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"The Effects of Foreign Direct Investment on Industrial Growth:
Evidence from a Regulation Change in China"

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The Effects of Foreign Direct Investment on Industrial Growth: Evidence from a Regulation Change in China*

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Abstract

Inward foreign direct investment (FDI) in China has been accompanied by rapid economic growth. A growing literature has emerged in recent years examining the role of FDI on Chinese economic growth. However, measuring the effects of FDI has been challenging, because other factors which influence firms' productivity occur in parallel with FDI, and because economic growth also simultaneously attracts FDI. To address these endogeneities, this paper analyzes the effects of a change in the FDI regulations on the productivity growth of Chinese industries using Chinese industry-level panel data. In 2002, the Chinese government lifted its regulations on the entry of foreign affiliates, which has made it substantially easier for foreign firms to engage in FDI in affected industries. As a result of this regulation change, our difference-in-differences estimates show that these industries experienced significantly larger increases in foreign firms' total sales, exports, and domestic sales. We also find that this increase in FDI resulted in an increase in labor productivity and in total factor productivity (TFP) of the affected industries and local industries, but we do not find that they experienced significantly larger inflows of FDI or productivity growth before 2002, which provides evidence against endogeneity concerns. The results above are sufficiently robust to include changes in industrial tariff reduction as controls. These findings suggest that the growth of foreign sales and TFP in affected industries is not well explained except by the effects of regulation changes.

Keywords: Foreign Direct Investment; Regulation Change; Industrial Growth; Technology Spillovers; Difference-in-Differences.

JEL Classification: F21, O33, O38, O43.

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1 Introduction

This paper considers the effects of changes in foreign direct investment (FDI) regulations on the productivity growth of Chinese industries. Economists have shown growing interest in whether FDI can bring productivity gains to host countries, developing countries in particular. Previous studies have recognized three main roles of FDI in developing countries. First, foreign entrants are major players influencing technological upgrades, and establishment and development of new industries. Second, a foreign presence will generate productivity spillovers to local industries by stimulating contact with local customers. Third, FDI inflows translate into capital formation in local industries (for a review of the literature on these three roles, see Harrison and Rodríguez-Clare forthcoming).

A growing body of literature that studies the role of FDI in China relates to two important questions. First, a recent study suggests that the resemblance of the bundle of goods exported from China to those from the OECD and the sophistication of China's exports are greater than one would expect given China's size and income level. In the trade literature, a number of papers examine the effect of FDI on export sophistication (Xu and Lu 2009, Feenstra and Wei ed. 2010). Second, during the period in which China has experienced rapid economic growth since economic reforms started in 1978, FDI inflows have totaled 92 billion U.S. dollars, making it the largest FDI recipient among the developing countries. In this context, there are a large number of studies focusing on the impact of FDI on economic growth in China.

This paper is related to two strands of literature on the topics of trade and development. First, it contributes to understanding the effect of foreign plants in developing countries. Aitken and Harrison (1999) found that a foreign presence in an industry is negatively associated with the performance of local firms in that industry, while Javorcik (2004) found that foreign plants lead to growth in the productivity of local plants in the industries supplying those foreign plants. Second, recent papers explore spillover effect mechanisms by analyzing what kinds of plants reap

greater benefits. Todo and Miyamoto (2006) show that FDI conducted by local R&D-performing firms have a larger impact on domestic firms than FDI conducted by firms that do not perform local R&D.

Measuring such effects empirically has been challenging, however, because of endogeneity problems. The main sources of endogeneity are omitted variable bias and simultaneous bias. The latter makes the evaluation of the impact of FDI a particularly difficult problem. Previous empirical studies typically regress some measures of productivity such as labor productivity or total factor productivity (TFP) on measures of foreign direct investment. However, growing industries may attract more FDI inflows. Industries with growing suppliers or buyers could also attract more FDI inflows. In order to examine the real impacts of FDI, we need exogenous variations in FDI that are not correlated with the growth potential of industries or firms.

To address the endogeneity of FDI, this paper focuses on an FDI regulation change that occurred in accordance with the protocol on China's WTO accession. In 2002, the Chinese government lifted its regulations on the entry of foreign subsidiaries, which makes it substantially easier for foreign firms to engage in FDI in more than 40 percent of all listed industries (first and second columns of Table 1 below). Foreign investors or foreign firms would not have expected this regulation change, because this was the initial regime shift in FDI made to comply with the protocol on their WTO accession. The crucial implication of this change was that foreign investors might have viewed this as a signal that the Chinese government would commit to complying with existing international rules on investment and trade. Additionally, they would not have known all the information about which industries would be subject to the lifting of the regulations until at least half a month before the regulation change was put in force[1]. We thus interpret this initial regime shift with respect to FDI as varying significantly among industries.

Several studies are closely related to the approach taken in this paper. Pérez-González (2005) focuses on the effect of a change in Mexico's FDI regulations on plant performance. The Mexican government eliminated restrictions on foreign majority ownership in 1989. Endogeneity concerns cannot be avoided when using acquiring majority ownership as an exogenous variation because

[1] To our knowledge, the whole list was first published in the "International Trade News" on March 15, 2002.

we do not know what kinds of plants underwent ownership structure changes. Blonigen and Ma (2009) and Du, Harrison, and Jefferson (2010) use FDI policy in China to evaluate FDI's impact on firm productivity[2]. To our knowledge, none of the previous literature on this topic examines the difference between groups affected by the policy change and a control group. We set up a difference-in-differences analysis, contrasting the outcomes of affected industries and unaffected industries before and after the regulation change was implemented.

In the empirical part of this paper, we use Chinese industry-level panel data to estimate the effect of FDI on productivity measures. An advantage of having industry-level panel data is that we address omitted variable bias by controlling for unobserved heterogeneity among industries. Our difference-in-differences estimates show that these industries experienced significantly larger increases in the foreign firms' total sales, exports, and domestic sales. We also find that this change in FDI led to an increase in labor productivity and in the TFP of the affected industries and local industries. Our results suggest that FDI contributes to industrial growth, thus to improved labor productivity, capital intensity, and TFP.

We perform two kinds of analysis to provide evidence that alternative hypotheses cannot fully explain the results described above. First, we show that there is no significant increase in foreign sales and productivity measures for these industries in the periods where there was no regulation change, which provides evidence that the increase in FDI since 2002 is due to deregulation. Second, we see that the result above is robust enough to allow including changes in industrial tariff reduction as controls for omitted variables. These findings suggest that the growth of foreign sales and TFP in affected industries cannot be explained by such factors as tariff reductions, which are correlated with regulation changes.

We then consider whether there are productivity spillovers from industries affected by the regulation change. We find that concomitant with the regulation change there was an increase in foreign sales in an affected industries and downstream industries. We also find that this change led to an increase in labor productivity, in capital stock, and in the TFP of downstream industries. In contrast, we find the regulation change led to a decrease in foreign sales in upstream industries.

[2] We refer to Blonigen and Ma (2009) and Du, Harrison, and Jefferson (2010) again in the next section.

It also resulted in a decrease in labor productivity, in capital stock, and in the TFP of upstream industries.

Finally, we provide evidence on the mechanisms of this productivity growth using two types of analysis. First, we examine the impact of FDI on separating foreign capital in the affected industries. We find evidence that the affected industries attracted increased foreign capital from non-Chinese sources, while there was no significant change in foreign capital from Chinese sources (including Hong Kong, Taiwan, and Macau). Second, using United Nations' Broad Economic Categories, we classified each affected project into one of three categories: intermediate goods, capital goods, or final goods. This showed that almost all the projects that benefited were for intermediate or capital goods. Difference-in-differences estimates show that the regulation change increased foreign firms' total sales, exports, and domestic sales in intermediate-or-capital-good-intensive industries("Intermediate-or-capital-good-intensive industries" hereafter will mean an industry that produces more intermediate or capital goods than final goods). It also resulted in an increase in labor productivity, the capital–labor ratio, and the TFP in final-good-intensive industries ("Final-good-intensive industries" hereafter will mean an industry that produces more final goods than intermediate or capital goods as well). This suggests that expansion of the activities of affected firms receiving foreign investment was induced by increased foreign sales in intermediate-or-capital-good-intensive industries and resulted in increased productivity as the specialization of final goods using the affected intermediate or capital goods increased.

The paper is organized as follows. The next subsection describes the related literature. Section 2.1 outlines the background of FDI policy in China. We describe the details of the regulation change in Section 2.2 and provide data in Section 2.3. Section 3 describes our econometric strategy and shows the baseline results. Section 4 deals with endogeneity concerns. We present a robustness check to provide evidence that alternative hypotheses cannot fully explain the results of Section 3. Section 4.1 shows the increase in the affected industries' foreign-owned firms' sales after the implementation of the regulation change. Section 4.2 shows that the results are robust, allowing inclusion of tariff reductions. In Section 5, we present results of the analysis of productivity

spillovers from industries affected by the regulation change. Section 6.1 shows additional results for different types of foreign capital. Section 6.2 provides evidence that the results came from change in the regulations applying to intermediate-or-capital-good-intensive industries. Section 7 concludes.

2 Related Literature: Effect of FDI on the Chinese Economy

This study is related to a number of papers examining the impact of a foreign presence on productivity in China. Based on a growth accounting approach framework, Whally and Xin (2010) show that firms having foreign investment contributed about 20 to 40 percent of China's GDP growth during 1996–2004. Using province-level panel data, Aoki (2009) also shows that FDI contributed 17 percent of the GDP growth rate over the period 1987–2005. He also shows that FDI inflows led to an increase in the regional income disparity index. It has also been reported that foreign enterprises in China have introduced more than twice as many new goods as domestic firms (Brambilla, 2009), and that their sales have grown faster in China than the sales of domestic firms (Du and Girma, 2009).

This paper is a part of a growing body of literature using various levels of data from China to examine the spillover from foreign to domestic enterprises. Hu and Jefferson (2002) show a negative effect of the average share of foreign equity participation in domestic enterprises on the TFP of the Chinese electronics industry. Their results are consistent with the results of Aitken and Harrison (1999). Liu (2002) finds a positive spillover effect of average share of foreign equity participation on real value-added growth among the domestic sectors of Shenzhen. Ran, Voon, and Li (2007) find that higher foreign equity participation shares in industry levels relate to output growth in related industries. However, these papers do not consider vertical spillover from firms receiving foreign investment. Previous studies investigating vertical spillovers include Liu (2008) and Lin, Liu, and Zhang (2009). Liu (2008) finds that backward linkages seem to be the most important channel through which spillover affects the productivity of domestic firms[3]. This result

[3] In terms of the distribution of effects across provinces, they also show that local industries in the western region do not benefit from FDI inflows. Cheung and Lin (2004) find a positive correlation between foreign equity share

is consistent with the results of Javorcik (2004). Liu (2008) also finds that spillovers through forward linkages between industries have positive effects on the productivity of domestic firms. Along with Liu (2008), Lin, Liu, and Zhang (2009) find consistent positive forward spillover from FDI on Chinese firms. Note that their results are based on a full sample which includes domestic and foreign firms. The fact that forward spillover has positive effects on the productivity of domestic firms in China is different from the results of previous papers in international trade. However, their results are not robust for the domestic sample, and they do not explore the mechanism behind the positive forward spillover.

