Trade Costs and Location of Foreign Firms in China*

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Abstract

This study examines the determinants of entry by foreign firms, using information on 515 Chinese industries at the provincial level during 1998-2001. The analysis is based on new economic geography theory and thus focuses on market and supplier access within and outside the province of entry, as well as production and trade costs. The results indicate that market and supplier access are the most important factors affecting foreign entry. Access to markets and suppliers in the province of entry matters more than access to the rest of China, which is consistent with market fragmentation due to underdeveloped transport infrastructure and informal trade barriers.

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1. Introduction

Governments all over the world spend large sums of money to entice foreign direct investment (FDI), usually offering generous tax incentives. It is often expected that foreign firms will generate positive externalities on domestic firms, particularly in developing countries. For example, Javorcik (2004) provides evidence consistent with the existence of positive inter-industry spillovers from foreign firms in Lithuania. However, the evidence on the success of tax incentives in attracting FDI is rather mixed (see Desai et al. 2004), which raises the question of what factors in fact influence where foreign firms locate.

New economic geography theories on firm location emphasize a tension between production costs and access to large final goods markets and input suppliers. Krugman and Venables (1995), and Markusen and Venables (1998, 2000) show that while market size is an important consideration for firms, the larger the market the higher the cost of immobile factors. And the relative strength of these factors in determining location depends critically on trade costs. Building on these predictions, this study examines the relative importance of market access, supplier access, trade costs and factor costs for the entry of foreign firms into China.

While FDI determinants have been analyzed extensively (for example, see Caves 1982; and Markusen 1995), little attention has been paid to the new economic geography aspects of the investment decision.[1] Notable exceptions are studies by Head and Mayer (2004) and

[1] Other aspects of new economic geography have been addressed in the empirical literature. The relationship between wages and market potential was studied in a seminal paper by Hanson (2005). Building on Hanson's work, Redding and Venables (2004) and Amiti and Cameron (2006) related wages to both market access and supplier access measures. The home market effect was examined by Davis and Weinstein (1999, 2003), Feenstra, Markusen and Rose (2001), Head and Ries (2001), and Hanson and Xiang (2004). All of

Head and Ries (1996). The former study focuses on market access and finds a positive correlation between entry of Japanese firms into the European Union (EU) and market potential measures. The latter study takes into account market and supplier access as determinants of foreign entry into China, but does not incorporate any spatial aspects.[2]

Our analysis extends the literature in several dimensions. First, we consider the importance of both market and supplier access in determining foreign entry, taking into account spatial aspects. We allow for the possibility that firms purchase inputs not only from within their own province, but also from other provinces within China. Second, our measures of market and supplier access take into account the varying degrees of inter-industry linkages. For example, proximity to a steel plant is likely to be more valuable to a car producer than a textile manufacturer. Third, by incorporating all the key factors highlighted in the new economic geography literature, we are able to provide an assessment of the relative importance of production costs and market size effects in attracting new entry.

China is a particularly interesting country in which to analyze FDI flows. It was among the top FDI recipients in the world during the period under study, receiving US$165 billion of direct investment flows between 1998 and 2001.[3] With over 90 per cent of foreign investment going to the coastal regions, the influx of FDI has widened regional disparities between coastal and central regions within China.[4] By providing an assessment of the importance of market size relative to production costs, this study provides some guidance on the kinds of policy

these studies found results consistent with theory, however, none of them analyzed the link between foreign entry decision and new economic geography variables.

[2]Head and Ries (1996) assume that firms buy all their inputs locally and they do not distinguish in their analysis between various degrees of input availability in different industries.

[3]See World Investment Report 2002, Annex Table B3.

[4]See Amiti and Wen (2001) for a discussion on regional inequality in China.

instruments that would be most successful in attracting FDI to disadvantaged regions. Our study also sheds some light on the economic impact of inter-provincial barriers to trade. Evidence suggesting that local governments in China are erecting provincial trade barriers to protect industries from competition is provided in Kumar (1994) and Young (2000).[5] Unfortunately, it is not possible to directly measure such barriers. As it is illegal to impose trade restrictions, the measures adopted to protect local industries from competition are usually more subtle than a direct border tax. Thus the only way to assess the significance of such barriers is indirectly, as is the case in our study.[6]

Our analysis is based on a comprehensive data set that covers nearly all manufacturing industries at a highly disaggregated level (515 industries) in 29 Chinese provinces during the period 1998-2001.[7] Using the information on the value of output by industry and province, the national input/output table and inter-provincial distances we construct measures of market access and supplier access, which we relate to the change in the number of foreign firms in each province and industry. We also control for a variety of provincial characteristics: proxies for trade costs include transport infrastructure, and proxies for production costs

[5] This is also consistent with anecdotal evidence. For instance, a manager of a medical manufacturing plant reported that the shipments to other provinces are occasionally stopped by local rail officials for 2 to 4 weeks for no apparent reason. The administrative units of industry and commerce department were reportedly obstructing access to markets through audits or local registration requirements. This information is drawn from unpublished interviews with firms and government officials in five different provinces conducted by Amiti as part of a World Bank mission in October 2001.

[6] A number of researchers have tried to estimate the size of these provincial trade barriers using indirect measures (see Poncet, 2003, 2005; Naughton 2003; Huang and Wei, 2003; and Bai et al., 2004). Although there is some disagreement about the direction of change in these barriers, none of the studies deny the existence of provincial border barriers in China.

[7] Other studies on the determinants of FDI in China rely either on information on provincial FDI stocks (Cheng and Kwan, 2000) or on the Almanac of China's Foreign Economic Relations and Trade which lists entry of individual firms (Head and Ries, 1996; Dean, Lovely and Wang, 2002). The latter data set is, however, limited in coverage as it includes only about 10 percent of new foreign firms, focuses exclusively on joint ventures and stopped being published in 1996.

include provincial wages and electricity prices. We consider separately market access and supplier access *within* and *outside* the province of foreign entry. A lower magnitude of the coefficients pertaining to trade *outside* the province of entry relative to trade *within* the province would suggest that the internal trade barriers may be restricting access of foreign investors to suppliers and customers in other provinces.

The results indicate that market access and supplier access are the most important factors affecting FDI inflows. Increasing supplier access by one standard deviation is associated with a 20% increase in entry of foreign firms, and increasing market access by one standard deviation is associated with a 13% increase. Further, the presence of customers and suppliers in the province of entry matters much more than market and supplier access to the rest of China, which is consistent with the presence of inter-provincial barriers to trade. The analysis also suggests that the availability of infrastructure is positively correlated with foreign entry. Although production costs also play a significant role in determining the location of foreign investment, the magnitude of these effects is around a quarter of that of the market and supplier access effects. An increase of wages or electricity prices by one standard deviation reduces entry of foreign firms by between 2 and 4%, respectively. Thus, our results suggest that local governments may do well by reducing inter-provincial barriers, and hence increasing the extent of market and supplier access in surrounding provinces in order to attract foreign investment.

The rest of the paper is organized as follows. Section 2 develops the formal model. Section 3 provides background information on China and details of the data sources. Section 4 presents the results, and section 5 concludes.

