertainty," *Annual Review of Economics*, 2022, *14* (1), 363–395.

Huang, Kenneth G, Nan Jia, and Yeyanran Ge, "Forced to Innovate? Consequences of United States' Anti-dumping Sanctions on Innovations of Chinese Exporters," *Research Policy*, 2024, *53* (1), 104899.

Ilut, Cosmin and Hikaru Saijo, "Learning, Confidence, and Business Cycles," *Journal of Monetary Economics*, 2021, *117*, 354–376.

_ , Matthias Kehrig, and Martin Schneider, "Slow to Hire, Quick to Fire: Employment Dynamics with Asymmetric Responses to News," *Journal of Political Economy*, 2018, *126* (5), 2011–2071.

Jabbour, Liza, Zhigang Tao, Enrico Vanino, and Yan Zhang, "The Good, the Bad and the Ugly: Chinese Imports, European Union Anti-dumping Measures and Firm Performance," *Journal of International Economics*, 2019, *117*, 1–20.

Jeon, Jihye, "Learning and Investment under Demand Uncertainty in Container Shipping," *RAND Journal of Economics*, 2022, *53* (1), 226–259.

Kopytov, Alexandr, Bineet Mishra, Kristoffer Nimark, and Mathieu Taschereau-Dumouchel, "Endogenous Production Networks under Supply Chain Uncertainty," *Econometrica*, 2024, *92* (5), 1621–1659.

Kozlowski, Julian, Laura Veldkamp, and Venky Venkateswaran, "Scarring Body and Mind: the Long-term Belief-scarring Effects of Covid-19," Technical Report, National Bureau of Economic Research 2020.

Krishnamurthy, Arvind and Wenhao Li, "Dissecting Mechanisms of Financial Crises: Intermediation and Sentiment," *Journal of Political Economy*, 2025, *133* (3), 935–985.

Kumar, Saten, Yuriy Gorodnichenko, and Olivier Coibion, "The Effect of Macroeconomic Uncertainty on Firm Decisions," *Econometrica*, 2023, *91* (4), 1297–1332.

Lakdawala, Aeimit and Timothy Moreland, "Firm-level uncertainty and the Transmission of Monetary Policy," *Review of Economics and Statistics*, 2024, pp. 1–28.

Li, Jiatao, Cuili Qian, and Fiona K. Yao, "Confidence in Learning: Inter-and Intraorganizational Learning in Foreign Market Entry Decisions," *Strategic Management Journal*, 2015, *36* (6), 918–929.

Liu, Ernest, Yukun Liu, Vladimir Smirnyagin, and Aleh Tsyvinski, "Supply Chain Disruptions, Supplier Capital, and Financial Constraints," 2025.

Lu, Yi, Zhigang Tao, and Yan Zhang, "How Do Exporters Respond to Antidumping Investigations?," *Journal of International Economics*, 2013, *91* (2), 290–300.

Ludvigson, Sydney C, Sai Ma, and Serena Ng, "Uncertainty and Business Cycles: Exogenous Impulse or Endogenous Response?," *American Economic Journal: Macroeconomics*, 2021, *13* (4), 369–410.

Luo, Kaicheng, Shaoda Wang, and David Y Yang, "Laboratories of Autocracy: Landscape of Central–Local Dynamics in China's Policy Universe," Technical Report, National Bureau of Economic Research 2025.

Maggio, Marco Di, Amir Kermani, Rodney Ramcharan, Vincent Yao, and Edison Yu, "The Pass-through of Uncertainty Shocks to Households," *Journal of Financial Economics*, 2022, *145* (1), 85–104.

Meinen, Philipp, Pierpaolo Parrotta, Davide Sala, and Erdal Yalcin, "Managers as Knowledge Carriers–Explaining Firms' Internationalization Success with Manager Mobility," *Journal of International Economics*, 2022, *138*, 103633.

Melitz, Marc J., "The Impact of Trade on Intra-industry Reallocations and Aggregate Industry Productivity," *Econometrica*, 2003, *71* (6), 1695–1725.

Miescu, Mirela and Raffaele Rossi, "COVID-19-induced Shocks and Uncertainty," *European Economic Review*, 2021, *139*, 103893.

Nieuwerburgh, Stijn Van and Laura Veldkamp, "Learning Asymmetries in Real Business Cycles," *Journal of Monetary Economics*, 2006, *53* (4), 753–772.

Novy, Dennis and Alan M Taylor, "Trade and Uncertainty," *Review of Economics and Statistics*, 2020, *102* (4), 749–765.

Ouimet, Paige and Geoffrey Tate, "Learning from Coworkers: Peer Effects on Individual Investment Decisions," *Journal of Finance*, 2020, *75* (1), 133–172.

Prusa, Thomas J, Robert Teh, and Min Zhu, "PTAs and the Incidence of Antidumping Disputes," *Journal of International Economics*, 2022, *138*, 103630.

Sager, Erick and Olga A Timoshenko, "Demand uncertainty, selection, and trade," 2024.

Sandkamp, Alexander, "The Trade Effects of Antidumping Duties: Evidence from the 2004 EU Enlargement," *Journal of International Economics*, 2020, *123*, 103307.

Straub, Ludwig and Robert Ulbricht, "Endogenous Uncertainty and Credit Crunches," *Review of Economic Studies*, 2024, *91* (5), 3085–3115.

Tian, Can, "Learning and Firm Dynamics in a Stochastic Equilibrium," *Journal of Economic Theory*, 2022, *203*, 105486.

Timoshenko, Olga A, "Product switching in a model of learning," *Journal of International Economics*, 2015, *95* (2), 233–249.

Vandenbussche, Hylke and Maurizio Zanardi, "The Chilling Trade Effects of Antidumping Proliferation," *European Economic Review*, 2010, *54* (6), 760–777.

Wagner, Rodrigo and Andrés Zahler, "New Exports from Emerging Markets: Do Followers Benefit from Pioneers?," *Journal of Development Economics*, 2015, *114*, 203–223.

Zeira, Joseph, "Informational Cycles," *Review of Economic Studies*, 1994, *61* (1), 31–44.

Appendices

Appendix A Statistics of AD Investigations& Detailed Results

A.1 Facts of Anti-Dumping Investigations against China

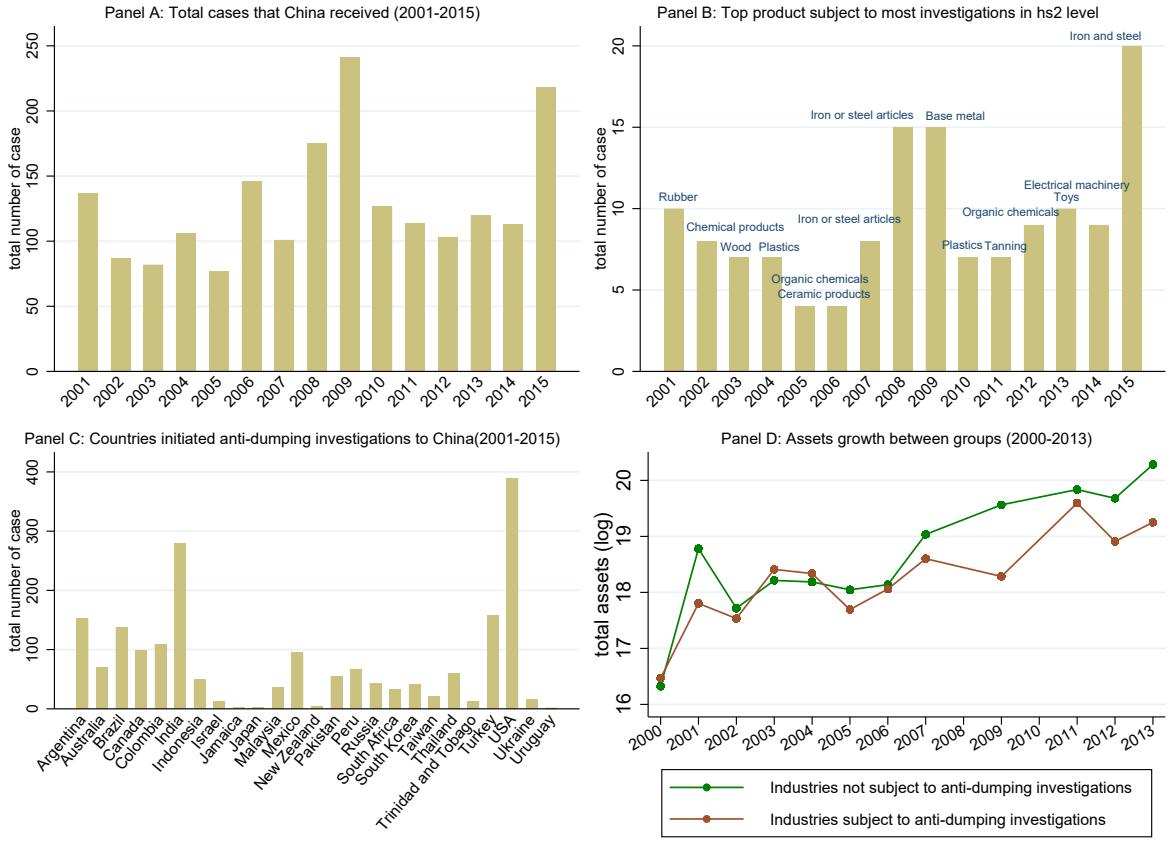


Figure A1: Statistics of AD Investigation Cases Against China

Table A1: Statistics of AD Investigation Cases Against China

Number of cases (2001-2015)	Dumping Decision (Preliminary)	Injury Decision (Preliminary)
68	Affirmative (97%)	Affirmative (96%)

37	Affirmative (73%)	Affirmative (62%)
83	Affirmative (72%)	Affirmative (72%)
33	Affirmative (97%)	Affirmative (76%)
41	Affirmative (88%)	Affirmative (88%)
144	Affirmative (85%)	Affirmative (85%)
19	Affirmative (58%)	Affirmative (53%)
19	Affirmative (79%)	Affirmative (79%)
6	Affirmative (84%)	Affirmative (84%)
1	Affirmative (100%)	Affirmative (100%)
3	Affirmative (67%)	Affirmative (67%)
11	Affirmative (73%)	Affirmative (73%)
50	Affirmative (78%)	Affirmative (78%)
5	Affirmative (80%)	Affirmative (80%)
17	Affirmative (59%)	Affirmative (59%)
16	Affirmative (75%)	Affirmative (75%)
1	Affirmative (0%)	Affirmative (0%)
12	Affirmative (92%)	Affirmative (92%)
24	Affirmative (75%)	Affirmative (54%)
22	Affirmative (82%)	Affirmative (82%)
2	Affirmative (100%)	Affirmative (100%)
82	Affirmative (87%)	Affirmative (87%)
109	Affirmative (85%)	Affirmative (88%)
8	Affirmative (100%)	Affirmative (100%)
1	Affirmative (100%)	Affirmative (100%)
10	Affirmative (70%)	Affirmative (70%)