Another set of empirical studies explores the mechanisms of spillover effects in China by analyzing what kinds of local firms are reaping greater benefits. Hu, Jefferson, and Qian (2005) show that domestic firms that perform local in-house R&D experienced larger productivity improvements through increased FDI inflows[4]. Abraham, Konings, and Slootmaekers (2010) show that export-driven foreign-invested firms do not generate positive spillover to the domestic market. They also find that joint ventures are more likely to have a positive impact on local productivity than wholly foreign-owned enterprises. Based on these results, they suggest that creating an environment in which collaboration with foreign firms is likely to generate benefit for local firms, but that attracting export-driven investment is not necessarily a beneficial strategy for generating positive spillover to domestic producers. Lin, Liu, and Zhang (2009) examine the extent to which FDI inflows affect firm productivity through various channels, including the market orientation of the foreign-invested firms, the sources of FDI, and ownership of domestic firms. They estimate that robust forward spillover effects occur regardless of such differences in firm characteristics. Du and Girma (2009) use propensity score matching to analyze the impact of foreign capital participation. They focus on firms that received some foreign finance for the first time between 2000 and 2003. The empirical results show that the effects of foreign acquisition on domestic sales growth exhibit a marked increase two to three years after acquisition. However, there is doubt

and the number of patent applications. Their findings suggest that foreign equity share affects patent applications through increases in external design rather than through increases in invention and utility models. Madariaga and Poncet (2007) find an increase in the local FDI rate raises the per capita income in surrounding localities.

[4]Lai, Peng, and Bao (2006) find that the positive effect of R&D activities on GDP growth arises in a region with higher human capital stocks and a higher exports ratio.

about whether foreign capital is invested in growing local firms.

This paper is related to this literature in that we examine spillover from foreign to domestic enterprises and analyze what kinds of local firms are receiving more of the benefits. The contribution of this paper is not only that we address the endogeneity issue in measuring the effect of FDI on productivity, but we also find a positive forward spillover effect on the productivity of domestic firms in China and explain a mechanism linking the positive forward spillover effect and the FDI regulation change.

Finally, our study is most closely related to papers by Blonigen and Ma (2009) and Du, Harrison, and Jefferson (2010), which examine the impact of FDI policy in China[5]. Blonigen and Ma (2009) use the industries and products listed in the Catalogue for the Guidance of Industries for Foreign Investment published in 2002 as a proxy for reducing the cost of technology transfer from foreign firms to examine whether the market share and export unit value of domestic firms match those of foreign firms that have invested in China. However, there is no evidence that Chinese firms have caught up to the foreign firms. It is notable that Blonigen and Ma (2009) do not analyze changes in the catalogue's listed industries and products. Du, Harrison, and Jefferson (2010) investigate the association between tax incentives for FDI and the spillover effect on domestic firms. Their findings suggest that firms with larger tax incentives generate larger spillover effects to domestic firms. They, however, do not investigate the effects of policy changes, and cannot exclude the possibility that the magnitude of the tax incentive relates to the characteristics of the firms.

[5]Branstetter and Feenstra (2002) use provincial data and find that local Chinese governments' FDI policies inherently weight the welfare of state-owned enterprises (SOEs) four to seven times larger than consumer welfare.

3 Background and Details of the Regulation Change and Data

3.1 Background of the regulation change

This section describes the FDI policy shift in China from the late 1970s to the 1990s. We then focus on the FDI policy change before and after China's WTO accession in 2001[6]. Hu and Jefferson (2008) discuss factors which contribute to rapid economic growth in China. These include high rates of literacy, its market size, and proximity to surrounding dynamic economies. The Chinese central government recognized these strength and implemented measures to attract FDI in order to transfer advanced technologies. They call these measures "trading the market for technology" They first enacted the "Law on Chinese-Foreign Equity Joint Venture" in 1979[7], which encouraged the joint venture form of inward foreign investment. Then they established special economic zones that give preferential tax and administrative treatment to foreign firms locating in eastern coastal cities. These policies were obviously motivated to introduce overseas Chinese capital from such places as Hong Kong, Taiwan, Macau, and Singapore. It was considerably easier to transfer technologies from them because of their cultural proximity. In 1986, the "Law on Foreign Capital Enterprise"[8] was established, which stated that foreign nationals could enter China wholly owned. These laws, however, include requirements on local content, export ratios, and balancing of foreign exchange to encourage technology transfer and to protect domestic market shares from foreign competition[9].

[Insert Figure 1]

[6] We focus on the policy change in the manufacturing sector. For this reason, we do not consider regulation changes in the retail and service sectors. For a recent comprehensive survey of FDI policy changes in China, see Branstetter and Lardy (2008).

[7] People's Daily, 9 July 1979.

[8] Gazette of the State Council of the People's Republic of China, No. 12, May 1986.

[9] These restrictions do not strictly apply to joint ventures since it is easier to acquire foreign partners' expertise. Regulations for the "Implementation of the Law on Chinese-Foreign Equity Joint Ventures" (Gazette of the State Council of the People's Republic of China, No. 21, November 1983) were designed to encourage Chinese exports (Articles 60–62), and provide for foreign exchange that allows the adjustment of trade balances (Article 75). On the other hand, the "Law on Foreign Capital Enterprises" required export restrictions (Article 3), local content (Article 15), and foreign exchange trade balancing (Article 18). The "Rules for the Implementation of the Law on Foreign Capital Enterprises" (Gazette of the State Council of the People's Republic of China, No. 25, May 1991.) enacted in 1990 required (in Article 3) that foreign-invested firms must export more than 50 percent of the annual output value of all their products, thereby realizing a balance between revenues and expenditures in foreign exchange.

In the early 1990s, establishment of laws related to foreign-invested firms and the economic infrastructure and China's commitment to re-accelerate economic reform announced in Deng Xiaoping's 1992 southern tour speech caused a huge upsurge in FDI. As illustrated in Figure 1, the number of FDI inflows increased sharply in 1992–1993 and the total number of FDI projects rose by about 57,000 in 1993. Subsequently, FDI decreased over the period 1995–1999. This shrinkage was affected by implementation of investment guidelines in the "Interim Provisions on Guiding Foreign Investment Direction", which adjusts FDI flows and the issuance of a detailed investment project list in the "Catalogue for the Guidance of Industries for Foreign Investment", which listed information on projects that the central government encouraged, restricted, or prohibited[10]. These measures prompted foreign investors to consider whether their investment projects met the standards of the guidelines and the project list[11]. The Asian financial crisis also affected FDI inflows in the late 1990s.

The magnitude of this decline was more serious than expected because of a series of FDI restrictions. Although the central government restored the expanded provisions for duty-free import of raw materials and production components in 1998[12], it was not likely to affect FDI inflows. FDI inflows increased sharply again after 2000. This increase occurred with the progress of negotiations for World Trade Organization (WTO) accession in the background, as well as revisions of Chinese laws and rules related to foreign-invested companies. Foreign investors interpreted these as signals that the Chinese government was committed to complying with existing international rules on investment and trade.

Local content requirements, export requirements, and export-balancing requirements are prohibited under the WTO Agreement on Trade-Related Investment Measures (TRIMs). For this reason, the central government revised its "Law on Foreign Capital Enterprises"[13] in October

[10] Both measures were published in the "Gazette of the State Council of the People's Republic of China" , No. 17, July 1995. The "Catalogue for the Guidance of Industries for Foreign Investment" was revised in 1998 (Gazette of the State Council of the People's Republic of China, No. 40, January 1998).

[11] In the automobile industry, the "Automotive Industry Policy" published in 1994 (Gazette of the State Council of the People's Republic of China, No. 15, July 1994) stated explicit local content and export requirements.

[12] See "Foreign-Invested Enterprises Approved Duty-Free Imports of Equipment" published in 1998 (Gazette of the State Council of the People's Republic of China, No. 40, January 1998).

[13] Gazette of the State Council of the People's Republic of China, No. 3, January 2001.

2000, and eliminated or modified articles related to these three requirements. Subsequently, the "Law on Chinese-Foreign Equity Joint Ventures"[14] was modified in March 2001, and the "Rules for the Implementation of the Law on Foreign Capital Enterprises"[15] were modified in April 2001. It is noteworthy that these modifications allowed foreign-invested firms to sell all their products domestically if the products were manufactured in China[16]. An additional change surrounding China's WTO accession is that Chinese authorities reduced import tariff rates from those in effect since the early 1990s. The average tariff was 43.2 percent in 1992, which declined to 15.3 percent in 2001.

China concluded negotiations on WTO entry with the European Union in November 1999 and the United States in May 2000. China has been a member of the WTO since 11 December 2001. The central government enforced its "Provisions on Guiding Foreign Investment Direction"[17], and greatly modified the "Catalogue for the Guidance of Industries for Foreign Investment"[18] in accordance with the protocol for China's WTO accession[19].

3.2 Details of the Regulation Change

The Chinese government does not permit all types of inward foreign investment. The "Catalogue for the Guidance of Industries for Foreign Investment" provides clear direction about which types of FDI are encouraged or restricted in certain industries or products. When investors set out to decide on investment projects in China, it is necessary to confirm whether they are eligible for investment by checking this catalogue. The advantage of paying attention to the Catalogue is that it allows us to construct an explicit index of which industries have experienced regulation changes by capturing project category shifts. More than 250 projects[20] are listed in the Catalogue. They

[14] Gazette of the State Council of the People's Republic of China, No. 14, May 2001.

[15] Gazette of the State Council of the People's Republic of China, No.17, June 2001.

[16] The "Automotive Industry Policy" was not modified even after China's WTO accession. The central government finally (in June 2004) published the "Automotive Industry Development Policy" with the "Automotive Industry Policy" being eliminated at the same time (Gazette of the State Council of the People's Republic of China, No. 7, March 2005). In this new policy, explicit local content requirements and export requirements were eliminated.

[17] Gazette of the State Council of the People's Republic of China, No. 9, March 2002.

[18] Gazette of the State Council of the People's Republic of China, No. 3, January 2003.

[19] Report of the working party on the accession of China, p. 8

[20] We do not consider service industries affected by the lifting of regulations.

are classified into one of four categories: (A) "Encouraged" projects receive preferential corporate tax rates and can import production equipment duty-free (no value added tax). (B) "Restricted" projects are not allowed to be controlled by foreign majority ownership, (C) "Permitted" projects can receive investment with no encouragement and no restrictions. (D) Investment in "Prohibited" projects is unconditionally prohibited.

[Insert Table 1]

We focus on the 2002 revision of the Catalogue. It had been revised three times by 2012 by the State Council[21]. The main reason that we focus on the 2002 revision is that it best captures the initial regime shift in FDI after China's WTO accession. There are other reasons that we do not focus on other revisions. The 2004 revision shows only minor changes in some project lists. The 2007 and 2011 revisions are excluded from our observation period as shown below. As we see in Table 1, there was an increase of 52 Encouraged projects, and a decrease of 51 Restricted projects. Note that "Permitted" projects include all projects that are not listed in the Catalogue, so we cannot show the total number of Permitted projects.