2. Theory

We derive our estimating equation from a new economic geography model, based on Krugman and Venables (1995).[8] Firms are assumed to compete in a monopolistically competitive environment, with each firm producing a differentiated variety. We model China as consisting of P provinces, with profits of a single representative firm in industry i in province p given by

$$\pi_p^i = p_p^i x_p^i - w_p^{\alpha^i} r_p^{\beta^i} \prod_u \left(P_p^u\right)^{\mu^{ui}} \left[c^i x_p^i\right] - F^i. \tag{2.1}$$

The total cost function comprises a fixed cost, F, a variable cost, c^i, which can be omitted by appropriate choice of units for measuring output, x_p^i; and factor prices, where w_p is the wage and r_p the price of capital in province p or any other factor of production, and P_p^u is the intermediate input price index of each upstream industry u that supplies inputs to industry i. It is defined as

$$P_p^u = \left[\sum_{l=1}^{P} n_l^u \left(p_l^u t_{lp}^u\right)^{1-\sigma^u}\right]^{\frac{1}{1-\sigma^u}}, \tag{2.2}$$

assuming that all n varieties of industry u products enter symmetrically. The transport cost, t_{lp}^u, of shipping a good from province l to p is modelled as Samuelsonian iceberg costs, where $t \geq 1$ units must be shipped to deliver one unit of a good.

Expenditure, E_l^i, on industry i output produced in province p, x_p^i, comes from consumers and firms located within province p, from other provinces within China, and from the rest of the world, which consists of K countries. Summing across all locations within China and the rest of the world, setting demand equal to supply, and substituting in the product market

[8] We also extend it to incorporate more than one factor of production as in Amiti (2005).

clearing condition and the profit maximizing price into the profit function, (2.1), gives

$$\pi_p^i = \left(w_p^{\alpha^i} r_p^{\beta^i} \prod_u \left(P_p^u\right)^{\mu^{ui}} \right)^{1-\sigma^i} \left(\theta^i - 1\right) \left(\theta^i\right)^{1-\sigma^i} \left[\left\{ \sum_{l=1}^{P+K} \left(t_{pl}^i\right)^{1-\sigma^i} E_l^i \left(P_l^i\right)^{\sigma^i - 1} \right\} \right] - F. \quad (2.3)$$

It is assumed that there is free entry and exit of firms and instantaneous adjustment, thus we set equation 2.3 equal to zero.[9] This implicitly defines the optimal number of firms in each industry in each province, so $n_{p,t}^i = f_t(\pi_{p,t}^i)$, for each period t. Taking first differences,

$$\Delta n_{p,t}^i = n_{p,t}^i - n_{p,t-1}^i = f_t(\pi_{p,t}^i) - f_{t-1}(\pi_{p,t-1}^i). \quad (2.4)$$

Given the nonlinearities in equation 2.3, it is not possible to get an explicit reduced form solution for the equilibrium number of firms in each period. However, if there is an exogenous change in a variable, such as trade costs, that affects the profits of incumbent firms, this leads to further entry or exit until profits are driven to zero.

An increase in the number of firms in province p bids up the wage rate as we assume a fixed labor force in each province. Our assumption that workers are immobile between provinces and mobile between industries within a province means that we are treating each province analogously to a country in the theoretical model. This assumption is a reasonable approximation in China, given the *hukou* system.[10] Further, we assume that the number of entrants in each industry i in each province p is too small relative to the total province size to affect the wage so new entrants in each industry take the provincial wage as given.[11]

[9] However, in the empirical specification we allow for adjustment that is not instantaneous, as for example in the presence of barriers to entry. In this case we could suppose that firms enter the most profitable industry/province first, hence entry would be a function of profits in each industry/province relative to some benchmark, say, average for China. The results are not sensitive with respect to either the assumption of free or costly entry and exit.

[10] The *hukou* is a system of residence permits that regulates the movement of labor. Adding labor mobility would complicate the model without changing the hypotheses. See Puga (1999).

[11] We will examine the robustness of our results with respect to this assumption.

To make equation 2.4 empirically tractable we assume the function $f_t = \ln(\pi_t)$.[12] Note that profits, inclusive of the fixed cost are given by $\pi' = \pi + F$, and if F is small then $\ln(\pi + F) \simeq \ln(\pi)$, hence taking natural logs of equation 2.3 we have[13]

$$\begin{aligned} \ln \pi^i_{p,t} &= \alpha^i(1-\sigma^i)\ln w_{p,t} + \beta^i(1-\sigma^i)\ln r_{p,t} + \mu^i(1-\sigma^u)\sum_u \ln\left\{\sum_{l=1}^{P+K} n^u_{l,t}\left(p^u_{l,t}t^u_{lp}\right)^{1-\sigma^u}\right\} \\ &\quad + \ln\left\{\sum_{l=1}^{P+K}\left(t^i_{pl}\right)^{1-\sigma^i} E^i_{l,t}\left(P^i_{l,t}\right)^{\sigma^i-1}\right\} + \nu_I + \nu_t. \end{aligned} \tag{2.5}$$

Taking first differences, denoted by Δ, our estimating equation becomes

$$\begin{aligned} \Delta n^i_{p,t} &= \gamma_0 + \gamma_1 \Delta \ln w_{p,t} + \gamma_2 \Delta \ln r_{p,t} + \beta_S \Delta \ln SA^i_{p,t} + \beta_M \Delta \ln MA^i_{p,t} \\ &\quad + \Delta \ln Z_{p,t} * \Gamma + D_t\delta_t + \epsilon^i_{p,t}. \end{aligned} \tag{2.6}$$

Note that the terms ν_I, which represent industry fixed effects such as the degree of market power, θ_i, are differenced out in equation 2.6. By including time fixed effects, δ_t, we are implicitly allowing entry to respond to the profitability of locating in province p relative to the average profitability of locating in China.

In the empirical analysis we include average wages varying by province and time. The theory predicts a negative coefficient on wages ($\gamma_1 < 0$), that is other things equal, firms prefer to locate in provinces that offer lower wages. The other province specific costs, r_p, could include any other factors of production whose costs vary across provinces, for example electricity prices. Similarly, we hypothesize that $\gamma_2 < 0$.

[12] It could be argued that the log of profits implicitly defines $\ln(n)$ rather than n. We will also experiment with this alternative, however, it should be noted that both of these alternatives are simplifications of the true relationship. For a discussion of the difficulties involved in estimating a structural model in a multi-country context see Berhens et al. (2005).

[13] Note that in Krugman and Venables (1995), the fixed cost is also a function of the factor prices and the intermediate input price index. To simplify the equation, we assume that foreign firms pay a fixed cost with resources from the parent company.

Our key variables of interest are market and supply access variables. The term in the first braces in equation 2.5 represents the intermediate input price indices, which we proxy by supplier access (SA) measures. Theory suggests that a lower input price index has a positive effect on profits. The more input varieties available and the lower the cost of accessing those varieties the lower the price index and the higher the profitability. Since individual input prices are unavailable we construct an inverse measure of the price index (described below), by measuring the proximity to potential suppliers. We hypothesize that profits are positively related to better access to intermediate inputs ($\beta_S > 0$). The term in the second set of braces in equation 2.5 represents demand from consumers and from other firms, which we proxy by market access (MA) measures,[14] has a positive effect on profits. The closer a firm is to its market, which comprises consumers and other firms that purchase its output, the higher the profits, thus we hypothesize that $\beta_M > 0$.

Access to markets is directly affected by transport cost, which we model as a function of distance. Transport costs can also be affected by the availability of infrastructure, such as the number of sea berths, river berths and length of railroads, which we include separately, represented by $Z_{p,t}$. In addition to internal trade costs, firms located in China face international trade costs. We proxy for these using average tariffs imposed by China on imported inputs, average tariffs imposed on Chinese exports by the rest of the world, a measure of provincial openness to trade as well as distance to the nearest port. We define all of these variables in the next section.

[14]Note that some papers refer to this measure as 'market potential'. We follow Redding and Venables (2005) and refer to it as market access.

3. Data and Measurement

3.1. NBS Data

The data used in the analysis have been collected by the China National Bureau of Statistics (NBS) at the firm level and then aggregated up to 515 industries by province, based on the 4 digit Chinese Industrial Classification. Before releasing these data to us, the NBS removed all 'sensitive industries' from the sample,[15] and then we excluded agriculture, extractive industries and services in order to focus on the manufacturing sector. The information available includes the number of foreign firms, the value of output of foreign firms and domestic firms. All of these variables vary by province, sector and time. Our sample covers the 1998-2001 period. It was not possible to include earlier years in the sample as data on the number of foreign firms were unavailable.