A.2 Detailed Results of Baseline Estimation

Table A2: Baseline Estimation Results

	Dependent Variable: $\ln Entrants_{jkt}$			
	(1)	(2)	(3)	(4)
$AD_{jk} \times T_{-11}$	0.0606	0.1264*	0.0531	0.1068
	(0.0605)	(0.0745)	(0.0786)	(0.0736)
$AD_{jk} \times T_{-10}$	-0.0145	0.0186	-0.0172	0.0055
	(0.0483)	(0.0648)	(0.0665)	(0.0637)
$AD_{jk} \times T_{-9}$	0.0031	0.1177*	0.1180*	0.1175*
	(0.0492)	(0.0685)	(0.0701)	(0.0667)
$AD_{jk} \times T_{-8}$	-0.0573	-0.0179	-0.0280	-0.0407
	(0.0441)	(0.0631)	(0.0638)	(0.0620)
$AD_{jk} \times T_{-7}$	0.0159	0.0226	-0.0409	0.0003
	(0.0374)	(0.0561)	(0.0575)	(0.0556)
$AD_{jk} \times T_{-6}$	-0.0113	0.0377	0.0184	0.0161
	(0.0332)	(0.0527)	(0.0539)	(0.0521)
$AD_{jk} \times T_{-5}$	-0.0149	-0.0395	-0.0576	-0.0593
	(0.0320)	(0.0529)	(0.0553)	(0.0529)
$AD_{jk} \times T_{-4}$	0.0424	0.0177	-0.0221	0.0022
	(0.0300)	(0.0480)	(0.0492)	(0.0472)
$AD_{jk} \times T_{-3}$	0.0025	-0.0352	-0.0663	-0.0555
	(0.0270)	(0.0429)	(0.0444)	(0.0424)
$AD_{jk} \times T_{-2}$	0.0536**	0.0645	0.0408	0.0535
	(0.0242)	(0.0416)	(0.0428)	(0.0412)
$AD_{jk} \times T_{0}$	-0.0378*	-0.0340	-0.0290	-0.0351
	(0.0229)	(0.0377)	(0.0391)	(0.0375)
$AD_{jk} \times T_{1}$	-0.1377***	-0.1145***	-0.1298***	-0.1197***
	(0.0239)	(0.0381)	(0.0392)	(0.0376)
$AD_{jk} \times T_{2}$	-0.1268***	-0.1203***	-0.1279***	-0.1220***
	(0.0259)	(0.0449)	(0.0449)	(0.0442)
$AD_{jk} \times T_{3}$	-0.0834***	-0.0986*	-0.0974*	-0.0967*
	(0.0273)	(0.0532)	(0.0529)	(0.0520)
$AD_{jk} \times T_{4}$	-0.1190***	-0.1773***	-0.1720***	-0.1683***
	(0.0278)	(0.0531)	(0.0523)	(0.0522)
$AD_{jk} \times T_{5}$	-0.1097***	-0.0810	-0.0925*	-0.0887*

Continued on next page

Table A2: (Continued)

	Dependent Variable: ln $Entrants_{jkt}$			
	(1)	(2)	(3)	(4)
	(0.0280)	(0.0507)	(0.0510)	(0.0497)
$AD_{jk} \times T_6$	-0.0855***	-0.1437**	-0.1587***	-0.1615***
	(0.0298)	(0.0603)	(0.0598)	(0.0584)
$AD_{jk} \times T_7$	-0.0708**	-0.1084*	-0.1297**	-0.1179**
	(0.0319)	(0.0606)	(0.0604)	(0.0592)
$AD_{jk} \times T_8$	-0.1390***	-0.1561**	-0.1721***	-0.1675***
	(0.0330)	(0.0648)	(0.0628)	(0.0626)
$AD_{jk} \times T_9$	-0.1576***	-0.1665**	-0.1798**	-0.1778**
	(0.0363)	(0.0733)	(0.0707)	(0.0703)
$AD_{jk} \times T_{10}$	-0.1212***	-0.2821***	-0.2695***	-0.2777***
	(0.0386)	(0.0831)	(0.0788)	(0.0786)
$AD_{jk} \times T_{11}$	-0.1318***	-0.2258***	-0.2385***	-0.2413***
	(0.0380)	(0.0722)	(0.0692)	(0.0695)
$AD_{jk} \times T_{12}$	-0.1246***	-0.2609**	-0.2703***	-0.2829***
	(0.0444)	(0.1076)	(0.0975)	(0.0972)
$Tariff_{jkt}$	-0.0079**	-0.0090**	-0.0097***	-0.0090***
	(0.0031)	(0.0035)	(0.0035)	(0.0035)
Cons	2.3179***	2.1985***	2.2098***	2.2056***
	(0.0275)	(0.0309)	(0.0316)	(0.0311)
Obs	55,310	41,593	41,621	42,161
R^2	0.950	0.946	0.946	0.946
HS6-Year FE	✓	✓	✓	✓
HS6-Country FE	✓	✓	✓	✓
HS2-Country-Year FE	✓	✓	✓	✓
Cohort FE	✓	✓	✓	✓

A.3 Results under different regression strategies

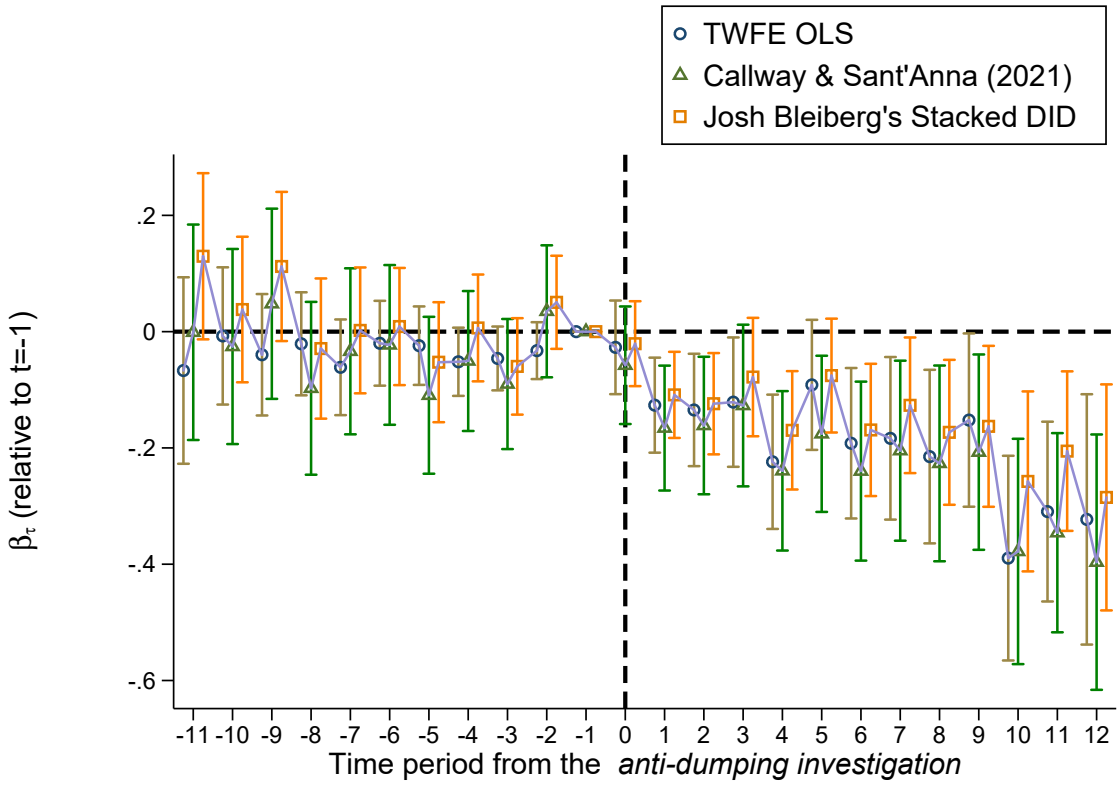


Figure A2: Baseline Results under various strategies (only 'non-affirmative' cases)

Appendix B More Evidence on Persistent Effects of AD Investigations

B.1 Alternative Measure of Explained Variable

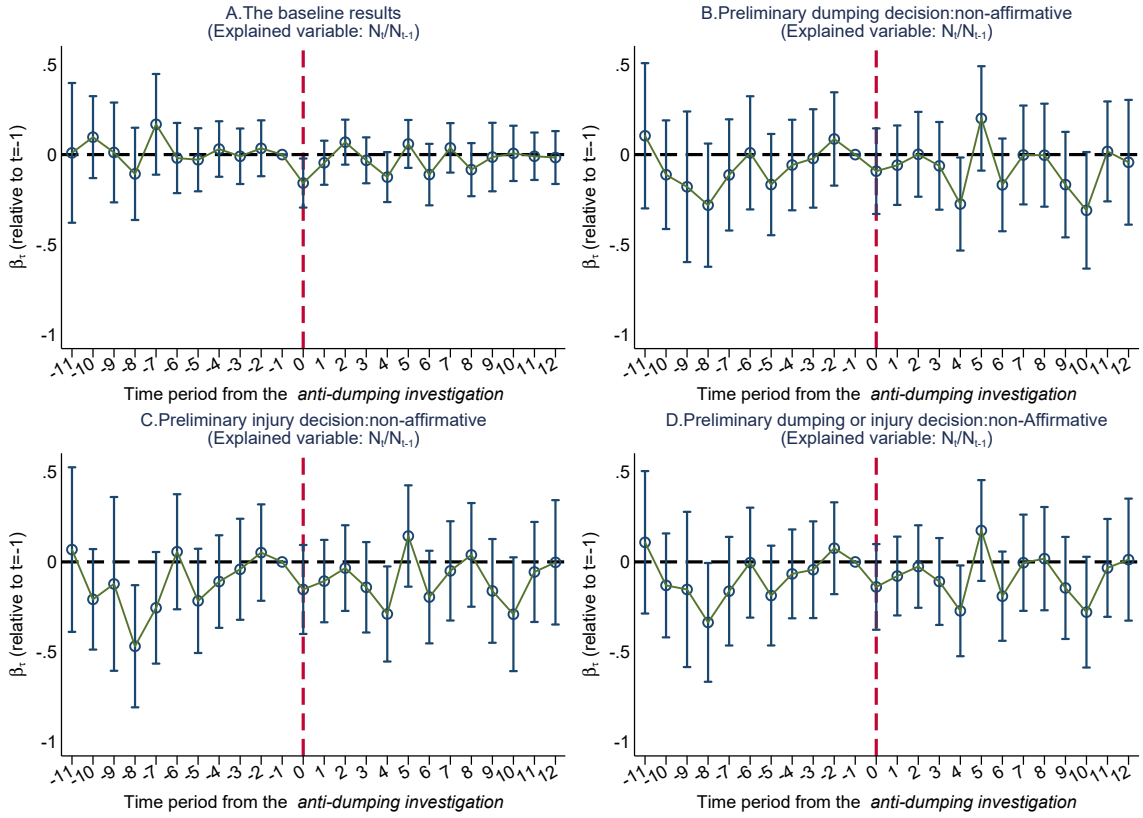


Figure B1: Alternative Measure of Explained Variable ($\frac{N_t}{N_{t-1}}$)