[Insert Table 2]

Details of the category changes from 1998 to 2002 are shown in Table 2. There were 80 Permitted or Restricted projects in 1998 that had been changed to Encouraged in 2002, and 38 projects that were Restricted in 1998 that had been changed to Permitted status in 2002. These facts show the magnitude of the policy change. These categorical changes can be classified into two groups. One is referred to as *Relaxed* projects for which regulations on entry were lifted. The other group of projects had their entry regulations strengthened. The former includes the 118 projects mentioned above. The latter group is referred to as *Strengthened* projects. It includes 32 projects that changed from Permitted in 1998 to Restricted in 2002, or from Encouraged in 1998 to Permitted in 2002. This study uses these changes as a source of variation.

[21] (2004 revision, Gazette of the State Council of the People's Republic of China, No. 21; July 2005, the 2007 revision, Gazette of the State Council of the People's Republic of China, No. 17, June 2008; the 2011 revision, http://www.ndrc.gov.cn/zcfb/zcfbl/2011ling/W020111229379511927834.pdf)

[Insert Table 3]

The index of regulation-related changes used in this study is constructed as follows. Starting with projects listed in the Catalogues, we designate each with its four-digit Chinese Standard Industrial Classification (CSIC)[22] and aggregate them at the two-digit CSIC level. An example of the process is shown in Table 3 for the case of transportation equipment manufacturing. The CSIC code 3721 for the manufacture of automobile assembly is assigned to listed projects engaged in automobile assembly [23]. This type of project was changed from Restricted in 1998 to Encouraged in 2002, so the "Relaxed" indicator is set to a value of one. Similarly, CSIC code 3725 matches listed projects involved in the manufacture of engines for automobiles and motorcycles. This type of project was also changed from Restricted in 1998 to Encouraged in 2002, so the indicator for relaxed regulation is set to one in this case as well. Although CSIC code 3725 also covers the manufacture of auto parts and fittings and corresponds to listed projects making key parts for automobiles, we did not consider this project in the process in order to avoid double counting. On the other hand, CSIC code 3732 covers listed projects that manufacture key parts of motorcycles. This type of project was changed from Encouraged in 1998 to Encouraged or Permitted in 2002, which suggests that the "Strengthened" indicator should be set to one. Blank cells in the project column indicate that there are no projects that correspond to a particular CSIC code. Then we constructed a policy change indicator, $Treatment_j$, as follows:

$$Treatment_j = \frac{Sales_{jk}}{\sum_{k \in K} Sales_{jk}} \frac{(Relaxed_{jk} - Strengthened_{jk})}{\sum_{k \in K} Industry_{jk}}, \tag{1}$$

where $Sales_{jk}$ denotes sales in the four-digit industry as collected from China Data Online. $Relax_{jk}$ indicates relaxed regulation. It is equal to one when regulation is lifted in the four-digit industry k that belongs in the two-digit industry j and is zero otherwise. $Strengthened_{jk}$

[22] We use product classifications as statistics in this process.

[23] China has explicitly agreed to lift regulations on entry into some manufacturing industries in accordance with the protocol for its WTO accession. These include the manufacture of automobile and motorcycle assemblies, the manufacture of engines for automobiles and motorcycles, and the manufacture of key parts of automobiles.

denotes strengthened regulation and is equal to one when regulation is strengthened in the four-digit industry k that belongs in the two-digit industry j and is zero otherwise. The indicators are constructed by taking the percentages of the total numbers of four-digit affected industries belonging to each two-digit industry. In addition, we weight the affected four-digit industries by sales share to control for differences in magnitude among industries. The reason for subtracting $Strengthened_{jk}$ from $Relax_{jk}$ is that industries belonging to the $Strengthened_{jk}$ group should have a negative impact on sales and productivity. If we include $Strengthened_{jk}$ in the control group, the estimated results would be positively biased when comparing the treatment group with control group.

[Insert Table 4]

Table 4 summarizes the policy change indicators, weighted indicators and $Treatment_j$ in each industry. It shows that regulation was lifted for an average of 4 projects in each two-digit industry. It also suggests that regulation was relaxed in industries that produce relatively high value-added products such as the manufacturing of special purpose machinery, the manufacturing of transportation equipment, and the manufacture of electrical machinery and equipment. The weighted relaxed indicator is large in industries that produce raw materials such as petroleum processing, coking, nuclear fuel processing, and the manufacture of chemical fibers. Regulation was strengthened in industries where China already had a comparative advantage such as the manufacturing of textiles and the smelting and pressing of ferrous metals.

[Insert Figure 2]

Figure 2 plots sales in foreign firms for treatment and control industries. The growth trend of foreign sales in both industries were reasonably similar until 2002. However, sales in foreign firms jump up from 2002 for the affected industries, while sales in foreign firms for control industries cannot observe a significant change. This graph provides a visual evidence of treatment and control industries with a common underlying trend, and a treatment effect that induces a large

deviation from the underlying trend (Angrist and Pischke, 2008)[24].

We also constructed an industrial tariff change index as another indicator of the policy changes that occurred in accordance with China's WTO entry. It is important to control these input tariffs because Amiti and Konings(2007) and Teshima(2008) provide evidence that lower tariffs can increase productivity or R&D expenditure by inducing tougher import competition. The data we used here came from the Trade Analysis and Information System database collected by the United Nations Conference on Trade and Development, the Integrated Database collected by the WTO, and the China Customs Statistical Yearbook. The index is constructed as follows:

$$Industry\ Tariff_{jt} = \frac{\sum_{i \in I} Import_{ij1999} \times Tariff_{ijt}}{\sum_{i \in I} Import_{ij1999}}, \tag{2}$$

where $Import_{ij1999}$ denotes the quantity of import good i which belonged in industry j in 1999. $Tariff_{ijt}$ denotes the tariff level on import good i which belonged to two-digit industry j in year t. We take a weighted average of $Tariff_{ijt}$ using $Import_{ij1999}$, and aggregate the data at the two-digit industry level[25].

3.3 Data

The results in this paper are based on various industry-level data from Chinese manufacturing sectors. We collected data from the "China Industrial Economy Statistics Yearbook" and the "China Economic Census Yearbook 2004" for the period from 1999 to 2007. The dataset can be considered to be a census of manufacturing firms with sales of 500 million Yuan or more. Tables 5 and 6 present summary statistics for the data before and after regulation changes[26], although

[24] It is important to note that this figure is constructed from four digit industry level data which do not use in the estimation part. We did not have fully access to this dataset when we conducted a main analysis in this paper. For this reason, this figure can be used as a major visual reference for checking on the validity of chinese regulation change in foreign entry that induces exogenous variations in FDI.

[25] Specific tariffs are converted to ad valorem tariffs as follows: we first calculate the amount of import duty from the import quantity, then compute the ratio of the import duty amount to the import amount. We regard this number as an ad valorem equivalent. For convenience, we did not consider slide tariffs and provisional tariffs.

[26] We excluded smelting and pressing of ferrous metals from the analysis because it has grown very rapidly since 2001. Raw steel production was 10.24 million tons in 1996 (when China became the largest raw steel producer) and increased to 14.89 million tons in 2001. In 2007, however, the volume reached 489 million tons, suggesting that it

variables related to exports were not included in this dataset before 2001. The tables show that sales by foreign firms increased sharply between 1999 and 2007. The growth rate of foreign exports exceeds the growth rate of foreign domestic sales. The increase in foreign sales was accompanied by a sharp increase in TFP[27], labor productivity and capital intensity by all industries and local firms[28].

[Insert Table 5]

[Insert Table 6]

The ratio of foreign sales to total sales represents the presence of foreign-invested firms in China. It shows that foreign-invested firms continue to account for nearly one third of the output of the Chinese manufacturing sector. Neither the ratio of total exports to total sales nor the ratio of foreign exports to foreign sales changed greatly during the period.

Thus, we see that foreign-invested firms did not just increase in terms of foreign sales but that they maintained a presence in China. We also find that the increase in foreign sales was accompanied by industrial and local productivity growth. The following section examines the effects of regulation change with respect to foreign investment on foreign firms' activity and industrial productivity measures.

4 Specification and Results

We consider the following questions:

1. Did the regulation change on foreign entry expand the activities of foreign-invested firms in China?

2. Did the regulation change on foreign entry enhance industrial productivity?

The baseline econometric model is the following difference-in-differences specification:

exceeds the combined tonnage from the second to the eighth largest countries. Because of the rapid development of such large-scale economies, we excluded this industry from the analysis.

[27] We calculate TFP as the residuals from industry-specific OLS regressions of log value added on log employment and log capital stock. We will present below.

[28] We recognize that we need to analyze the effects of eliminating local content requirements, export requirements, and trade balance requirements on the activities of foreign-invested firms. However, we cannot examine these changes, because the guidelines for applying these controls on foreign-invested firms differ by region and industry.

$$LogY_{jt} = \alpha + \sum_{i=2}^{26} \beta_i Industry_i + \sum_{t=2000}^{2007} \gamma_t Year_t + \delta Treatment_j \times Post2002_t + \epsilon_{jt}, \quad (3)$$

where j and t index industries and years, respectively; Y_{jt} denotes the dependent variables for foreign sales, foreign exports, foreign domestic sales, industry TFP, industry labor productivity, industry capital intensity, TFP by local firms, labor productivity by local firms, and capital intensity by local firms; β_i is an industry-fixed effect; γ_t is a year-fixed effect; $Treatment_j$ denotes the indicator of policy change as we saw previously; $Post2002_t$ is a time dummy that represents years 2002 and after; and ϵ_{jt} is an error term. The coefficient of interest in this regression is δ, which indicates how the difference between affected industries and unaffected industries changes before and after implementation of the regulation change.

[Insert Table 7]

Table 7 presents the results from the regressions using foreign sales, foreign exports, and foreign domestic sales as dependent variables. The first column of Table 7 shows that the coefficient is 0.1924 and is significant at the 1 percent level. This implies that affected industries increased their foreign sales by 19.24 percent from 2002 if the regulation change occurred in all the four-digit industries belonging to a two-digit industry. The standard deviation of $Treatment_j$ is 0.2862, which implies that affected industries' foreign sales increased by 0.2862×0.1924=5.51 percent from 2002 if affected industries experienced a regulation change one standard deviation larger than unaffected industries. The latter interpretation is due to the fact that $Treatment_j$ is not binary but takes a value [0,1] (For brevity, we hereinafter report the latter interpretation of estimated coefficients).

