Policy Uncertainty and Foreign Direct Investment: Evidence from the China-Japan Island Dispute

Cheng Chen* Tatsuro Senga† Chang Sun‡ Hongyong Zhang§

July 30, 2016

Abstract

Can a temporary uncertainty shock generate long-lasting effects on economic activities? To show causal evidence, we utilize data from Japanese multinational corporations (MNCs) and explore the economic impact of the unexpected escalation of an island dispute between China and Japan in 2012. Our difference-in-differences estimation substantiates that a sharp, but temporary fall in local sales of Japanese MNCs in China led to persistent downward deviation of foreign direct investment (FDI) from its trend. Moreover, despite the quick recovery of local sales, Japanese MNCs in China have continued to underestimate their local sales, which generates pessimistic and more dispersed forecast errors after the island crisis. We view this as evidence for a belief-driven channel through which a large and unexpected shock leads agents to revise their beliefs and start tail risk hedging.

JEL: D84, E22, E32, F23

Keywords: Uncertainty, Forecast Error, FDI, Geopolitical Conflicts, Business Cycles.

*University of Hong Kong. Email: ccfour@hku.hk.
†Queen Mary University of London. Email: t.senga@qmul.ac.uk.
‡Princeton University. Email: changsun@princeton.edu.
§RIETI. Email: zhang-hong-yong@rieti.go.jp.

1. Introduction

"... in practice the process of revision of short-term expectation is a gradual and continuous one, carried on largely in the light of realized results; ... producers' forecasts are more often gradually modified in the light of results than in anticipation of prospective changes."

— Keynes, 1936

The literature has extensively investigated the relationship between uncertainty and firm-level activities. One stylized fact emerging from the literature is the negative uncertainty-investment relationship. Various theories have been proposed to explain how increased uncertainty adversely affects firm investment.[1] A large body of empirical work has also shown this negative relationship between uncertainty and investment.[2] Moreover, both macro and micro uncertainty appears to be countercyclical.[3] The effects of this relationship are also found to be greaterer in developing countries due to political instability and geopolitical conflicts.

Despite the extensive research on uncertainty and its relationship with investment, there is still a lack of causal evidence on how increased uncertainty affects firm-level activities for two reasons.[4] First, in periods during which uncertainty increases, other economic factors are also likely to vary, such as economic policies. Second, there is a lack of high-quality firm-level data that can be used to obtain direct measures on firm-level uncertainty (e.g., forecast errors) at high frequency levels.[5] In this paper, we use the sudden escalation of the dispute over the Senkaku Islands (between China and Japan) in 2012 to explore the *causal* impact of increased uncertainty on economic activities. Specifically, we use this "island shock" which is arguably exogenous to solve the first problem discussed above. Furthermore, we utilize data from Japanese multinational corporations (MNCs) and their foreign affiliates to deal with the second problem. These data include both qualitative and quantitative measures of firm-level uncertainty at quarterly and annual frequencies.

Using data from Japanese MNCs and their foreign affiliates, we show how in-

[1] For example, existing theories have shown that increased uncertainty raises the option value of waiting (to undertake investment) in the presence of nonconvex adjustment costs (Bernanke 1983; Dixit and Pindyck 1994; Abel and Eberly 1996; Bloom 2009), which makes firms delay their investment and hiring.

[2] Various measures of uncertainty are under development, including the stock-price volatility (Leahy and Whited 1996), the frequency of appearance of words such as "uncertain" in news articles (Baker et al. 2012), and disagreement among forecasters (Backmann et al. 2013). These proxies are used for their panel analysis and show that investment is negatively associated with uncertainty at the firm level.

[3] See Bloom (2009), Kehrig (2011), Bloom et al. (2012), and Bachman and Bayer (2014) for plant/firm-level evidence. See Vavra (2014) for evidence on price changes.

[4] A notable exception is Baker and Bloom (2013), who use natural disasters as experiments to investigate the relationship between uncertainty and growth.

[5] An exception is Bachmann et al. (2013), who utilize quarterly data on firm-level uncertainty to study the impact of increased uncertainty on firm-level outcomes. Using market information, Senga (2015) constructs firm-level uncertainty measures to study how firms' learning in the aftermath of recessions affects economic recoveries during business cycles.

creased uncertainty (due to geopolitical conflicts) has variously affected sales of Japanese MNCs in China, forecast errors (FEs) of Japanese firms in China, and foreign direct investment (FDI) flows from Japan to China.[6] We document three sets of empirical findings. First, we look at the impact of the island shock on sales of Japanese affiliates in China. The data show that local sales of Japanese affiliates in China plummeted immediately after the sudden escalation of the island crisis (i.e., 2012/Q3). However, these sales recovered quickly and substantially surpassed their pre-crisis levels not long after the crisis. Taken together, this evidence implies that the negative demand shock on Japanese goods (sold in China) was temporary and does not seem to have generated long-term impact on Chinese consumers' confidence in Japanese goods.[7]

However, the impact of the island crisis on FDI differs substantially from our first finding. The data substantiate that FDI flows from Japan to China started to drop significantly when the island dispute suddenly escalated, although FDI had continually increased before the island shock. Figure 1 shows the evolution of the share of FDI inflows from Japan to China in total FDI inflows into China. When we implement difference-in-differences (DID) analysis by comparing FDI flows from Japan to China with FDI flows from Japan to other countries, this pattern becomes more pronounced. We have also looked at channels through which the island shock reduced the FDI flows from Japan to China and find that the extensive margin plays the dominant role. That is, more affiliates of Japanese MNCs exited from China and fewer Japanese affiliates entered China after the island crisis. Moreover, the fraction of existing Japanese affiliates that increased FDI in China (i.e., incumbents doing incremental investment) dropped significantly, as did those reporting zero FDI after the island shock. In addition, capital investment of Japanese affiliates in China, which is a part of FDI, it displays a similar pattern. We conclude that FDI flows from Japan to China were substantially reduced by the unexpected island shock, even in the long run, despite demand for Japanese goods recovering quickly and strongly after the shock. A natural question to ask is which factor is responsible for this difference.

Finally, we show that Japanese affiliates' forecasts of their sales in China became significantly pessimistic after the outbreak of the island crisis and have not returned to pre-event levels, even three years after the island shock (i.e., 2015/Q2). Importantly, this pessimistic belief holds only for local sales, which are the most important part of total sales of Japanese affiliates in China.[8] In addition, when we implement DID regressions by comparing FE of Japanese affiliates in China with FE in other countries, the above two findings become even more pronounced. Together, this suggests that local demand shock triggered the pessimistic forecast. Putting findings two and three together, we conjecture that the long-lasting pessimistic belief in local demand led to

[6] In this paper, China refers to mainland China (i.e., excluding Hong Kong).

[7] Our data also show that exports from Japan to China feature a similar pattern. Namely, they fell substantially in the short run after the event but recovered very quickly.

[8] In particular, this pattern ceases to exist when we look at FE of sales back to Japan and capital investment.

the sudden and persistent drop in FDI flows from Japan to China.[9] In addition, we also present evidence on how the forecast error of sales affects capital investment of Japanese MNCs in China. The results shows that conditional on other firm-level characteristics (including realized sales and employment), underestimation of sales has a negative and quantitatively sizable impact on firm-level investment. This finding substantiates that firm's belief (about future demand) has real effect on firm's investment.

To empirically isolate the relationship between uncertainty and firm actions such as investment and R&D, many authors have conducted various forms of panel analysis. For example, Leahy and Whited (1996) and Bloom et al. (2007) use realized volatilities of stock prices as proxies of the level of uncertainty and show a negative relationship between uncertainty and firm investment. Stein and Stone (2013) use option price to create forward-looking measures of uncertainty and arrive at a similar result on the uncertainty-investment relationship and a different result on the uncertainty-R&D relationship. Using information on the subjective probability distribution from an Italian manufacturing firm survey, Guiso and Parigi (1999) also find a negative relationship between uncertainty and investment. Our paper, to the best of our knowledge, is the first to show a causal relationship between uncertainty and FDI.

An increasing number of studies examine the importance of one specific type of uncertainty: policy uncertainty. For instance, by using the policy uncertainty index developed by Baker et al. (2013), Gulen and Ion (2013) show that firm-level capital investment is negatively affected by uncertainty associated with future policies. Furthermore, Morikawa (2013, 2016) explores the type(s) of policy uncertainty affecting business behavior and finds that uncertainty related to the tax system and trade policy affects capital investment and overseas activities of firms. Among various factors regarding policy uncertainty, our paper sheds light on the economic consequences of the government's geopolitical actions. We will quantify the role of this type of uncertainty in future work.

This paper finds that uncertainty due to a short-term event plays an important role in generating persistent impact on economic variables. This has not been studied well in the literature that looks at the effects of sudden short-term events. For instance, event studies in international trade fail to find long-run impact of sudden events on trade variables (e.g., Fuchs and Klann 2013; Boehm et al. 2014). On the contrary, our paper finds a long-run negative impact of a geopolitical conflict on FDI. This finding points out an important channel through which sudden events can affect international trade and investment in the long run. That is, agents face increased uncertainty due to sudden events, and they revise their beliefs in the long run, even after the end of the event. This in turn has long-lasting effects on real economic activities, similarly

[9] When we looked at FE of total sales using the annual data, the standard deviation of FE also increased substantially from 2011 to 2013. This hints that local demand of Japanese goods in China has become more volatile and difficult to predict. However, we could not find a similar pattern in the quarterly data.

explored by Kozlowski et al. (2015) in the study of business cycles. We view our finding on the long-run revision of beliefs as a mechanism behind the long-run effects of the island crisis studied by Fisman et al. (2013).[10]

Studies of uncertainty involve dynamics analysis. Research in international trade has just started to investigate how uncertainty affects exports and FDI (Carballo 2015; Handley 2014; Handley and Limao 2014, 2015; Novy and Taylor 2014) in a dynamic setting. However, due to the lack of high-quality firm-level data and exogenous events, there is little evidence on how increased uncertainty affects FDI causally. Our work fills this gap by using high-quality Japanese data and studying the impact of an unexpected geopolitical event.

The rest of the paper is organized as follows. Section 2 describes the escalation of the island crisis. Section 3 presents our empirical results, starting with some stylized facts, followed by difference-in-differences estimation. Section 4 presents a brief conclusion.

2. The Island Crisis

China and Japan have been disputing the sovereignty of the Senkaku islands (or Diaoyu Islands) for many years; however, the most serious conflict between the two countries by far is the conflict that occurred in the middle of 2012. On 7 July 2012, Japanese Prime Minister Yoshihiko Noda, expressed his consideration for the Japanese government to buy the disputed islands, which triggered the first wave of anti-Japanese protests in several Chinese cities on 19 August. On 10 September, the Japanese government said that it had decided to purchase the disputed islands from a private Japanese owner in an effort, Tokyo claimed, to diffuse territorial tensions. However, this was followed by much larger scale anti-Japanese demonstrations. During the weekend of 15-16 September, citizens in mainland China participated in protest marches and called for a boycott of Japanese products in as many as 85 Chinese cities. Moreover, on 18 September, people in over 180 Chinese cities attended protests against Japan on the 81st anniversary of the Mukden Incident.[11]

The severity of the island dispute from July to September 2012 was unprecedented, and it was unexpected by Japanese firms in China. The anti-Japanese sentiment during those three months generated significant impact on the Sino-Japan economic relationship. As Figure 2 shows, the share of imports from Japan (of China's total imports) fell from 8% to 4.8% within three months of the outbreak of the island crisis. The share of manufacturing FDI flows from Japan in China's total manufacturing FDI inflows plummeted from 22% (2012/Q3) to 9% (2014/Q3) in two years. One survey done by Teikoku Databank in October 2010 shows that one third of firms surveyed thought

[10]They study the effect of shocks to political tension between China and Japan on the valuation of individual firms and focus on listed firms only.

[11]For details, see https://en.wikipedia.org/wiki/2012_China_anti-Japanese_demonstrations.

the unexpected anti-Japanese demonstrations would negatively affect their sales in China.[12] Moreover, one sixth of them planned to withdraw or reduce their investment in China.[13]

3. Empirical Findings: Difference-in-Differences Estimation

3.1. Data Description

We use two data sets to implement our analysis. The first one is annual parent-affiliate-level data and the second one is affiliate-level data at quarterly frequency.

3.1.1. Annual Data of Japanese MNCs and Affiliates

We use parent-affiliate-level data from the Basic Survey on Overseas Business Activities (BSOBA, Kaigai Jigyo Katsudo Kihon Chosa) prepared by the Ministry of Economy, Trade and Industry (METI). This survey covers two types of overseas subsidiaries of Japanese MNCs: (1) direct subsidiaries with ratio of investment by Japanese enterprises' 10% or higher as of the end of the fiscal year (31 March); and (2) second-generation subsidiaries with ratio of investment by Japanese subsidiaries' 50% or higher as of the end of the fiscal year (31 March). This survey is conducted annually using a questionnaire based on self-declaration survey forms (one for the parent firm and another one for each foreign affiliate) sent to the parent firm, and each year refers to the period from 1 April of that year to 31 March of the next year. The survey form for parent firms includes information on parent's sales, capital, employment, industry classification, etc. The survey form for the foreign affiliate reports affiliate's capital, sales, investment, number of employees, country and industry information, the date of establishment or capital participation, and operation status, including dissolution or withdrawal. Since the dataset also reports the fraction of capital invested by the Japanese parental firm each year, we can calculate the FDI inflow from Japan to China at the firm level.[14]

Importantly, regarding sales and capital investment, foreign affiliates report both the realized value and the projected value. These variables allow us to calculate quantitative FEs at the affiliate-year level. Specifically, FE for sales and investment is calculated as (realized value-projected value)/projected value. Based this annual cross-section survey, we constructed a panel dataset of foreign affiliates from 2003 to 2013. Each parent-affiliate pair is traced throughout the period using the identification code.