B.2 Reactions to AD Investigations in Product and Country Scope

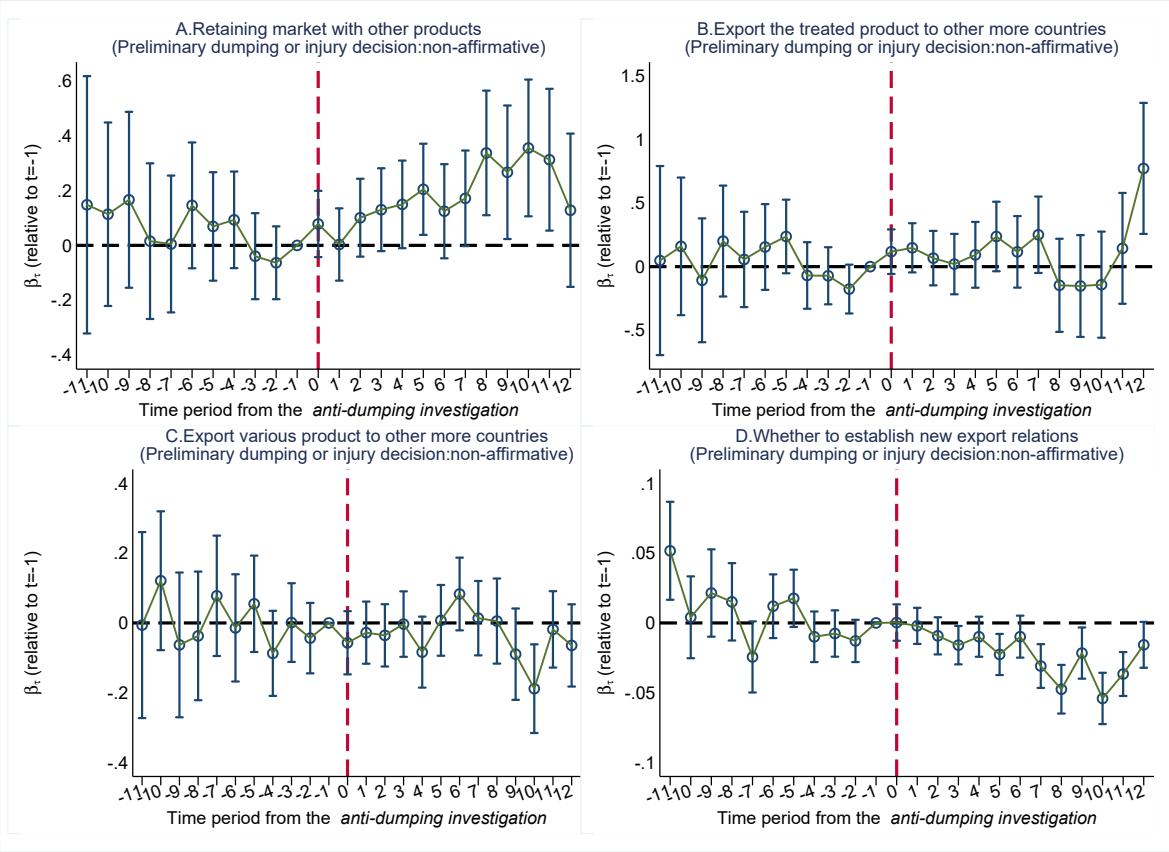


Figure B2: Evidence of Export relation

B.3 Addressing the Concerns of Risk

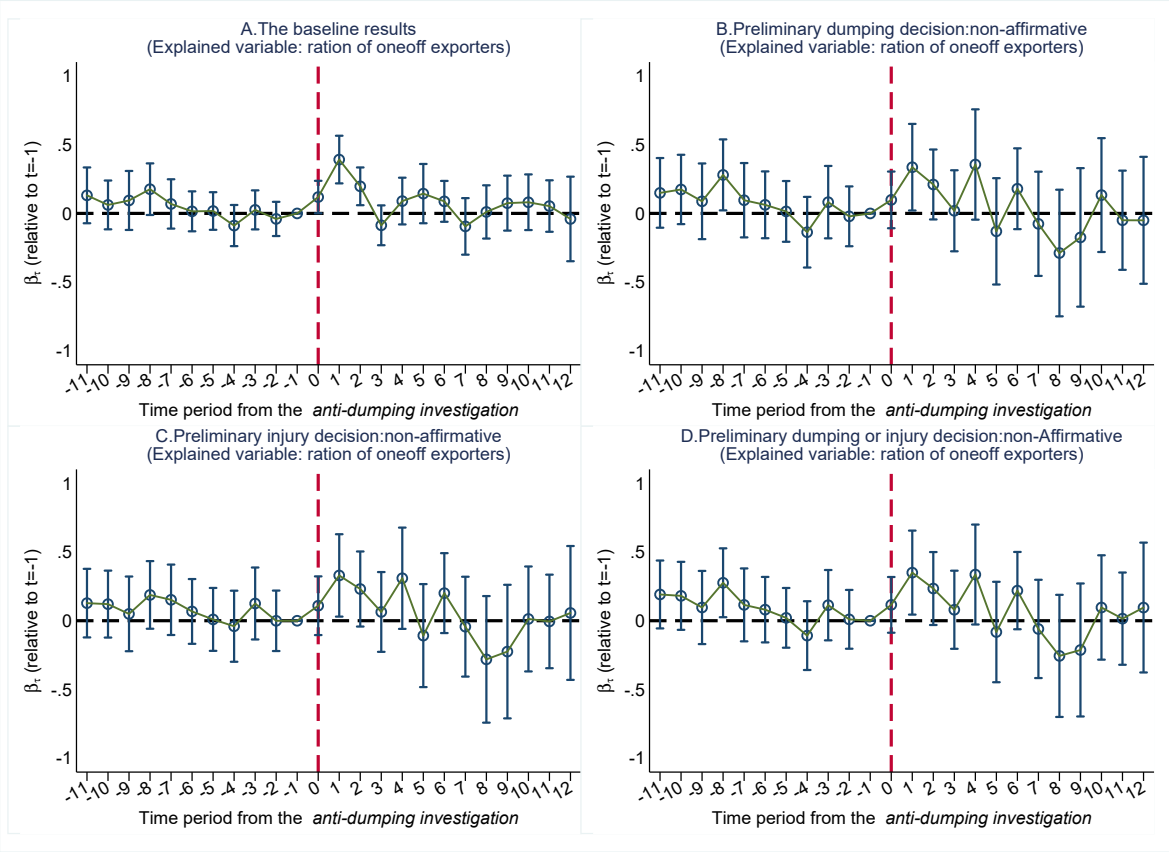


Figure B3: Oneoff exports with considerations of risk in destination

B.4 Robustness Checks

Figure B4 displays regression results after considering the scope and magnitude of AD investigation impacts. To mitigate disruptions from industries less or more affected by AD investigations, industries with product categories at the HS 8-digit level that are below the 15% percentile or above the 85% percentile in AD investigation incidence were excluded. Further consideration was given to industries frequently subjected to AD investigations by the same country, with results depicted in the bottom-right chart. Across all charts, the interaction term coefficients remain significantly negative at the 95% confidence level, and the trend of increasing absolute values of coefficients continues.

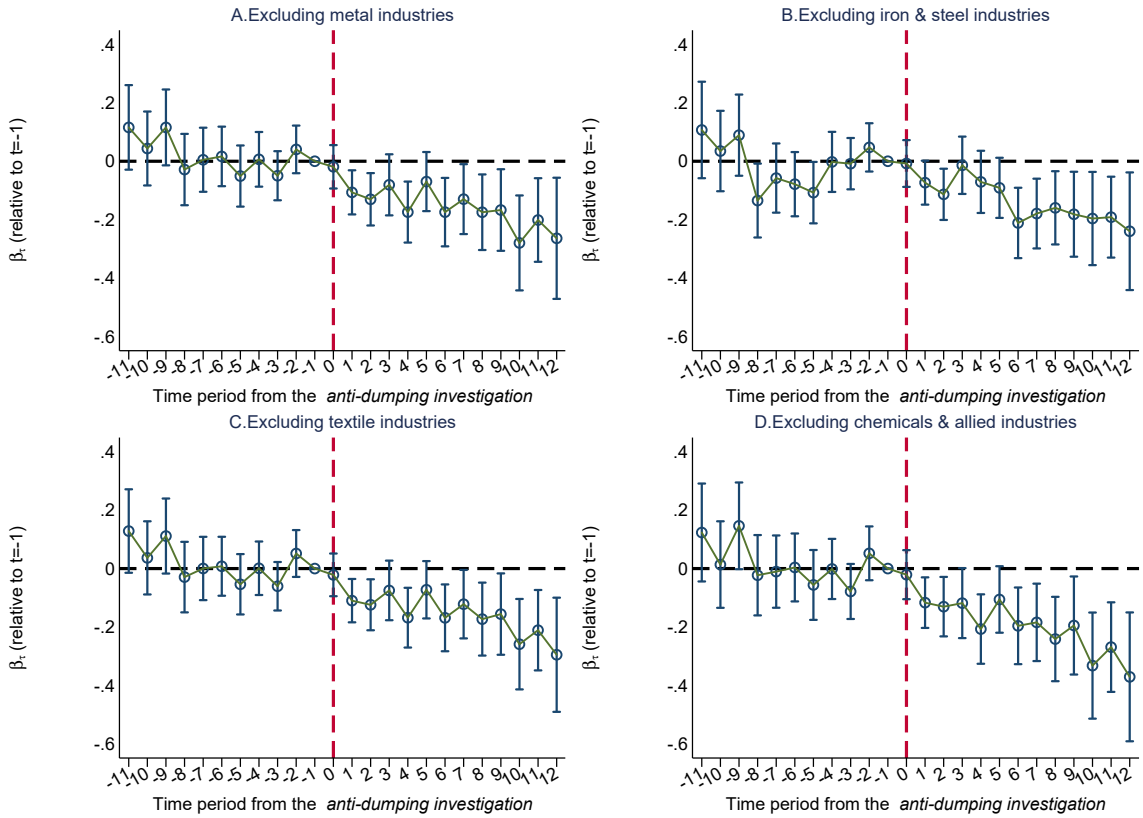


Figure B4: Robustness Check — Excluding Special-Investigation Related Industries

Figure B5 presents regression results. The interaction term coefficients across the three adjusted charts remain significantly negative at the 95% confidence level, and their absolute values continue to display a rising trend, which ensures our results are not driven by special investigations targeting some industries.