In these columns, we give estimates for the period from 2001 to 2007 for exports that were available beginning in 2001. The second column shows that the result of the first column is robust for the period from 2001 to 2007. The purpose of the rest of the columns of Table 7 is to examine the sources of foreign sales increases. The third column shows that the coefficient is 0.2074 and

significant at the 5 percent level, implying that affected industries' foreign exports increased by 0.2862×0.2074=5.94 percent from 2002 if the affected industries experienced a regulation change one standard deviation larger than unaffected industries. The fourth column shows that the coefficient is 0.1933 and significant at the 5 percent level, implying that affected industries foreign domestic sales increased by 0.2862×0.1933=5.53 percent from 2002 if the affected industries experienced a regulation change one standard deviation larger than unaffected industries. Thus, these results suggest that the increased production by foreign-invested firms' increase that accompanied the regulation change came from the expansion of both foreign exports and foreign domestic sales.

[Insert Table 8]

Table 8 reports the results of the regressions using TFP, labor productivity, and capital intensity by affected industry as dependent variables. The TFP index is calculated in log form as the difference between value-added and factor use using estimated input shares, that is,

$$logTFP_{jt} = logY_{jt} - \hat{\alpha} logL_{jt} - \hat{\beta} logK_{jt}, \tag{4}$$

where Y denotes industry value added; L denotes industry total employment; and K denotes industry total capital stock, respectively. As a deflator for industry value added we used the ex-factory price index of each industry. As a deflator for industry total capital stock, we used the price index of investment in fixed assets by year[29].

It examines the effect of the regulation change on productivity measures at the industry level. The first column of Table 8 shows a coefficient of 0.0981, significant at the 5 percent level. This suggests that affected industries' TFP increased by 0.2862×0.0981=2.81 percent from 2002 if the affected industries experienced a regulation change one standard deviation larger than unaffected industries. The second and third columns have coefficients of 0.1287 and 0.1301, both significant

[29] We cannot estimate TFP using the Olley-Pakes
or Levinson–Petrin approach, because the dataset we used does not include industry-level annual investment or intermediate input data.

at the 1 percent level. These values imply that in affected industries, labor productivity and capital intensity both increased, by 0.2862×0.1287=3.68 percent and 0.2862×0.1301=3.72 percent respectively from 2002 if they underwent a regulation change one standard deviation larger than unaffected industries.

[Insert Table 9]

Table 9 shows the results of the regressions using the TFP, labor productivity, and capital intensity of domestic firms as dependent variables. The first column of Table 9 has a coefficient of 0.0832 which is significant at the 5 percent level. This implies that affected industries' TFP increased by 0.2862×0.0832=2.38 percent from 2002 if local firms in affected industries underwent a regulation change one standard deviation larger than local firms in unaffected industries. The second and third columns have coefficients of 0.0790 and 0.0130, but the coefficient in the third column is not significant. This suggests that affected industries labor productivity and capital intensity increased by 0.2862×0.0790=2.26 percent from 2002 if affected industries experienced a regulation change one standard deviation larger than unaffected industries. These results show that regulation change in FDI induced an expansion of the affected foreign-invested firms activities as well as an increase in labor productivity and TFP in affected industries and local firms.

5 Robustness Checks

We perform two kinds of analysis to provide evidence that alternative hypotheses cannot fully explain the results of Section 3. Section 4.1 deals with endogeneity concerns. Section 4.2 deals with control variables.

5.1 Endogeneity Check

Our difference-in-differences estimates confirmed that the FDI regulation change that occurred in 2002 resulted in an increase in foreign sales and also resulted in productivity growth. However, in estimating our difference-in-differences estimator, a crucial assumption to be met is that trends

in the outcome variables for affected industries cannot be systematically different from the trends for unaffected industries even if no regulation change occurred in 2002. We cannot directly test this assumption, because we do not have information on the counterfactual status (no regulatory change), but we can test it indirectly by examining the difference in the trends of affected and unaffected industries before the regulation change.

To do so, we estimate using the following equation:

$$Y_{jt} = \sum_{t=2000}^{2007} \beta_t Treatment_j \times Year_t + \sum_{i=2}^{26} \gamma_i Industry_i + \sum_{t=2000}^{2007} \delta_t Year_t + \epsilon_{jt}, \tag{5}$$

[Insert Figure 3]

[Insert Figure 4]

[Insert Figure 5]

where β_t denotes how the difference between the trends of the affected and unaffected industries changes over time. If the trend prior to the regulation change of the affected and unaffected industries are similar, β_{2000} and β_{2001} will not change significantly. Figure 3 depicts the effects of the regulation change on sales by foreign firms over time. It indicates that β_t has increased since 2002, while it did not change significantly prior to 2002. Figure 4 shows the effects of the regulation change on industrial TFP over time. It also shows that there is no evidence of a differential between the trends of affected industries and those of unaffected industries in TFP, but the differences between the trends increased from 2002 to 2004, then decreased after 2004. As discussed in the context of the international trade literature, it may be that TFP growth is related to productivity-enhancing investment before foreign firms begin to export, along with the fact that foreign exports in affected industries increased after the regulation change[30]. This trend can be also seen in Figure 5, which shows the coefficients of the regulation change effects on the

[30] Using industry R&D investment data from a large- and medium-sized enterprises survey recorded in the "China Statistical Yearbook on Science and Technology" we tried to test the implication. However, the definition of "large and medium-sized enterprises" was broadly revised in the "Circular on Issuing Provisional Rules on Criteria of Small and Medium Sized Enterprises" No. 17, April 2003. For this reason, we cannot examine this potential relationship because of data inconsistency.

TFP of local firms.

5.2 Other Hypothesis: Tariff reduction

We examine whether the previous conclusion is robust enough to allow inclusion of the degree of tariff reduction taken in accordance with China's WTO entry. Tariff reduction may correlate the characteristics of regulation change on entry and productivity growth at the same time, which would result in biases in the estimated effects of regulation change on productivity growth. The equation used to estimate this is as follows:

$$Y_{jt} = \alpha + \sum_{i=2}^{26} \beta_i Industry_i + \sum_{t=2000}^{2007} \gamma_t Year_t + \delta Treatment_j \times Post2002_t + \eta Industry\ Tariff_{jt} + \epsilon_{jt}, \tag{6}$$

where $Industry\ Tariff_{jt}$ is the index described in Section 2.

[Insert Table 10]

[Insert Table 11]

The results are shown in Tables 10 and 11. The result above is robust to the inclusion of the industrial tariff reductions as controls. The coefficients are also similar in magnitude and significant at the 1 percent or 5 percent level.

5.3 Vertical Spillover Effects

We examine whether there are productivity vertical spillovers from industries affected by the regulation changes to domestic firms. Following Javorcik (2004), the variable $Backward_j$ captures the intensity of the effect of the regulation change on foreign entry on downstream industries that are supplied by industry j. It is calculated as follows:

$$Backward_j = \sum_{k\ if\ k \neq j} \theta_{jk} Treatment_j, \tag{7}$$

where θ_{jk} denotes the proportion of industry j's total intermediate use that is purchased by industry k. Data on intermediate use was collected from the "2002 Input-Output Table of China".

Similarly, $Forward_j$ measures the intensity of the effect of the regulation change on foreign entry on upstream industries from which industry j purchases its intermediate inputs. Thus, we calculate $Forward_j$ as follows:

$$Forward_j = \sum_{m\ if\ m \neq j} \tau_{jm} Treatment_j, \tag{8}$$

where τ_{jm} denotes the proportion of industry j's total intermediate input that is supplied by industry m[31].

To investigate vertical productivity spillover effects from the regulation change, we estimate the following equation:

$$\begin{aligned} Y_{jt} \quad = \quad & \alpha + \sum_{i=1}^{26} \beta_i Industry_i + \sum_{t=2000}^{2007} \gamma_t Year_t + \delta Treatment_j * Post2002_t \\ & + \eta Backward_j * Post2002_t + \kappa Forward_j * Post2002_j + \epsilon_{jt} \end{aligned} \tag{9}$$

δ indicates how the difference between affected and unaffected industries changes before and after implementation of the regulation change. η indicates how the difference between suppliers in upstream sectors to affected industries and others changes before and after implementation of the regulation change. κ indicates how the difference between buyers in downstream sectors to affected industries and others changes before and after implementation of the regulation change.

[31] This form of the variable $Forward_j$ is slightly different from the form in Javorcik (2004), because "China Data Online" the database we used, does not collect export sales data at the four-digit industry level.

To examine effects on foreign firms' activity and industrial productivity measures, we use Y_{jt} to stand for the dependent variables of foreign sales, foreign exports, foreign domestic sales, industry TFP, industry labor productivity, and industry capital intensity.

[Insert Table 12]

Table 12 shows the regression results using foreign sales, foreign exports, and foreign domestic sales as dependent variables. The first row of the table reports the horizontal spillover within affected industries. The second row indicates spillover that affects backward linkages whose industries supply intermediate inputs used by affected downstream industries. The third row indicates the spillover that carries forward through linkages where industries purchase intermediate inputs from affected upstream industries. The first column of the first row in Table 12 shows a coefficient of 0.7523, which is significant at the 1 percent level. This implies that affected industries' foreign sales decreased by $0.2862 \times 0.7523 = 21.53$ percent from 2002 for affected industries that underwent a regulation change one standard deviation larger than unaffected industries. The first column of the second row has a coefficient of -0.5776, significant at the 1 percent level, implying that the foreign sales of suppliers to affected industries decreased by $0.2252 \times (-0.5776) = -13.01$ percent from 2002 for suppliers to affected industries that underwent experience a regulation change one standard deviation larger than other industries (The standard deviation of $Backward_j$ is 0.2252). We again estimate for the period from 2001 to 2007 in the second column for exports that became available beginning in 2001. We obtain similar results in the first and second row. Unlike the first column, however, the coefficient of the third row is 0.3250 and is significant at the 5 percent level. This suggests that buyers from affected industries increased their foreign sales by $0.1803 \times 0.3250 = 5.86$ percent from 2002 when those buyers experienced a regulation change one standard deviation larger than other industries (the standard deviation of $Forward_j$ is 0.1803).

The rest of the columns in Table 12 examine the sources of foreign sales increases. The third and fourth columns of the first row have coefficients of 0.7878 and -0.1257, but the coefficient for foreign domestic sales is not significant. This suggests that affected industries' foreign exports increased by $0.2862 \times 0.7878 = 22.55$ percent from 2002 under a regulation change one standard de-

viation larger than unaffected industries. The coefficients of the third and fourth columns of the second row have are -0.7674 and -0.2871, both significant at a reasonable level. This indicates that the foreign exports of supplyers to affected industries decreased by $0.2252\times(-0.7674)=-17.28$ percent and that their foreign domestic sales decreased by $0.2252\times(-0.2871)=-6.47$ percent from 2002 those suppliers experience regulatory change one standard deviation larger than other industries. The third and fourth columns of the third row have coefficients of -0.0771 and 0.8802, but the coefficient for foreign export sales is not significant. This implies that the foreign domestic sales by buyers from affected industries increased by $0.1803\times(0.8802)=15.87$ percent from 2002 if those buyers experienced a regulatory change one standard deviation larger than other industries.