[12] For details, see https://www.tdb.co.jp/report/watching/press/pdf/keiki_w1210.pdf.

[13] It was reported that the substantial scale-up of anti-Japan protests was related to problems associated with the transition of political power in China around the same time (e.g., the incident of Bo Xilai). This further shows that the escalation of the island dispute was exogenous. For details, see http://www.cnn.com/2012/09/18/world/asia/china-protests-japan-fury/index.html.

[14] Specifically, the FDI flow from Japan into affiliate j in year t equals $s_{jt} * K_{jt} - s_{j,t-1} * K_{j,t-1}$, where s_{jt} is the fraction of capital invested by the Japanese parental firm in affiliate j in year t, and K_{jt} is the total capital stock of affiliate j in year t. Note that $s_{j,t-1} * K_{j,t-1}$ equals zero for FDI entrants in year t and $s_{jt} * K_{jt}$ equals zero for FDI exiters in year t.

To obtain real output and investment, parent and affiliate's sales and investment are deflated by GDP deflators of Japan and each destination country, respectively. Summary statistics of this dataset are reported in Table 13; the total number of observations across 11 years is roughly 220,000.

3.1.2. Quarterly Data of Foreign Affiliates

The quarterly data on foreign affiliates collected by the METI is called the Quarterly Survey of Overseas Subsidiaries (QSOS, Kaigai Genchi Hojin Shihanki Chosa). This survey is conducted every quarter in order to trace out trends in Japanese foreign affiliates' business activities. It includes overseas subsidiaries above certain size in manufacturing sectors.[15] The Number of foreign subsidiaries covered by this survey is around 5,000 every year and the response rate is about 80%. Compared with the first survey, the key advantage of this survey is that it reports realized value and predicted value of various variables (e.g., local sales, capital investment, and the number of employees, etc.) at the quarterly level. Moreover, in this survey, sales are decomposed into local sales, sales to Japan, and sales to countries other than Japan. The high frequency of the data and the finer division of sales are crucial for our empirical analysis. Based on this quarterly cross-section survey, we constructed a panel dataset of foreign affiliates from 2006/Q4 to 2015/Q2.

Variables appearing in this survey are defined as follows. Capital investment is the acquisition of tangible fixed assets excluding land and depreciation. The number of employees is measured at the end of each quarter. Regarding the forecast, subsidiaries report its value on various sales (e.g., local sales, sales back to Japan, etc.), capital investment and the number of employees for the next quarter and the next next quarter. Specifically, for each item "A", subsidiaries are requested to compare the predicted value of "A" (for the next quarter and the next next quarter) with its current value and choose from the following three options: "Increase (1)", "Unchanged (0)", and "Decrease (-1)". Note that they are asked to exclude seasonal factors when making predictions. With the forecast information in hand, we construct FE, which is the difference between the realized value and the predicted value. FE is defined over the grid of [-2, -1, 0, +1, +2]. For instance, if both the realized and predicted local sales increase, FE is 0(=1-1). However, if the realized local sales increase while the predicted local sales were forecast to "Decrease", FE is 2 [=1-(-1)]. Summary statistics of this dataset are reported in Table 14; and the total number of observations across 35 quarters is roughly 180,000.

[15] Firms included in this survey have to have (1) at least 50 employees; (2) the value of capital bigger than or equal to 100 million JPY; (3) at least 50% of the total capital coming from the Japanese parental firms (including both direct and indirect funds, such as funds provided via local subsidiaries).

3.2. Stylized facts

In this section, we empirically explore how the outbreak of the island dispute in the summer of 2012 affected Japanese multinational firms that serve Chinese local markets through vertical integration. Our findings are summarized by the following four stylized facts. First, local sales by affiliates of Japanese MNCs in China dropped sharply but rebounded quickly. Second, FDI flows from Japanese MNCs into China deviated downward from its previous trend and remained persistently at a lower level. Third, Japanese MNCs in China kept reporting negative FE of local sales. That is, even after their local sales rebounded quickly, they kept underestimating the local sales. Finally, underestimation of sales (i.e., positive forecast error) has a negative and quantitatively sizable impact on firm-level investment.

The first three stylized facts are more pronounces when we compare activities of Japanese affiliates in China with activities of Japanese affiliates in other countries. Since we want to exclude common shocks to all Japanese MNCs from our analysis, we implement DID regressions in our analysis. DID analysis suggests that the third quarter of 2012 is indeed a turning point for affiliates of Japanese MNCs in China. In the subsection below, we show these stylized facts and point out an explanation: a belief-driven relationship between policy uncertainty and investment.

3.2.1. Finding One: Large Transitory Demand Shock to Local Sales in China

In this subsection, we present evidence that local demand faced by Japanese affiliates in China fell only temporarily after the island shock. Figure 3 compares historical cyclical series of local sales reported by Japanese subsidiaries in China and in other countries. While both lines exhibit a large drop in the first two quarters of 2009 during the financial crisis, only the blue solid line hits the lowest level in the fourth quarter of 2012. Local sales in China bounced back from the trough quickly starting from the first quarter of 2013.

We use quarterly data to further examine this large but transitory fluctuation of local sales in China. Figure 4 presents the distribution of local sales growth rate across firms for quarters around the outbreak of the island crisis (2012/Q2 to 2013/Q1). The figure shows a significant drop in average growth rate in the third quarter and the fourth quarter of 2012. As we saw in the aggregate series, the plummet in the average sales growth rate disappeared in the first quarter of 2013 and reverted to the level of the second quarter of 2012. If we turn our attention to the dispersion of local sales, it gets larger when the average level goes down. However, it remains more dispersed in the first quarter of 2013 relative to the second quarter of 2012. This heterogeneity suggests that some are behind the average recovery pace of local sales in China even though the aggregate series displayed a quick recovery. Using the annual data, we document a similar pattern. Specifically, Figure 5 verifies that average annual growth rate of local sales did fall substantially in 2012 (i.e., compared with 2010 and 2011),

although it recovered and surpassed its pre-crisis level in 2013.

3.2.2. Finding Two: Persistently Negative Impact on FDI Flows and Capital Investment

In this subsection, we show that FDI flows (from Japan to China) started to drop after the outbreak of the island crisis. In addition, when we look at capital investment of Japanese affiliates in China, which is a part of FDI, it displays a similar pattern at both the annual frequency and the quarterly frequency. Furthermore, evidence suggests that the extensive margin plays a dominant role in shaping the change in FDI flows and capital investment (relative to Japanese affiliates in other countries).

To this end, we start off presenting evidence on aggregate FDI flows. The left panel of Figure 6 clearly shows that FDI inflows from Japan to China started to drop after the island shock and remained lower than its pre-shock trend even in 2016. The right panel of Figure 6 shows the four-quarter change rate of FDI flows, which removes seasonal components. It is evident that FDI flows from Japan to China stayed in the negative region, the level of which was lower than during the financial crisis. Furthermore, the duration of the decline was also longer compared to the financial crisis. This is distinctive relative to FDI inflows to other countries during the same period. In fact, FDI flows into countries other than China kept growing, as shown by the dashed lines in both panels of Figure 6. In order to see this different pattern more clearly, we plot series of FDI flows into China and into other countries in Figure 7.[16] After the island shock in late 2012, the two series start to fluctuate differently. Specifically, FDI flows into China dropped substantially while those to other countries continued stable growth.

We use annual data to isolate the channels through which the island shock negatively affected the aggregate FDI flows from Japan to China. Figure 8 shows that the fraction of inactive affiliates (i.e., firms that did not change the amount of their FDI in China) increased from 2012 to 2013, while the fraction of Japanese affiliates that increased the amount of FDI in China dropped substantially during the same period. Furthermore, if we look at the entry-exit margin, a similar pattern appears. Figure 9 substantiates that there are more exiters and fewer entrants after the island shock in 2012. In addition, total FDI stock of incumbents in the Chinese market did not change too much. In short, we argue that the extensive margin is the most important factor in understanding the collapse of FDI flows from Japan to China after the island crisis.

Regression analysis using firm-level data further confirms our above findings. We use the DID approach to tease out the differential impact of the island crisis on FDI flows from Japan to China relative to FDI flows from Japan to other countries. Specif-

[16] The level of the first quarter of 2012 is normalized to one.

ically, the regression equation is

$$\begin{aligned}\log(FDI)_{ft} &= \beta_0 + \beta_1 Shock_t + \beta_2 Shock_t China_f + \beta_3 \ln(Capital)_{ft} + \beta_4 \ln(Revenue)_{ft} \\ &= +\beta_3 \ln(Capital)_{p(f)t} + \beta_4 \ln(Revenue)_{p(f)t} + year_t + country_j + firm_f + \epsilon_{ft}, \quad (1)\end{aligned}$$

where f represents the firm, and t and j denote the year and the country, respectively. Subscript $p(f)$ is the ID of the parental firm of affiliate f.[17] Dummy variable, $Shock_t$, takes the value of one if the year is 2013 and zero otherwise. Dummy variable, $China$, equals one if the affiliate is located in China and zero otherwise. We focus on years after the financial crisis and set 2013 as the first year after the island crisis.[18] Because more than 75% of observations have zero FDI flows, we add one to the actual FDI flows (in million yen) when taking logs. Finally, standard errors are clustered at the country level, since we are exploiting the cross-country difference in the impact of the island shock.

Regression results are reported in Table 1. The first two columns show results for the years 2012 and 2013. The first regression shows that FDI flows from Japan to China dropped about 9% more after 2012 relative to FDI flows from Japan to other countries. When we add (the log of) the parental firm's revenue and capital stock into the regression, the result barely changes. In columns three and four, we add the year 2011 into the regression, resulting in an even stronger negative impact.[19] Namely, FDI flows from Japan to China dropped about 13% more after 2012 than to FDI flows from Japan to other countries. The regression results using the annual data thus support our argument. investment, which is a part of FDI, displays a similar pattern to FDI flows. For this variable, we run a similar regression to equation 1 and replace log FDI flows with log capital investment. The regression results are reported in Table 2. Depending on the specification, the island shock decreased capital investment of Japanese affiliates in China by 9% to 16% relative to other countries.

Finally, we use the quarterly data to further disentangle the differential impact of the island shock on capital investment. The main shock dummy is *shock*1, which equals one for quarters starting from 2012/Q3. Since there might be a delayed effect of the island shock on capital investment, we define an alternative shock dummy that equals one for quarters starting from 2012/Q4. In order to avoid the effect of the financial crisis on capital investment, we use observations from 2010/Q1. Since capital stock is not available in the quarterly data, we use $\log(Employment)_{ft}$ as one of the explanatory variables instead. Finally, standard errors are still clustered at the country level, and China and non-China specific linear time trends are included in all regres-

[17] Because there are very few affiliates that did not change their IDs when they moved from one country to another, we were still able to identify the country fixed effect.

[18] Since FDI decisions are probably made in advance, we assume that most FDI inflows in 2012 were not affected by the island shock.

[19] We also used $\log(employment)$ instead of $\log(capital)$ to run equation 1 and obtained qualitatively the same result for the coefficient in front of $Shock_t China_f$.

sions.

Regression results are reported in Table 3 and confirm our previous findings. Depending on the specification, the island shock reduced capital investment of Japanese affiliates in China by 9% to 20% relative to the investment in other countries. We also implemented several placebo tests by assigning the timing of the island shock to other quarters (e.g., 2011/Q3 or 2013/Q3), and the regression results in Table 4 show that we cannot obtain any statistically significant results. Taken together, we conjecture that the island shock happening in the third quarter of 2012 is the cause of the reduction in FDI flows from Japan to China and capital investment of Japanese affiliates in China.

3.2.3. Finding Three: Persistent Effects on Forecast Errors

The Third finding is that forecasts of Japanese affiliates in China for local sales became substantially pessimistic after the outbreak of the island dispute. We use our annual data to substantiate this finding first. As shown by Figure 10, the distribution of FEs in 2013 dramatically changed compared with that in 2012. The average level of FE increased and the dispersion became larger, suggesting that realized sales were substantially higher than projected sales for many firms in 2013 but that the degree of miscasts was quite heterogeneous. As shown by our first finding, realized sales in 2013 were much larger than in 2012 and the dispersion of sales distribution was also larger than in 2013. Overall, it appears that the quick recovery in sales was not anticipated by the Japanese affiliates, and the recovery pace seems to be heterogeneous across firms as well. As a result, many projections were less accurate, which suggests the existence of increased uncertainty when firms made projections during the recovery phase following the island shock.