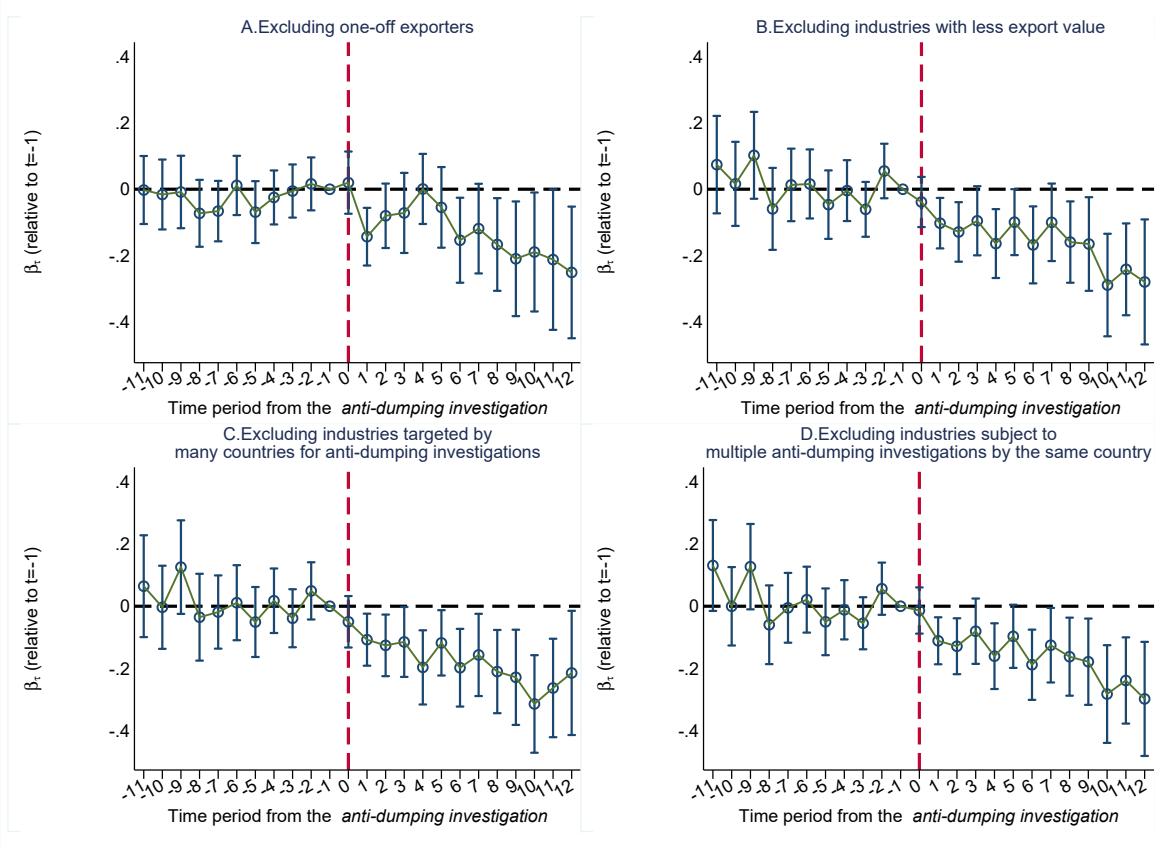


Figure B5: Robustness Check — Excluding Special Export Value Industries

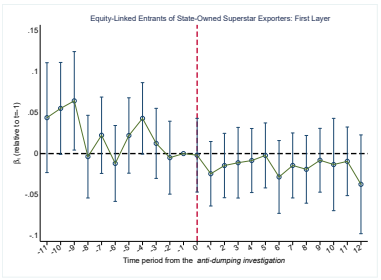
Although AD investigations by destination countries are relatively exogenous to firms, some industries are more prone to such investigations, particularly those with high import volumes (Sandkamp, 2020). This paper excludes samples from industries exporting either below the 15% percentile or above the 85% percentile to the same destination country to minimize bias from less likely or more likely targeted industries. Additionally, due to frequent AD investigations, samples from the textile and steel industries, where China has a comparative advantage in export market, are also excluded.

Figure B5 compares the baseline results with the dynamic treatment effects after excluding some special samples. The top left shows baseline results, the top right and bottom left show results of excluding industries with low and high export values, and the bottom right after excluding textile and steel industries. The coefficients of interaction terms remain significantly negative in all estimates, and the absolute values of the regression coefficients continue to show an increasing trend, confirming the robustness and credibility of the baseline results.

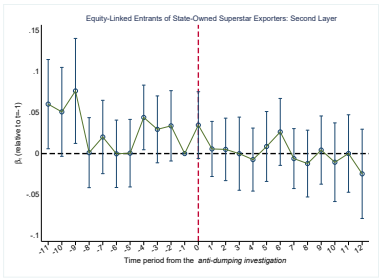
Considering that the degree of competition in an industry can be a factor in firms' choice

of whether to enter the destination country market, and that competition among firms may also make the industry a target of AD investigations in the destination country (Blonigen and Park, 2004), we need to mitigate the estimation bias possibly driven by the degree of industry competition. To do so, we use the number of firms and the HHI index as a measure of the competition degree in the industry, respectively, and further exclude the industries with a low degree of competition as well as those with a high degree of competition, with the specific results as shown in Figure A4. The lower right figure shows the regression results after excluding industries exporting to the same destination country but with HHI indexes above the 70% percentile. The coefficients of the interaction terms are significantly negative in all periods, which once again ensures the robustness of the benchmark results.

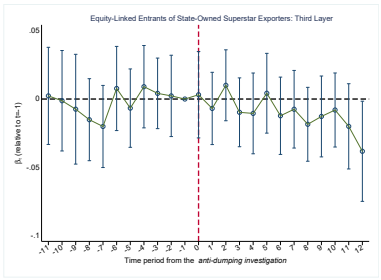
Appendix C Other Evidence of Superstars' Information Diffusion to Equity-Linked Entrants



(a) Equity-Linked Entrants of SOE Superstars (1st Tier)



(b) Equity-Linked Entrants of SOE Superstars (2nd Tier)



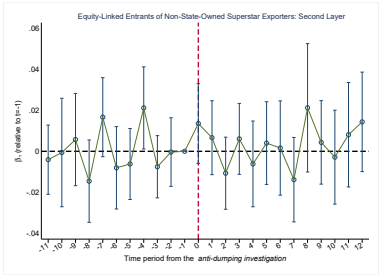
(c) Equity-Linked Entrants of SOE Superstars (3rd Tier)

Figure C1: Entrants with Multi-layer Equity-Linked of SOE Superstars

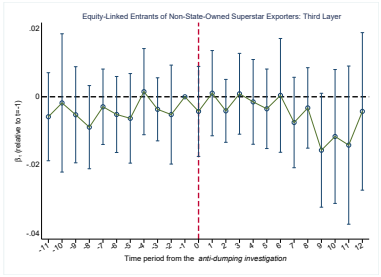
Notes: Figure C1 shows the effect of AD investigations on the number of new entrants which establish equity linkage with SOE superstar exporters. The line segment perpendicular to the horizontal axis corresponds to the 95% confidence interval of the regression coefficients for each period, and the dots correspond to the regression coefficients for each period. (a),(b),(c) reports the results which the explained variable is equity-linked entrants in the the first tier of SOE superstars, equity-linked entrants in the the second tier of SOE superstars, and equity-linked entrants in the third frst tier of SOE superstars, respectively. Standard errors are clustered by HS-6 digit-destination country group.



(a) Equity-Linked Entrants of non-SOE Superstar Exporters (1st Tier)



(b) Equity-Linked Entrants of non-SOE Superstar Exporters (2nd Tier)



(c) Equity-Linked Entrants of non-SOE Superstar Exporters (3rd Tier)

Figure C2: Entrants with Multi-layer Equity-Linked of non-SOE Superstar Exporters

Notes: Figure C2 shows the effect of AD investigations on the number of new entrants which establish equity linkage with non-SOE superstar exporters. The line segment perpendicular to the horizontal axis corresponds to the 95% confidence interval of the regression coefficients for each period, and the dots correspond to the regression coefficients for each period. (a),(b),(c) reports the results which the explained variable is equity-linked entrants in the the first tier of non- SOE superstars, equity-linked entrants in the the second tier of non-SOE superstars, and equity-linked entrants in the third frst tier of non-SOE superstars, respectively. Standard errors are clustered by HS-6 digit-destination country group.

Appendix D Social Learning and Firm Entry under AD Investigations

D.1 Learning from normal peer firms

In this section, we investigate whether normal peer firms' response play a role. The most important feature of AD investigation is uncertainty about whether the tariff will be imposed and how long it might take. Firms respond to the resulting uncertainty in diverse ways and the diversity of response shapes an potential entrant's judgement about the market and is less likely to enter. We quantify this variation using two measures. The first is turnover of exportersdefined as sum of new entrants and exits normalized by the total number of exporters for a given HS-6 product and destination country. The second is variance of export value for a specific HS-6 product and destination. Greater information asymmetry lowers the likelihood that potential exporters will enter a market under investigation. We formally examine this hypothesis by estimating the following equation:

$$\begin{aligned} \ln Entrants_{jkt} = \text{Cons.} + \beta \times AD_{jkt} \times Turnover_{jkt} + X\gamma \\ + FE_{jk} + FE_{kt} + FE_{rt} + FE_{cohort} + \varepsilon_{jkt} \end{aligned} \tag{D.1}$$

The estimation results are shown in Table D1. In Columns (1) through (5), we measure turnover in different dimensions, based on the hypothesis that information sharing could occur along various lines. The coefficient of the interaction term, $AD_{jkt} \times Turnover_{jkt-1}$, is significantly negative, indicating that greater dispersion in firms' responses to the investigation reduces the likelihood of new firm entry. On the contrast, $Tariff_{jkt} \times Turnover_{jkt-1}$ is insignificant in almost all the columns. This finding is consistent with our hypothesis, as the information dispersion only plays a role in the scenario of uncertainty (AD investigation), not the in the case of certainty (import tariff).

Table D1: Learning from normal peer firms

	(1)	(2)	(3)	(4)
	All cases		non-Affirmative cases	
Learning Dimension:	HS4-Country	HS4-City	HS4-Country	HS4-City
AD_{jkt}	-0.0483**		-0.0025	
	(0.0234)		(0.0361)	
$Turnover_{jkt}$	-0.6065***		-0.5485***	
	(0.0558)		(0.0659)	
$AD_{jkt} \times Turnover_{jkt}$	-0.1860**	0.0057	-0.4091***	-0.0002
	(0.0787)	(0.0139)	(0.1365)	(0.029)
$Tariff_{jkt}$	-0.0040		-0.0025	
	(0.0025)		(0.0028)	
$Tariff_{jkt} \times Turnover_{jkt}$	-0.0085**	-0.0016	-0.0106***	-0.0068***
	(0.0034)	(0.0015)	(0.004)	(0.002)
Cons	2.3368***	0.6486***	2.2043***	0.6537***
	(0.0242)	(0.0116)	(0.0268)	(0.0158)
Obs	64,194	645,582	52,576	439,548
R^2	0.899	0.855	0.89	0.85
Country-Year FE	✓		✓	
HS4-Year FE	✓		✓	
Country-HS6 FE	✓		✓	
Cohort FE	✓	✓	✓	✓
Country-Year-City FE		✓		✓
HS6-City-Country FE		✓		✓
Country-HS6-Year FE		✓		✓
HS4-City-Year FE		✓		✓

Notes: The dependent variable is number of entrants exporting product j to country k in year t. $AD_{jkt} \times Turnover_{jkt}$ is key explanatory variable capturing the effect of information dispersion on a firm's response to investigation. Standard errors are clustered by HS-6 digit product-destination country group. *** p<0.01, ** p<0.05, * p<0.1.

In Table D2, we measure the dispersion of normal peer firms' response in a different way, i.e. the variance of export value by existing exporters and estimate the following equation:

$$\ln Entrants_{jkt} = \text{Cons.} + \beta \times AD_{jkt} \times Variance_{jkt} + X\gamma + FE_{jk} + FE_{kt} + FE_{jt} + \varepsilon_{jkt} \quad (5)$$

The results are qualitatively consistent with in Table D1. The coefficient of $AD_{jkt} \times Variance_{jkt}$ is significantly negative, suggesting that larger variance in export value by incumbent exporters after the investigation, less firms would enter that market. Again, the coefficients of $Tariff_{jkt} \times Variance_{jkt}$ are insignificant.