We found that increases in foreign sales in affected industries came from the expansion of foreign exports and that increased foreign sales in supplier industries came from the expansion of foreign domestic sales. The latter result is, however, not robust across observation periods. Conversely, the results indicate that foreign sales consistently decrease in industries that purchase intermediate inputs from affected upstream industries.

[Insert Table 13]

Table 13 reports the results from the regressions using TFP, labor productivity, and capital intensity in affected industries as the dependent variables. The first row of Table 13 shows that none of the coefficients are significant at the 10 percent level. All the coefficients in the second row are significantly different from zero at the 1 or 5 percent level and have a negative sign. This indicates that that the TFP of suppliers to affected industries decreased by $0.2252\times(-0.4220)=-9.50$ percent, their labor productivity decreased by $0.2252\times(-0.5170)=-11.64$, and their capital intensity decreased by $0.2252\times(-0.5170)=-3.23$ percent from 2002 when their customers in affected industries experience underwent a regulation change one standard deviation larger than other industries. In contrast, in the third row, all the coefficients are significantly different from zero at the 5 percent level and have positive signs, implying that the TFPs of buyers from affected industries increased by $0.1803\times0.6293=11.35$ percent. Their labor productivity increased by $0.1803\times0.7327=13.21$ percent, and their capital intensity increased by $0.1803\times0.3920=7.07$

percent.

Overall, these results show that the FDI regulation change induced an expansion of the affected foreign-invested firms activities in affected intra-industries and buyer industries as well as an increase in TFP, labor productivity ,and capital intensity in buyer industries. In contrast, It also shows that the regulation change induced a decrease in foreign sales and productivity measures in supplier industries.

These positive spillover effects in downstream industries are consistent with the results of Liu(2008) and Lin, Liu, and Zhang(2009). However, the results are specific to China in contrast to previous findings in international trade. We examine the mechanism of this productivity growth through forward linkages in the next section.

6 Further Discussion

In this section, we determine what mechanism corresponds to the results estimated in Section 3. Section 5.1 examines the effects of regulatory change on different sources of foreign capital. Section 5.2 deals with the types of products affected by the regulatory change.

6.1 Effects of the Regulation Change on Different Sources of Foreign Capital

[Insert Figure 6]

Figure 6 illustrates the correlations between the policy change indicator and variables in the first year of the observation period. The purpose is to see the initial characteristics of affected industries. It shows that affected industries were likely to have lower export ratios and lower foreign presence at the outset, although they were more productive in terms of TFP and capital intensity at that time.

First, we consider the effects of the regulation change on different sources of foreign capital. We use equation (4) to do the estimation. The dependent variables are foreign capital from Chinese sources (Hong Kong, Taiwan, and Macau) and non-Chinese sources.

[Insert Table 14]

Table 14 reports the results of the estimations. There is no evidence that foreign capital in affected industries from Hong Kong, Taiwan, or Macau changed after the regulatory change, while foreign capital from non-Chinese sources increased by 13.63 percent[32]. Foreign enterprises from Hong Kong, Taiwan, and Macau have invested massively in China since the late 1970s[33], and in particular they have been engaged in labor-intensive sectors that produce primarily for export. These are different from the industries affected in the case at hand, which had initially lower export ratios, lower foreign presence, and higher productivity[34].

6.2 Effects of Regulation Change on Intermediate or Capital Goods

[Insert Table 15]

In this subsection, we examine how different characteristics of products were affected by the regulation change. Table 15 presents the product classifications of projects affected by the 2002 regulation change. Using the United Nations' Broad Economic Categories (BEC), we classified each project into three groups: intermediate goods, capital goods, and final goods. We see that about 90 percent of the projects for which restrictions were lifted are for intermediate or capital goods, with intermediate goods accounting for 70 percent of the total regulated projects.

Gaulier, Lemoine, and Ünal-Kesenci (2007) report that China's imports have been heavily dominated by intermediate or capital products since the late 1990s, because East Asian production networks have formed a "triangular trade pattern". Japan and newly industrialized economies (NIEs) export sophisticated capital goods and intermediate goods to the less developed countries of the region (ASEAN countries and China). Policy makers in China often expressed concern

[32] As discussed above, affected industries foreign capital from non-Chinese sources increased by $0.2862 \times 0.1362 = 3.90\%$ from 2002 in affected industries that experienced a regulation change one standard deviation larger than that undergone by unaffected industries.

[33] Taiwanese enterprises were not allowed to invest in China until October 1990 ("Regulations Governing Indirect Investment or Technical Cooperation in Mainland China" Presidential Office Gazette, No. 5312, October 1990). However, it was well known that they had been actively engaging in investment in China before 1990.

[34] Ge and Chen (2008) found that the productivity of foreign enterprises sourced from Hong Kong, Taiwan, and Macau are relatively lower than other foreign enterprises. Lin, Liu, and Zhang (2009) find no evidence of positive spillover to domestic firms from foreign enterprises from Hong Kong, Taiwan, and Macau.

about this trend as it might disturb the process of upgrading China's industrial structure (Hu, 2009). This regulation change aimed to induce foreign firms that produce sophisticated capital or intermediate goods to invest in China in order to enhance China's industrial structure by obtaining technology spillover from that FDI. To see the effect of the regulation change concerning different types of products, we ran regressions of the following form:

$$Y_{jt} = \alpha + \sum_{i=2}^{26} \beta_i Industry_i + \sum_{t=2000}^{2007} \gamma_t Year_t + \delta Treatment_j \times Post2002_t \tag{10}$$
$$+ \eta Treatment_j \times Int\_Cap_j \times Post2002_t + \epsilon_{jt},$$

where Int_Cap_j denotes the ratio of the total numbers of intermediate or capital goods to the total numbers of goods belonging to each industry:

$$Int\_Cap_j = \frac{\sum_{k \in K} Intermediate\_Goods_{kj} + \sum_{l \in L} Capital\_Goods_{lj}}{\sum_{i \in I} Goods_{ij}}. \tag{11}$$

The total number of goods was counted using the Harmonized System (HS) codes included in the "Product Classification for Statistics". Then, using a conversion table relating the BECs and HS 2007 codes, we classified goods into three basic classes: intermediate, capital, or final goods. The coefficient δ indicates how the difference between affected and unaffected industries that are final-good-intensive changes before and after implementation of the regulation change. The coefficient of interest in the regression η, indicates how the differences between intermediate or capital goods industries and others change in affected industries before and after implementation of the regulation change. The usual difference-in-differences estimates are presented as $\delta+\eta$, which suggests how the difference between affected and unaffected industries changes before and after implementation of the regulation change.

[Insert Table 16]

Table 16 presents the results of a regression using foreign sales, foreign exports, and foreign domestic sales as dependent variables. The first column of the first row in Table 16 shows a coefficient of −0.3088, significant at the 1 percent level. This implies that the foreign sales of affected industries that were final-good-intensive decreased by 0.2862×(−0.3088)=−8.84 percent from 2002 in affected industries that had a regulatory change one standard deviation larger than unaffected industries (Hereinafter we adopt the latter interpretation of estimated coefficients). The first column of the third row in Table 16 presents a comparison of results for affected final-good-intensive industries and affected intermediate-or-capital-intensive-industries. It shows that the coefficient is 0.5557, significant at the 1 percent level, which suggests that the foreign sales of affected intermediate-or-capital-intensive-industries increased by 0.2862×0.6797×0.5557=10.81 percent more on average than affected final-good-intensive industries if the affected industries experienced a regulatory change one standard deviation larger than the unaffected industries (We evaluate Int_Cap_j using the industrial average, of 0.6797). The result of $\delta+\eta$ shows that the foreign sales of affected industries increased by 0.2862×(−0.3088)+0.2862×0.6797×0.5557=1.97 percent [35]. The second column shows that the results of the first column also hold in the period from 2001 to 2007.

The rest of the columns in Table 16 examine the source of the foreign sales increase. The estimated coefficients are interpreted as explained earlier. The third and forth columns of the first row in Table 16 show coefficients of −0.2881 and −0.1902, significant at the 10 percent and 5 percent level, respectively. This indicates that the foreign exports of affected industries that are final-good-intensive decreased by 0.2862×(−0.2881)=−8.05 percent, and their foreign domestic sales decreased by 0.2862×(−0.1902)=−5.44 percent from 2002 if the affected industries experienced a regulatory change one standard deviation larger than unaffected industries. The third and forth column of the third row in Table 16 shows that the coefficients are 0.5495 and 0.4253, and significant at the 1 percent level, respectively, meaning that the foreign exports of affected intermediate-or-capital-intensive industries increased by 0.2862×0.6797×0.5495=10.69 percent on

[35] For brevity, we hereinafter abbreviate the formal interpretation of $\delta+\eta$ as follows: $\delta+\eta$ implies that the foreign sales of affected industries increased by 0.2862×(−0.3088)+0.2862×0.6797×0.5557=1.97 percent on average from 2002 if they experienced a regulation change one standard deviation larger than unaffected industries.

average, and their foreign domestic sales grew by 0.2862×0.6797×0.4253=8.27 percent on average more than affected final-good-intensive industries one standard deviation below the affected industries. The results of $\delta+\eta$ shows that the foreign exports of affected industries increased by 0.2862×(−0.2881)+0.2862×0.6797×0.5495=2.64 percent and their foreign domestic sales grew by 0.2862×(−0.1902)+0.2862×0.6797×0.4253=2.83 percent. Thus, we find that the FDI regulation change significantly increased foreign sales in intermediate-or-capital-intensive industries over final-good-intensive industries. This leads us to believe that the increase in foreign sales in downstream industries was induced by an expansion of the affected foreign-invested firms' activities in intermediate-or-capital-intensive industries and by the purchase of sophisticated intermediate or capital goods from these industries.

[Insert Table 17]

Table 17 reports the results for industrial productivity measures. The coefficient in the first column of the first row in Table 17 is 0.1822, significant at the 5 percent level. This indicates that the TFP of affected industries that were final-good-intensive increased by 0.2862×(0.1822)=5.21 percent from 2002 in affected industries one standard deviation above unaffected industries. The first column of the third row in Table 17 presents a comparison of results for affected final-good-intensive industries and affected intermediate-or-capital-good-intensive industries. The coefficient is −0.0933, and it is not significant even at the 10 percent level. This would indicate that the TFP of affected intermediate-or-capital-good-intensive industries decreased by 0.2862×0.6797×(−0.0933)=−1.82 percent on average compared to affected final-good-intensive industries when the affected industries were one standard deviation above the unaffected industries in terms of the effect of the regulatory change. The result of $\delta+\eta$ shows that the TFP of affected industries increased by 0.2862×0.1822+0.2862×0.6797×(−0.0933)=3.39 percent.