Foreign investment enterprises accounted for nearly a third of industrial output produced in China in 2001. A vast majority of foreign entry occurred in coastal provinces: 7 out of 12 coastal provinces saw the number of foreign investment projects rising by more than a hundred. Although midland provinces received much less net foreign investment, some provinces such as Hunan recorded a net entry as high as 40, similar to some of the coastal provinces such as Beijing. In terms of the distribution of net entry across industries, those producing both consumer goods and industrial parts and components appeared to be attractive to

[15] These include manganese mining and processing (0821), chrome mining and processing (0822), antimony ore (0916), other heavy nonferrous metals and processing (0919), titanium ore (0933), other light nonferrous metals and processing (0939), noble metal mining and processing (095), manufacturing of feed additive (1316), manufacturing of food additives (146), explosive and priming systems (2674), radioactive chemicals (2676), antimony smelting (3317), other smelting and pressing of nonferrous metals (3319), magnesium smelting (3322), titanium smelting (3323), other light nonferrous metal smelting (3329), noble metal smelting (333), ocean petroleum platforms (3765), navigation marks (3791), diving equipment (3792), highway signs (3793), radars (412), other electronic equipment (4190), and nucleon and nuclear radiation measuring (4228).

foreign investors. See Appendix for more details.

3.2. Entry and Exit of Foreign Firms

The dependent variable is defined as the change in the number of foreign firms operating in industry i, province p, at time t, or in other words the net entry of foreign firms: $\Delta n^i_{p,t} = n^i_{p,t} - n^i_{p,t-1}$. The variable is positive if the number of firms that entered is greater than the number of firms that exited; zero if there has been no change or the number of new firms exactly equals the number of exiting firms; and negative if the number of exiting firms exceeded the number of new entrants.[16]

3.3. Market and Supplier Access

The size of the market crucially depends on trade costs. Firms sell their output within their province, to other provinces and to the rest of the world. Similarly, firms buy inputs from within their province, other provinces and the rest of the world. Inter-provincial demand depends on internal trade costs, such as freight charges and provincial border barriers. Trade costs have generally been proxied as some function of distance. The simplest approach is the inverse distance rule as in Harris (1954). In that formulation market potential is proxied as the sum of regional income divided by the distance to that region. As an alternative, Hanson (2005) models the trade costs in the market potential as a function of the exponential of distance and estimates the coefficient on distance using non-linear estimation.[17] Redding and Venables (2004) use exporter and importer dummies from a gravity equation of trade

[16] 20% of the observations are non-zero. To demonstrate that the large number of zeros does not affect our results, we will also estimate a Tobit model.

[17] This coefficient indicates the geographic spread of externalities, which is not the focus of our study.

flows between different countries to proxy for market and supplier access (inclusive of trade costs), respectively. We are unable to follow the gravity approach because inter-provincial trade data are unavailable for China. In our specifications, we adopt the Harris approach which assumes the exponent on distance is equal to -1.[18]

3.3.1. Supplier Access

The supplier access effect comes through the price indices of intermediate inputs. Since individual input prices are unavailable we approximate this effect using value of output data. Our measure of supplier access comprises two parts: (i) inner province supply access, denoted by $SA(I)$, measuring the availability of inputs within the province in which the firm is located; and (ii) outer supply access, denoted by $SA(O)$, measuring proximity to inputs available in other provinces. The availability of inputs within a province that are used by industry i in province p is defined as

$$SA(I)^i_{p,t} = \sum_{j=1}^{J} a_{ij} * \phi^j_{p,t} * D^{-1}_{pp}, \quad \text{where } \phi^j_{p,t} = \frac{Y^j_{p,t}}{Y^j_{CHINA,t}}. \tag{3.1}$$

The term $\phi^j_{p,t}$ is output of industry j produced in province p at time t, $Y^j_{p,t}$, as a share of the total output of industry j produced in China. Since industries use more than one intermediate input, these output shares are weighted by a_{ij}, the coefficients from the China national input/output (I/O) table for 1997, which is the most recent I/O table available. Even though individual prices are unavailable, the effects should still be well represented since the price index is lower the higher the share of intermediate inputs produced in close

[18] Applying this same exponent for all industries may seem unduly restrictive given that transport costs vary by industry. However, we found that incorporating distance elasticities that vary by industry, estimated from a gravity equation in Berthelon and Freund (2005), does not affect our results.

proximity. There are 68 manufacturing I/O codes, which we concord with the industrial data. Thus, while we analyze entry for 515 industries, our proxies for supplier access are defined for 68 I/O codes. There is variation in the supplier access variables due to entry and exit of firms and changes in output. In order to make this variable comparable with the proxy for input availability in other provinces we adjust it for the within province distance, D_{pp}, assuming the provinces are circular, as in Leamer (1997), $D_{pp} = \sqrt{\frac{Area_p}{\pi}}$.

The availability of intermediate inputs in the rest of China is proxied by

$$SA(O)^i_{p,t} = \sum_{j=1}^{J} a_{ij} \sum_{l \neq p}^{P} \phi^j_{l,t} * D^{-1}_{lp}, \tag{3.2}$$

analogous to the inner province supplier access measure. The output shares produced in each province are weighted by the inverse of distance from province p to province l, as in Harris (1954). The total supplier access measure will be entered in the estimation as:

$$\Delta \ln SA^t_{p,t} = \Delta \ln \left[SA(I)^i_{p,t} + \beta_{SA(O)} * SA(O)^i_{p,t} \right].$$

We hypothesize that an increase in $SA^i_{p,t}$ will make industry i in province p more profitable and thus will induce entry. We will also estimate the coefficient on $SA(O)^i_{p,t}$ as an indirect way of ascertaining whether there are any provincial border barriers. A coefficient $\beta_{SA(O)}$ below one would suggest that the presence of suppliers in other provinces is less important than the ability to source within the own province, and thus would be consistent with the presence of inter-provincial barriers to trade.

Poncet uses a gravity approach to estimate a provincial border effect in China, a methodology that requires inter-provincial trade data. Unfortunately such data do not exist for

China, so her estimation is based on the inter-China trade figures constructed from provincial I/O tables, providing information on each province's total trade with the rest of China and with foreign countries, rather than bilateral provincial trade figures. Poncet's estimates are available for 1992 and 1997. In some of our specifications, instead of estimating $\beta_{SA(O)}$ we adjust $SA(O)^i_{p,t}$ by Poncet's measures for 1997.