Table D2: Learning from normal peer firms

	(1)	(2)	(3)	(4)	(5)	(6)
	All cases			non-Affirmative cases		
Learning Dimension:	HS4-country	HS2-country	HS4-City-Country	HS4-country	HS2-country	HS4-City-Country
AD_{jkt}	-0.0798***	-0.0497		-0.0155	0.0194	
	(0.0289)	(0.0327)		(0.043)	(0.0512)	
$Variance_{jkt-1}$	0.0008	-0.0007	-0.0019***	0.0006	-0.001	-0.0022**
	(0.0018)	(0.0021)	(0.0008)	(0.0021)	(0.0023)	(0.0009)
$AD_{jkt} \times Variance_{jkt-1}$	-0.0028	-0.0042*	-0.0007	-0.0089**	-0.0092**	-0.0000
	(0.0025)	(0.0025)	(0.0006)	(0.0042)	(0.0044)	(0.0016)
$Tariff_{jkt}$	-0.0062**	-0.0081**		-0.0039	-0.0050	
	(0.0031)	(0.0031)		(0.0033)	(0.0034)	
$Tariff_{jkt} \times Variance_{jkt-1}$	0.0004***	0.0005***	0.0001*	0.0004**	0.0004**	0.0001
	(0.0002)	(0.0002)	(0.0001)	(0.0002)	(0.0002)	(0.0001)
Cons	2.3211***	2.3679***	0.8254***	2.1947***	2.2396***	0.7590***
	(0.0292)	(0.0313)	(0.0018)	(0.0311)	(0.034)	(0.0023)
Obs	55,243	56,387	405,621	45,023	45,895	283,260
R^2	0.879	0.887	0.865	0.869	0.878	0.86
Country-Year FE	✓	✓		✓	✓	
HS4-Year FE	✓	✓		✓	✓	
Country-HS6 FE	✓	✓		✓	✓	
Cohort FE	✓	✓	✓	✓	✓	✓
Country-Year-City FE			✓			✓
HS6-City-Country FE			✓			✓
Country-HS6-Year FE			✓			✓
HS4-City-Year FE			✓			✓

Notes: The dependent variable is the number of entrants exporting product j to country k in year t. $AD_{jkt} \times Variance_{jkt}$ is the key explanatory variable capturing the effect of information dispersion on a firm's response to investigation. Standard errors are clustered by HS-6 digit product-destination country group,*** p<0.01, ** p<0.05, * p<0.1.

D.2 Learning from Influential Firms

Information-sharing would extend beyond equity-linkage. Exporters are expected to obverse how influential firms respond to AD investigations. We define influential firms in two ways: first, as top exporters within the same HS-6 digit product category[22], and second, as intermediary firms in the destination market. Existing literature, such as Ciliberto and Jäkel (2021) and Jeon (2022), suggests that superstar firms possess an information advantage regarding market demand in destination countries. Building on this insight, we examine the impact of the exit of incumbent top firms in shaping other firms' export decisions after the investigation. We also take into account the geographic location of firms, as information sharing may be more pronounced when firms are located in the same city. Additionally, a significant portion of China's exports are facilitated by trade intermediaries, which play a key role in matching information between buyers and sellers. We hypothesize exporters would learn from intermediaries' response to the investigation. We formally examine this

[22]The definition of top exporters is consistent with in the previous section. The difference is we relax the assumption that information sharing occurs through equity linkage.

hypothesis by estimating the following equation:

$$\begin{aligned}\ln Entrants_{jkt} = \text{Cons.} + \beta \times AD_{jkt} \times Influential_{jkt-1} + X\gamma \\ + FE_{jk} + FE_{kt} + FE_{rt} + FE_{cohort} + \varepsilon_{jkt}\end{aligned} \tag{D.2}$$

The regression results are reported in Table D3. j, r, c, k, t and $cohort$ refer to HS-6 digit product, HS-4 digit product, city, country, year and corhort respectively. The dependent variable $\ln Entrants_{jkt}$ indicates number of entrants exporting product j to country k in year t. The dummy variable AD_{jkt} equals to 1 if product j is subject to an investigation by country k in yeat t. $Influential_{jkt-1}$ indicates $\ln Top_exit_{jkt-1}$ and $\ln Interjkt - 1$ respectively, i.e. the export value of the best exporter who exists from market and average number of intermediaries present in a given product-country. The interaction term captures whether influential firm plays a role. In order to disentangle the effect of AD investigation and regular tariff, we have average tariff rate and its interactions with learning measures controlled for in all the regressions, as included by variable X.

Column (1)-(3) report the estimation results with all AD investigations cases, while column (4)-(6) we define top exporter as firm whose export value ranked top 1 in a HS6-digit product-country, HS4-digit product-city-country, respectively. The interaction term $AD_{jkt} \times Top_exit_{jkt-1}$ measure whether the response of top exporter to investigation affect other exporters' response. The negative coefficient on the interaction term indicates that, the negative impact of investigation on firm entry, will be magnified by the size of top 1 exporter who exit. In other word, the top quitter's size carries more weight in information sharing. In column (4)-(6), we use the mean and median value of intermediaries number in a given HS6-digit product-country, to measure to what extent the information would be transmitted by the intermediary firms. The positive coefficients indicate that more intermediaries would mitigate the effect of investigations. Specifically, if there are more intermediaries in a given HS6-digit product-country, potential entrants would have more information about that market.

Table D3: Learning from influential firms

	(1)	(2)	(3)	(4)	(5)	(6)
	All cases			non-Affirmative cases		
	Superstar Exit		Trade intermediaries	Superstar Exit		Trade intermediaries
Learning Dimension:	HS4-country	HS4-country-city	HS6-country	HS4-country	HS4-country-city	HS6-country
AD_{jkt}	-0.0656***		-0.3843***	-0.0321		-0.4325***
	(0.0223)		(0.0478)	(0.0361)		(0.0734)
$\ln Top_exit_{jkt-1}$	-0.0040***	-0.0019***		-0.0040***	-0.0028***	
	(0.0009)	(0.0006)		(0.0010)	(0.0007)	
$AD_{jkt} \times \ln Top_exit_{jkt-1}$	-0.0011	0		-0.0062***	-0.001	
	(0.0013)	(0.0008)		(0.0024)	(0.0016)	
$AD_{jkt} \times \ln Inter_{jkt-1}$			0.0992***			0.1411***
			(0.0132)			(0.0237)
$Tariff_{jkt}$	-0.0073***		0.0241***	-0.0085***		0.0281***
	(0.0024)		(0.0040)	(0.0026)		(0.0045)
$Tariff_{jkt} \times \ln Top_exit_{jkt-1}$	0.0002***	-0.0000		0.0003***	0.0001	
	(0.0001)	(0.0001)		(0.0001)	(0.0001)	
$Tariff_{jkt} \times \ln Inter_{jkt-1}$			-0.0118***			-0.0127***
			(0.0010)			(0.0011)
Cons	2.2781***	0.6253***	2.6230***	2.1779***	0.5851***	2.4894***
	(0.0222)	(0.0024)	(0.0305)	(0.0243)	(0.0031)	(0.0343)
Obs	64,194	645,586	43,216	53,152	439,548	34,268
R^2	0.898	0.855	0.908	0.863	0.85	0.901
Country-Year FE	✓		✓	✓		✓
HS4-Year FE	✓		✓	✓		✓
Country-HS6 FE	✓		✓	✓		✓
Cohort FE	✓	✓	✓	✓	✓	✓
Country-Year-City FE		✓			✓	
HS6-City-Country FE		✓			✓	
Country-HS6-Year FE		✓			✓	
HS4-City-Year FE		✓			✓	

Appendix E Details for Proof of Equilibrium

Before the formal equilibrium proof, we list the lemmas and definitions that need to be used in the subsequent proofs.

E.1 lemma on the renewal of beliefs

Lemma 1. *The potential entrant's belief expectation μ obeys the following first-order stochastic process :*

$$s(n,\gamma)=\sqrt{D\left(\mu' \mid \mu,\gamma,n\right)}=\left(\frac{1}{\gamma}-\frac{1}{\gamma+\gamma_z+n\gamma_x}\right)^{\frac{1}{2}} \mu'=\mu+s(n,\gamma)\varepsilon, \quad \varepsilon\sim\mathcal{N}(0,1) \quad \text{(E.1)}$$

$$E\left(\mu' \mid \mu,\gamma,n\right)=\mu, \quad s(n,\gamma)=\sqrt{D\left(\mu' \mid \mu,\gamma,n\right)}=\left(\frac{1}{\gamma}-\frac{1}{\gamma+\gamma_z+n\gamma_x}\right)^{\frac{1}{2}}$$

and we can get:

$$s_n(n,\gamma)=\frac{\gamma_x\gamma^{\frac{1}{2}}}{2\left(\gamma_z+n\gamma_x\right)^{\frac{1}{2}}\left(\gamma+\gamma_z+n\gamma_x\right)^{\frac{3}{2}}}\geq 0, \quad s_\gamma(n,\gamma)=-\frac{\left(\gamma_z+n\gamma_x\right)^{\frac{1}{2}}\left(2\gamma+\gamma_z+n\gamma_x\right)}{2\gamma^{\frac{3}{2}}\left(\gamma+\gamma_z+n\gamma_x\right)^{\frac{3}{2}}}\leq 0$$

The above equation shows that the fluctuation of μ is monotonically increasing about γ and monotonically decreasing about the ex-ante belief accuracy, which is consistent with the previous analysis.Moreover, further solving can be obtained:

$$s_{nn}(n,\gamma)=s_n(n,\gamma)\left(-\frac{1}{2}\gamma_x\right)\left[\left(\gamma_z+n\gamma_x\right)^{-1}+3\left(\gamma+\gamma_z+n\gamma_x\right)^{-1}\right]\leq 0$$

$$s_{\gamma\gamma}(n,\gamma)=\frac{\left(\gamma_z+n\gamma_x\right)^{\frac{1}{2}}\gamma^{\frac{1}{2}}\left(\gamma+\gamma_z+n\gamma_x\right)^{\frac{1}{2}}\left[\left(2\gamma+\gamma_z+n\gamma_x\right)\left(2\gamma+3\gamma_z+3n\gamma_x\right)+4\gamma^2\right]}{4\gamma^3\left(\gamma+\gamma_z+n\gamma_x\right)^3}\geq 0$$

$$s_{n\gamma}(n,\gamma)=\frac{\gamma_x\gamma^{-\frac{1}{2}}}{4\left(\gamma_z+n\gamma_x\right)^{\frac{1}{2}}\left(\gamma+\gamma_z+n\gamma_x\right)^{\frac{5}{2}}}\left(\gamma_z+n\gamma_x-2\gamma\right), \text{ when } \gamma_z+n\gamma_x-2\gamma<0, s_{n\gamma}(n,\gamma)<0$$

$$s_{\gamma n}(n,\gamma)=-\frac{\left(\gamma_z+n\gamma_x\right)^{-\frac{1}{2}}\gamma}{4\gamma^{\frac{3}{2}}\left(\gamma+\gamma_z+n\gamma_x\right)^{\frac{5}{2}}}\left(2\gamma-\gamma_z-n\gamma_x\right), \text{ when } 2\gamma-\gamma_z-n\gamma_x<0, \quad s_{\gamma n}(n,\gamma)>0$$