The coefficients in the second and third columns of the first row in Table 17 are 0.1320, significant at the 1 percent level and 0.0159, not significant even at the 10 percent level. This suggests that the labor productivity of affected industries that were final-good-intensive increased by 0.2862×0.1320=3.78 percent, and their capital intensity grew by 0.2862×0.0159=0.46 percent

from 2002 in affected industries that experienced a regulatory change one standard deviation larger than unaffected industries. The second and third columns of the third row in Table 17 have coefficients of -0.0037, not significant even at the 10 percent level, and 0.1266, significant at the 5 percent level. This shows that the labor productivity of affected intermediate-or-capital-intensive industries decreased by $0.2862\times0.6797\times(-0.0037)=-0.07$ percent on average, and their capital intensity increased by $0.2862\times0.6797\times0.1266=2.46$ percent on average more than affected final-good-intensive industries when the regulatory change applied to the affected industries was one standard deviation higher than the unaffected industries. Calculating $\delta+\eta$ shows that the labor productivity of affected industries increased by $0.2862\times0.1320+0.2862\times0.6797\times(-0.0037)=3.71$ percent, and their capital intensity increased by $0.2862\times0.0159+0.2862\times0.6797\times0.1266=2.92$ percent. Thus, the FDI regulation change significantly increased foreign sales in intermediate-or-capital-good-intensive industries and resulted in increased labor productivity, capital–labor ratios and TFP in final-good-intensive industries. These findings suggest that the positive spillovers from the regulation change that passed through forward linkages where industries purchase intermediate inputs from affected upstream industries came via the expansion of production possibility curves induced by the affected foreign-invested firms' activities in intermediate-or-capital-good-intensive industries.

7 Conclusion

In this paper, using industry level panel data on manufacturing firms in China during the period from 1999 to 2007, we investigated the effects of regulation change on foreign entry and the growth in productivity of Chinese industries. We found that industries affected by the change experienced larger increases in foreign firms' total sales, exports and domestic sales. We also found that this expansion of foreign-invested firms' activity resulted in an increase in labor productivity, capital–labor ratios, and TFP. These results support the hypothesis that the FDI regulation change induced an expansion of the affected foreign invested firms' activities as well as an increase in labor productivity, capital–labor ratios, and TFP. We did not find that these industries experienced

significantly larger sales by foreign-invested firms or productivity growth before 2002. The result above is robust to the inclusion of reductions in industrial tariffs as controls.

We then examined whether there were vertical productivity spillovers from industries affected by the regulation change to domestic firms. The results show that the regulatory change for FDI induced an expansion of the affected foreign-invested firms activities in affected intra-industries and buyer industries as well as increases in TFP, labor productivity, and capital intensity in buyer industries.

Additionally, we consider two potential mechanisms linking the regulation change and productivity growth. First, there is no evidence of a change in foreign capital from Hong Kong, Taiwan, and Macau in affected industries after the regulation change. We found that the increase in foreign capital came from non-Chinese sources. Second, using the United Nations' BEC, we confirmed that about 90 percent of all the projects that experienced a lifting of regulations produced intermediate or capital goods. Difference-in-differences estimates showed that the affected intermediate-or-capital -good-intensive industries experienced significantly larger increases in foreign firms' total sales, exports, and domestic sales. We also found that this increase in FDI resulted in an increase in labor productivity, capital–labor ratio, and TFP in the affected final-good-intensive industries.

In this paper, however, we do not provide a definite answer to the mechanism through which the FDI regulation change induced a decrease in foreign sales and productivity measures in supplier industries. A plausible explanation is that the performance of foreign firms in affected industries (such as productivity) are systematically different from existing domestic and foreign firms in upstream industries. Consequently, this regulation change generated negative spillover effects in upstream industries, because expansion shifted firms' production input demand from domestic firms to other foreign-invested firms or imported goods (Rodríguez-Clare, 1996). More detailed investigations are beyond the scope of this paper.

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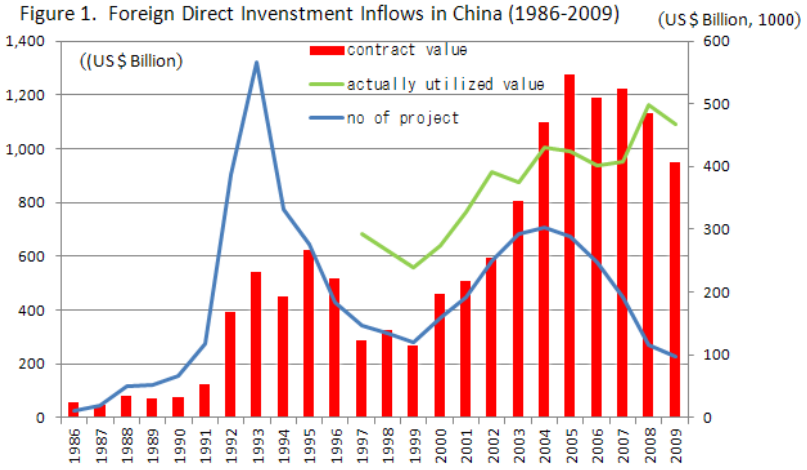
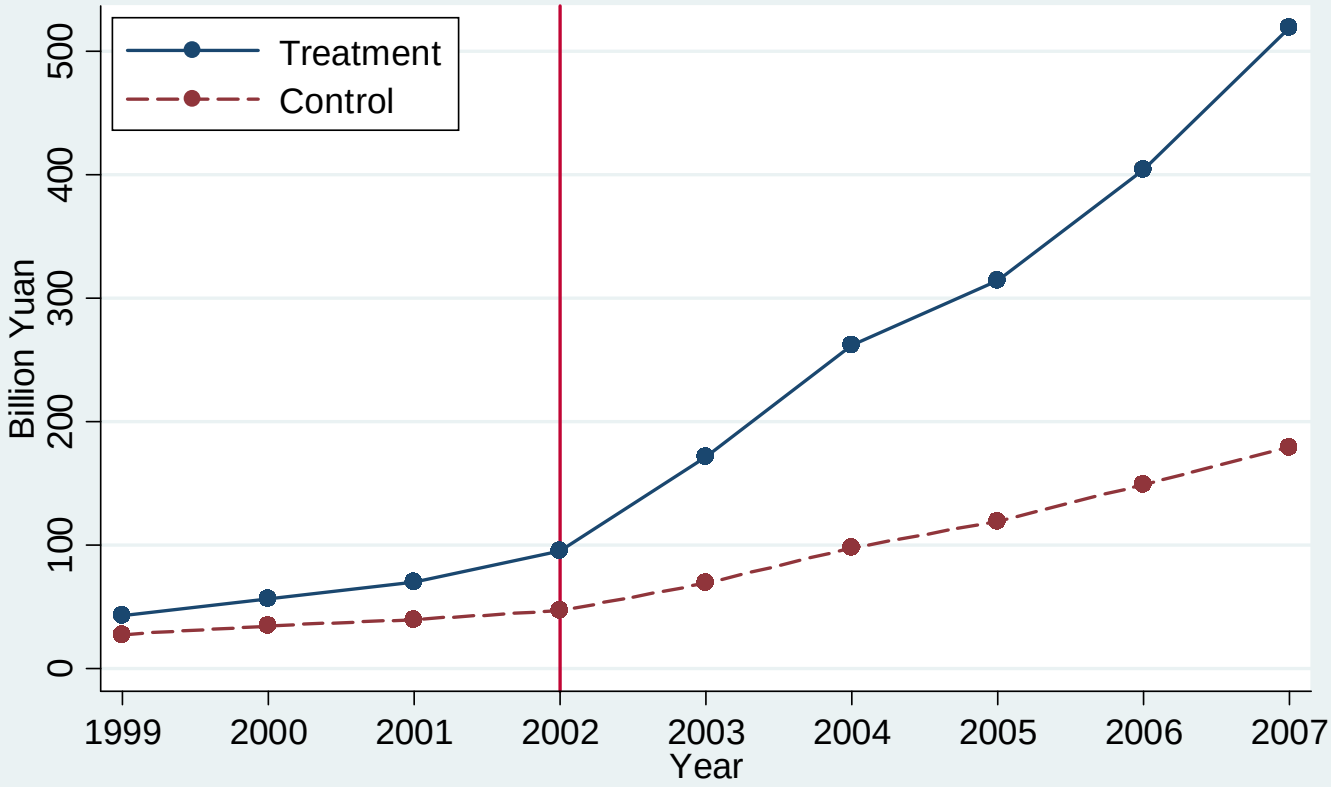
Figure 1. Foreign Direct Investment Inflows in China (1986-2009)



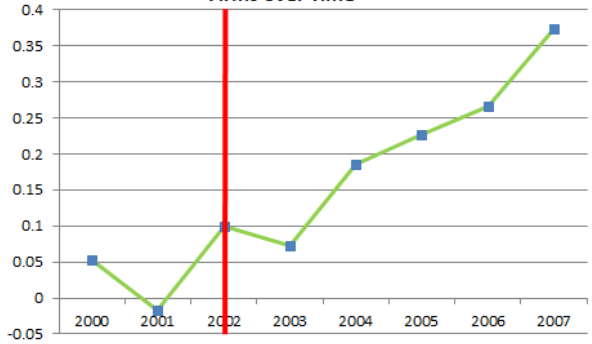
Source: Almanac of China's Foreign Economic Relations and Trade (various years) and China Commerce Yearbook (various years)

Figure 2. Average Sales by Foreign Firms for Treatment and Control Industries



Source: Calculated by author from China Data Online

Figure 3. Effects of Regulation Change on Sales by Foreign Firms over Time



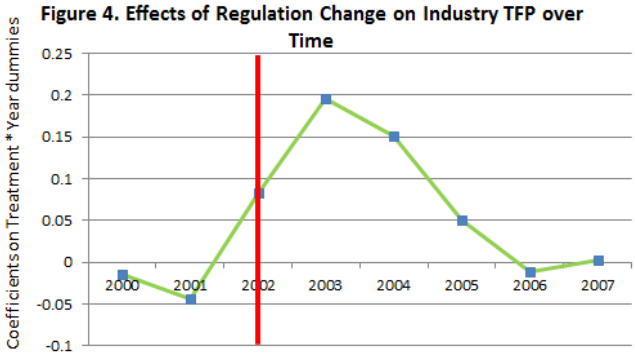


Figure 4. Effects of Regulation Change on Industry TFP over Time
Coefficients on Treatment * Year dummies
0.25
0.2
0.15
0.1
0.05
0
-0.05
-0.1
2000
2001
2002
2003
2004
2005
2006
2007