3.4. Market Access

We construct analogous measures of market access to reflect that firms can supply other firms and households within their own province, $MA(I)^i_{p,t}$, and in other provinces, $MA(O)^i_{p,t}$. The inner province market access is defined as

$$MA(I)^i_{p,t} = \left[\sum_{j=1}^{J} b_{ij} * \phi^j_{p,t} + b_i * \ \lambda_{p,t}\right] * D^{-1}_{pp}, \text{with } \lambda_{p,t} = \frac{GDP_{p,t}}{GDP_{CHINA,t}}. \tag{3.3}$$

The share of industry i's output produced in province p is weighted by b_{ij}, the fraction of industry i's output sold to industry j as intermediate input, and b_i is the fraction sold for final consumption to households. Note that $\sum_{j=1}^{J} b_{ij} + b_i = 1$. The coefficients b_{ik} and b_i have been calculated based on the China national I/O table for 1997. Similarly, market access to the rest of China is defined as

$$MA(O)^i_{p,t} = \sum_{j=1}^{J} b_{ij} \sum_{l \neq p}^{P} \phi^j_{l,t} * D^{-1}_{lp} + b_i \sum_{l \neq p}^{P} \lambda_{l,t} * D^{-1}_{lp}, \tag{3.4}$$

where each province's consumption of industry's i's output is weighted by the inverse of distance. These measures are good proxies for the expenditure component of market access in the second set of braces in equation 2.5, $E^i_{l,t}$, which directly benefits firms. But being close to large markets also leads to a competition effect, via the price index $\left(P^i_{l,t}\right)^{\sigma^i - 1}$ in

equation 2.5. The lower the price of substitute goods, the lower the demand for that firm's output. In robustness checks, we include the consumer price index by province and time to take account of this competition effect. Ideally, this measure would be industry specific but price indices by province at this level are unavailable.[19]

In our basic specification, the total market access measure will be entered as

$$\Delta \ln MA^t_{p,t} = \Delta \ln \left[MA(I)^i_{p,t} + \beta_{MA(O)} * MA(O)^i_{p,t} \right].$$

We hypothesize that profits are increasing in market access, and we estimate the coefficient $\beta_{MA(O)}$ as an indirect way of ascertaining the existence of provincial border barriers. If $\beta_{MA(O)} < 1$ this implies the existence of provincial border barriers or differences in provincial transport and distribution networks. Note that it is possible for $\beta_{MA(O)}$ to differ from $\beta_{SA(O)}$ since provincial governments may not necessarily protect all goods in the same way.

3.5. International Trade

Treating international demand and supply in the same way as their domestic counterparts would require detailed production and trade data for all countries that trade or could potentially trade with China. These data are unavailable at a sufficiently disaggregated level so instead we add a number of controls to proxy for international trade costs.

The cost of accessing intermediate inputs from the rest of the world is proxied by trade weighted tariffs imposed by China on imported intermediate inputs, weighted by the I/O

[19] In other studies, such as Redding and Venables (2004), this effect is incorporated in the exporter dummies from the gravity equation. Head and Mayer (2004) compare results obtained using *exporter* and *importer* dummies with the more simple Harris formulation and conclude that Harris' assumption of an inverse rule is a rough but reasonable approximation and 'outperforms' the alternative. Hanson (2005) uses the housing stock and wages at the US county level to proxy for the price index, and he finds that this approach results in a lower coefficient on market potential but a higher coefficient on distance and provides a better fit than the Harris specification.

coefficient a_{ij}, to reflect that the relative importance of inputs varies by industry,

$$inverse\_china\_tariff_t^i = \sum_{j=1}^{J} a_{ij} * \left(1 + tariffs_{t,china}^j\right)^{-1}. \tag{3.5}$$

The information on trade weighted tariffs on products corresponding to the I/O codes comes from the World Bank's WITS database. It should be noted that many industries in China have access to duty free intermediate inputs through duty drawbacks and hence would not be affected by tariffs on intermediate inputs. Nonetheless, there are many industries that do pay these tariffs and thus it is important to include this variable in the estimation.[20]

Similarly, the cost of exporting goods abroad is proxied by

$$inverse\_world\_tariff_t^i = \left(1 + \frac{1}{K}\sum_{k=1}^{K} tariff_{t,k}^i\right)^{-1}, \tag{3.6}$$

where $tariff_{t,k}^i$ is the trade weighted tariff imposed on Chinese exports of good i to country k at time t. Thus this variable captures the average tariff faced by Chinese exports of good i in the world. We also include a measure of the degree of openness of a province, defined as the share of provincial imports and exports to GDP, constructed using international trade data from the Chinese Customs Office.

3.6. Provincial characteristics

In addition to using distance as a proxy for internal trade costs, we include in the estimation the number of river and sea berths and length of railroads, reported in the China Annual Statistical Yearbooks. The production cost variables at the provincial level include electricity prices and wages obtained from the NBS. Wages are calculated as the ratio of the total wage

[20] Approximately 40 per cent of imports are subject to tariffs.

bill to employment by province and year. We also control for the size of the province with population. And as another measure of the attractiveness of a province, in some specifications we add the total number of firms at the provincial level, lagged one period. We include all locations in China except Tibet and Inner Mongolia, which have very little industrial activity. This gives us 29 locations comprising 25 provinces and 4 directly administered cities: Shanghai, Beijing, Tianjin and Chongqing. Table 1 provides summary statistics of all the variables.

3.7. Model Specification

Substituting in the proxies for supplier and market access, our estimating equation (2.6) can be rewritten as

$$\begin{aligned}\Delta n^{i,}_{p,t} &= \delta_0 + \beta_S \Delta \ln\left[SA(I)^i_{p,t} + \beta_{SA(o)} * SA(O)^i_{p,t}\right] + \beta_M \Delta \ln\left[MA(I)^i_{p,t} + \beta_{MA(O)} * MA(O)^i_{p,t}\right] \\ &\quad + \gamma_1 \Delta \ln(inv\_china\_tariff^i_t) + \gamma_2 \Delta \ln(inv\_world\_tariff^i_t) \\ &\quad + \Delta \ln Z_{p,t} * \Gamma + D_t \delta_t + \varepsilon^i_{p,t}.\end{aligned} \tag{3.7}$$

We estimate equation (3.7) using non-linear least squares (nls). The standard errors are adjusted for clustering on I/O-code-year combinations in all specifications. Since market access and supplier access variables tend to be highly correlated, in addition to the full specification, we also estimate models with either only supplier access or market access variables.

4. Results

The results from estimating equation 3.7 using nls, presented in Table 2, confirm the importance of proximity to markets and suppliers. The coefficients on SA and MA are larger when they are included separately (in columns 2 and 3) than when included jointly (in column 1), which is likely due to the correlation between the terms. Note that even though some of the access variables are individually insignificant in column (1), Wald tests indicate they are jointly significant with a $p-$value equal to 0.03. Using estimates from column 1 with the full specification, the results indicate that increasing SA by one standard deviation increases entry of foreign firms by 1.2 firms and a one standard deviation increase in MA increases entry of foreign firms by about 0.8 of a firm. Evaluated at the mean number of foreign firms (equal to 6),[21] this is equivalent to a 20% and 13% increase in the number of foreign firms in an industry/province, respectively.[22]

Interestingly, both outer terms on market access and supplier access are positive and less than one. Since both own and outer supplier access have been adjusted for distance, the parameter on $SA(O)$ allows us to compare the relative magnitude of the two effects. A coefficient below one suggests that the presence of suppliers in other provinces is less

[21] This is the mean number of foreign firms when $n > 0$. Alternatively, we could evaluate the percentage increase at the mean number of firms including observations when $n = 0$, equal to 1.83. Of course this does not affect the relative magnitude of the effects but would inflate the percentage increase.

[22] Our measure of market access captures the expenditure term in equation 2.5 and the transport costs but so far has omitted the competition effect represented by the price index. Although being close to a large market is beneficial due to higher demand from consumers and downstream firms, a large market is also likely to comprise competitor firms. The larger the number of competing firms within the same industry the lower the price index and thus the lower the demand. In unreported regressions, we incorporated a consumer price index (CPI) varying by province and time into the market access calculation. Multiplying the market access terms in equations 3.3 and 3.4 by CPI, we found that the coefficients on the market access terms were almost identical to the basic specification in columns 1 and 3 of Table 2. However, we note that CPI is not an ideal proxy for the competition effect.

important than the ability to source within the own province. This is indeed the case with $\beta_{SA(O)}$ equal to 0.16 and $\beta_{MA(O)}$ equal to 0.32 in column 1, which implies that outer supplier access is approximately 16% of the total supplier access effect, and the outer market access effect is approximately 32% of the total market access effect. This finding suggests that firms may face some difficulties with accessing inputs and selling their products in neighboring provinces due to interprovincial barriers to trade or differences in transport and distribution costs.

