

Protectionism and Industry Localization in Chinese provinces

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Abstract

This paper investigates the determinants of industry location in Chinese provinces, paying particular attention to the role of local protectionism. Data from 1992 and 1997 provincial input output tables (that decompose output and use of factors and intermediary inputs for agriculture, 20 industrial and 10 service activities) allow us to overcome traditional data limitations. We estimate a model of production location across Chinese provinces that combines factor endowments and geographical considerations to show how industry and regional characteristics interact to determine the localization of activities. We rely on an all-inclusive indicator of inter-provincial trade barriers to study the impact of regional protectionism. Results emphasize that the dynamics of comparative advantages and the forces of the new geographic economy are at work in Chinese provinces. We find greater geographic concentration in industries that enjoy significant comparative advantages, strong supply linkages and high market potential. Results however lend strong support to the role of local protectionism on the concentration of activities. The localization of economic activities in Chinese provinces does not exclusively follow the logic of the market. It is also influenced by interregional trade barriers put in place by local governments. Greater location quotients are found for industries that enjoy high protection from interregional competition. The influence of local protectionism on activities localization does seem to have increased between 1992 and 1997 in the least internationally opened provinces.

JEL Codes: F02, F14, F15, P2, R12.

Keywords: China, protectionism, international trade liberalization, regional specialization, external economy, resource endowment.

1 Introduction

This study analyzes the relation between protectionism and localization of economic activities in Chinese provinces. The analysis is motivated by the existence of a double paradox concerning China's economy over the reforms. First, several studies evidence reduced regional specialization over the liberalization process. Moreover, the structure of regional specialization¹ appears to be detrimental to the growth of value added. Some empirical works find a negative impact of the degree of regional concentration on the performance of industries (Batisse, 2002; Mody and Wang, 1997).

These findings are all the more counter-intuitive that Chinese authorities initiated in the late 1970s a program of reforms that broke dramatically with the Maoist introverted development strategy. These reforms promoted spatial domestic market integration alongside state withdrawal, economic modernization and international openness. This radical move is rooted in the recognition of the economic inefficiencies and wastage of resources resulting from the introverted development and planification policies. Central authorities advocated the introduction of market and competition mechanisms, economic openness and the reorientation of the production structure in accordance with comparative advantages in order to reinforce growth dynamics and competitiveness.

Authors agree to recognize the successful transition of China from a planned economy towards a market economy (Naughton, 1995). Modernization and industrialization have fostered rapid economic growth². However recent findings of a negative relation between industry-level specialization and growth and of converging production structures in Chinese provinces conflict with the increased international openness of the country over the period as well as with the objectives pursued by the reforms (promotion of competition, rationalization of the production structure, specialization according to comparative advantages).

Batisse (2002) investigates how regional economic structure (industry-level specialization and diversity) affects the various forces of agglomera-

tion and dispersion of economic activities, and thereby influences regional growth³. Results obtained over the period 1988-1997 emphasize that firms benefit from a diverse industrial environment. However, the greater the relative size of an industry in the local industrial fabric, the lower its subsequent growth. A specialized economic environment or geographic groupings of similar activities do not appear to favor value-added growth in Chinese provinces. This observation has already been made by Mody and Wang (1997) for the coastal provinces over the period 1985-1989. These findings appear coherent with the acknowledgement of converging regional economic structures in China. The World Bank (1994) and Young (2000) evidence a reduction in regional specialization in China. Bai et al. (2002) confirm that regional specialization of Chinese industries decreases over the 1980s. They however find that the trend reversed in the later years.

The concomitance of international trade liberalization and of converging economic structures of Chinese provinces as well as the negative impact of regional specialization on value-added growth lead us to wonder about the mechanisms of industry-level specialization and concentration in China. This paper investigates whether the localization of industries in China is rooted in a market process or on the opposite is influenced by industrial and trade policies disconnected from the logic of comparative advantages.

These interrogations are based on the knowledge of a Chinese singularity: the existence of regional protectionism. Various studies⁴ describe the numerous ‘creative’ actions taken by local governments to keep their production of scarce raw materials to themselves or prevent the inflow of goods produced in other provinces. Some struggles at the end of the 1980s were so intense as to be called “wars” by observers. Local protectionism and impediments to the economic unification of the national market remain topical issues⁵. Young (2000) argue that over the past 20 years of economic reform China has devolved into “a fragmented internal market with fiefdoms controlled by local officials”. It therefore appears necessary to take into account local impediments to trade in the study of economic

specialization of Chinese provinces.