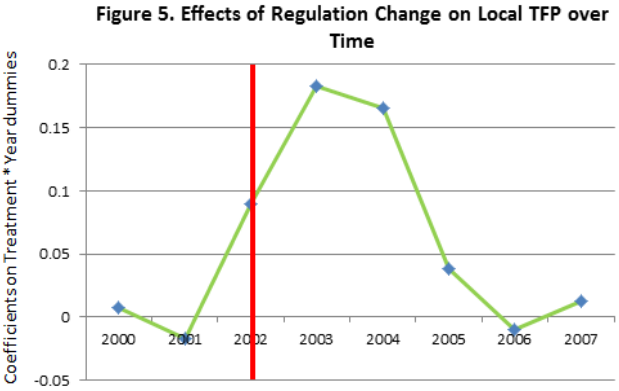
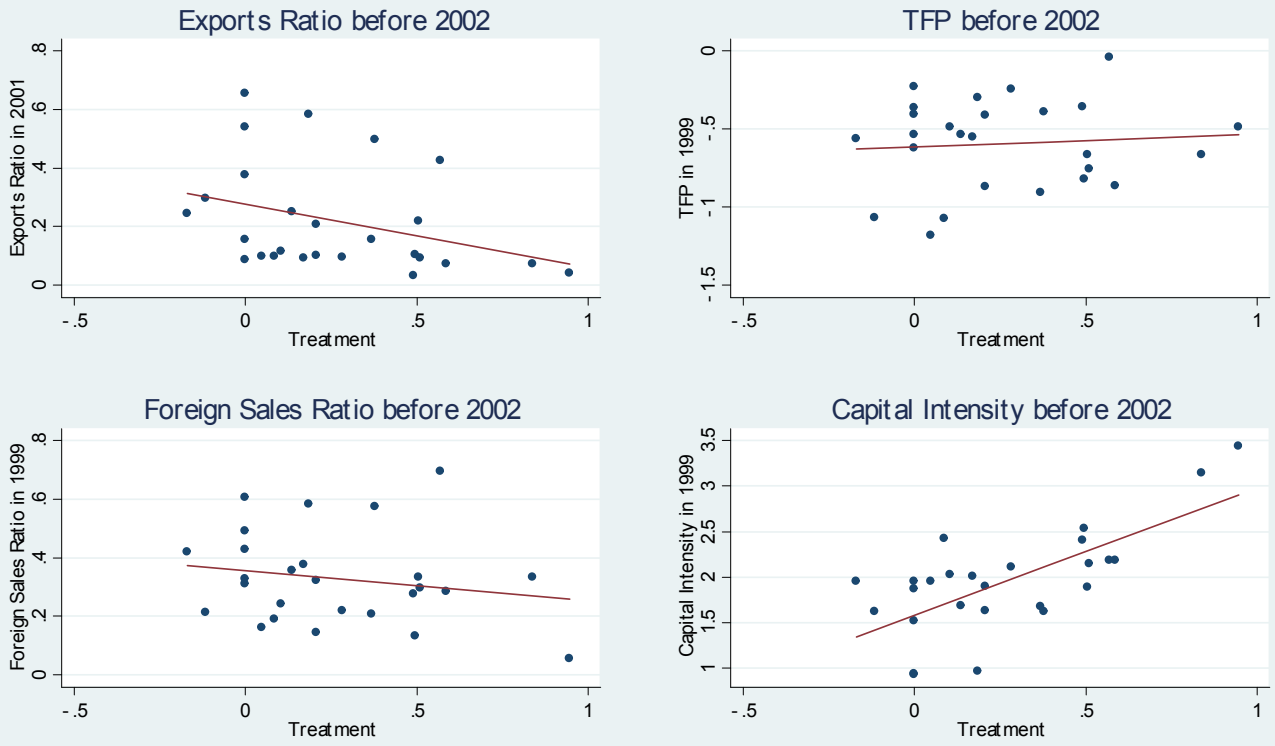


Figure 5. Effects of Regulation Change on Local TFP over Time
Coefficients on Treatment * Year dummies
0.2
0.15
0.1
0.05
0
-0.05
2000
2001
2002
2003
2004
2005
2006
2007

Figure 6. the Correlation between Industry Characteristics and Treatment before 2002



Source: Calculated by Author from China Industrial Economy Statistics (2001, 2002, and 2008)

Table 1. Numbers of Encouraged, Restricted and Prohibited Projects

Date	Encouraged	Restricted	Prohibited	Total
January 1998	159	86	5	250
April 2002	211	35	5	251

Source: Calculated by author from data published by Gazette of the State Council of the People's Republic of China, No. 40, January 1998 and No. 3, January 2003.

Table 2. Project Category Transitions from 1998 to 2002

		Jan. 2002				
		Encouraged	Permitted	Restricted	Prohibited	Total
Apr. 1998	Encouraged	131	28	0	0	159
	Permitted	63	—	4	0	—
	Restricted	17	38	31	0	86
	Prohibited	0	0	0	5	5
	Total	211	—	35	5	

Source: Calculated by author from data published by Gazette of the State Council of the People's Republic of China, No. 40, January 1998 and No. 3, January 2003.

Table 3. The Case of Transport Equipment Manufacturing

SIC 4-digit industry code	SIC 4-digit industry name	Project	Category transition	Relaxed	Strengthened
3711	Train carriages and locomotives				
3712	Special railed vehicles in works and mines				
3713	Railway carriage parts				
3714	Railway special equipment, apparatus and parts				
3719	Other rail equipment and repairs				
3721	Automobile sets	Manufacture of automobile assemblies	Restricted⟶Encouraged	1	0
3722	Refit automobiles				
3723	Electric vehicles				
3724	Car bodies, trailers				
3725	Auto parts and fittings	Manufacture of engines for automobiles	Restricted⟶Encouraged	1	0
		Manufacture of key parts for automobiles	Permitted⟶Permitted, Encouraged	—	—
		Aluminium alloy wheel hubs	Restricted⟶Permitted	—	—
		Manufacture of parts for automobiles	Encouraged⟶Encouraged, Permitted	0	1
3726	Auto repair	Reconditioning and disassembling of old automobiles	Restricted⟶Permitted	1	0
3731	Motorcycle sets	Manufacture of motorcycle assemblies	Restricted⟶Encouraged	1	0
3732	Motorcycle parts and fittings	Manufacture of key parts for motorcycles	Encouraged⟶Encouraged, Permitted	0	1
3741	Man-powered bicycles and wheelchairs				
3742	Battery-powered bicycles				
3751	Metal vessels	design and manufacture of special vessels	Restricted⟶Encouraged	1	0
3752	Non-metal vessels	Manufacture of glass fibre-reinforced fishing boats	Permitted⟶Encouraged	1	0
3753	Recreational and sports vessel building and repairing	Manufacture of yachts	Permitted⟶Encouraged	1	0
3754	Vessel auxiliary equipment	manufacture of vessel equipment and accessories	Restricted⟶Encouraged	1	0
3755	Vessel repairing and dismantling	Repairing of special vessels	Restricted⟶Encouraged	1	0
3759	Navigation signs and other floating devices				
3761	Aircraft and aircraft repair	Design and manufacture of civil helicopters	Permitted⟶Encouraged	1	0
3762	Spacecraft				
3769	Other aircraft	Design and manufacture of civil aircraft	Encouraged⟶Encouraged	0	0
		Manufacture of parts for civil planes	Encouraged⟶Encouraged	0	0
3791	Diving and underwater rescue equipment				
3792	Metal signs and equipment for traffic control purposes				
3799	Other traffic and transport equipment				
Total				10/27	2/27

Source: Calculated by author from data published by Gazette of the State Council of the People's Republic of China, No. 40, January 1998 and No. 3, January 2003.

Table 4. Details of Regulation Change

SIC 2-digit industry name	No. of SIC 4-digit categories	Relaxed	Strengthened	Sales Share*Relaxed	Sales Share*Strengthened	Treatment
Total	467	100	32			
Farm Products and Byproduct Processing	21	1	0	0.105	0	0.105
Food	20	3	1	0.217	0.045	0.172
Breweries	13	5	0	0.491	0	0.491
Textiles	21	1	1	0.018	0.133	-0.115
Garments, Footwear and Headgear	3	0	0	0	0	0
Leather, Fur, and Feather Products	11	1	0	0.186	0	0.186
Timber Processing and Wood, Bamboo, Rattan, Palm, and Straw Products	10	0	0	0	0	0
Furniture	5	0	0	0	0	0
Paper-making and Paper Products	6	1	1	0.606	0.019	0.587
Printing and Recording Medium Duplication	5	0	0	0	0	0
Cultural, Educational, and Sports Goods Making	17	0	0	0	0	0
Petroleum Refining, Coking, and Nuclear Fuel Processing	4	1	0	0.946	0	0.946
Chemical Materials and Chemical Products	35	10	8	0.435	0.349	0.086
Pharmaceuticals	7	4	2	0.647	0.364	0.283
Chemical Fibres	7	4	0	0.839	0	0.839
Rubber	9	1	0	0.505	0	0.505
Plastic Products	10	0	1	0	0.17	-0.17
Non-metallic Mineral Products	31	6	3	0.523	0.475	0.048
Ferrous Metal Smelting and Rolling	4	1	2	0.438	0.912	-0.474
Nonferrous Metal Smelting and Rolling	18	2	0	0.496	0	0.496
Metal Products	24	3	0	0.136	0	0.136
General Equipment	34	8	0	0.37	0	0.37
Special Equipment	51	13	3	0.297	0.09	0.207
Transportation Equipment	27	10	2	0.784	0.274	0.51
Electric Machinery and Equipment	28	8	1	0.238	0.03	0.208
Communications Equipment, Computers and Other Electronic Equipment	21	13	6	0.839	0.27	0.569
Instruments/Meters, Cultural and Office Machinery	25	4	1	0.405	0.026	0.379
Average	17.296	3.704	1.185	0.353	0.117	0.236

Source: Calculated by author from data published by Gazette of the State Council of the People's Republic of China, No. 40, January 1998 and No. 3, January 2003.

Table 5. Descriptive Statistics in 1999 units: Billion Yuan

Variable	Obs.	Ave.	Std. Dev.
Foreign Sales	26	641.59	733.69
Foreign Exports	26	397.88	740.71
Foreign Domestic Sales	26	582.76	696.55
Industrial TFP	26	0.57	0.16
Industrial Labor Productivity (10,000/person)	26	3.69	1.53
Industrial Capital Intensity (10,000/person)	26	8.38	6.19
Local TFP	26	1.01	0.23
Local Labor Productivity (10,000/person)	26	3.13	1.26
Local Capital Intensity (10,000/person)	26	7.35	5.86
Export Ratio	26	0.22	0.18
Foreign Sales Ratio	26	0.33	0.16
Foreign Export Ratio	26	0.36	0.23

Source: China Industrial Economy Statistics Yearbook (2001, 2002)
Note: Due to data limitations, variables related to exports present the values in 2001. Each variable is deflated by the producer price index and the price index of fixed asset investment from the China Statistical Yearbook.

Table 6. Descriptive Statistics in 2007 units: Billion Yuan

Variable	Obs.	Ave.	Std..Dev.
Foreign Sales	26	4849.74	9351.57
Foreign Exports	26	2362.57	7049.72
Foreign Domestic Sales	26	2487.17	2981.45
Industrial TFP	26	1.46	0.35
Industrial Labor Productivity (10,000/person)	26	12.09	4.37
Industrial Capital Intensity (10,000/person)	26	12.08	9.20
Local TFP	26	3.09	0.79
Local Labor Productivity (10,000/person)	26	11.50	3.31
Local Capital Intensity (10,000/person)	26	10.83	8.17
Export Ratio	26	0.22	0.18
Foreign Sales Ratio	26	0.35	0.22
Foreign Export Ratio	26	0.36	0.16

Source: China Industrial Economy Statistics Yearbook (2008)
Note: Each variable is deflated by the producer price index and the price index of fixed asset investment from the China Statistical Yearbook.