Interestingly, the distribution of FEs in 2012 is not too much different from those in 2011 and 2010, as shown in Figure 10. Although Japanese subsidiaries in China experienced a large drop in local sales in the third and fourth quarters of 2012, local sales bounced back and overshooted their pre-crisis level in the first quarter of 2013. This reduced the size of the drop in annual sales, which makes the distribution of FEs in 2012 not too different from those in 2011 and 2010. Therefore, the large positive FEs in 2013 do not necessarily come from the fact that many firms missed their forecasts in the previous year; rather, they adjusted their forecasts conservatively. This implies that they tried erring on the side of caution.

Since the fluctuation in local sales was transitory, we use our quarterly panel data to confirm our previous findings and examine them more in detail. Figure 11 shows that the share of firms with pessimistic forecasts (or with optimistic forecasts) increased (or decreased) after 2012/Q3 *only* for local sales and total sales,[20] i.e., there is no system-

[20]We use FEs two periods ahead to draw Figure 11 and 12; qualitatively, the same results can be obtained if we use FEs from one period ahead.

atic change for sales back to Japan after the outbreak of the island crisis. Note that forecast error of 2012/Q3 is the difference between the projected change in sales and the realized change in sales in 2013/Q1, as the forecast is made two quarters in advance. Furthermore, the evolution of the mean of the distribution of FEs shows the same result, which is shown in Figure 12. Specifically, the mean of FEs for both local sales and total sales went up after 2012/Q3 or 2012/Q4 , meaning that Japanese affiliates in China became more pessimistic about local demand.[21] This pattern does not hold for the distribution of FEs of sales back to Japan. In addition, there is also no systematic change in the distribution of FEs of capital investment after 2012/Q3. Taken together, this evidence suggests that it is probably the change in *local demand in China* that has caused the change in Japanese firms' forecasts.[22]

In order to further confirm our previous findings, we run difference-in-differences regressions again. Specifically, using the annual data, we run the following regression:

$$\begin{aligned} \log(FE)_{ft} &= \beta_0 + \beta_1 Shock_t + \beta_2 Shock_t China_f + \beta_3 \ln(Capital)_{ft} + \beta_4 \ln(Revenue)_{ft} \\ &= +\beta_3 \ln(Capital)_{p(f)t} + \beta_4 \ln(Revenue)_{p(f)t} + year_t + country_j + firm_f + \epsilon_{ft} \end{aligned} \quad (2)$$

where f represents the firm, and t and j denote the year and the country, respectively. Subscript $p(f)$ is the ID of the parental firm of affiliate f. Dummy variable, *Shock*, takes the value of one if the year is 2013 and zero otherwise. Dummy variable, *China*, is one if the affiliate is located in China and zero otherwise. We focus on years after the financial crisis and set 2013 as the first year after the island crisis, and standard errors are clustered at the country level as before. Regression results in Table 5 show that after the island shock, Japanese affiliates in China became more pessimistic about their local sales and investment in China, which verifies our findings in Figures 10 and 12.

Finally, we use the quarterly data to further disentangle the differential impact of the island shock on FEs. Shock dummies of *shock*1 and *shock*2 are re-defined to be one if the period is after 2013/Q1 or 2013/Q2, as firms adjust their beliefs after experiencing the island shock and forecasts are made one or two quarters ahead. In order to avoid the effect of the financial crisis on capital investment, we use observations from the first quarter of 2010. Since capital stock is not available in the quarterly data, we use $\log(Employment)_{ft}$ as one of the explanatory variable instead. Finally, standard errors are clustered at the country level, and China and non-China specific linear time trends are included in all regressions.

Regression results are reported in Table 6 and confirm our previous findings. Depending on the specification, the island shock increased the mean value of FEs by

[21] Note that firms make sales forecasts one or two quarters ahead. Therefore, underestimation of local sales began to appear from 2013/Q1 or 2013/Q2.

[22] Interestingly, the standard deviation of the distribution of FEs does not seem to increase for local demand and total demand, which is different from what we find from the annual data.

about 0.17 to 0.26. The coefficients in front of $Shock1 * China$ and $Shock2 * China$ are highly statistically. In unreported regressions, we did placebo tests by moving the timing for the adjustment of forecast errors to earlier periods (such as 2012/Q2 or 2012/Q3) and found no significant results. This suggests that the island shock is indeed unexpected and Japanese firms in China began to adjust their belief only after experiencing the negative and temporary demand shock. These findings echo what we have found in Figures 10 and 12. Taken together, we argue that it is the island shock happening in the third quarter of 2012 that made Japanese affiliates in China more pessimistic about the local demand for their products.

3.2.4. Finding Four: Impact of Forecasts on Firm Investment

The final finding of this paper is that understimation of firm sales (i.e., positive forecast error) has a negative and quantitatively sizable impact on firm-level investment. In order to substantiate this point, we run regressions of log capital investment on forecast errors of total sales and other firm-level characteristics in order. In order to alleviate the endogeneity problem of the forecast error, we purposely use the forecast error of firm sales (instead of capital investment) and one-period lag of it in our regressions. We cluster standard errors at the firm level, as the variation we explore now is at the firm level. For the quarterly data, we use the same time span as before (2010Q1-2015Q2) to keep the consistency.[23] For the annual data, we extend our time span to 2004-2013, since we do not have to restrict our attention to years around the outbreak of the island crisis in this subsection.

Tables 7 to 9 present our results and support the hypothesis that a pessimistic belief reduces capital investment, since the forecast error defined in the paper will go up when the firm becomes pessimistic. In the quarterly data, if the forecast error changes from 2 (extremely pessimistic) to -2 (extremely optimistic), the capital investment goes up by 8% to 10% which is quantitatively significant. In the annual data, if the firm underestimates its total sales by 20%, its annual capital investment would go down by roughly 1.2%.

4. Model

In this section, we build up an industry equilibrium dynamic model of trade and (horizontal) FDI in order to quantitatively match the three findings documented above. Compared with traditional models of trade and FDI, our model has several innovations. First, it is a dynamic model and accordingly has value functions for two types of activities: FDI and exporting. Exiting is assumed to go back to implement domestic production only. Second, we introduce firm's forecast (or belief) into the model and will endogenize the formation of the belief. Third, we introduce uncertainty concerning local demand and will back out how the distribution of local demand has changed

[23] The same empirical findings are obtained, if we use periods starting from the 2007Q2

after the island crisis (a higher mean and a bigger variance?) Fourth, we introduce sunk entry costs and per-period fixed production cost into the model. As a result, we have endogenous entry and exit (into different production modes). Finally, we introduce the adjustment cost of capital into the model in order to match patterns related to inactive firms.

The model has several simplifications. First, we treat wage, the interest rate, the exchange rate and the price of capital goods (normalized to one) exogenous. The rationale is that the island crisis should not generate general equilibrium feedbacks on input prices and terms of trade in the long run. Second, we also don't consider factor market clearing conditions and trade balance condition which are usually used to pin down input prices and the exchange rate in general equilibrium models.

There are two types of extensive margins: entry and exit into FDI and exporting markets; inactive firms (i.e., incumbent MNCs' stopping further investment through FDI).

4.1. Overview

We follow Alessandria and Choi (2007) and Bloom (2009) to set up the model. The model abstracts from domestic production and assumes a standard CES preference function. Specifically, Chinese consumers' expenditure on Japanese goods at year t is $A_d(t)E(t)$ where $E(t)$ is the total expenditure and $A_d(t)$ is the share of total spending on Japanese goods which is a stochastic variable even every firm. The variable of $A_d(t)$ is assumed to be affected by the island shock (i.e., both the mean and the dispersion of the distribution) and firm-specific (i.e., idiosyncratic). This is the only shock (and firm heterogeneity) we consider: the firm-specific demand shock.[24] $A_d(t)$ is assumed to be distributed according to distribution $G(a_0, a_1)$ where a_0 and a_1 denote mean and variance respectively. We can obtain the value of a_0 before and after the shock from the sales data directly (i.e., total exports plus local sales/total consumption of tradable goods). We need to back out the value of a_1 before and after the shock. Hopefully, we will find that a_1 increased across time.

Next, we assume that sunk entry costs into FDI and exporting are f_I^e and f_x^e respectively. On top of the sunk costs, there exists per-period fixed production cost for FDI and exporting: f_I and f_x. Exiting both the exporting market and the FDI market means that the firm returns to domestic production. Next, labor productivity of each firm is assumed to be the same. As a result, bigger firm or firms having higher revenue productivity are those that receive better demand shocks. Finally, the belief before the shock is rational in the sense that every firm predicts that the demand parameter is $b_0 * a_0^{before}$. While after the shock, all firms forecast that the demand shock is $b_2 * a_0^{after}$, where $b_0 < 1$. It is probably true that $b_2 < 1 < b_0$, and we will use the data on an-

[24] In our empirical findings, we find that sales back to Japan did not change that much after the island shock. This shows that the supply side was barely affected by the island shock.

nual forecast to obtains values of b_0 and b_2 directly. We will also endogenize the belief formation later.

4.2. Assumptions

Now, we make several assumptions at the current stage. First, the price of capital goods in both China and Japan are exogenously given, we obtain value for them from the data. Second, the wage rates are given in two countries. We use $w(t)$ to denote the wage rate in China and obtain empirical measure for this from aggregate data. We will obtain information on wage of an efficiency unit of labor inputs in Japan. If this is b_1 times as high as in China, then wage rate in Japan is simply $b_1 w(t)$. Third. nominal exchange rate is assumed to move exogenously, and we will use data to estimate the value. Due to these three simplifications, we do not use factor market clearing conditions and trade balance condition.

Three things are worth mentioning. First, the iceberg trade cost should be calibrated. Second, with the existence of a fixed cost of operation, the nice feature of the value function (i.e., homogenous of degree one with respect to capital stock) is going to be lost. Otherwise, there will be no exits. Third, we still have to decide how to model investment and hiring behaviors of exporting firms. In total, we have three firm-level state variables: $A_d(t,\theta)$, $K(t)$ and the production mode (i.e., $m = 0$ for exiting; $m = 1$ for exporting; $m = 2$ for FDI). On top of that, we have a bunch of exogenous aggregate-level state variables: $(E(t), w(t), b_1 w(t), r, \tau(t), e(t), a_0, a_1, b_0, b_1)$. There is one endogenous aggregate-level state variables: the ideal price index $P(t)$. This variable captures the market competitiveness.

4.3. Supply and Demand

The demand function for a variety θ from Japan in year t is

$$q(\theta,t) = \frac{p(\theta,t)^{-\sigma}}{P(t)^{1-\sigma}} A_d(t) E(t), \tag{3}$$

where σ is the elasticity of substitution and P is the usual ideal price index. Based on equation 3, we derive the revenue function as

$$R(A_d(t,\theta)) = p(\theta,t) q(\theta,t) = (A_d(t)E(t))^{\frac{1}{\sigma}} \left(q(\theta,t) P(t)\right)^{\beta}, \tag{4}$$

where $\beta \equiv \frac{\sigma-1}{\sigma}$. Output is produced using a Cobb-Douglas production technology:

$$q = K(t)^{\alpha} L(t)^{1-\alpha}, \tag{5}$$

and capital depreciates at a rate of δ annually. We assume that there is no adjustment cost for labor, and accordingly the choice of labor is a static. For capital, we follow

Bloom (2009) to assume that the adjustment cost takes the following form:

$$C(K_t, I_t, A_d(\theta,t)) = (I^+ + (1-C_K^P)I^-) + \left(C_K^F 1_{I\neq 0}\right) R(A_d(t,\theta)) + C_K^Q K\left(\frac{I}{K}\right)^2, \quad (6)$$

where $C_K^P \in (0,1)$ is the loss due to resell; C_K^F is the fixed cost; C_K^Q is the convex adjustment cost.

The value function for FDI is

$$\begin{aligned} & V_f(A_d(\theta,t), K(t); S_0(t)) \quad (7)\\ = & \max_{I(t),L(t)} (A_d(\theta,t)E(t))^{\frac{1}{\sigma}} P(t)^{\beta} K(t)^{\beta\alpha} L(t)^{\beta(1-\alpha)} - C(K_t, I_t, A_d(\theta,t)) - w(t)L(t) - f_I \\ & + \frac{1}{1+r} \\ & E\Big[\max\left\{V_f(A_d(\theta,t+1), K(t+1); S_0(t+1)), V_x(A_d(\theta,t+1), K(t+1); S_1(t+1)) - f_x^e, 0\right\}\Big], \end{aligned}$$

where $K(t+1) \equiv (1-\delta)K(t) + I(t)$, and $S_0(t) \equiv (P(t), E(t), w(t))$ is a three-dimension vector capturing the aggregate state in China. $S_1(t) \equiv (P(t), E(t), b_1 w(t), \tau(t), e(t))$ is a five-dimension vector capturing the aggregate state in both China and Japan. $V_x(.;.)$ is the value function of exporting.