To facilitate the later proof, we also need to solve supremum and infimum of s_n and s_γ, i.e.,

the number of consistent paradigms as follows:

$$\|s_n\| = \sup_{n\in[0,1],\gamma\in[\underline{\gamma},\bar{\gamma}]} \mid s_n\left(n,\gamma\mid = s_n\left(0,\frac{\gamma_z}{2}\right) = \frac{\gamma_x}{(3\gamma_z)^{\frac{3}{2}}}\right. \tag{E.2}$$

$$\left\|s_\gamma\right\| = \sup_{n\in[0,1],\gamma\in[\underline{\gamma},\bar{\gamma}]} \left|s_\gamma(n,\gamma)\right| = s_\gamma\left(\gamma_x^{-1}\left(2\underline{\gamma}-\gamma_z\right),\underline{\gamma}\right) = \left(\frac{2}{3\underline{\gamma}}\right)^{\frac{3}{2}} \tag{E.3}$$

$$\bar{\Gamma}_\gamma = \sup_{n\in[0,1],\gamma\in[\underline{\gamma},\bar{\gamma}]} \Gamma_\gamma(n,\gamma) = \left(\frac{\underline{\gamma}}{\underline{\gamma}+\gamma_z}\right)^2, \quad \underline{\Gamma}_\gamma = inf_{n\in[0,1],\gamma\in[\underline{\gamma},\bar{\gamma}]}\Gamma_\gamma(n,\gamma) = \left(\frac{\bar{\gamma}}{\bar{\gamma}+\gamma_z+\gamma_x}\right)^2$$

$$\bar{\Gamma}_n = \sup_{n\in[0,1],\gamma\in[\underline{\gamma},\bar{\gamma}]} \Gamma_\gamma(n,\gamma) = \gamma_x\bar{\Gamma}_\gamma, \quad \underline{\Gamma}_n = inf_{n\in[0,1],\gamma\in[\underline{\gamma},\bar{\gamma}]}\Gamma_\gamma(n,\gamma) = \gamma_x\underline{\Gamma}_\gamma$$

Lemma 2. *The process of updating the accuracy of potential entrants' beliefs can be represented as the function:*

$$\gamma'(n) = \left(\frac{1}{\gamma+n\gamma_x+\gamma_z}+\sigma_\tau^2\right)^{-1} = \Gamma(n,\gamma) \tag{E.4}$$

$\Gamma(n,\gamma)$ *is an increasing function about and ex-ante beliefs, so we can further get supremum and infimum of* Γ_n *and* Γ_γ *:*

$$\bar{\Gamma}_\gamma = \sup_{n\in[0,1],\gamma\in[\underline{\gamma},\bar{\gamma}]} \Gamma_\gamma(n,\gamma) = \left(\frac{\underline{\gamma}}{\underline{\gamma}+\gamma_z}\right)^2, \quad \underline{\Gamma}_\gamma = inf_{n\in[0,1],\gamma\in[\underline{\gamma},\bar{\gamma}]}\Gamma_\gamma(n,\gamma) = \left(\frac{\bar{\gamma}}{\bar{\gamma}+\gamma_z+\gamma_x}\right)^2$$

$$\bar{\Gamma}_n = \sup_{n\in[0,1],\gamma\in[\underline{\gamma},\bar{\gamma}]} \Gamma_\gamma(n,\gamma) = \gamma_x\bar{\Gamma}_\gamma, \quad \underline{\Gamma}_n = inf_{n\in[0,1],\gamma\in[\underline{\gamma},\bar{\gamma}]}\Gamma_\gamma(n,\gamma) = \gamma_x\underline{\Gamma}_\gamma$$

E.2 Defining the space in which beliefs reside

Because $\gamma(n)$ *is a monotonically increasing function, belief accuracy* γ *satisfies* $\bar{\gamma} = \Gamma(1,\bar{\gamma})$, $\underline{\gamma} = \Gamma(0,\underline{\gamma})$*, so we can decide that the boundary of* γ *is* $[\underline{\gamma},\bar{\gamma}] = [\gamma(0),\gamma(1)]$*, while belief expectations* $\mu \in [0,\infty)$*, Considering that the use of the compressed mapping principle needs to be defined in a continuous bounded space, we also need to restrict the values to one that encompasses all possible values within the scope of the discussion in this paper, namely* $\mu \in [\underline{\mu},\bar{\mu}]$.

Assumption 1. *To ensure that the interval in which it is located satisfies all possible values of*

the belief expectation update, we assume that the belief expectation μ' obeys a broken-tailed Markov process on $[\underline{\mu}, \bar{\mu}]$, as in the following equation:

$$\mu' = \min\{\max[\mu + s(n,\gamma)\varepsilon, \underline{\mu}], \bar{\mu}\} \tag{E.5}$$

Equation (E.5) similarly shows that the broken-tailed Markov process obeyed in μ' converges to the first-order stochastic process described in the text when the range of the interval $[\underline{\mu}, \bar{\mu}]$ is sufficiently large.

Definition 1. *Define an normed vector space $B(C), B(C)$ is a set containing a series of consecutive bounded functions., function $g : C \subseteq \mathbb{R}^l \to \mathbb{R}, l \in \mathbb{N}$, i.e. g is a mapping from a multidimensional vector space to a real number space, The consistent paradigm of g is expressed as $\|g\| = \sup_{x \in C} |g(x)| = \bar{g}$, and $\bar{g}$ is the supremum of g, $\underline{g}$ denotes infimum.*

Definition 2. *According to $\mu \in [\underline{\mu}, \bar{\mu}]$ and $\gamma \in [\underline{\gamma}, \bar{\gamma}], \mathcal{S} = [\underline{\mu}, \bar{\mu}] \times [\underline{\gamma}, \bar{\gamma}]$ is defined as a space where all $(\mu, \gamma)_{locate}$, In order to minimize the inconvenience caused by cumbersome formulas in the later analysis, $R : g \in B(\mathcal{S}) \to B(\mathbb{R} \times [\underline{\gamma}, \bar{\gamma}])$ is defined as a an extended function of g,i.e. definition domain $\mathcal{S} \to \mathbb{R} \times [\underline{\gamma}, \bar{\gamma}]$, the details are as follows:*

$$[R(g)](\mu,\gamma) = \begin{cases} g(\bar{\mu},\gamma) & \text{if } \mu > \bar{\mu} \\ g(\mu,\gamma) & \text{if } \bar{\mu} \geq \mu \geq \underline{\mu} \\ g(\mu,\gamma) & \text{if } \mu < \mu \end{cases} \tag{E.6}$$

And, according to the expectation of g and $R(g)$ can be computed as:

$$\begin{aligned} E[g \mid \mu,\gamma,n] = & \int_{(\underline{\mu}-\mu)/s(n,\gamma)}^{(\bar{\mu}-\mu)/s(n,\gamma)} g(\mu + s(n,\gamma)\varepsilon, \Gamma(n,\gamma))\Phi(d\varepsilon) \\ & + \Phi\left(\frac{\underline{\mu}-\mu}{s(n,\gamma)}\right) g(\underline{\mu}, \Gamma(n,\gamma)) + \left(1 - \Phi\left(\frac{\bar{\mu}-\mu}{s(n,\gamma)}\right)\right) g(\bar{\mu}, \Gamma(n,\gamma)) \\ = & \int_{-\infty}^{\infty} R(g)(\mu + s(n,\gamma)\varepsilon, \Gamma(n,\gamma))\Phi(d\varepsilon) \end{aligned} \tag{E.7}$$

Φ is the probability distribution function of the standard normal distribution.

E.3 Labor cost issues

Assumption 2. *Labor cost c_i defines the heterogeneity of firms, and it is assumed that the labor cost c_i of potential entrants in the industry obeys the F probability distribution, and the cumulative probability distribution function F is first-order derivable , when $F' = f > 0$ and $\int |f| dF < \infty$, Firms with labor costs below the critical cost will choose to enter , so $N\left(\mu, \gamma, \{c_i\}_{1 \le i \le \bar{N}}\right) = \sum_{i=1}^{\bar{N}} \Psi\left(c_i \le c'^{\,cutoff\,f}\right)$, When the total number of potential entrants in each period $\bar{N} \to \infty, n(\mu, \gamma) = F\left(c^{cutoff}(\mu, \gamma)\right)$*[23].

Definition 3. *Define a self-mapping $\mathcal{T} : c^{cutoff} \in B(\mathcal{S}) \to B(\mathcal{S})$, to make $\forall(\mu, \gamma) \in \mathcal{S}$, we can always get:*

$$\left[\mathcal{T} c^{cutoff\,f}\right](\mu, \gamma) = \left(\frac{A}{1-\beta}\right)^{\frac{1}{\sigma-1}} \underbrace{\left(1 - \beta - a e^{\frac{a^2}{2\gamma} + a\mu}\left(1 - \beta e^{\frac{a^2}{2}\sigma_\tau^2}\right)\right)^{\frac{1}{\sigma-1}}}_{S(\mu,\gamma)}$$
$$\cdot \underbrace{\left\{(1-\beta) f_e + \beta \iint \max\left[c_i - R\left(c^{cutoff}\right)(\mu + s(n(\mu,\gamma),\gamma)\varepsilon), \Gamma(n(\mu,\gamma),\gamma)\right), 0\right] F(dc_i)\,\Phi(d\varepsilon)\right\}^{\frac{1}{1-\sigma}}}_{P} \tag{E.8}$$

Definition 4. *Definition4: define $\mathcal{F}_0$ is a continuous bounded function, c^{cutoff} is monotonically decreasing about μ and monotonically increasing about $\gamma_\cdot, \mathcal{F}_0 \subset B(\mathcal{S})$. The supremum of function c^{cutoff} is $\overline{c^{cutoff}}, \overline{c^{cutoff}}$ is Lipschitz continuous about $\mu_{and}\,\gamma$, and the formula of $\overline{c^{cutoff}}$ is:*

$$\overline{c^{cutoff}} = \left|\frac{A}{1-\beta}\right|^{\frac{1}{\sigma-1}} \cdot \underbrace{\left|1 - \beta + a e^{\frac{a^2}{2\underline{\gamma}} + a\bar{\mu}}\left(1 - \beta e^{\frac{a^2}{2}\sigma_\tau^2}\right)\right|}_{H(H>0)}{}^{\frac{1}{\sigma-1}} \cdot \underbrace{\left|(1-\beta) f_e + \beta \int \left|c\left|dF - \beta \overline{c^{cutoff}}\right|\right|^{\frac{1}{1-\sigma}}}_{Q(Q>0)} \tag{E.9}$$

In fact, $\overline{c^{cutoff}}$ is not a global Lipschitz continuum under arbitrary conditions about μ and γ, We need to show that the condition of Lipschitz continuity is satisfied in order to clarify the basic premise when proving equilibrium using the compressive mapping principle later.

[23] In fact, the number of firms choosing to enter the market in each period satisfies a binomial distribution $N \mid \mu, \gamma \sim \text{Bin}\left(\bar{N}, F\left(c^{cutoff}(\mu, \gamma)\right)\right)$, i.e.under the assumption that the total number of potential entrants in each period is $\bar{N}$, the number of firms entering the market in the destination country N, equals the number of times event $\left\{c_j, c_j < c^{cutoff}\right\}$ occurs, while the share of firms entering the market n, equals the probability that event $F\left(c^{cutoff}(\mu, \gamma)\right)$ occurs.