Since foreign investors may also import some of their inputs or export their output, the model controls for the inverse of the average tariff charged on inputs used by industry i and the inverse of the average tariff imposed by the rest of the world on China's exports of industry i. As hypothesized, lower average tariffs on inputs attract foreign entry, while the average tariff on exports does not appear to be statistically significant. This suggests that ease of access to imported intermediates is important to foreign investors.

Production costs are also important in determining location. As hypothesized, the coefficients on the average provincial wage and electricity prices are negative and significant. In all three specifications in Table 2, the coefficient on wage is equal to about -0.5 and on electricity it is around -0.4. Thus, an increase of one standard deviation in wages or electricity prices decreases foreign entry by around 2% and 4%, respectively. This is less than a quarter of the size of the effect of increasing either MA or SA by a standard deviation.

The availability of infrastructure also plays a role in the entry decision. The higher the number of sea berths or the length of railroads the more foreign entry. The number of river berths, on the other hand, appears to have a very small negative effect. A one standard

deviation increase in the number of sea berths and the length of rail increases foreign entry by around 11% and 7%, respectively. The results suggest that provinces close to ports appear to be more attractive investment destinations.[23] Indeed, as discussed earlier, coastal regions have been the primary recipients of FDI in China.

The ability to sell products within China is likely to matter less for export-oriented investors. Thus, to check the robustness of our findings we re-estimated the above models restricting the sample to industry-province-year combinations where less than 30% (or alternatively less than 50%) of output is exported.[24] The results confirmed our earlier conclusions. The coefficients were slightly smaller than in the full sample, however the relative magnitudes corresponded to our earlier findings.

4.1. Extensions

In the next three columns of Table 2, we explore the effect of additional controls for the attractiveness of a province. We add a measure of openness to trade (defined as the share of provincial imports and exports to GDP) and a proxy for the quality of the investment climate in the province (the presence of foreign firms in the province, lagged one period). The latter variable is defined as the total number of foreign firms in *all* industries in a province, rather than a particular industry as is the case with the dependent variable.

The results suggest that openness to trade is positively correlated with foreign entry and

[23] Distance to port is measured as the shortest distance to one of the three major ports: Shanghai, Hong Kong SAR, and Qinhuangdao (Hebei).

[24] The export-orientation of a given industry in a particular province was calculated by summing the value of exports of all firms operating in a given industry, province and year combination and dividing it by the sum of the total production in the same cell. If an observation for a particular year was missing it was substituted with an observation for the closest year available. This data series, constructed from firm-level information, has been provided by Sourafel Girma. See Girma and Gong (2004) for detailed information on the data source.

the coefficient on foreign presence in the previous period is also positive and significant. Provinces with a large number of foreign firms are more attractive to new entrants either due to agglomeration benefits or due to a better investment climate that attracted the earlier entrants. It seems that the competition for resources or congestion externalities have not yet outweighed the benefits of being in a province with many other foreign firms present. These additional controls reduce the market and supplier access coefficients only slightly. Thus, conditional on the other controls, they appear to be uncorrelated with the access variables thus we drop them in subsequent specifications due to concerns of potential endogeneity.

4.2. Sensitivity

Now, we turn to the robustness of our assumptions on border barriers, transport costs, and entry and exit.

Border barriers and transport costs We allow for heterogeneity across industries in trade costs by estimating coefficients on SA and MA by industry. Table 3 reports coefficients on SA and MA for 2 digit industries. The coefficients on all of the access variables are positive. We see that there is indeed large variation across industries, with the largest effects in wood, furniture and toys, textiles and electric machinery and electronics industries. As shown in Berthelon and Freund (2004), trade costs and elasticities vary considerably across industries; and so do incentives on which industries local governments want to protect (see Naughton, 2003).

An alternative way to account for provincial border barriers is to incorporate Poncet's

border barrier measures in our supplier and market access measures.[25] Poncet's estimates are available for 25 out of 29 provinces.[26] We use the 1997 estimates, except for two provinces where the data are not available and thus we substitute the 1992 estimates. In the case of supplier access, we divide the access to suppliers in other provinces by the border barrier estimate in the sourcing province. Therefore, higher protectionism in the sourcing province is associated with less access to suppliers in other provinces. In the case of market access, we adjust the potential demand from each province by its border barrier estimate. Thus, greater protectionism in other provincial markets is associated with a lower value of the market access variable. As border barriers are taken into account explicitly, the measures of market and supplier access encompass both own and other provinces. From Table 4, we see that the coefficients on supplier and market access are positive and significant and the magnitudes of the other coefficients unchanged.[27]

Entry and Exit Now we consider our assumptions on entry and exit. The free entry and exit condition provides an implicit solution for the number of firms. However, given the nonlinearities in the model we could not get a closed form solution, so we assumed that the

[25] Only the market and supplier access, and the production cost variables are presented for all subsequent specifications to save space. However, all specifications include all of the same controls as the basic specification in columns 1, 2 and 3 of Table 2.

[26] They are not available for Anhui, Chongqing, Hainan and Heilongjiang. The higher the estimated value obtained by Poncet, the lower the barriers to trade. To ease the interpretation, we think of the inverse of Poncet's measure as an index of provincial protectionism.

[27] Additionally, we explored two alternative assumptions on border barriers to check for robustness of results: (i) no border effect, with $\beta_{SA(O)} = \beta_{MA(O)} = 1$, thus $SA = SA(I) + SA(O)$ and $MA = MA(I) + MA(O)$. This has the effect of increasing the size of the coefficients on SA and MA but leaves the other coefficients almost unchanged; and (ii) infinite border barriers, thus setting $\beta_{SA(O)} = \beta_{MA(O)} = 0$, effectively only including supplier and market access within a province. Again, both the supplier access and market access terms are positive and significant but the magnitudes of the effects are much smaller. The estimations that include outer provinces produce much higher coefficients on supplier and market access than those that exclude outer effects, which confirms our finding that access to other provinces is important for entry.

equilibrium number of firms is a function of log profits, and hence net entry is a function of the difference of log profits. It could be argued that the log of profits implicitly defines $\ln(n)$ rather than n so that the proportional change in the number of firms is related to the log difference in profits. This would be problematic given the large numbers of zeros in industry/province/time cells. However, given that the log is a monotonic transformation the expected signs on the coefficients should be unaffected. Therefore, as an additional robustness check we also estimate equation 3.7 with the log difference of $(1 + n^i_{p,t})$ as the dependent variable. The results are presented in columns 4, 5 and 6 of Table 4. All the coefficients have the expected signs. The magnitudes are smaller now because it is a log log specification, so the coefficients can be interpreted as elasticities.

Next we test whether our results are robust to taking into account the corner solution, that is the situation where the expected profits are negative or falling but since no foreign firms are present in a particular industry in a given province this has no implications for net entry (i.e. $n^i_{p,t} = n^i_{p,t-1} = 0$). To do so, we estimate a Tobit specification with $n^i_{p,t}$ as the dependent variable and $n^i_{p,t-1}$ as an explanatory variable with its coefficient constrained to equal one. All other explanatory variables enter the model in first differences, as specified in equation 3.7.[28] The results, presented in columns 7, 8 and 9 of Table 4, are expressed in terms of marginal effects. These specifications confirm our original results. All coefficients have the expected signs, and the size of the coefficients on the access variables are larger than those on production costs.

[28] The reason we do not use net entry as the dependent variable is that we want to distinguish between the corner solution and the situation in which the number of new entrants is exactly offset by the number of exits i.e. $n^i_{p,t} = n^i_{p,t-1} > 0$.