For exporting, the demand is going to be

$$\frac{q(\theta,t)}{\tau(t)} = \frac{p(\theta,t)^{-\sigma}}{P(t)^{1-\sigma}} A_d(t)E(t), \quad (8)$$

which yields the following revenue function:

$$R(A_d(t),\theta) = p(\theta,t)\frac{q(\theta,t)}{\tau(t)} = (A_d(t)E(t))^{\frac{1}{\sigma}} \left(\frac{q(\theta,t)P(t)}{\tau(t)}\right)^{\beta}, \quad (9)$$

The value function of exporting is

$$\begin{aligned} & V_x(A_d(\theta,t), K(t); S_1(t)) \quad (10)\\ = & \max_{I(t),L(t)} (A_d(\theta,t)E(t))^{\frac{1}{\sigma}} \left(\frac{P(t)}{\tau(t)}\right)^{\beta} K(t)^{\beta\alpha} L(t)^{\beta(1-\alpha)} - e(t)C(K_t, I_t, A_d(\theta,t)) \\ & - e(t)b_1 w(t)L(t) - e(t)f_x + \frac{1}{1+r} \\ & E\Big[\max\left\{V_f(A_d(\theta,t+1), K(t+1); S_0(t+1)) - f_I^e, V_x(A_d(\theta,t+1), K(t+1); S_1(t+1)), 0\right\}\Big], \end{aligned}$$

where $K(t+1) \equiv (1-\delta)K(t) + I(t)$.

4.4. Equilibrium Conditions and Simulation

We state equilibrium conditions in this subsection. First, let us rewrite the the idiosyncratic firm-specific demand shock as $\theta(t)$ (i.e., $A_d(t,\theta) = \theta$).

Since the key innovation of our model is that firm's forecast affects its choice of investment and hiring, we need to introduce this into the first order condition (FOC) concerning the choice of labor and capital. Specifically, we assume that the firm thinks the realized demand shock is $b\theta$ with $b \in \{b_0, b_2\}$. Furthermore, it is assumed that $b_0 > 1$ (pre-crisis) and $b_2 < 1$ (after the shock). Based on these assumptions, FOC with respect to labor is

$$(b\theta(t)E(t))^{\frac{1}{\sigma}} P(t)^{\beta} K(t)^{\beta\alpha}[\beta(1-\alpha)]L(t)^{\beta(1-\alpha)-1} = w(t). \tag{11}$$

for FDI firms and

$$(b\theta(t)E(t))^{\frac{1}{\sigma}} \left(\frac{P(t)}{\tau(t)}\right)^{\beta} K(t)^{\beta\alpha}[\beta(1-\alpha)]L(t)^{\beta(1-\alpha)-1} = e(t)b_1 w(t). \tag{12}$$

for exporting firms. From these two conditions, we derive labor demand at the firm level in equilibrium. If $b < 1$, the firm chooses to hire fewer workers than the case with the correct forecast. When the firm contemplates the choice of capital investment, a smaller b is going to negatively affect the investment and make more firms choose to be inactive. Price of the good can be derived using the firm-level choices of capital and labor and the demand functions (i.e., equations (3) and (8)). The comparative statics is the change in b and a_1.

Third, the demand for capital investment (or FDI) is a dynamic choice. We should solve it numerically.

Fourth, we assume that $\tau(t)e(t)b_1$ is much smaller than one, and f_I^e is much bigger than f_x^e. As a result, we have the pecking-order pattern for various activities. Specifically, when $\theta > \theta_e^f$, firms choose FDI. When $\theta \in [\theta_d^e, \theta_e^f]$, firms choose exporting.[25] When $\theta < \theta_x^e$, firms exit (i.e., choosing domestic production). Since we have three production modes now, we should have six cutoffs (i.e., three entry cutoffs and three exit cutoffs). The zero profit conditions (ZPC) imply that

$$V_f(\theta_e^f, K(t); S_0(t)) - f_I^e = V_x(\theta_e^f, K(t); S_1(t)), \tag{13}$$

$$V_f(\theta_d^f, K(t); S_0(t)) - f_I^e = 0, \tag{14}$$

and

$$V_x(\theta_d^e, K(t); S_1(t)) - f_x^e = 0. \tag{15}$$

[25] θ_e^f is the entry cutoff from exporting to FDI. θ_d^e is the entry cutoff from domestic production to exporting.

These three conditions are used to pin down the three entry cutoffs into exporting and FDI. From the above equations, we conclude that

$$\theta_e^f > \theta_d^f > \theta_d^e, \tag{16}$$

if $f_I^e >> f_x^e$ and $\tau >> 0$.

Fifth, we discuss the exit margin. Exit conditions imply that[26]

$$V_f(\theta_f^e, K(t); S_0(t)) = V_x(\theta_f^e, K(t); S_1(t)) - f_x^e, \tag{17}$$

$$V_f(\theta_f^d, K(t); S_0(t)) = 0, \tag{18}$$

and

$$V_x(\theta_e^d, K(t); S_1(t)) = 0. \tag{19}$$

These three conditions are used to pin down the three exit cutoffs (θ_f^e, θ_f^d and θ_e^d). From the above equations, we conclude that

$$\theta_f^e > \theta_e^d > \theta_f^d, \tag{20}$$

if $f_I^e >> f_x^e$ and $\tau >> 0$.

A simple comparison between equations (28) to (20) shows the following ordering:

$$\theta_e^f > \theta_f^e, \tag{21}$$

$$\theta_d^e > \theta_e^d, \tag{22}$$

and

$$\theta_d^f > \theta_f^d. \tag{23}$$

Free entry condition is used to pin down the mass of active firms in equilibrium M_a:

$$\int_{\theta_d^e}^{\theta_e^f} [V_x(\theta, K(t); S_1(t)) - f_x^e] + \int_{\theta_e^f}^{\infty} [V_f(\theta, K(t); S_0(t)) - f_I^e] = f_E, \tag{24}$$

where f_E is the entry cost into this "big" industry. Note that the mass of active firms affect the ideal price index $P(t)$ which in turn affects the value function. Intuitively, when the mass of firms increases in the steady state, the ideal price index goes down and the market becomes tougher. As a result, the value of entry goes down. A higher entry cost f_E should lead to a smaller mass of active firms.

The condition that entry equals exit pins down the mass of entrants, M_e, in the steady state as follows. Suppose every period the firm redraws the demand shock.

[26] θ_f^e is the exit cutoff from FDI to exporting. θ_e^d is the exit cutoff from exporting to domestic production.

Then, entry into FDI equals exit from FDI implies that

$$M_e[1 - G(\theta_d^f)] + M_a[1 - G(\theta_e^f)] = M_a G(\theta_f^e). \tag{25}$$

We have other equilibrium conditions as well: entry into exporting = exit from exporting; the number of surviving entrants = the number if exiting firm among incumbents.

Finally, the determination of the ideal price index is

$$P(t) \equiv \left[\int_{\theta_d^e}^{\theta_e^f} p_x^{1-\sigma}(\theta, t) \frac{M_a}{1 - G(\theta_d^e)} + \int_{\theta_e^f}^{\infty} p_f^{1-\sigma}(\theta, t) \frac{M_a}{1 - G(\theta_d^e)} \right]^{\frac{1}{1-\sigma}}, \tag{26}$$

where $G(.)$ is the CDF of the firm-specific demand shock. $p_x(\theta, t)$ is the price changed by the exporting firm and $p_f(\theta, t)$ is the price changed by the FDI firm.

4.5. A Simplified Model

Let us ignore the margin of domestic production and consider the choice between exporting and FDI only. Several modifications are needed. First, we assume that the fixed operation cost of exporting is zero (i.e., $f_x = 0$) and the entry cost into exporting is also zero (i.e., $f_x^e = 0$). These assumptions imply that every entrant survives (i.e., at least exporting) in equilibrium, and exporting firms will not exit the market. Second, we will only have two cutoffs: θ_e^f (i.e., the entry) and θ_f^e (i.e., the exit). The two conditions that are used to pin down the cutoffs are

$$V_f(\theta_e^f, K(t); S_0(t)) - f_I^e = V_x(\theta_e^f, K(t); S_1(t)) \tag{27}$$

and

$$V_f(\theta_f^e, K(t); S_0(t)) = V_x(\theta_f^e, K(t); S_1(t)). \tag{28}$$

The above two indifference conditions imply that

$$\theta_e^f > \theta_f^e.$$

As a result, there is an inaction range (i.e., entry and exit). We are interested in how a change in a_1 or(/and) b affects the length of this range as well as other firm-level activities.

4.5.1. Discussion

We can throw away the mode of domestic production only when the entry/exit margin between exporting and domestic production was not affected by the island crisis substantially. Otherwise, we have to incorporate this margin into the model. Two

value functions in the simplified model are modified to

$$\begin{aligned} & V_f(\theta(t), K(t); S_0(t)) \\ = & \max_{I(t), L(t)} (\theta(t)E(t))^{\frac{1}{\sigma}} P(t)^{\beta} K(t)^{\beta\alpha} L(t)^{\beta(1-\alpha)} - C(K_t, I_t, \theta(t)) - w(t)L(t) - f_I \\ & + \frac{1}{1+r} E\Big[\max\left\{ V_f(\theta(t+1), K(t+1); S_0(t+1)), V_x(\theta(t+1), K(t+1); S_1(t+1)) \right\} \Big] \end{aligned} \tag{29}$$

and

$$\begin{aligned} & V_x(\theta(t), K(t); S_1(t)) \\ = & \max_{I(t), L(t)} (\theta(t)E(t))^{\frac{1}{\sigma}} \Big(\frac{P(t)}{\tau(t)} \Big)^{\beta} K(t)^{\beta\alpha} L(t)^{\beta(1-\alpha)} - e(t)C(K_t, I_t, \theta(t)) - e(t)b_1 w(t)L(t) \\ & + \frac{1}{1+r} E\Big[\max\left\{ V_f(\theta(t+1), K(t+1); S_0(t+1)) - f_I^e, V_x(\theta(t+1), K(t+1); S_1(t+1)) \right\} \Big]. \end{aligned} \tag{30}$$

The free entry condition in the steady state is changed to

$$\int_{\theta_{min}}^{\theta_e^f} V_x(\theta, K; S_1) + \int_{\theta_e^f}^{\infty} [V_f(\theta, K; S_0) - f_I^e] = f_E. \tag{31}$$

The ideal price index is redefined as

$$P(t) \equiv \left[\int_{\theta_{min}}^{\theta_e^f} p_x^{1-\sigma}(\theta, t) M_a + \int_{\theta_e^f}^{\infty} p_f^{1-\sigma}(\theta, t) M_a \right]^{\frac{1}{1-\sigma}}, \tag{32}$$

The choice of labor and capital is still determined by equations (12), (13) and the adjustment cost.

4.6. Quantitative results: TO BE ADDED

We need to use calibration to back out values of the following parameters:

$$f_E, f_I^e, f_x^e, f_I, f_x, C_K^P, C_K^F, C_K^Q, \tau, a_1.$$

We should try to obtain values of the following parameters from the data or exiting papers:

$$E(t), w(t), b_1, e(t), a_0, b_0, b_2, r, \delta, \sigma.$$

For instance, $\sigma = 4$ (Melitz Ghironi QJE); $r = 6.5\%$ and $\delta = 10\%$ (Bloom ECMA); We can also do robustness check by changing the price of capital goods.

The comparative statics is the change in b and a_1.

In the simplified model, we don't need to back out f_x^e and f_x.

Extensions: Endogenous formation of forecast; three production modes; GE feed-

back.

5. Concluding Remarks

Using data of Japanese MNCs and the sudden escalation of the island dispute between China and Japan in 2012, we provide causal evidence on the effect of a temporary uncertainty shock on long-term business activities. Specifically, we find that a sharp, but temporary fall in local sales of Japanese MNCs in China (after the island crisis) led to persistent downward deviation of FDI flows from Japan to China from its pre-crisis trend. Moreover, despite the quick recovery of local sales, Japanese MNCs in China persistently underestimated their local sales which generate pessimistic forecast errors. We view this as evidence for a belief-driven channel through which an unexpected shock leads agents to revise their beliefs and start tail risk hedging.

Nevertheless, much remains to be done. Currently, we are modeling the belief-driven channel proposed above theoretically and exploring its quantitative impact on the drop of FDI inflows and capital investment of Japanese MNCs in China. In addition, other effects of the island crisis on Sino-Japan economic relationship (e.g., its impact on the location choice of global value chains) also wait to be analyzed.

6. Acknowledgement

We are grateful to the Ministry of Economy, Trade and Industry (METI) for providing the micro-data of the Basic Survey of Japanese Business Structure and Activities (BSJBSA), the Basic Survey on Overseas Business Activities (BSOBA), and the Quarterly Survey of Overseas Subsidiaries (QSOS). This research was conducted under the project "Data Management" at the Research Institute of Economy, Trade and Industry (RIETI).