This study aims at analyzing how trade liberalization apprehended both in terms of domestic market integration and international trade openness affects the regional specialization in China. To our knowledge, this paper is the first to measure directly the impact of impediments to domestic trade on the process of industry-level specialization of Chinese provinces beside other traditional factors such as resource endowment, external economies and increasing returns to scale⁶.

Our investigation of the trend and determinants of economic localization in China is based on a unique panel data set extracted from provincial input-output tables for 1992 and 1997. The final-demand columns of these matrices provide the decomposition of production inputs, consumption, trade, demand and output for 31 comparable industries goods in 1992 and 1997. This dataset allows us to overcome traditional data limitations as it provides a more complete coverage of enterprises and includes not only twenty industry sectors but also agriculture and ten non-tradable sectors⁷. We consider that our paper allows a better and fuller assessment of the patterns of location of economic activities in China than previous studies on Chinese economic structure as it is not limited to manufacturing industries.

Section 2 describes the process of liberalization of Chinese economy and introduces the issue of regional protectionism. Section 3 briefly reviews the literature on spatial distribution of activities. Section 4 exposes the data sources and performs a descriptive analysis of industry location across Chinese provinces. Section 5 presents and tests econometrically a model of industry localization in which industry characteristics are nested within each provincial dimension. Section 6 concludes.

2 Reforms, trade liberalization and provincial protectionism in China

The policies conducted by Mao Zedong before the launching of the reforms in 1978 have led to a spatial dispersion of economic activities. Mao's strategy was to implement balanced regional development and to encourage relative regional autonomy. The emphasis was placed on self-reliance, that is to say the ability for each province to support itself with its own resources, not only in food production but also in industrial goods. This policy led to a lack of regional specialization.

Moreover, there has been a kind of "remodelling" of the Chinese economic geography. Industrial enclaves have been implanted in the inland part of the country, in mostly backward provinces while neglecting coastal provinces despite their economic assets. This dispersion of heavy-industry activities has limited the potential of economies of scale and spillovers effects⁸.

The policy of economic opening-up and reforms launched when Deng Xiaoping acceded to power broke with the autarchic development strategy. Its primary objective was the introduction of market mechanisms.

The promotion of international opening-up and market integration lay also at the centre of the reforms. Great latitude was given to local governments to attract Foreign Direct Investments and to promote international trade⁹. The successful promotion of international opening-up is widely acknowledged. The beneficial impact of economic openness has been emphasized in various studies (Mody and Wang, 1997; Démurger, 2000). Various papers however underline difficulties encountered in the implementation of reforms, especially the emergence of reluctance vis-à-vis reforms based on their social costs (bankruptcy, lay-offs and rise in inequalities). The defense of local interest and the minimization of these costs have taken growing importance for provincial authorities which resources and responsibilities have increased with the decentralization process. Fiscal decentralization

provided the local governments with a strong incentive to protect their tax base by shielding local firms and industries from outside competition. Zhao and Zhang (1999) describe the disastrous economic impact of decentralization reforms in China. The fiscal system aimed at promoting the decentralization of powers in China (*fiscal contract-responsibility system*) has, according to the authors, reinforced China's de facto economic federalism as more regulatory responsibilities, ownership of firms, economic and financial powers were placed in the hands of provincial governments. Under the name of assistance to the local economy, local governments used their heightened administrative powers (in terms of trade, investment, budget and price fixation) to implement a multiform protection of workers and enterprises under their authority. World Bank (1994) and Wedeman (2002) describe in great details the various impediments put in place by provincial authorities. Local authorities often justified their protectionist measures by their regional import substitution strategies. These provincial policies, just as those at the national level, intended to develop import-replacing infant industries at home in the shelter of trade restrictions. Duplication of under-optimal enterprises, convergence of industrial production across different regions, wastefulness and territorial segmentation along provincial border logically arose.

The role of protectionism in determining industrial localization therefore deserves careful study. One needs to investigate whether the driving forces behind industry localization in Chinese provinces relate to free market rule or on the opposite to local interventionism.

3 Literature on spatial distribution of activities

There is a sizeable literature that studies the location of economic activities and focuses on the dynamics of specialization, especially in Europe and in the United States¹⁰. Most of these contributions agree to recognize the

increasing regional specialization in Europe over the last decades in conjunction with the growing economic integration (Amiti (1999), Davis and Weinstein (1996, 1998, 2001), Brülhart and Torstensson (1996), Midelfart-Knarvik et al. (2001a) among others)¹¹.