Endogeneity of Wages The Chinese hukou system, restricting the movement of labor across provinces, was weakened during the 1990s raising the concern that provincial wages could potentially be endogenous. It is possible that workers and firms may be attracted to the same provinces, with the increased labor supply reducing wages and thus causing a spurious negative correlation between wages and firm entry. Further, provincial wages could be correlated with unobserved provincial income shocks that attract foreign firms thus leading to a positive correlation between firm entry and wages. Given the short time period covered in our analysis, we address these issues by estimating a model with provincial fixed effects. This modification has no effect on the signs or the significance pattern of the variables of interest. Moreover, in all three specifications presented in the first three columns of Table 5, the coefficient on wages remains negative and statistically significant.

Although the provincial fixed effects help reduce the endogeneity problem, it may still persist if the income shocks are time varying. A further concern is reverse causality, that is the possibility that the entry of foreign firms may affect the provincial wage. This possibility is attenuated by the fact that while wages entering the model are province specific, foreign entry is measured at the province-industry level. Nevertheless, as an additional robustness check we instrument for provincial wages with logarithms of total provincial population and population grouped by educational attainment (primary, secondary and tertiary education) in years 1984, 1987 and 1990.[29] The F-statistic indicates that these instruments provide a good fit in the first stage regression. The Sargan overidentification test (with the p-value of 0.18) also supports the validity of the instruments. The two stage least squares estimates

[29] The choice of years was driven by data availability for the longest possible lags.

in columns 4 to 6 produce results which are almost identical to the ols estimates except the wage coefficient now has a slightly larger effect on foreign entry. The wage coefficient remains negative and statistically significant in all of the specifications.

5. Conclusion

This study examines factors driving entry of foreign firms in China, using a comprehensive data set covering nearly all manufacturing industries at the provincial level during the period 1998-2001. The analysis is based on a new economic geography model and thus focuses on the importance of supplier and market access effects both within and outside the province of entry, relative to production costs. The findings suggest that access to customers and suppliers of intermediate inputs are the key determinants of FDI inflows. The results show that increasing supplier access by one standard deviation is associated with a 20% increase in entry of foreign firms, and a one standard deviation increase in market access is associated with a 13% increase in the foreign entry, whereas a one standard deviation increase in production costs reduces entry of foreign firms by between 2 and 4%. The analysis also shows that the presence of customers and suppliers in the province of entry matters much more than market and supplier access to the rest of China. This may be due to the underdeveloped transport infrastructure and informal barriers to trade and is consistent with the fragmentation of the Chinese market.

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Table 1: Summary statistics (1998 to 2001)

Variable	no. of obs	mean	std dev	min	max
$(n)^i_{pt}$	59,740	1.83	11.89	0.00	922.00
$\Delta(n)^i_{pt}$	44,805	0.11	1.57	-116.00	101.00
$\ln(1+n)^i_{pt}$	59,740	0.42	0.79	0.00	6.83
$\Delta\ln(1+n)^i_{pt}$	44,805	0.01	0.23	-2.40	2.08
$MA(I)^i_{pt}$	59,740	0.0002	0.0004	0.0000	0.0057
$\Delta\ln(MA(I))^i_{pt}$	44,805	-0.0133	0.1125	-2.7159	1.6639
$MA(O)^i_{pt}$	59,740	0.0011	0.0005	0.0001	0.0036
$SA(I)^i_{pt}$	59,740	0.0002	0.0004	0.0000	0.0032
$\Delta\ln(SA(I))^i_{pt}$	44,805	-0.0182	0.1201	-1.5659	1.5223
$SA(O)^i_{pt}$	59,740	0.0011	0.0005	0.0001	0.0043
$MA(\text{Poncet border barriers})^i_{pt}$	59,740	0.0003	0.0004	0.0000	0.0059
$\Delta\ln MA(\text{Poncet border barriers})^i_{pt}$	44,805	-0.0031	0.0490	-1.6011	0.5141
$SA(\text{Poncet border barriers})^i_{pt}$	51,500	0.0003	0.0005	0.0000	0.0035
$\Delta\ln SA(\text{Poncet border barriers})^i_{pt}$	38,625	-0.0059	0.0649	-0.6964	1.2420
$\ln(1 + 1/\text{china\_tariff})^i_t$	59,740	0.0033	0.0078	0.0001	0.0473
$\Delta\ln(1 + 1/\text{china\_tariff})^i_t$	44,805	0.0012	0.0127	-0.1852	0.0390
$\ln(1+1/\text{world\_tariff})^i_t$	59,740	0.0036	0.0086	0.0001	0.0506
$\Delta\ln(1+1/\text{world\_tariff})^i_t$	44,805	-0.0052	0.0295	-0.3102	0.1969
$(\text{wage})_{pt}$	59,740	8.32	2.52	4.70	17.72
$\Delta\ln(\text{wage})_{pt}$	44,805	0.12	0.10	-0.06	0.85
$(\text{elect\_price})_{pt}$	59,740	490.73	311.00	38.17	1480.07
$\Delta\ln(\text{elect\_price})_{pt}$	44,805	0.01	0.04	-0.13	0.14
$(\text{population})_{pt}$ (millions)	59,740	41.86	25.28	4.82	93.90
$\Delta\ln(\text{population})_{pt}$	44,805	0.0007	0.04	-0.07	0.21
$(\text{seaberths})_{pt}$	59,740	31.42	63.67	0.00	272.00
$\Delta(\text{seaberths})_{pt}$	44,805	0.92	4.81	-10.00	31.00
$(\text{riverberths})_{pt}$	59,740	34.37	96.89	0.00	594.00
$\Delta(\text{riverberths})_{pt}$	44,805	-9.52	57.61	-337.00	170.00
$(\text{rail})_{pt}$	59,740	1,923	1,161	219	5,503
$\Delta\ln(\text{rail})_{pt}$	44,805	0.07	0.15	-0.20	1.02
$\text{Distance\_port}_{pt}$	59,740	1,024	1,611	20	9,047
$(\text{openness})_{pt}$	59,740	0.25	0.30	0.04	1.50
$\Delta\ln(\text{openness})_{pt}$	44,805	0.04	0.20	-0.55	0.56
$\ln(\text{total foreign firms})_{p,t-1}$	44,805	5.61	1.63	1.79	9.00