7. Reference

1. Abel, Andrew B., and Janice C. Eberly (1996): "Optimal investment with costly reversibility," *Review of Economic Studies*, 63(4): 581-593.
2. Antràs, Pol (2003): "Firms, Contracts, and Trade Strucuture," *Quarterly Journal of Economics* 118(4): 1375-1418.
3. Antràs, Pol (2005): "Incomplete Contracts and the Product Cycle," *American economic review* 95(4): 1054-1073.
4. Antràs, Pol and Elhanan, Helpman (2004): "Global Sourcing," *Journal of Political Economy* 112(3): 552-580.
5. Bachmann, Rudiger and Christian Bayer (2014): "Investment Dispersion and the Business Cycle," *American Economic Review* 104(4): 1392-1416.
6. Bachmann, Ruediger, Steffen Elstner, and Erik R. Sims (2013): "Uncertainty and Economic Activity: Evidence from Business Survey Data," *American Economic Journal: Macroeconomics* 5(2): 217-249.
7. Baker, Scott R., Nicholas Bloom, and Steve J. Davis (2012): "Measuring Economic Policy Uncertainty," Unpublished manuscript, Stanford University.
8. Baker, Scott R., and Nicholas Bloom (2013): "Does Uncertainty Drive Business Cycles? Using Disasters as Natural Experiments," NBER working paper 19475.
9. Bernanke, Ben. S. (1983): "Irreversibility, Uncertainty, and Cyclical Investment," *Quarterly Journal of Economics*, 98(1): 85-106.
10. Bloom, Nicholas (2009): "The Impact of Uncertainty Shocks," *Econometrica* 77(3): 623-685.
11. Bloom, Nicholas (2014): "Fluctuations in Uncertainty," *Journal of Economic Perspectives*, 28(2): 153-76.
12. Bloom, Nicholas, Stephen Bond, and John Van Reenen (2007): "Uncertainty and Investment Dynamics," *Review of Economic Studies* 74(2): 391-415.
13. Bloom, Nicholas and Floetotto, Max and Jaimovich, Nir and Saporta Eksten, Itay and Terry, Stephen (2012): "Really Uncertain Business Cycles," NBER working paper 18245.
14. Boehm, Christoph, Aaron Flaaen, and Nitya Pandalai Nayar (2014): "Input Linkages and the Transmission of Shocks: Firm-Level Evidence from the 2011 Tohoku Earthquake," Unpublished manuscript, University of Michigan.
15. Brainard, S. L. (1997): "An Empirical Assessment of the Proximity-Concentration Trade-off Between Multinational Sales and Trade," *The American Economic Review* 87(4): 520-544.
16. Carballo, Jeromino (2015): "Global Sourcing Under Uncertainty," Unpublished manuscript, University of Colorado.

17. Dixit, Avinash K., and Robert S. Pindyck (1994): "Investment under Uncertainty," Princeton University Press.

18. Fisman, Raymond J., Yasushi Hamao, and Yongxiang Wang (2013): "The Impact of Interstate Tensions on Economic Exchange: Evidence from Shocks to Sino-Japanese Relations," Unpublished manuscript, University of Southern California.

19. Fuchs, Andreas, and Nils-Hendrik Klann (2013): "Paying a Visit: The Dalai Lama Effect on International Trade," *Journal of International Economics*, 91(1): 164-177.

20. Guiso, Luigi, and Giuseppe Parigi (1999): "Investment and Demand Uncertainly," *Quarterly Journal of Economics* 114(1): 185-227.

21. Gulen, Huseyin and Mihai Ion (2015): "Policy Uncertainty and Corporate Investment," *Review of Financial Studies forthcoming*.

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

23. Handley, Kyle, and Nuno Limao (2014): "Policy Uncertainty, Trade and Welfare: Theory and Evidence for China and the U.S." NBER working paper 19376.

24. Handley, Kyle, and Nuno Limao (2015): "Trade and Investment under Policy Uncertainty: Theory and Firm Evidence," *American Economic Journal: Economic Policy* 7(4): 189-222.

25. Helpman, Elhanan (1984): "A Simple Theory of International Trade with Multinational Corporations," *Journal of Political Economy* 92(3): 451-471.

26. Helpman, Elhanan, Marc J. Melitz and Steven R. Yeaple (2004): "Export vs. FDI," *American Economic Review* 94(1): 300-316.

27. Kehrig, Matthias (2011): "The Cyclicality of Productivity Dispersion," Working Papers 11-15, Center for Economic Studies, U.S. Census Bureau.

28. Kozlowski, Julian, Laura Veldkamp, and Venky Venkateswaran (2015): "The Tail that Wags the Economy: Belief-Driven Business Cycles and Persistent Stagnation," NBER working paper 21719.

29. Leahy, John, and Toni Whited (1996): "The Economic Effect of Uncertainty on Investment: Some Stylized Facts," *Journal of Money, Credit and Banking*, 28(1): 64-83.

30. Markusen, James R. (1984): "Multinationals, Multi-Plant Economies, and the Gains from Trade," *Journal of International Economics* 16(3): 205-226.

31. Morikawa, Masayuki (2013): "What Type of Policy Uncertainty Matters for Business?," Discussion papers 13076, Research Institute of Economy, Trade and Industry (RIETI).

32. Morikawa, Masayuki (2016): "Policy Uncertainty: Evidence from survey data (in Japanese)," Discussion papers 16005, Research Institute of Economy, Trade and Industry (RIETI).

33. Novy, Dennis, and Alan M. Taylor (2014): "Trade and Uncertainty," Unpublished manuscript, University of Warwick.

34. Senga, Tatsuro (2015): "A New Look at Uncertainty Shocks: Imperfect Information and Misallocation," Unpublished manuscript, Queen Marry University of London.

35. Stein, Luke C.D. and Elizabeth Stone (2013): "The Effect of Uncertainty on Investment, Hiring, and R&D: Causal Evidence from Equity Options," Unpublished manuscript, Arizona State University.

8. Tables and Figures

Table 1. *Annual FDI Flows and the Island Shock: Negative Impact (Unit: One Million JPY)*

	(1) log(FDI flow)	(2) log(FDI flow)	(3) log(FDI flow)	(4) log(FDI flow)
$Shock_t$	-0.137***	-0.137***	-0.122***	-0.129***
	(-4.50)	(-4.42)	(-3.38)	(-3.78)
$Shock_t * China_f$	-0.0860***	-0.0871**	-0.125***	-0.127***
	(-2.63)	(-2.59)	(-4.80)	(-4.63)
$\log(Capital)_{ft}$	3.361***	3.376***	2.234***	2.286***
	(6.91)	(7.19)	(7.39)	(8.50)
$\log(Revenue)_{ft}$	-0.319***	-0.316***	-0.356***	-0.357***
	(-6.98)	(-6.66)	(-7.86)	(-7.46)
$\log(Capital)_{p(f)t}$		-0.0580		-0.0631
		(-0.54)		(-1.48)
$\log(Revenue)_{p(f)t}$		0.0155		0.0198
		(0.36)		(0.58)
Year F.E. in 2011	-	-	Yes	Yes
Country F.E.	Yes	Yes	Yes	Yes
Firm F.E.	Yes	Yes	Yes	Yes
Time span	2012-2013	2012-2013	2011-2013	2011-2013
Year after shock	2013	2013	2013	2013
N	32002	31599	46057	45538
R^2	0.761	0.761	0.644	0.646
adj. R^2	0.412	0.412	0.364	0.366

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standard errors are clustered at the country level.

Since 75% obs. have zero FDI flows, we add one to the actual FDI flow when taking logs.

Top and bottom one percent obs. are winsored.

Table 2. *Annual Capital Investment and the Island Shock: Negative Impact (Unit: One Million JPY)*

	(1) linv1	(2) linv1	(3) linv1	(4) linv1	(5) linv	(6) linv
$Shock_t$	0.0322	0.0327	0.0951**	0.0976**	0.126**	0.130**
	(0.78)	(0.76)	(1.99)	(1.99)	(2.20)	(2.24)
$Shock_t * China_f$	-0.0887*	-0.0900*	-0.156***	-0.155***	-0.160***	-0.159***
	(-1.78)	(-1.77)	(-4.06)	(-4.05)	(-3.09)	(-3.05)
$\log(Capital)_{ft}$	0.142	0.139	0.192*	0.194*	0.181	0.184
	(0.97)	(0.98)	(1.83)	(1.78)	(1.36)	(1.29)
$\log(Revenue)_{ft}$	0.00669	0.00882	0.109**	0.108**	0.0845	0.0784
	(0.08)	(0.11)	(2.25)	(2.20)	(1.28)	(1.18)
$\log(Capital)_{p(f)t}$		-0.163		0.0505		0.0466*
		(-1.05)		(1.45)		(1.77)
$\log(Revenue)_{p(f)t}$		0.00201		0.0212		-0.0125
		(0.06)		(1.30)		(-0.46)
Year F.E. in 2011	-	-	Yes	Yes	Yes	Yes
Country F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Time span	2012-2013	2012-2013	2011-2013	2011-2013	2011-2013	2011-2013
Year after shock	2013	2013	2013	2013	2013	2013
N	27827	27549	40107	39760	28041	27790
R^2	0.936	0.936	0.904	0.904	0.895	0.896
adj. R^2	0.835	0.835	0.820	0.821	0.799	0.799

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standard errors are clustered at the country level.

linv=log(capital investment); linv1=log(capital investment+1)

Top and bottom one percent obs. are winsored.

Table 3. *Quarterly Capital Investment and the Island Shock: Negative Impact (Unit: One Million JPY)*

	(1) linv1	(2) linv1	(3) linv	(4) linv	(5) linv	(6) linv
$Shock1_t$	1.433***		1.688***		1.680***	
	(6.21)		(7.42)		(6.67)	
$Shock1_t * China_f$	-0.172***		-0.212***		-0.194***	
	(-4.22)		(-6.45)		(-5.37)	
$Shock2$		1.387***		1.654***		1.647***
		(5.65)		(7.81)		(7.01)
$Shock2 * China$		-0.0903***		-0.0954***		-0.0803***
		(-3.19)		(-3.73)		(-3.24)
$\log(Revenue)_{ft}$	0.401***	0.243***	0.382***	0.383***	0.210***	0.210***
	(7.33)	(5.74)	(7.28)	(7.33)	(5.08)	(5.11)
$\log(Employment)_{ft}$		0.774***			0.795***	0.796***
		(10.23)			(8.31)	(8.29)
Quarterly F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Country F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Time after shock	2012Q3-	2012Q4-	2012Q3-	2012Q4-	2012Q3-	2012Q4-
N	28435	28390	24939	24939	24938	24938
R^2	0.592	0.596	0.653	0.653	0.659	0.659
adj. R^2	0.549	0.554	0.616	0.615	0.622	0.622

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Two quarterly dummies are excluded. Therefore, the shock dummy is identifiable.

Standard errors are clustered at the country level.

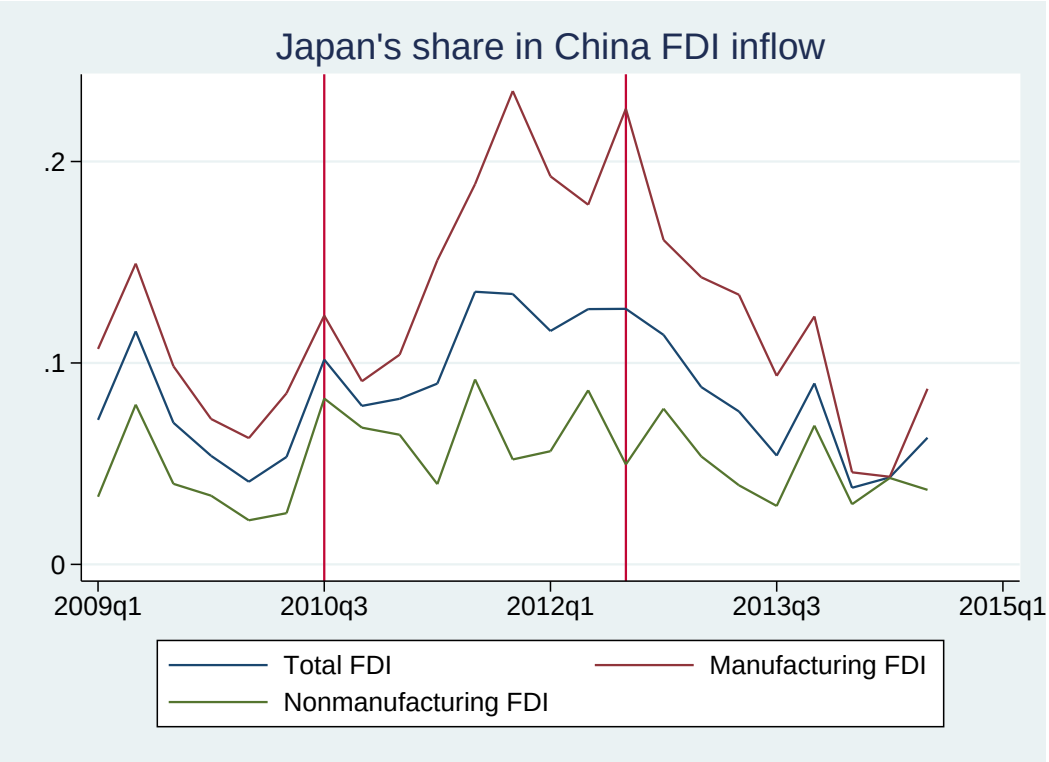
linv=log(capital investment); linv1=log(capital investment+1)

Top and bottom one percent obs. are winsored.