A number of these papers tried to go beyond descriptive exercises and investigated the determinants of industry location. They constructed measures of industry characteristics (such as indicators of economies of scale and resource intensity) and ran regressions of localization coefficients on these industry characteristics (Kim, 1995 and 1997; Brülhart and Tortenson, 1996; Amiti, 1999; Haaland et al., 1999; Bai et al., 2002 on China). As argued by Overman, Redding and Venables (2001), results are mixed and suffer from the limited number of observations. More importantly, these studies lack real theoretical foundation for the estimation.

Two main strands of theoretical reasoning guide these attempts to disentangle the various forces determining location of activities: neo-classical Heckscher-Ohlin-Vanek (HOV) trade models and the “New Economic geography” (NEG) models. The neo-classical approach emphasizes that “First nature”, i.e. the spatial distribution of natural endowments, technologies and/or factors, determines the location of economic activities. The New Economic Geography literature dispenses instead with all exogenous “first nature” elements, modelling an endogenous pattern of location determined by specific features of the economy such as imperfect competition, differentiated products and increasing returns. Besides traditional production factors and endowments, sectors use intermediates to produce differentiate goods. With imperfect competition and increasing returns, input-output linkages are sources of pecuniary externalities that encourage economic agglomeration¹². Proximity to other firms affects a firm’s market size and costs. The new economic geography predicts that input-output linkages should have two types of effects: backward linkages affecting market size for the industry and forward linkages through which the cost of production is affected. Krugman and Venables (1995) and Venables (1996) show

that a large number of downstream firms attract a large number of upstream firms due to ‘demand linkages’. The more upstream firms in one location, the more intense the competition, providing a feedback effect for the downstream firms which is referred to as a ‘cost linkage’ (Amiti, 1999). Moreover, downstream firms have access to a bigger variety of differentiated inputs. These “second nature” characteristics translate themselves into positive “pecuniary” externalities deriving from the combination of increasing returns and transport costs, which act as centripetal forces producing self-reinforcing agglomeration processes.

The complementary of these two strands of literature and the evidence that both comparative advantages and agglomeration forces affect the location of activities explain the attempt by recent empirical studies to nest economic geography forces within neo-classical models¹³. Studies of Davis and Weinstein (1998 and 2001), Amiti (1999), Haaland et al. (1999) and Midelfart-Knarvik et al. (2001a and 2001b) all investigate the determinants behind location of activities looking at both comparative advantages and agglomeration forces¹⁴.

Midelfart-Knarvik, Overman and Venables (2001a,b) show how the effects can be combined. They develop a model of location of industries across European countries that nest factor endowments and geographical consideration. This method, albeit some limits, is appealing as it allows to derive an estimable log-linear equation from a fully described general equilibrium model of trade and location. Our dataset will allow us to use explanatory variables that have the double dimension sector/province instead of relying on the interaction of provincial characteristics with industry features.

The literature on industry location in China is rather scarce in part due to data constraints. Decomposition of employment or output data by sector for Chinese provinces over a long period is very difficult to come by. Young (2000) studies the evolution of the five sectors in the socialist measure of national income (agriculture, industry, construction, transport and commerce) and the evolution of the three sectors in GDP accounting

(primary, secondary and tertiary). His results support the conclusion of reduced regional specialization. However the low degree of disaggregation is a very serious limitation of his study. The lack of a theoretical yardstick with which to evaluate changes is also put forward by Naughton (1999) as a problem with arguments based on structure of production¹⁵.

Bai et al. (2002) rely on current prices output¹⁶ to compute indicators of industry-level concentration. They find that the overall time trend of regional concentration of China's industries has reversed an early drop in the mid 1980s and registered a significant increase in the later years¹⁷. The authors regress their computed industry-level localization coefficients on industry-characteristics in order to test the role of resource endowments, scale economies, external economies¹⁸ and local protectionism. They however lack direct measures of local government protection of activities and therefore need to rely on two indirect hypotheses focusing on the supposed governments' benefits from erecting barriers on interregional competition. First, they conjecture that the governments protect in priority industries that have high profits and/or tax margins. Second, the authors argue that as authorities are concerned with employment in their respective regions of governance, they tend to be receptive to calls for protection in the enterprises that they administer (state-owned).