Table 2: Determinants of Foreign Entry

Dependent Variable: $\Delta(n)^i_{pt}$						
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta\ln(SA)^i_{pt}$	1.107*	1.462***		0.993*	1.270**	
	(0.576)	(0.535)		(0.550)	(0.507)	
$\Delta(SA(O))^i_{pt}$	0.157	0.174*		0.144	0.154	
	(0.125)	(0.097)		(0.127)	(0.097)	
$\Delta\ln(MA)^i_{pt}$	0.983		1.635**	0.837		1.402**
	(0.797)		(0.701)	(0.757)		(0.668)
$\Delta(MA(O))^i_{pt}$	0.318		0.306	0.285		0.274
	(0.398)		(0.216)	(0.403)		(0.216)
$\Delta\ln(population)_{pt}$	1.005**	1.025**	0.961**	0.249	0.246	0.258
	(0.472)	(0.473)	(0.473)	(0.202)	(0.202)	(0.203)
$\Delta\ln(inv\_china\_tariff)^i_t$	1.122**	1.109**	1.097**	0.578	0.581	0.521
	(0.495)	(0.496)	(0.476)	(0.454)	(0.454)	(0.455)
$\Delta\ln(inv\_world\_tariff)^i_t$	0.246	0.247	0.260	1.119**	1.101**	1.065**
	(0.202)	(0.202)	(0.203)	(0.494)	(0.493)	(0.466)
$\Delta\ln(wage)_{pt}$	-0.459***	-0.460***	-0.465***	-0.486***	-0.487***	-0.493***
	(0.086)	(0.086)	(0.087)	(0.090)	(0.090)	(0.090)
$\Delta\ln(elect\_price)_{pt}$	-0.377**	-0.379**	-0.427**	-0.272*	-0.275*	-0.312*
	(0.183)	(0.182)	(0.186)	(0.165)	(0.165)	(0.168)
$\Delta(seaberths)_{pt}$	0.010***	0.010***	0.010***	0.006**	0.006**	0.006**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
$\Delta(riverberths)_{pt}$	-0.0003***	-0.0003***	-0.0003**	-0.0003**	-0.0003**	-0.0003**
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
$\Delta\ln(rail)_{pt}$	0.726***	0.734***	0.713***	0.746***	0.754***	0.734***
	(0.175)	(0.175)	(0.176)	(0.176)	(0.176)	(0.177)
$\ln(distance\_port)_p$	-0.092***	-0.092***	-0.092***	-0.046***	-0.045***	-0.043***
	(0.014)	(0.014)	(0.014)	(0.011)	(0.011)	(0.011)
$\Delta\ln(openness)_{pt}$				0.185***	0.188***	0.179**
				(0.070)	(0.070)	(0.070)
$\ln(total\ foreign\ firms)_{p,t-1}$				0.043***	0.044***	0.046***
				(0.011)	(0.011)	(0.011)
Year2000	0.051*	0.048*	0.057**	0.014	0.011	0.022
	(0.026)	(0.026)	(0.026)	(0.032)	(0.032)	(0.032)
Year2001	0.062**	0.059**	0.070***	0.043*	0.039	0.051**
	(0.026)	(0.026)	(0.026)	(0.024)	(0.024)	(0.024)
H_0: All market and supplier access terms insignificant						
Wald Statistic	10.86	8.61	5.47	9.76	7.81	4.52
p-value	0.03	0.01	0.06	0.04	0.02	0.10
RSS	108,323.3	108,349.9	108,393.5	108,207.5	108,229.0	108,267.7
Observations	44,805	44,805	44,805	44,805	44,805	44,805

Notes: a)* significant at 10%; ** significant at 5%; *** significant at 1%; b) Robust standard errors corrected for clustering in parentheses; c) MA(O) and SA(O) terms enter non-linearly as in equation (3.7).

Table 3: Foreign Entry by Industry

Dependent Variable: $\Delta(n)^{i}_{pt}$

	Industry						
	Food, beverage and tobacco	Textiles	Wood, furniture and toys	Chemicals, rubber and plastic	Mineral and metal products	Machinery & Transport equipment	Electric machinery & electronics
$MA(I)^{i}_{pt}$	2.25	7.73*	3.52	0.85	2.33	0.42	8.31***
	(2.52)	(4.50)	(3.18)	(0.99)	(1.45)	(0.45)	(2.02)
$MA(O)^{i}_{pt}$	0.19	0.14	0.19	0.16	0.10	0.28	0.60***
	(0.27)	(0.14)	(0.98)	(0.24)	(0.10)	(0.49)	(0.27)
$SA(I)^{i}_{pt}$	2.20*	3.63**	3.53*	0.08	0.87	1.05*	6.10**
	(1.37)	(1.54)	(2.14)	(1.07)	(0.67)	(0.56)	(2.78)
$SA(O)^{i}_{pt}$	0.39*	0.12	0.12	0.33	0.16	0.17	0.64*
	(0.21)	(0.09)	(0.11)	(5.82)	(0.19)	(0.18)	(0.37)
N	6,177	4,611	3,654	7,395	6,090	10,701	6,177

Notes: a) * significant at 10%; ** significant at 5%; *** significant at 1%; b) Robust standard errors corrected for clustering in parentheses; c) Specification is the same as in columns 2 and 3 of Table 2. Only the market access and supplier access variables are reported to save space.

Table 4: Estimation with Poncet's Measure of Border Barriers

	OLS						Tobit		
	Dep Variable: $\Delta(n)^i_{pt}$			Dep Variable: $\Delta\ln[(n)^i_{pt}+1]$			Dep Variable: n^i_{pt}		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\Delta\ln(SA)^i_{pt}$	0.661***	0.813***		0.092***	0.104***		1.212***	1.522***	
	(0.187)	(0.169)		(0.024)	(0.022)		(0.188)	(0.174)	
$\Delta\ln(MA)^i_{pt}$	0.541***		0.861***	0.042		0.087***	1.105***		1.779***
	(0.165)		(0.162)	(0.028)		(0.028)	(0.256)		(0.283)
$\Delta\ln(wage)_{pt}$	-0.523***	-0.525***	-0.534***	-0.041***	-0.041***	-0.042***	-0.123	-0.131	-0.14*
	(0.062)	(0.060)	(0.066)	(0.012)	(0.011)	(0.012)	(0.082)	(0.085)	(0.079)
$\Delta\ln(elect\_price)_{pt}$	-0.342**	-0.356*	-0.380**	-0.041	-0.042*	-0.046*	-0.864***	-0.872***	-1.006***
	(0.1733)	(0.185)	(0.174)	(0.028)	(0.026)	(0.027)	(0.186)	(0.223)	(0.252)
H_0: $\beta_{MA}=0$; $\beta_{SA}=0$									
Wald Statistic	37.29			24.35			54.74		
p-value	0.00			0.00			0.00		
Observations	38,625	38,625	38,625	38,625	38,625	38,625	38,625	38,625	38,625
Uncensored observations							12,740	12,740	12,740
Censored observations							25,885	25,885	25,885

Notes: a) * significant at 10%; ** significant at 5%; *** significant at 1%; b) Bootstrapped standard errors in parentheses; c) Results in columns (7)–(9) are reported in terms of marginal effects evaluated at sample means. Wald statistic pertains to the coefficients underlying the marginal effects; d) Models (7)–(9) include n_{ipt-1} as an additional explanatory variable. Its coefficient is restricted to one; e) All models include the following explanatory variables: $\ln(population)_{pt}$, $\Delta\ln(inv\_china\_tariff)^i_t$, $\Delta\ln(inv\_world\_tariff)^i_t$, $\Delta(seaberths)_{pt}$, $\Delta(riverberths)_{pt}$, $\Delta\ln(rail)_{pt}$, $\ln(distance\_port)_p$ and year fixed effects.

Table 5: Estimation with Poncet's Measure of Border Barriers - Additional Robustness Checks