China and non-China specific linear time trends are included.

Time span: 2010/Q1-2015/Q2.

Figure 1. *Share of FDI Flows from Japan*



The island shock happened in the third quarter of 2012 (i.e., the second red vertical line). Data are obtained from the Bank of Japan.

Table 4. *Quarterly Capital Investment and the Island Shock: Placebo Tests (Unit: One Million JPY)*

	(1) linv1	(2) linv	(3) linv1	(4) linv	(5) linv1	(6) linv1	(7) linv
*Shock*3	1.366***	1.614***					
	(5.80)	(7.48)					
*Shock*3 ∗ *China*	-0.0245	0.0350					
	(-0.50)	(1.17)					
*Shock*4			1.359***	1.642***			
			(5.77)	(7.13)			
*Shock*4 ∗ *China*			-0.000852	-0.0679			
			(-0.01)	(-1.39)			
*Shock*5					1.337***		
					(5.75)		
*Shock*5 ∗ *China*					0.0750		
					(1.43)		
*Shock*6						1.333***	1.611***
						(5.79)	(7.32)
*Shock*6 ∗ *China*						0.0897	0.0447
						(1.66)	(0.92)
$\log(Revenue)_{ft}$	0.244***	0.210***	0.244***	0.211***	0.244***	0.243***	0.210***
	(5.74)	(5.10)	(5.78)	(5.77)	(5.20)	(5.78)	(5.15)
$\log(Employment)_{ft}$	0.775***	0.797***	0.775***	0.796***	0.775***	0.775***	0.797***
	(10.24)	(8.27)	(10.22)	(8.28)	(10.20)	(10.22)	(8.27)
Quarterly F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time after shock	2013Q3-	2013Q3-	2011Q3-	2011Q3-	2014Q1-	2011Q1-	2011Q1-
N	28390	24938	28390	24938	28390	28390	24938
R^2	0.596	0.659	0.596	0.659	0.596	0.596	0.659
adj. R^2	0.554	0.622	0.554	0.622	0.554	0.554	0.622

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

Two quarterly dummies are excluded. Therefore, the shock dummy is identifiable.

Standard errors are clustered at the country level. Top and bottom one percent obs. are winsored.

linv=log(capital investment); linv1=log(capital investment+1).

Time span: 2010/Q1-2015/Q2. China and non-China specific linear time trends are included.

Table 5. *Forecast Errors of Annual Sales and Investment: More Pessimistic after the Island Crisis*

	(1) FEsales	(2) FEsales	(3) FEsales	(4) FEinv	(5) FEinv
$Shock_t$	0.0146	0.0133	0.0442***	-0.0951	-0.0862
	(0.76)	(0.70)	(2.76)	(-1.60)	(-1.44)
$Shock_t * China_f$	0.0479**	0.0487***	0.0240*	0.169**	0.173**
	(2.59)	(2.70)	(1.69)	(2.30)	(2.37)
$\log(Capital)_{ft}$	-0.00577	-0.00611	-0.0236	0.117	0.119
	(-0.16)	(-0.16)	(-1.33)	(0.38)	(0.37)
$\log(Revenue)_{ft}$	0.388***	0.386***	0.323***	0.134	0.112
	(9.88)	(9.98)	(15.06)	(0.93)	(0.81)
$\log(Capital)_{p(f)t}$		-0.00944	-0.0254**		-0.00102
		(-0.73)	(-2.25)		(-0.01)
$\log(Revenue)_{p(f)t}$		0.0181	0.0154*		-0.107
		(1.20)	(1.80)		(-0.96)
Year F.E. in 2011	-	-	Yes	Yes	Yes
Country F.E.	Yes	Yes	Yes	Yes	Yes
Firm F.E.	Yes	Yes	Yes	Yes	Yes
Time span	2012-2013	2012-2013	2011-2013	2011-2013	2011-2013
Belief adjusts from	2013	2013	2013	2013	2013
N	21264	21021	30540	15745	15635
R^2	0.769	0.765	0.655	0.538	0.540
adj. R^2	0.407	0.398	0.358	0.091	0.091

t statistics in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standard errors are clustered at the country level.

FEsales=(realized sale-projected sales)/projected sales.

FEinv=(realized capital investment-projected capital investment)/projected capital investment.

Top and bottom one percent obs. are winsored.

Table 6. *Forecast Errors of Local Sale and the Island Shock: More Pessimistic After Shock*

	(1)	(2)	(3)	(4)
	Forecast Error1	Forecast Error1	Forecast Error2	Forecast Error2
$Shock1_t$	0.865*		0.914***	
	(1.86)		(3.21)	
$Shock1_t * China_f$	0.171***		0.265***	
	(2.72)		(4.39)	
$Shock2_t$		0.864*		0.921***
		(1.84)		(3.24)
$Shock2_t * China_f$		0.179***		0.254***
		(2.79)		(4.96)
$\log(Revenue)_{ft}$	0.703***	0.700***	0.899***	0.893***
	(14.35)	(14.03)	(13.71)	(13.45)
$\log(Employment)_{ft}$	-0.373***	-0.371***	-0.395***	-0.392***
	(-11.08)	(-10.96)	(-7.69)	(-7.70)
Quarterly F.E.	Yes	Yes	Yes	Yes
Country F.E.	Yes	Yes	Yes	Yes
Firm F.E.	Yes	Yes	Yes	Yes
Belief adjusts from	2013Q1-	2013Q2-	2013Q1-	2013Q2-
N	21770	21770	21296	21296
R^2	0.171	0.171	0.212	0.212
adj. R^2	0.079	0.079	0.125	0.125

t statistics in parentheses. Time span: 2010Q1-2015Q2.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Two quarterly dummies are excluded. Therefore, the shock dummy is identifiable.

Standard errors are clustered at the country level.

Only observations with non-missing value of the forecast is included.

China and non-China specific linear time trends are included.

*Forecast Error*1: forecast error one-period before.

*Forecast Error*2: forecast error two-period before.

Table 7. *Capital Investment and Forecast Error: Quarterly*

	(1) linv	(2) linv1	(3) linv	(4) linv1	(5) linv	(6) linv1
$sales\_fr\_l1$	-0.0248***	-0.0179*				
	(-2.92)	(-1.84)				
$lagsales\_fr\_l1$			-0.0150*	-0.0236**	-0.0150*	-0.0236**
			(-1.82)	(-2.45)	(-1.82)	(-2.45)
lR	0.468***	0.463***	0.276***	0.274***	0.276***	0.274***
	(9.44)	(9.83)	(5.22)	(5.25)	(5.22)	(5.25)
lemp			0.835***	0.820***	0.835***	0.820***
			(9.78)	(9.67)	(9.78)	(9.67)
Quarterly F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes
N	23372	26413	20198	22209	20198	22209
R^2	0.656	0.597	0.665	0.600	0.665	0.600
adj. R^2	0.618	0.554	0.627	0.555	0.627	0.555

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standard errors are clustered at the firm level.

linv=log(capital investment); linv1=log(capital investment+1)

$sales\_fr\_l1$: Forecast Error (one period ahead)

$lagsales\_fr\_l1$: Lagged forecast Error (one period ahead)

Top and bottom one percent obs. are winsored.

Time span: 2010Q1-2015Q2.

Table 8. *Capital Investment and Forecast Error: Quarterly*

	(1) linv	(2) linv1	(3) linv	(4) linv1
sales_fr_l2	-0.0211**	-0.0235**		
	(-2.53)	(-2.50)		
lagsales_fr_l2			-0.00155	-0.0133
			(-0.18)	(-1.31)
lR	0.259***	0.284***	0.261***	0.263***
	(5.53)	(6.33)	(5.01)	(5.17)
lemp	0.795***	0.773***	0.841***	0.817***
	(10.55)	(10.22)	(10.09)	(9.71)
Quarterly F.E.	Yes	Yes	Yes	Yes
Firm F.E.	Yes	Yes	Yes	Yes
N	24535	27926	20750	22976
R^2	0.660	0.597	0.664	0.594
adj. R^2	0.623	0.555	0.625	0.550

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standard errors are clustered at the firm level.

linv=log(capital investment); linv1=log(capital investment+1)

sales_fr_l2: Forecast Error (two periods ahead)

lagsales_fr_l2: Lagged forecast Error (two periods ahead)

Top and bottom one percent obs. are winsored.

Time span: 2010Q1-2015Q2.

Table 9. *Forecast Error and Capital Investment: Kaiji*

	(1) linv	(2) linv	(3) linv1	(4) linv1
$sales_{err}$	-0.0590**	-0.0584**	-0.0579***	-0.0585***
	(-2.20)	(-2.16)	(-3.00)	(-3.01)
lsubR	0.329***	0.324***	0.297***	0.294***
	(14.15)	(13.89)	(16.73)	(16.53)
lparR		0.0642***		0.0544***
		(3.50)		(3.46)
Year F.E.	Yes	Yes	Yes	Yes
Firm F.E.	Yes	Yes	Yes	Yes
Country F.E.	Yes	Yes	Yes	Yes
N	56543	56220	81880	81431
R^2	0.819	0.820	0.827	0.827
adj. R^2	0.756	0.757	0.772	0.772

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standard errors are clustered at the firm level.

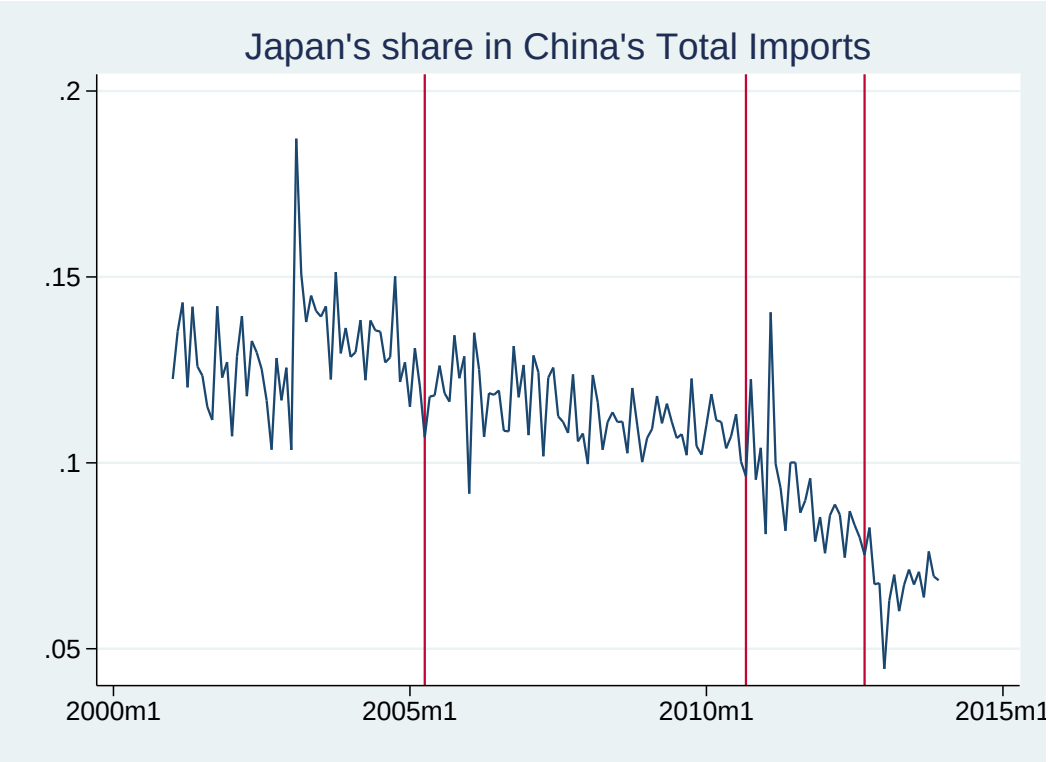
Top and bottom one percent obs. are winsored.

linv=log(capital investment); linv1=log(capital investment+1)

$sales_{err}$: Forecast error of total sales.

Time span: 2004-2013.