We argue that the data used by Bai et al. (2002) offer an incomplete coverage of the industrial data. The NBS only collects and reports statistics on "*all industrial enterprises with independent accounting system at or above the township level*". The under-reporting is obvious when comparing the data from the *China statistical Yearbooks on Industrial Economy* and from the input output tables computed by Chinese provinces for the years 1992 and 1997. This paper aims at overcoming these caveats by relying on data from the Input Output tables to investigate the trend of industrial localization in China. Our main interest is in the role of local protectionism as in Bai et al. (2002).

4 The Model

We follow the model derived by Midelfart-Knarvik et al. (2001a) to study how comparative advantages and geography interact to determine location.

The theoretical framework starts from a canonical economic geography model, in which industrial characteristics are nested in order to take into account the effects of comparative advantages on the location decision of economic activities.

It considers R provinces denoted i and j , and K industries each denoted by k ¹⁹. All industries use both primary factors and intermediate goods in their production function: goods are tradable but incur transport costs t_{ij}^k and trade barriers imposed by province j when transported from province i to j . We adopt an iceberg cost specification of these transport costs so that t_{ij}^k depends on distance between home province i and destination province j and assume ad valorem barriers of B_{ij}^k for all cross-border trade of k sector goods between i and j .

Prices are set proportional to marginal costs according to:

$$p_i^k = c(v_i : \phi^k) \quad (1)$$

where v_i is the vector of input prices (comprising primary factors of prices w_i and a composite intermediate good of price q_i) so that $v_i = [w_i, q_i]$ and ϕ^k refers to the costs of industry k regarding both primary and intermediary production factors.

Let G_j^k be the a price index for industry k in province j and E_j^k be the total expenditure on industry k products (produced in j or in other provinces i) in province j .

They define the total value of industry k output in province i , y_i^k , expressed relative to the size of the industry and the province as:

$$\frac{y_i^k}{y_i y^k} = c([w_i, q_i] : \phi^k)^{1-\sigma} \sum_{j=1}^R (B_{ij}^k)^{1-\sigma} (t_{ij}^k)^{1-\sigma} E_j^k (G_j^k)^{\sigma-1} \exp(\epsilon_i^k) \quad (2)$$

where y_i is the output value of province i , y^k is the output value of industry k and B_{ij}^k captures the protectionism applied by province j on

industry k products imported from province i .

We observe that the relative output value $\frac{y_i^k}{y_i y^k}$ is influenced by two elements. The first parameter can be referred as a parameter of technological efficiency, inversely linking output to the vector of input prices and to the quantity used in primary factors and intermediate goods in each industry.

Following Midelfart-Knarvik et al. (2001a), we consider that the first component of equation (2) is an aggregate version of our industry-specific technology efficiency parameter, whose determinants at the regional level might be brought back to factor endowments. Indeed, the authors argue that “for primary factors, we want to go back to factor endowments rather than use factor prices, since the latter are endogenous”. We work in the estimation with four primary factors x : namely capital, labour, skilled labour and natural resources²⁰. For natural resources, rather than using endowments, we use output of oil, coal and ferrous and non ferrous minerals. The model assumes a single composite intermediate good which availability and intensity of use affect the relative output level of downstream sectors through ‘forward linkages’: industries with high intermediate shares are drawn into locations with good access to supply of intermediates, and vice versa. Appendix 2 describes in detail the construction of the various variables of our model. Input Output tables provide us with data on the resource intensity of industries by province. In that respect we solve the potential problems of other studies that in absence of information on natural resources intermediate consumption have to rely on imperfect proxies²¹.

The second term, captured by the sum, relates relative regional output to the location of demand. As explained in Altomonte and Bonassi (2002), this term essentially corresponds the one of market potential originally developed by Harris (1954) and namely the fact that the demand arising in a given region i is not only deriving from local consumers, but also, from the demand originating from all consumers in the regions surrounding i . The “external” source of demand has to be weighted by the transport cost and trade barriers on the delivery the industry k products from province i ,

where they are produced, to the other provinces j . As our specific interest is in studying the impact of trade barriers imposed by regional governments we decide to decompose this term into two parts: the indicator of provincial protectionism $(B_i^k = \sum_j B_{ij}^k)^{22}$ and the traditional market potential. We assume transport costs to be an isoelastic function of the distance d_{ij} between location i and j , as such the distance is the same for every industry k , and take the total demand as a proxy of the total expenditure function of each province for every industry k . The market potential, MP_i^k , of province i in k industry products is defined as in Altomonte and Bonassi (2002):

$$MP_i^k = \sum_{j=1}^R (t_{ij}^k)^{1-\sigma} E_j^k (G_j^K)^{\sigma-1} = \sum_{j=1}^R Demand_j^k d_{ij}^\delta \quad (3)$$