The proof procedure is as follows: Solve for the partial differential of $\overline{c^{cutoff}}$ *with respect to* μ *and* γ *as* $\frac{\partial \overline{c^{cutoff}}}{\partial \mu}$, $\frac{\partial \overline{c^{cutoff}}}{\partial \gamma}$ $\left(\overline{c^{cutoff}}_{\mu}, \overline{c^{cutoff}}_{\gamma}\right)$ *:*

$$\begin{aligned}
\frac{\partial \overline{c^{cutoff}}}{\partial \mu} &= \left|\frac{A}{1-\beta}\right|^{\frac{1}{\sigma-1}} \frac{1}{\sigma-1}\left\{H^{\frac{2-\sigma}{\sigma-1}} a^2 e^{\frac{a^2}{2\gamma}+a\bar{\mu}}\left(1-\beta e^{\frac{a^2}{2}\sigma_\tau^2}\right) Q^{\frac{1}{1-\sigma}}\right. \\
&\quad \left. -H^{\frac{1}{\sigma-1}} Q^{\frac{\sigma}{1-\sigma}} \beta\left(\|F'\|\left(\|s_n\| \frac{\partial \overline{c^{cutoff}}}{\partial \mu}+\bar{\Gamma}_n \frac{\partial \overline{c^{cutoff}}}{\partial \gamma}\right)-1\right) \frac{\partial \overline{c^{cutoff}}}{\partial \mu}\right\} \\
&= \underbrace{\left|\frac{A}{1-\beta}\right|^{\frac{1}{\sigma-1}} \frac{1}{\sigma-1} H^{\frac{2-\sigma}{\sigma-1}} Q^{\frac{\sigma}{1-\sigma}}}_{W(W>0)}\left\{a^2 e^{\frac{a^2}{2\gamma}+a\bar{\mu}}\left(1-\beta e^{\frac{a^2}{2}\sigma_\tau^2}\right) Q\right. \\
&\quad \left. -\beta H\|F'\|\left(\|s_n\| \frac{\partial \overline{c^{cutoff}}}{\partial \mu}+\bar{\Gamma}_n \frac{\partial \overline{c^{cutoff}}}{\partial \gamma}\right) \frac{\partial \overline{c^{cutoff}}}{\partial \mu}+\beta H \frac{\partial \overline{c^{cutoff}}}{\partial \mu}\right\}
\end{aligned} \tag{E.10}$$

$$\begin{aligned}
\frac{\partial \overline{c^{cutoff}}}{\partial \gamma} &= W\left\{-\frac{a^3}{2\underline{\gamma}^2} e^{\frac{a^2}{2\underline{\gamma}}+a\bar{\mu}}\left(1-\beta e^{\frac{a^2}{2}\sigma_\tau^2}\right) Q\right. \\
&\quad -\beta H\left[\left(\|F'\|\left(\|s_n\| \frac{\partial \overline{c^{cutoff}}}{\partial \mu}+\bar{\Gamma}_n \frac{\partial \overline{c^{cutoff}}}{\partial \gamma}\right)-1\right) \frac{\partial \overline{c^{cutoff}}}{\partial \gamma}\right. \\
&\quad \left.\left. -\left\|s_\gamma\right\| \overline{\Delta_s c}\right]\right]
\end{aligned} \tag{E.11}$$

$\overline{\Delta_s c} = \overline{c^{cutoff}}\left(\frac{1}{s(0,\bar{\gamma})}+\frac{1}{s(0,\bar{\gamma})^3}\right)$*, further, through* $(E.7)\times\frac{\partial \overline{c^{cutoff}}}{\partial \gamma}-(E.8)\times\frac{\partial \overline{c^{cutoff}}}{\partial \mu}$*, we can get:*

$$\frac{\partial \overline{c^{cutoff}}}{\partial \gamma} = \underbrace{\frac{-\frac{a^3}{2\underline{\gamma}^2} e^{\frac{a^2}{2\underline{\gamma}}}+a\bar{\mu}}{\left(1-\beta e^{\frac{a^2}{2}\sigma_\tau^2}\right) Q+\beta H\left\|s_\gamma\right\| \overline{\Delta_s c}}}_{Y} \cdot \frac{\partial \overline{c^{cutoff}}}{\partial \mu} \tag{E.12}$$

Substituting equation (E.12) into equation (E.10) yields:

$$\beta H W\|F'\|\left(\|s_n\|+\bar{\Gamma}_n Y\right)\left(\frac{\partial \overline{c^{cutoff}}}{\partial \mu}\right)^2+(1-\beta H W) \frac{\partial \overline{c^{cutoff}}}{\partial \mu}-a^2 e^{\frac{a^2}{2\gamma}+a\bar{\mu}}\left(1-\beta e^{\frac{a^2}{2}\sigma_\tau^2}\right) Q=0 \tag{E.13}$$

To ensure that equation (E.10) has two distinct solutions, it is necessary to satisfy at least:

$$(1-\beta HW)^2+4\beta HW^2\left\|F'\right\|\left(\left\|s_n\right\|+\bar{\Gamma}_nY\right)a^2e^{\frac{a^2}{2\underline{\gamma}}+a\bar{\mu}}\left(1-\beta e^{\frac{a^2}{2}\sigma_\tau^2}\right)Q>0 \tag{E.14}$$

Further, two solutions in equation (E.13) can be obtained:

$$\frac{\beta HW-1\pm\sqrt{(1-\beta HW)^2+4\beta HW^2\left\|F'\right\|\left(\left\|s_n\right\|+\bar{\Gamma}_nY\right)a^2e^{\frac{a^2}{2}}+a\bar{\mu}}\left(1-\beta e^{\frac{a^2}{2}\sigma_\tau^2}\right)Q}{2\beta HW\left\|F'\right\|\left(\left\|s_n\right\|+\bar{\Gamma}_nY\right)} \tag{E.15}$$

In order to ensure $\frac{\partial\overline{c^{cutoff}}}{\partial\mu}<0$ *and* $\frac{\partial\overline{c^{cutoff}}}{\partial\gamma}>0$*, In addition to (E.14), the conditions to be fulfilled are:*

$$\begin{aligned}\beta HW-1=&\frac{\beta}{\sigma-1}\left|\frac{A}{1-\beta}\right|^{\frac{1}{\sigma-1}}\\&\times\left|1-\beta+ae^{\frac{a^2}{2\underline{\gamma}}+a\bar{\mu}}\left(1-\beta e^{\frac{a^2}{2}\sigma_\tau^2}\right)\right|^{\frac{1}{\sigma-1}}\\&\times\left|(1-\beta)f_e+\beta\int|c|dF-\beta\overline{c^{cutoff}}\right|\frac{1}{1-\sigma}-1>0\end{aligned} \tag{E.16}$$

$$Y=\frac{-\frac{a^3}{2\underline{\gamma}^2}e^{\frac{a^2}{2\underline{\gamma}}+a\bar{x}}\left(1-\beta e^{\frac{a^2}{2}\sigma_\tau^2}\right)Q+\beta H\left\|s_\gamma\right\|\overline{\Delta_sc}}{a^2e^{\frac{a^2}{2\underline{\gamma}}+a\bar{\mu}}\left(1-\beta e^{\frac{a^2}{2}\sigma_\tau^2}\right)Q}<-\frac{\left\|s_n\right\|}{\bar{\Gamma}_n} \tag{E.17}$$

(E.16) and (E.17) ensure that the maximum solution of equation (E.17) $\frac{\partial\overline{c^{cutoff}}}{\partial\mu}$ *is negative, so that the space in which* $\frac{\partial\overline{c^{cutoff}}}{\partial\mu}$ *is located both ensures that when beliefs are expected to be pessimistic, the critical cost of firms to enter the market of the destination country is lower, and also ensures that there is no moving point in the space. And, from equation (E.13), since* $-\frac{\left\|s_n\right\|}{\bar{\Gamma}_n}<0$*, equation (E.21) also guarantees* $\frac{\partial\overline{c^{cutoff}}}{\partial\gamma}>Q$*.*

Taken together, combining Lemma 1 and Lemma 2, the conditions further satisfied can be obtained by simplification as

$$\frac{\beta H\left(\frac{2}{3\underline{\gamma}}\right)^{\frac{3}{2}}\frac{c^{cutoff}}{c^c}\left[\left(\frac{\bar{\gamma}^2+\gamma_z\bar{\gamma}}{\gamma_z}\right)^{\frac{1}{2}}+\left(\frac{\bar{\gamma}^2+\gamma_z\bar{\gamma}}{\gamma_z}\right)^{\frac{3}{2}}\right]}{a^2e^{\frac{a^2}{2\underline{\gamma}}+a\bar{x}}\left(1-\beta e^{\frac{a^2}{2}\sigma_\tau^2}\right)Q}<\frac{a}{2\underline{\gamma^2}}-\frac{\left(\bar{\gamma}+\gamma_z+\gamma_x\right)^2}{\left(3\gamma_z\right)^{\frac{3}{2}}\bar{\gamma}^2} \tag{E.18}$$

(E.18) shows that when γ_x is sufficiently small, when other conditions are guaranteed to be constant, it can be obtained that the function $\overline{c^{cutoff}}$ is Lipschitz continuous with respect to μ and γ. The function c^{cutoff} is monotonically decreasing about c^{cutoff} and monotonically increasing about γ.

E.4 Prove of the Existence and Uniqueness of Equilibrium

According to the three sufficient conditions for satisfying Banach's immovable point theorem, we prove each of them as follows.

(1) Prove that the mapping $\mathcal{T}$ is a self-mapping on $\mathcal{F}_0$.

Proof. First, the supremum of the $\mathcal{T}c^{\text{cutoff}}$ map coincides with the function c^{cutoff}, which is also $\overline{c^{\text{cutoff}}}$. Second, $\mathcal{T}c^{\text{cutoff}}$ is also Lipschitz continuous on $\left(\overline{c^{\text{cutoff}}}_{\mu}, \overline{c^{\text{cutoff}}}\gamma\right)$ .because $\left|\mathcal{T}c^{\text{cutoff}}\right|$ satisfies the following equation:

$$\begin{aligned}\left|\mathcal{T}c^{\text{cutoff}}\right| \leq & \left(\frac{A}{1-\beta}\right)^{\frac{1}{\sigma-1}} \\ & \times\left[1-\beta+ae^{\frac{a^2}{2\gamma}+a\mu}\left(1-\beta e^{\frac{a^2}{2}\sigma_\tau^2}\right)\right]^{\frac{1}{\sigma-1}} \\ & \times\left[(2-\beta)f_e+\beta\int|c|dF-\beta\overline{c^{\text{cutoff}}}\right]^{\frac{1}{1-\sigma}} \\ \leq & \overline{c^{\text{cutoff}}}\end{aligned} \tag{E.19}$$

So the boundary of the mapping $\mathcal{T}c^{\text{cutoff}}$ in the normed space is consistent with the function c^{cutoff}.