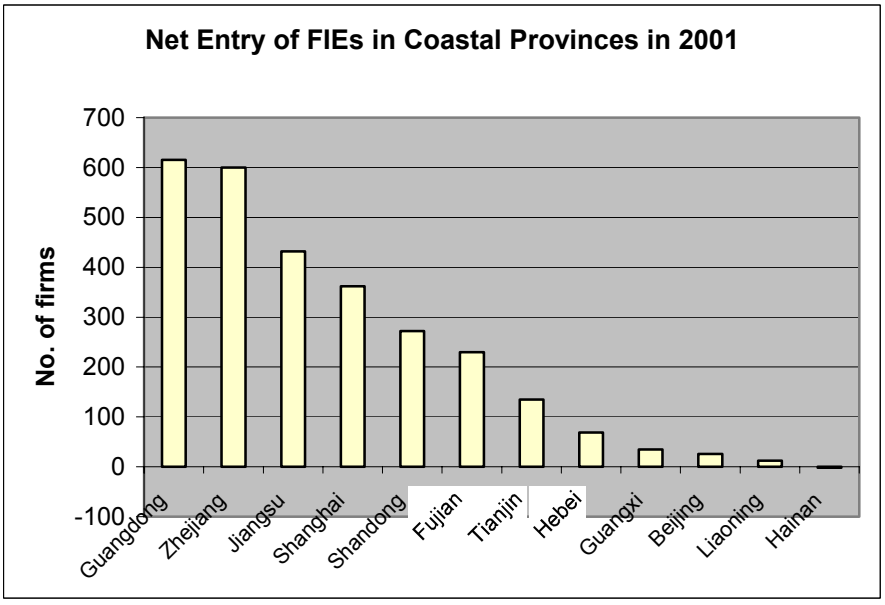
Dependent Variable: $\Delta(n)^i_{pt}$						
	Model with provincial fixed effects					
	OLS			2SLS		
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta\ln(SA)^i_{pt}$	0.483***	0.573***		0.483***	0.573***	
	(0.167)	(0.160)		(0.183)	(0.169)	
$\Delta\ln(MA)^i_{pt}$	0.352**		0.500***	0.352**		0.552***
	(0.159)		(0.119)	(0.165)		(0.157)
$\Delta\ln(wage)_{pt}$	-0.534***	-0.535***	-0.488***	-0.575*	-0.576*	-0.562*
	(0.079)	(0.084)	(0.076)	(0.343)	(0.343)	(0.333)
$\Delta\ln(elect\_price)_{pt}$	-0.677***	-0.701***	-0.768***	-0.682***	-0.706***	-0.732***
	(0.202)	(0.205)	(0.188)	(0.219)	(0.217)	(0.218)
Sargan statistic				4.92	5.09	5.28
p-value				0.18	0.17	0.15
H_0: $\beta_{MA}=0$; $\beta_{SA}=0$						
Wald Statistic	20.15			21.19		
p-value	0.00			0.00		
Coefficients on instrumental variables in stage I dep var = $\Delta\ln(wage)_{pt}$						
$\ln(tertiary)_{pt-k}$				0.094***	0.094***	0.094***
				(0.003)	(0.003)	(0.003)
$\ln(secondary)_{pt-k}$				-0.005	-0.005	-0.005
				(0.007)	(0.007)	(0.007)
$\ln(primary)_{pt-k}$				-0.139***	-0.139***	-0.139***
				(0.006)	(0.006)	(0.006)
$\ln(population)_{pt-k}$				2.951***	2.952***	2.951***
				(0.052)	(0.052)	(0.052)
F-stat				640.36	643.14	640.82
p-value				0.00	0.00	0.00
Observations	38,625	38,625	44,805	38,625	38,625	38,625

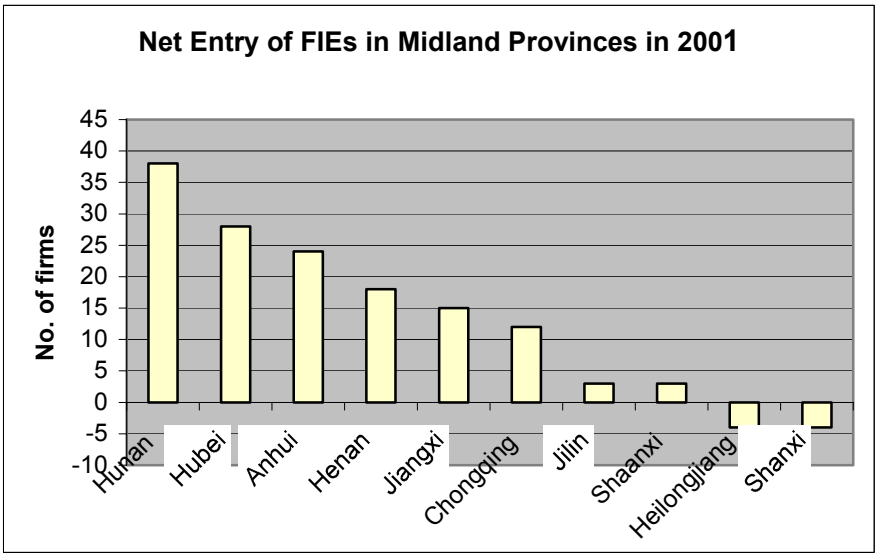
Notes: a)* significant at 10%; ** significant at 5%; *** significant at 1%; b) Bootstrapped standard errors in parentheses; c) All models include the following explanatory variables: $\Delta\ln(population)_{pt}$, $\Delta\ln(inv\_china\_tariff)^i_t$, $\Delta\ln(inv\_world\_tariff)^i_t$, $\Delta(seaberths)_{pt}$, $\Delta(riverberths)_{pt,}$ $\Delta\ln(rail)_{pt}$, as well as year and provincial fixed effects; d) Instrumental variables in models (4)–(6) include the the log of the number of people with tertiary, secondary and primary education in a given province as well as the log of the total population of the province. All instruments enter in natural logs. They pertain to years 1984, 1987 and 1990. The first stage also includes other explanatory variables included in the second stage.

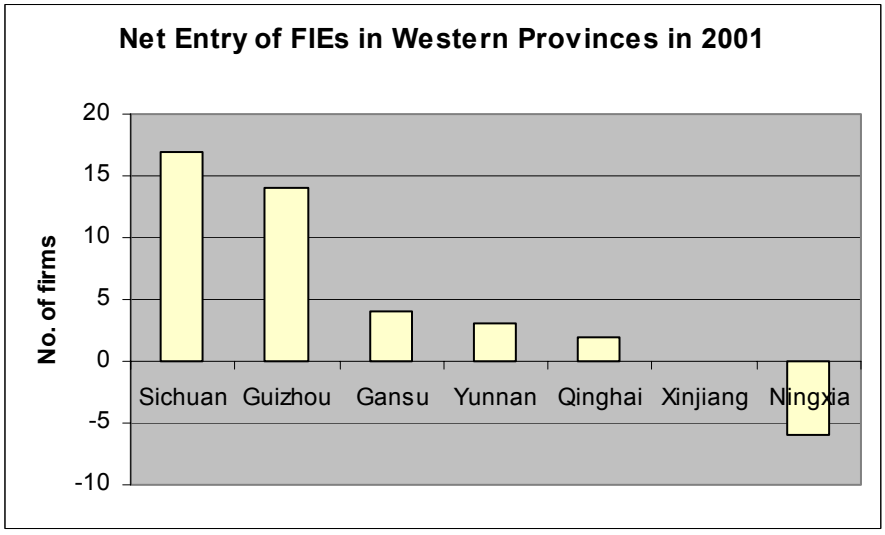
Appendix

Table 1A. Industries with the Highest Net Entry of Foreign Investment Enterprises (FIEs)

Rank	Year	Industry code	Industry description	Net entry
1	2001	1810	Manufacture of clothing	260
2	2000	1810	Manufacture of clothing	160
3	2001	4160	Manufacture of electronic elements	131
4	2000	4160	Manufacture of electronic elements	83
5	2001	2230	Manufacture of paper products	79
6	2001	3070	Manufacture of household plastic products	70
7	2000	3727	Manufacture of automobile fittings and parts	69
8	2001	3727	Manufacture of automobile fittings and parts	64
9	2001	4073	Manufacture of lamp and lanterns	59
10	2001	1781	Manufacture of cotton knitting	58
11	1999	3090	Manufacture of other plastic products	51
12	2001	1390	Processing of other food	48
13	2001	1790	Other textile industry	48
14	2001	3434	Manufacture of abrasive tools	48
15	2001	2312	Printing of packing , decorating	47




Net Entry of FIEs in Midland Provinces in 2001
No. of firms
45
40
35
30
25
20
15
10
5
0
-5
-10
Hunan
Hubei
Anhui
Henan
Jiangxi
Chongqing
Jilin
Shaanxi
Heilongjiang
Shanxi


Net Entry of FIEs in Western Provinces in 2001
No. of firms
20
15
10
5
0
-5
-10
Sichuan
Guizhou
Gansu
Yunnan
Qinghai
Xinjiang
Ningxia