Figure 2. *Share of Japanese Imports*

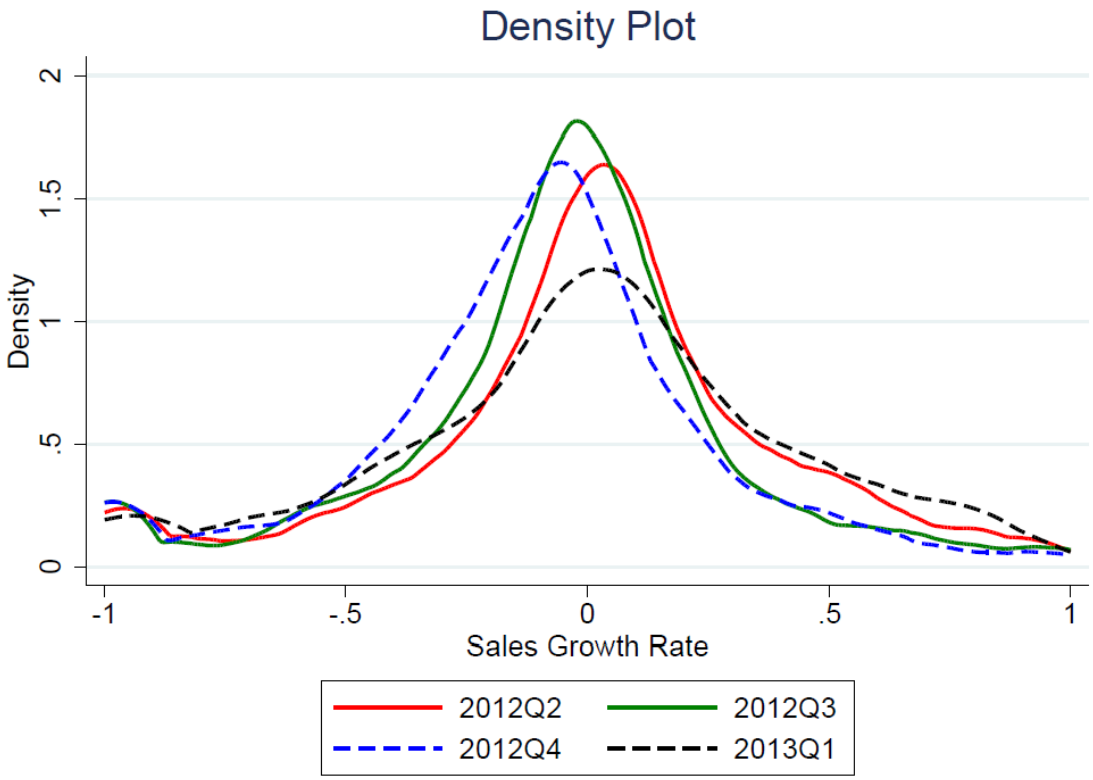


The last red vertical line corresponds to the month when the large scale anti-Japanese demonstrations happened. Data are obtained from Japanese customs.

Figure 3. *Local sales in China dropped in 2012 Q3 and 2012 Q4 after the burst of the island dispute*

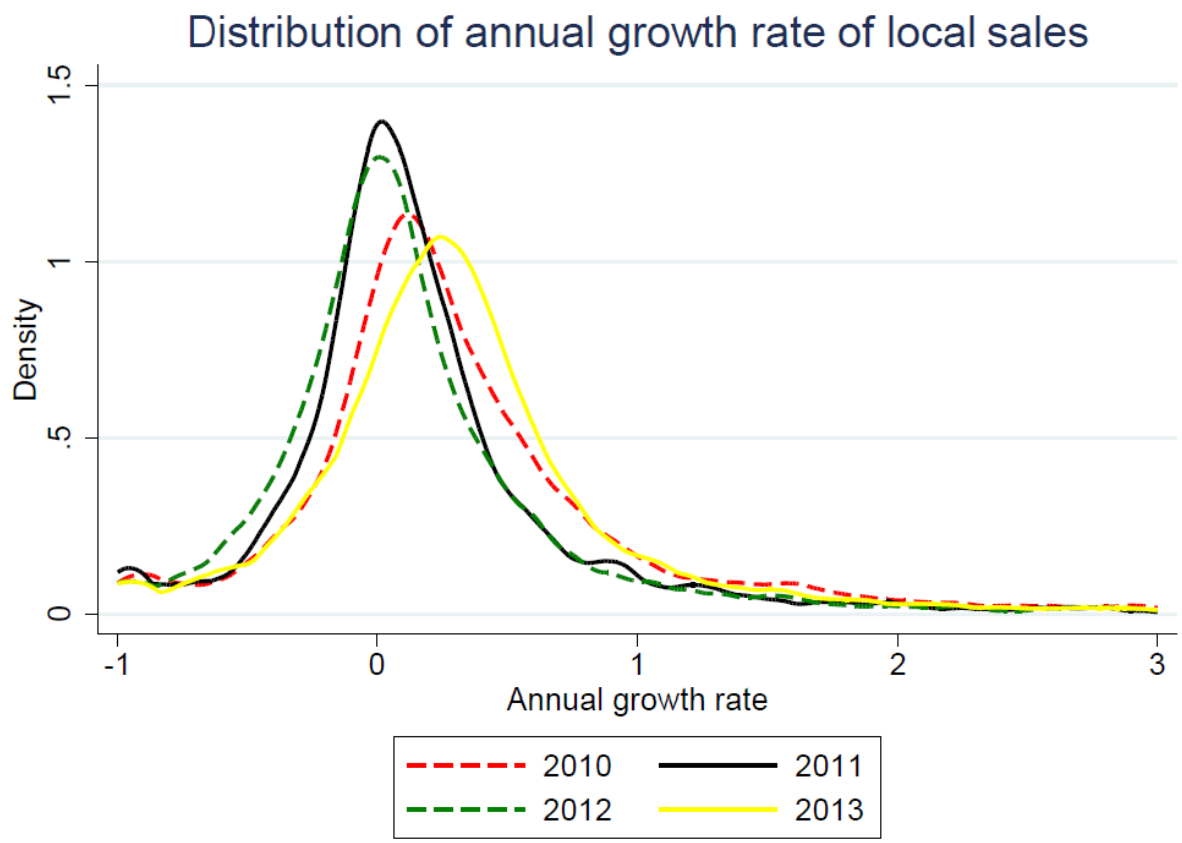
Constructed from the Quarterly Survey of Overseas Subsidiaries released by the Ministry of Economy, Trade and Industry. Two series are HP-filtered log local sales of subsidiaries of Japanese multinational firms: Blue solid line is for China and red dashed line is for all other countries. Both are in US dollars.

Figure 4. *Distribution of Quarterly Growth Rate of Local Sales*



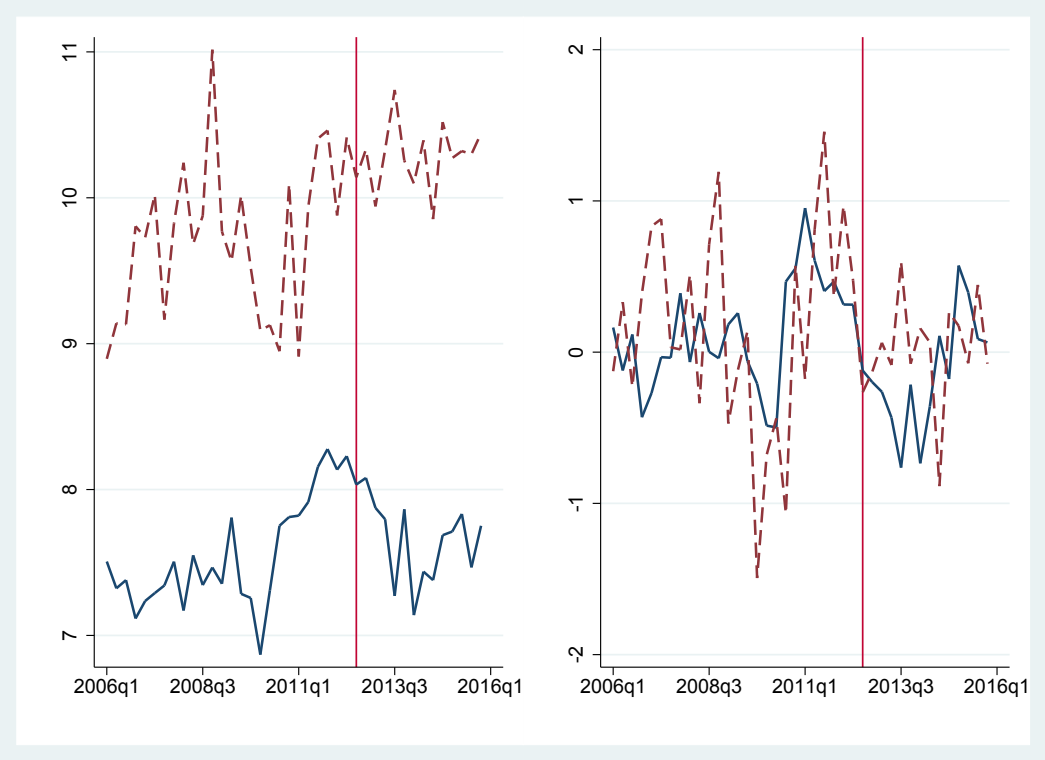
Plotted from our unbalanced panel using the Quarterly Survey of Overseas Subsidiaries released by the Ministry of Economy, Trade and Industry. Observations with growth rate lower than −100% *or higher than* 100% *are excluded.*

Figure 5. *Distribution of Annual Growth Rate of Local Sales*



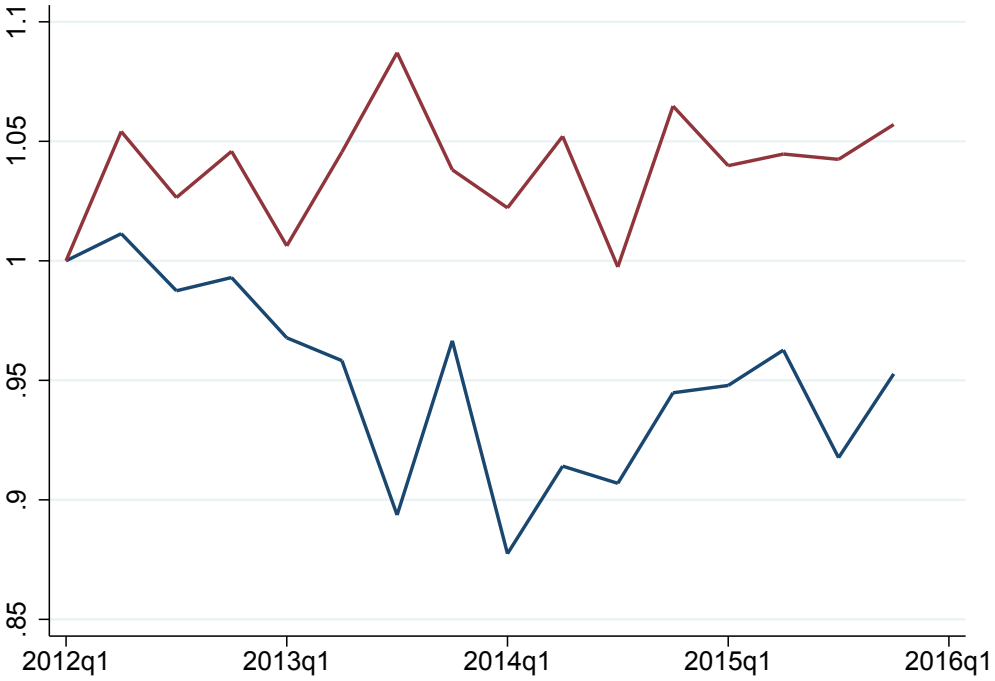
Plotted from our unbalanced panel using the firm-level data of the Survey of Overseas Business Activities released by the Ministry of Economy, Trade and Industry. Observations with growth rate lower than −100% *or higher than* 300% *are excluded.*

Figure 6. *Aggregate FDI flows from Japan to China and Other Countries*



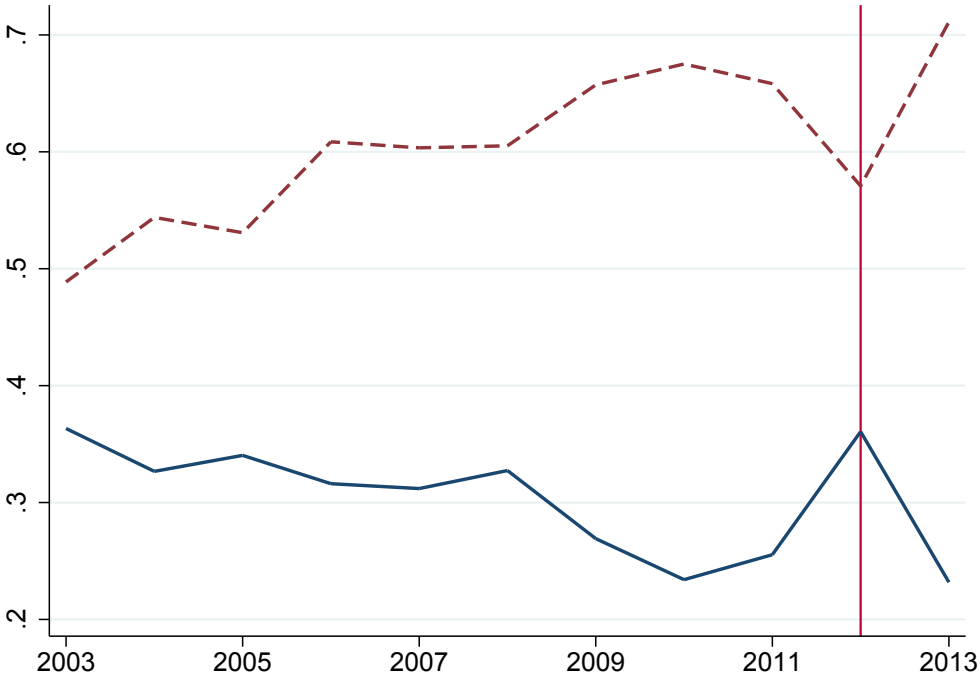
Constructed from the dataset called Japan's Outward and Inward Foreign Direct Investment reported by the The Japan External Trade Organisation. The left panel shows log series of FDI flows from Japan to China (blue solid line) and the other countries (red dashed line). Both are in US dollars. Since the Ministry of Finance and the Bank of Japan revised the balance of payments statistics and thus the data series is disconnected around January 2014. The right panel shows the annual change rate of FDI flows calculated as $log(FDI_t) - log(FDI_{t-4})$ *where t denotes the quarter.*