According to (E.8) , mapping $\mathcal{T}c^{\text{cutoff}}$ first order partial derivative about to μ is:

$$\begin{aligned}\frac{\partial\mathcal{T}c^{\text{cutoff}}}{\partial\mu} = & \left(\frac{A}{1-\beta}\right)^{\frac{1}{\sigma-1}}\frac{1}{\sigma-1}\Bigg[S(\mu,\gamma)^{\frac{2-\sigma}{\sigma-1}}S_\mu(\mu,\gamma)P^{\frac{1}{1-\sigma}} \\ & +\beta S(\mu,\gamma)P^{\frac{\sigma}{1-\sigma}}\max\left\{\frac{\partial c^{\text{cutoff}}}{\partial\mu}-\left(s_n\frac{\partial c^{\text{cutoff}}}{\partial\gamma}+\Gamma_n\frac{\partial c^{\text{cutoff}}}{\partial\gamma}\right)dF,0\right\}\Bigg]\end{aligned} \tag{E.20}$$

Further, according to(E.13),

$$\begin{aligned}\left|\frac{\partial \mathcal{T} c^{\text{cutoff}}}{\partial \mu}\right| \leq & \mid \left(\frac{A}{1-\beta}\right)^{\frac{1}{\sigma-1}} \frac{1}{\sigma-1} \mid \Bigg[\mid S(\mu,\gamma)^{\frac{2-\sigma}{\sigma-1}} S_\mu(\mu,\gamma) P^{\frac{1}{1-\sigma}} - \beta S(\mu,\gamma) P^{\frac{\sigma}{1-\sigma}} \\ & \left\{\left\{\|F'\|\left(\|s_n\| \frac{\partial \overline{c^{\text{cutoff}}}}{\partial \mu} + \bar{\Gamma}_n \frac{\partial \overline{c^{\text{cutoff}}}}{\partial \gamma}\right) - 1\right\} \frac{\partial \overline{c^{\text{cutoff}}}}{\partial \mu} \mid\right] \\ \leq & \left|\frac{\partial \overline{c^{\text{cutoff}}}}{\partial \mu}\right|\end{aligned} \tag{E.21}$$

According to (E.10) and definition 4,

$$\begin{aligned}\frac{\partial \mathcal{T} c^{\text{cutoff}}}{\partial \gamma} = & \left(\frac{A}{1-\beta}\right)^{\frac{1}{\sigma-1}} \frac{1}{\sigma-1} \Bigg[S(\mu,\gamma)^{\frac{2-\sigma}{\sigma-1}} S_\mu(\mu,\gamma) P^{\frac{1}{1-\sigma}} \\ & + \beta S(\mu,\gamma) P^{\frac{\sigma}{1-\sigma}} \max\left\{s_\gamma c^{\text{cutoff}}\left[\frac{1}{s(n,\gamma)} + \frac{1}{s(n,\gamma)^3}\right]\right. \\ & \left. + \frac{\partial c^{\text{cutoff}}}{\partial \gamma} - \frac{\partial c^{\text{cutoff}}}{\partial \gamma}\left(s_n \frac{\partial c^{\text{cutoff}}}{\partial \mu} + \Gamma_n \frac{\partial c^{\text{cutoff}}}{\partial \gamma}\right) dF, 0\right\}\end{aligned} \tag{E.22}$$

Similarly, $\left|\frac{\partial \mathcal{T}_{c^{\text{cutoff}}}}{\partial \gamma}\right| \leq \left|\frac{\partial \overline{c^{\text{cutoff}}}}{\partial \gamma}\right|$, so we can know that $\left|\frac{\partial \overline{c^{\text{cutoff}}}}{\partial \mu}\right|$ and $\left|\frac{\partial \overline{c^{\text{cutoff}}}}{\partial \gamma}\right|$ get maximum values on the set $\mathcal{F}_0$ from (E.15), indicating $\forall \mu \in [\underline{\mu}, \bar{\mu}]$ or $\forall \gamma \in [\underline{\gamma}, \bar{\gamma}], \mathcal{T} c^{\text{cutoff}}$ corresponding partial derivatives are bounded, i.e., the Lipschitz continuity condition is satisfied on $\mathcal{F}_0$. □

(2)The space in which $\mathcal{F}_0$ is located is Banach space

Proof. According to definition 1, $B(\mathcal{S})$ is an normed vector space consisting of continuous bounded functions, and is complete for the defined paradigm $\|\cdot\|$, so $B(\mathcal{S})$ is Banach space. According to definition 4, $\mathcal{F}_0$ is a subset of $B(\mathcal{S})$, and for the functions $c^{\text{cutoff}} \in \mathcal{F}_0$, One can arbitrarily construct such a Cauchy sequence on $\mathcal{F}_0$, $\left\{c_k^{\text{cutoff}}\right\}_{k\in\mathbb{N}} \in \prod_{k\in\mathbb{N}} \mathcal{F}_0$, From Definition 4 and Lipschitz continuity, it follows that , $\forall \mu_1, \mu_2 \in [\underline{\mu}, \bar{\mu}]$, $k \in \mathbb{N}$, $\left|c_k^{\text{cutoff}}(\mu_2) - c_k^{\text{cutoff}}(\mu_1)\right| \leq \left|\overline{c^{\text{cutoff}}}_{\mu}\right| \cdot |\mu_2 - \mu_1|$, and when $k \to \infty$, $\left|c^{\text{cutoff}}(\mu_2) - c^{\text{cutoff}}(\mu_1)\right| \leq \left|\overline{c^{\text{cutoff}}}_{\mu}\right| \cdot |\mu_2 - \mu_1|$. Similarly, we can also know $\forall \gamma_1, \gamma_2 \in [\underline{\gamma}, \bar{\gamma}]$, when $k \to \infty, \left|c^{\text{cutoff}}(\gamma_2) - c^{\text{cutoff}}(\gamma_1)\right| \leq \left|\overline{c^{\text{cutoff}}}\gamma\right| \cdot |\gamma_2 - \gamma_1|$, revealing that the above Cauchy sequence is convergent on both about μ and γ. Thus, it follows that c^{cutoff} defined on a space $\mathcal{F}_0$ about μ and γ is Lipschitz continuous, and it is also proved that $\mathcal{F}_0$ is a closed set belonging to a Banach space, and so is likewise a Banach space. □

(3) Mapping $\mathcal{T}c^{\text{cutoff}}$ is a contraction mapping on $\mathcal{F}_0$

Proof. $\mathcal{T}c^{\text{cutoff}}$ is continuous derivative on $\mathcal{F}_0$, To show that $\mathcal{T}c^{\text{cutoff}}$ is a compressed mapping, it is necessary to show that the derivative of $\mathcal{T}c^{\text{cutoff}}$ about c^{cutoff} is less than 1, namely $\frac{\partial T_{c^{\text{cutoff}}(\mu,\gamma)}}{\partial c^{\text{cutoff}}} < 1$ From (E.8) :

$$\begin{aligned}\frac{\partial \mathcal{T}c^{\text{cutoff}}(\mu,\gamma)}{\partial c^{\text{cutoff}}} =& \frac{1}{\sigma-1}\left(\frac{A}{1-\beta}\right)^{\frac{1}{\sigma-1}} S(\mu,\gamma)^{\frac{1}{\sigma-1}} P^{\frac{\sigma}{-\sigma}} \\ &\times\left\{\beta\left(\frac{\partial R\left(c^{\text{cutoff}}\right)}{\partial c^{\text{cutoff}}}+\left[s_n(\mu,\gamma)\frac{\partial c^{\text{cutoff}}}{\partial \mu}+\Gamma_n(\mu,\gamma)\frac{\partial c^{\text{cutoff}}}{\partial \gamma}\right]\frac{\partial F}{\partial c^{\text{cutoff}}}\right)\right\}\end{aligned} \tag{E.23}$$

It follows from Lemma 1, Lemma 2, and Definition 1 that equation. must hold under the space $\mathcal{F}_0$:

$$\frac{\partial \mathcal{T}c^{\text{cutoff}}(\mu,\gamma)}{\partial c^{\text{cutoff}}} \leq \frac{1}{\sigma-1}\left(\frac{A}{1-\beta}\right)^{\frac{1}{\sigma-1}} S(\mu,\gamma)^{\frac{1}{\sigma-1}} P^{\frac{\sigma}{1-\sigma}}\beta\left\{1+\|F'\|\left(\|s_n\|\frac{\partial\overline{c^{\text{cutoff}}}}{\partial\mu}+\bar{\Gamma}_n\frac{\partial\overline{c^{cutoff}}}{\partial\gamma}\right)\right\} \tag{E.24}$$

and according to equation (E.9) in definition 4:

$$\begin{aligned}\frac{\partial\overline{c^{cutoff}}}{\partial\mu} =& \underbrace{\frac{1}{\sigma-1}\left(\frac{A}{1-\beta}\right)^{\frac{1}{\sigma-1}} H^{\frac{1}{\sigma-1}} Q^{\frac{\sigma}{1-\sigma}}}_{J} \\ &\times\left\{\left|S_\mu(\mu,\gamma)\right| Q/H\right. \\ &+\beta\left(1-\|F'\|\left(\|s_n\|\frac{\partial\overline{c^{cutoff}}}{\partial\mu}+\overline{\Gamma}_n\frac{\partial\overline{c^{cutoff}}}{\partial\gamma}\right)\right) \\ &\left.\times\frac{\partial\overline{c^{cutoff}}}{\partial\mu}\right\}\end{aligned}$$

Further, $\frac{\partial\overline{c^{cutoff}}}{\partial\mu} < Q$, so:

$$(1-\beta J)\left|\frac{\partial c^{\text{cutoff}}}{\partial\mu}\right| = J\left|S_\mu(\mu,\gamma)\right| Q/H+\beta J\|F'\|\left(\|s_n\|\frac{\partial c^{\text{cutoff}}}{\partial\mu}+\overline{\Gamma}_n\frac{\partial\overline{c^{\text{cutoff}}}}{\partial\gamma}\right)\left|\frac{\partial\overline{c^{cutoff}}}{\partial\mu}\right| \tag{E.25}$$

By further simplification and simultaneous division of both sides by $\left|\frac{\partial c^{\text{cutoff}}}{\partial\mu}\right|$, The follow-

ing relation is obtained:

$$1-\frac{J\left|S_{\mu}(\mu,\gamma)\right|Q/H}{\left|\frac{\partial\overline{c\ \text{cutoff}}}{\partial\mu}\right|}=\beta J\left(1+\|F'\|\left(\|s_n\|\frac{\partial\overline{c^{\text{cutoff}}}}{\partial\mu}+\bar{\Gamma}_n\frac{\partial\overline{c^{\text{cutoff}}}}{\partial\gamma}\right)\right) \tag{E.26}$$

Because $J\left|S_{\mu}(\mu,\gamma)\right|Q/H<\left|\frac{\partial\overline{c^{cutoff}}}{\partial\mu}\right|$, so $\beta J\left(1+\|F'\|\left(\|s_n\|\frac{\partial\overline{c^{cutoff}}}{\partial\mu}+\bar{\Gamma}_n\frac{\partial\overline{c^{\text{cutoff}}}}{\partial\gamma}\right)\right)<1$, and from (E.8) and (E.9),$\frac{1}{\sigma-1}\left(\frac{A}{1-\beta}\right)^{\frac{1}{\sigma-1}}S(\mu,\gamma)^{\frac{1}{\sigma-1}}P^{\frac{\sigma}{1-\sigma}}<J$, so we can prove $\frac{\partial\mathcal{T}^{\text{cutoff}}(\mu,\gamma)}{\partial c^{\text{cutoff}}}<1$ In summary, we can conclude that the self mapping $\mathcal{T}c^{\text{cutoff}}$ defined on the space of $\mathcal{F}_0$ is a compressed mapping, and according to the principle of compressed mapping or Banach's immovable point theorem, it can be shown that there exists and only exists a unique equilibrium point $c^{\text{cutoff}}\in\mathcal{F}_0$ on $\mathcal{F}_0$. □