Table 7. Impact on Foreign Sales

	Log (Foreign Sales)	Log (Foreign Sales)	Log (Foreign Exports)	Log (Foreign Domestic Sales)
Treatment×Post2002	0.1924***	0.2217***	0.2074**	0.1933***
	(0.0504)	(0.0483)	(0.0705)	(0.0223)
Industry dummy	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes
R-squared	0.9721	0.9851	0.9852	0.9862
Period	1999–2007	2001–2007	2001–2007	2001–2007
Observations	234	182	182	182

Note) The table reports coefficients of Treatment×Post2002 from industry-level regressions of foreign sales, foreign exports, and foreign domestic sales on Treatment×Post2002, industry dummies, and year dummies. The coefficients for Treatment×Post2002 indicates the percentage change in the dependent variables if affected industries experience a regulation change one standard deviation larger than unaffected industries. Standard errors adjusted for clustering by year are in parentheses (*p-value < 0.10; **pvalue < 0.05; ***pvalue < 0.01).

Table 8. Impact on Industrial Productivity Measures

	Log (Industry TFP)	Log (Industry Labor Productivity)	Log (Industry Capital Intensity)
Treatment×Post2002	0.0981**	0.1287***	0.1301***
	(0.0362)	(0.0302)	(0.0251)
Industry dummy	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes
R-squared	0.8674	0.9177	0.9828
Period	1999-2007	1999-2007	1999-2007
Observation	234	234	234

Note) The table reports coefficients of Treatment×Post2002 from industry-level regressions of TFP, labor productivity, and capital intensity on Treatment×Post2002, industry dummies, and year dummies. The coefficients of Treatment×Post2002 indicate the percentage change in dependent variables if affected industries experience a regulation change one standard deviation larger than unaffected industries. Standard errors adjusted for clustering by year are in parentheses (*p-value < 0.10; **pvalue < 0.05; ***pvalue < 0.01).

Table 9. Impact on Local Firms' Productivity Measures

	Log (Local TFP)	Log (Local Labor Productivity)	Log (Local Capital Intensity)
Treatment×Post2002	0.0832**	0.0790*	0.0130
	(0.0344)	(0.0375)	(0.0211)
Industry dummy	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes
R-squared	0.8529	0.8978	0.9806
Period	1999–2007	1999–2007	1999–2007
Observation	234	234	234

Note) The table reports coefficients of Treatment×Post2002 from industry-level regressions of local TFP, local labor productivity, and local capital intensity on Treatment×Post2002, industry dummies, and year dummies. The coefficients of Treatment×Post2002 indicate the percentage change in dependent variables if affected industries experience a regulation change one standard deviation larger than unaffected industries. Standard errors adjusted for clustering by year are in parentheses (*p-value < 0.10; **pvalue < 0.05; ***pvalue < 0.01).

Table 10. Robustness Check with Industrial Tariff Change as a Control Variable

	Log (Foreign Sales)	Log (Industry TFP)	Log (Industry Labor Productivity)	Log (Industry Capital Intensity)
Treatment×Post2002	0.1952***	0.0924**	0.1235***	0.1281***
	(0.0503)	(0.0363)	(0.0301)	(0.0265)
Industry tariff	0.0017	-0.0034***	-0.0031***	-0.0012
	(0.0013)	(0.0008)	(0.0009)	(0.0008)
Industry dummy	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes
R-squared	0.9721	0.8703	0.9188	0.9829
Period	1999–2007	1999–2007	1999–2007	1999–2007
Observations	234	234	234	234

Note) The table reports coefficients of Treatment×Post2002 from industry-level regressions of foreign sales, industry TFP, industry labor productivity, and industry capital intensity on Treatment×Post2002, industry dummies, and year dummies with industrial tariffs as a control variable. Coefficients on Treatment×Post2002 indicates the percentage change in dependent variables if affected industries experience a regulation change one standard deviation larger than unaffected industries. Standard errors adjusted for clustering by year are in parentheses (*p-value < 0.10; ** pvalue < 0.05; ***pvalue < 0.01).

Table 11. Robustness Check with Industrial Tariff Change as a Control Variable

	Log (Local TFP)	Log (Local Labor Productivity)	Log (Local Capital Intensity)
Treatment×Post2002	0.0814***	0.0772*	0.0123
	(0.0352)	(0.0382)	(0.0301)
Tariff	-0.0011	-0.0011	-0.0031***
	(0.0007)	(0.0006)	(0.0009)
Industry dummy	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes
R-squared	0.8533	0.8980	0.9806
Period	1999-2007	1999–2007	1999–2007
Observation	234	234	234

Note) The table reports coefficients of Treatment×Post2002 from regressions of foreign sales, local TFP, local labor productivity, and local capital intensity on Treatment×Post2002, industry dummies, and year dummies with tariffs as control variables. The coefficients of Treatment×Post2002 indicate the percentage change in dependent variables if affected industries experience a regulation change one standard deviation larger than unaffected industries. Standard errors adjusted for clustering by year are in parentheses (*p-value < 0.10; ** pvalue < 0.05; ***pvalue < 0.01).

Table 12. Vertical Spillover Effects on Foreign Sales

	Log (Foreign Sales)	Log (Foreign Sales)	Log (Foreign Exports)	Log (Foreign Domestic Sales)
Treatment×Post2002	0.7523***	0.3657***	0.7878**	−0.1257
	(0.2172)	(0.0793)	(0.2010)	(0.0859)
Backward×Post2002	−0.5776***	−0.4816***	−0.7674**	-0.2871**
	(0.1331)	(0.1295)	(0.3040)	(0.0870)
Forward×Post2002	−0.2668	0.3250**	−0.0771	0.8802***
	(0.3220)	(0.1209)	(0.1630)	(0.1586)
Industry dummy	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes
R-squared	0.9737	0.9854	0.9852	0.9893
Period	1999–2007	2001–2007	2001–2007	2001–2007
Observation	234	182	182	182

Note) The table reports coefficients of Treatment×Post2002, Backward×Post2002, and Forward×Post2002 from industry-level regressions of foreign sales, foreign exports, and foreign domestic sales on Treatment×Post2002, Backward×Post2002, Forward×Post2002, industry dummies, and year dummies. Standard errors adjusted for clustering by year are in parentheses (*p-value < 0.10; **pvalue < 0.05; ***pvalue < 0.01).

Table 13. Vertical Spillover Effects on Productivity

	Log (Industry TFP)	Log (Industry Labor Productivity)	Log (Industry Capital Intensity)
Treatment×Post2002	0.0211	0.0570	-0.0013
	(0.0803)	(0.1049)	(0.1014)
Backward×Post2002	-0.4220**	-0.5170***	-0.1432**
	(0.1398)	(0.1271)	(0.0528)
Forward×Post2002	0.6293**	0.7327**	0.3920**
	(0.2398)	(0.2380)	(0.1371)
Industry dummy	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes
R-squared	0.8741	0.9220	0.9831
Period	1999–2007	2001–2007	2001–2007
Observations	234	182	182

The table reports coefficients of Treatment×Post2002, Backward×Post2002, and Forward×Post2002 from industry-level regressions of industry TFP, industry labor productivity, and industry capital intensity on Treatment×Post2002, Backward×Post2002, Forward×Post2002, industry dummies, and year dummies. Standard errors adjusted for adjusted for clustering by year are in parentheses (*p-value < 0.10; **pvalue < 0.05; ***pvalue < 0.01).

Table 14. Impact on Different Sources of Foreign Capital

	Log (Chinese Capital)	Log (Non-Chinese Capital)
Treatment×Post2002	−0.0658	0.1363**
	(0.0521)	(0.0545)
Industry dummy	Yes	Yes
Year dummy	Yes	Yes
R-squared	0.9318	0.9777
Period	1999–2007	1999–2007
Observations	234	234

Note) The table reports coefficients of Treatment×Post2002 from industry level regressions of foreign capital from Chinese and Non-Chinese sources on Treatment×Post2002, industry dummies, and year dummies. The Coefficients of Treatment×Post2002 indicate the percentage change in dependent variables if affected industries experience a regulation change one standard deviation larger than unaffected industries. Standard errors adjusted for clustering by year are in parentheses (*p-value < 0.10; ** pvalue < 0.05; ***pvalue < 0.01).

Table 15. Numbers of Relaxed and Strengthened Projects Classified by Broad Economic Categories

	Intemediate	Capital	Final	Total
Relaxed	55	57	19	131
Strengthened	23	7	3	33

Source: Gazette of the State Council of the People's Republic of China, No. 40, January 1998 and No. 3, January 2003.
Note: Affected projects are grouped into United Nations Broad Economic Categories. These figures do not match the figures presented in Table 1 or 2, because a project sometimes falls into multiple product categories.

Table 16. Impact of Foreign Sales Interactions with Intermediate or Capital Goods Intensity

	Log (Foreign Sales)	Log (Foreign Sales)	Log (Foreign Exports)	Log (Foreign Domestic Sales)
Treatment×Post2002	−0.3088***	−0.3329***	−0.2881*	−0.1902**
	(0.0721)	(0.0736)	(0.1192)	(0.0759)
Treatment×Int_Cap×Post2002	0.5557***	0.6150***	0.5495***	0.4253***
	(0.1153)	(0.1139)	(0.1046)	(0.1064)
Industry dummy	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes
R-squared	0.9727	0.9855	0.9853	0.9863
Period	1999–2007	2001–2007	2001–2007	2001–2007
Observations	234	182	182	182

Note) The table reports coefficients of Treatment×Post2002 and Treatment×Int_Cap×Post2002 from industry-level regressions of foreign sales, foreign exports, and foreign domestic sales on Treatment×Post2002, Treatment× Int_Cap×Post2002, industry dummies, and year dummies. The coefficients of standard errors adjusted for clustering by year are in parentheses (*p-value < 0.10; **pvalue < 0.05; ***pvalue < 0.01).

Table 17. Impact of Productivity Interactions with Intermediate or Capital Goods Intensity

	Log (Industry TFP)	Log (Industry Labor Productivity)	Log (Industry Capital Intensity)
Treatment×Post2002	0.1822**	0.1320***	0.0159
	(0.0637)	(0.0385)	(0.0307)
Treatment×Int_Cap×Post2002	−0.0933	-0.0037	0.1266**
	(0.0991)	(0.0652)	(0.0475)
Industry dummy	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes
R-squared	0.8676	0.9177	0.9829
Period	1999–2007	1999–2007	1999–2007
Observations	234	234	234

Note) The table reports coefficients of Treatment×Post2002 and Treatment×Int_Cap×Post2002 from industry-level regressions of industry TFP, industry labor productivity, and industry capital intensity on Treatment×Post2002, Treatment×Int_Cap×Post2002, industry dummies, and year dummies. Standard errors adjusted for clustering by year are in parentheses (*p-value < 0.10; **pvalue < 0.05; ***pvalue < 0.01).