Under these assumptions, it is possible to log-linearize equation (2). We obtain:

$$\ln \frac{y_i^k}{y_i y^k} = \alpha \ln \sum_{x=1}^4 c(w_i : \phi^k) c(q_i : \phi^k) + \beta \ln MP_i^k + \gamma \ln B_i^k + \epsilon_i^k \quad (4)$$

5 Data sources and descriptive analysis

5.1 Data

Most of the data that we use in this study come from Input-Output tables of Chinese provinces. The final-demand columns of these matrices provide the decomposition of provincial output, international and domestic trade for 21 tradable and 10 nontradable comparable industries in 1992 and 1997²³. These data were obtained for 25 provinces in 1992 and 24 provinces in 1997²⁴. Provincial input-output tables report the intermediate use of inputs of production (notably natural resources) as well as the utilization of capital by industry. Industry-level employment data for 1992 and 1997 are obtained from the *China Industrial Statistical Yearbook* (SSB, yearly issues between 1989 and 1998).

Distances between provinces are computed following the quickest route based on very detailed maps.

5.2 Descriptive analysis

Provincial specialization can be investigated through an index that compares each provincial production structure with the economic pattern of all our sample's provinces. This index is defined as: $spec.i = \sum_k \frac{y_i^k/y_n^i}{y_n^k/y_n}$ where y_i^k is the output of sector k in province i , and n characterizes the whole nation. It is the share of production of sector k in province i 's total production, normalized by the share of the location i in overall activity of the country.

Values of these indices for each province are given in Appendix 1. They are calculated for 1992 and 1997, based on 31 comparable sectors from input-output tables (20 industry sectors, agriculture and 10 service sectors). On average, we observe a decrease in specialization between 1992 and 1997, indicating that locations become more similar. Most provinces show a decrease in production specialization. Greatest decreases are observed in coastal provinces of Beijing, Hebei, Shanghai and Jiangsu. Over the same period however, our specialization index increased slightly for eight provinces, mostly western provinces. Greatest rises of the index are found for resource-rich provinces of Qinghai, Xinjiang, Gansu and Shandong.

The localization of a given economic activity is studied using an index of concentration: $conc^k = \sum_i \frac{y_i^k/y_n^k}{y_i/y_n}$. Levels of geographical concentration appears in the left panel of Appendix 1. We note that the strongest activity concentration is found for extractive industries such as petroleum and natural gas exploitation and for electric production. These sectors, as agricultural activity which is spatially concentrated too, are sectors for which proximity of natural resources is essential. Energy production centers are primarily concentrated in the North and the Northeast areas, in particular Heilongjiang (for oil and natural gas extraction) and Shaanxi (coal) and in the western provinces such as Xinjiang (petroleum, natural gas). Major increases in the concentration index between 1992 and 1997 are found for these resource-dependent industries, especially petroleum extraction and processing, metallurgy, agriculture and electricity.

In contrast, weaker indexes of concentration are found for market-oriented sectors for which access to final consumers dominates location decisions such as electric equipment and machinery, textile goods, electronic and instruments. On average the concentration degree of these sectors decreased between 1992 and 1997.

Appendix 3 provides industry-level indicators of factor intensity and demand and supply linkages while Appendix 4 reports indicators of provincial protectionism computed by Poncet (2002) based on domestic trade flows. The estimation procedure of these indicators is described in appendix 2. These trade barriers increase between 1992 and 1997.

6 Empirical analysis

6.1 Empirical estimation

6.1.1 Estimation

We now turn to the econometric implementation and estimation of the structure (4) presented above. We run the following equation for every year t , industry k and province i :

$$\begin{aligned} \ln \frac{y_{i,t}^k}{y_{i,t} y_{i,t}^k} &= \alpha_1 \ln labour_{i,t}^k + \alpha_2 \ln capital_{i,t}^k & (5) \\ &+ \alpha_3 \ln education_{i,t}^k + \alpha_4 \ln natural\ resources_{i,t}^k \\ &+ \alpha_5 \ln suppliers\ linkages_{i,t}^k + \beta \ln market\ potential_{i,t}^k \\ &+ \gamma \ln domestic\ protectionism_{i,t}^k + \epsilon_{i,t}^k \end{aligned}$$

In addition to traditional variables of comparative advantages and market linkages, we aim at paying particular attention to the role of impediments to inter-provincial trade in China. As explained more fully in Appendix 2 trade barriers (tariff- and non tariff-barriers) are apprehended through industry-level border effects of Chinese provinces computed by Poncet (2002) for the years 1992 and 1997 based on domestic trade flows extracted from the same input output tables that we use for other variables.