Figure 7. *Evolution of Log FDI flows*



Constructed from the data called Japan's Outward and Inward Foreign Direct Investment reported by the The Japan External Trade Organisation. Blue solid line plots log series of FDI flows from Japan into China. Red line plots log series of FDI flows from Japan into all other countries. We normalize $\log(FDI)$ *in 2012Q1 to one and both are in US dollars. Since the Ministry of Finance and the Bank of Japan revised the balance of payments statistics and thus the data series is disconnected around January 2014.*

Figure 8. *FDI inaction increases and positive FDI flows decreases*

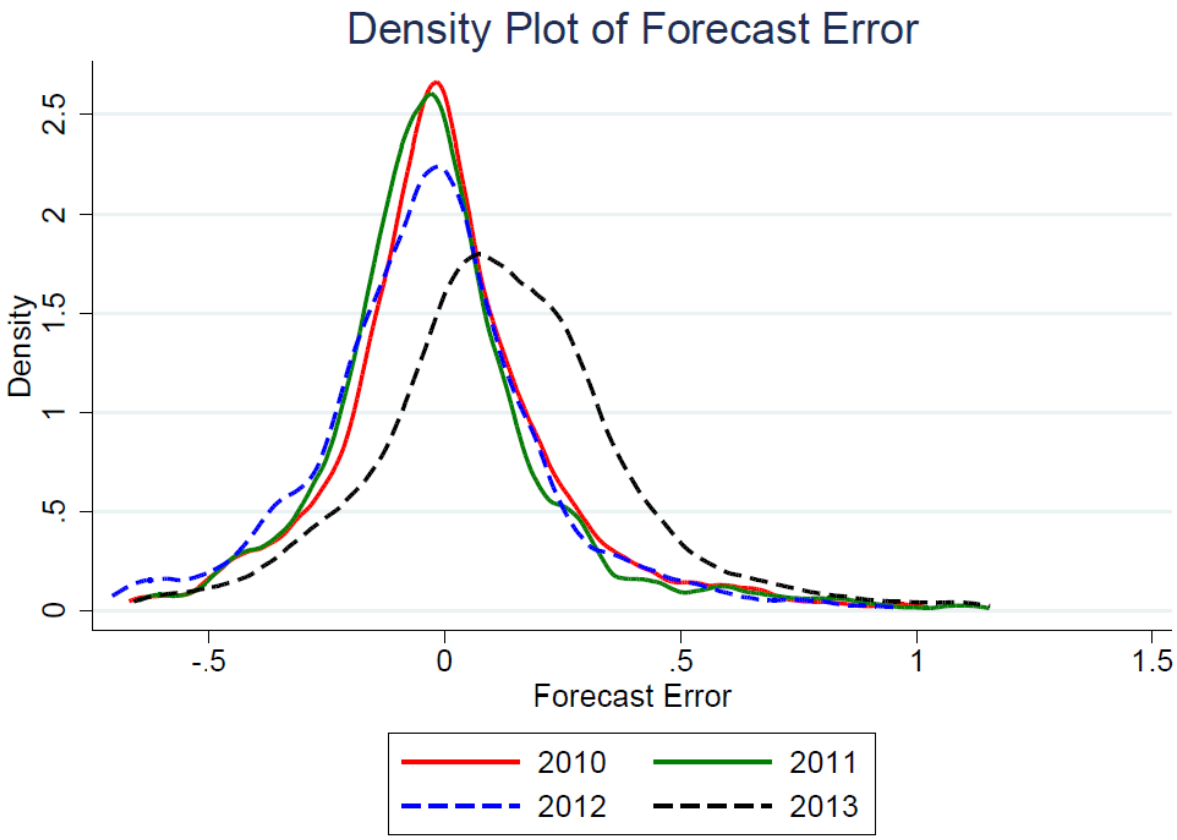


Constructed from our unbalanced panel using the firm-level data of the Survey of Overseas Business Activities released by the Ministry of Economy, Trade and Industry. Blue solid line plots the population share of firms that undertake positive FDI in China. Red dashed line plots the population share of firms that report zero FDI inflows. The fractions are calculated amongst total number of Japanese subsidiaries in China.

Figure 9. *FDI entry decreases and FDI exit increases*

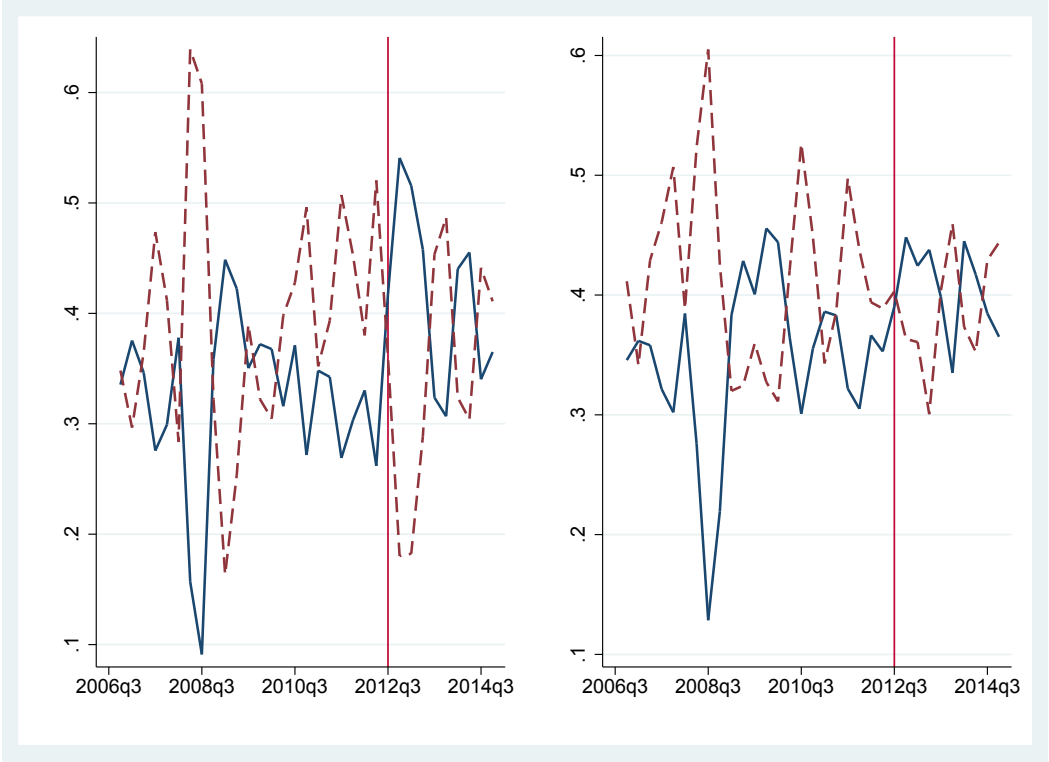
Constructed from our unbalanced panel using the Survey of Overseas Business Activities released by the Ministry of Economy, Trade and Industry. Blue solid line plots the population share of firms that enter by undertaking the initial FDI into China during each year. Red dashed line plots the population share of firms that report exit in the previous year. The fractions are calculated amongst total number of Japanese subsidiaries in China.

Figure 10. *Distribution of Forecast Errors of Annual Total Sales*



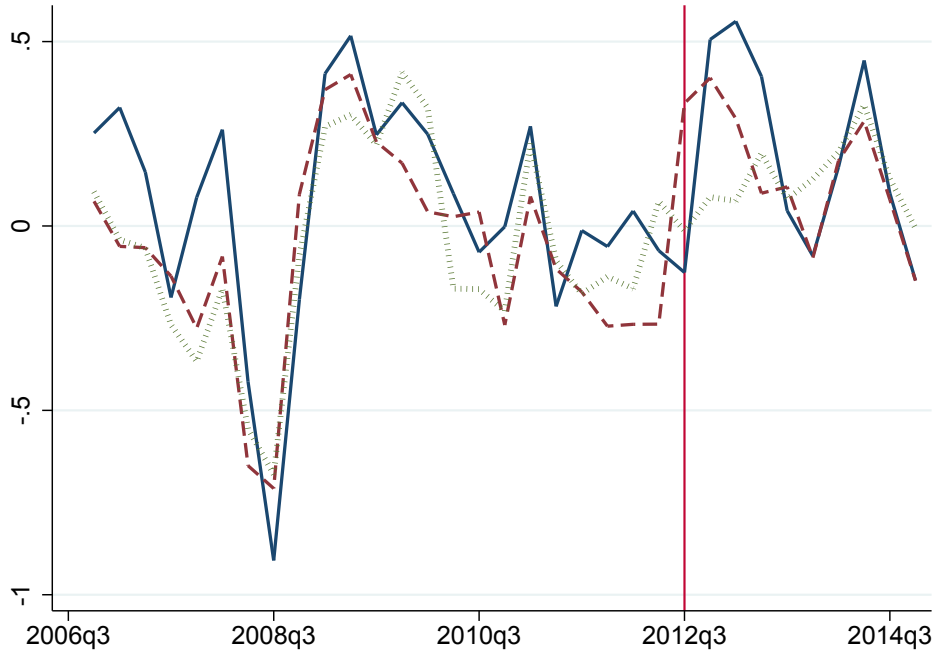
Constructed from our unbalanced panel using the Survey of Overseas Business Activities released by the Ministry of Economy, Trade and Industry. Forecast error is calculated as $\frac{Realized\ Sales - Projected\ Sales}{Projected\ Sales}$. *Therefore, any positive value of forecast error implies that a firm underestimates its sales and vice versa.*

Figure 11. *Downside Scenarios for Local Sales in China*



Constructed from our unbalanced panel using the Quarterly Survey of Overseas Subsidiaries released by the Ministry of Economy, Trade and Industry. Forecast errors are defined over the grid points [-2, -1, 0, +1, +2], being calculated as (up(+1), down(-1) or unchanged(0): realized changes in sales) - (up(+1), down(-1) or unchanged(0): projected changes in sales), for each destination (total sales, local sales and sales to Japan). Blue solid line plots the fraction of firms whose forecast error is greater than or equal to +1. Red dashed line plots the fraction of firms whose forecast error is smaller than or equal to -1. The left panel is for local sales and the right panel is for sales to Japan. Note that the forecast error of 2012/Q3 is the difference between the projected change in sales and the realized change in sales in 2013/Q1, as the forecast is made two quarters in advance.

Figure 12. *Cross-sectional Average of Forecast Errors at the Quarterly Level (Total Sales, Local Sales and Sales to Japan)*



Constructed from our unbalanced panel using the Quarterly Survey of Overseas Subsidiaries released by the Ministry of Economy, Trade and Industry. Forecast error is defined over the grid points [-2, -1, 0, +1, +2], being calculated as (up(+1), down(-1) or unchanged(0): realized changes in sales) - (up(+1), down(-1) or unchanged(0): projected changes in sales), for each destination (total sales, local sales and sales to Japan). Blue solid line plots the cross-sectional weighted average of forecast error for total sales, while red dashed line and gray dotted line plot that for local sales and for sales back to Japan, respectively. The weight we use is total sales. Note that the forecast error of 2012/Q3 is the difference between the projected change in sales and the realized change in sales in 2013/Q1, as the forecast is made two quarters in advance.

Figure 13. *Summary Statistics of the Basic Survey on Overseas Business Activities*

Annual Data Summary Statistics (Unit: One Million JPY)

Variable	Obs	Mean	Std. Dev.	Min	Max
FDI flow	166,855	89	8,582	-2,874,730	553,445
Capital investment of foreign affiliate	141,316	388	5,968	-299	1,107,438
Capital of foreign affiliate	210,603	1,924	17,898	-52	4,542,300
Sales of foreign affiliate	182,904	11,591	88,160	-51	7,888,623
Number of employees of foreign affiliate	188,809	277	1,182	0	80,575
Capital of parental firm	213,840	55,217	106,010	0	1,467,840
Sales of parental firm	210,025	1,025,806	2,610,635	0	23,100,000
Number of employees of parental firm	208,566	4,704	11,906	0	210,000

Figure 14. *Summary Statistics of the Quarterly Survey of Overseas Subsidiaries*

Quarterly Data Summary Statistics (Unit: One Million JPY)

Variable	Obs	Mean	Std. Dev.	Min	Max
Total sales	170,923	4,517	20,384	0	1,194,321
Local sales	170,923	3,174	18,475	-2	1,128,653
Capital investment	170,977	148	982	-1	101,263
Number of employees	170,940	727	1,842	0	58,874
Forecast of total sales in the next quarter	113,061	0.106	0.679	-1	1
Forecast of total sales in the next next quarter	111,307	0.144	0.633	-1	1
Forecast of local sales in the next quarter	93,372	0.094	0.651	-1	1
Forecast of local sales in the next next quarter	92,202	0.135	0.607	-1	1