Our model is applied on a three-dimensional panel for 21 sectors, 25

provinces and 2 years²⁵. We rely on a panel fixed effects specification. We introduce simultaneously specific fixed effects by couple industry/year and province/year. This approach allows to control for heterogeneity of industries and provinces separately for each year of the study.

This equation confronts us to two econometric problems. First, our indicator of inter-provincial trade barriers is the residual of a preliminary econometric estimation. Border effects are therefore measured with error. We therefore provide bootstrap estimates of standard errors. Second, border effects may be endogenous with respect to the production structure²⁶.

We therefore rely on a Fixed Effects (within) Instrumental Variables specification²⁷ with bootstrap estimation of standard errors²⁸.

We show for each estimation the Sargan test for validity of instruments (test of overidentifying restrictions)²⁹ and the test of exogeneity of Davidson-MacKinnon³⁰. The Huber/White/sandwich estimator of variance is used to correct potential heteroskedasticity.

6.1.2 Results

< Insert table 5, appendix 5 >

Results are reported in Appendix 5. We first estimate our equation on our complete dataset, that is pooling across the two years 1992 and 1997 (columns 1 and 2). The second column differentiates the impact of our indicator of domestic protectionism by year. In the two following columns 3 and 4, the model is estimated without taking into account extraction activities. Their location decision may indeed be mostly driven by the availability of raw materials that they exploit. Columns 5 and 6 run separate regressions for 1992 and 1997. The last three columns examine the heterogeneity in the industry localization process depending on the degree of international liberalization of provinces.

The three first determinants correspond to the influence of comparative advantages, respectively endowment in labor, capital and natural resources. These factor intensities variables all enter significantly (at the confidence

level of 1%) in the regression with the sign predicted by theory. The only exception is the variable of natural resources which is not significant when all provinces are pooled together: the three last columns reveal that the impact of natural resources on localization depends on the provincial degree of international liberalization. The variable of labour also fails to enter significantly in the regression for year 1992. Factor endowments have an important impact on the structure of production of Chinese provinces.

Estimations also consider two forces predicted by the new trade theory and the new economic geography: the suppliers linkages (availability of intermediary inputs) and the demand linkages (size of the market potential). Both indicators enter with a significant and positive sign in the localization equation. Results thus stress that access to suppliers and markets matters. Industries tend to locate close to the production of their vital intermediary inputs and to their customers.

The last determinant considered in the regression is the domestic border effect. It reflects the protectionist policies put in place by provincial authorities against goods from the rest of the country. The significant positive sign in front of the border effect emphasize that the greater the protection against the competition of non-local products enjoyed by an industry in a province, the larger its local relative output share. Local protectionism reinforces the presence of protected industries. This may occur at the expense of the market logic and induce inefficiencies.

Results confirm that the industry localization in Chinese provinces is not completely disconnected from the logic of market. Comparative advantages, resources endowments and market externalities matter in firms' location choices. Evidence supports predictions from the new trade theory and the new economic geography. Localization of activities not only corresponds to resource-endowments criteria (labor and capital) but also to suppliers and demand linkages.

Local domestic protectionism put in place by provincial authorities interfere with these market mechanisms. Impediments to domestic trade have

a significant influence on provinces' output structure. This result emphasize that provincial economic interventionism has an impact on activities location through its effect on trade integration. This finding appear all the more alarming that provincial protectionism seems to have increased over the studied period of time. Border effects increased between 1992 and 1997³¹ in coherence with arguments of growing market fragmentation in China put forward by Young (2000). A significant proportion of activities location decisions result from local protection strategies that go against the exploitation of comparative advantages and external economies.

We further proceed to regression estimations without taking into account for extraction activities for which regional concentration indicators are traditionally higher than the national average. Results confirm those found at the global level (columns 3 and 4).

Dependence on capital input and demand linkages are the driving forces of industry localization in 1992. Supply linkages and dependence on labor become the leading forces in 1997. This evolution is coherent with the decentralization process and the new objectives of industrial policies in the mid 1990s. Provincial authorities with newly acquired economic and regulatory powers exhibited, in the drawing up of the Ninth Five Year plan (1996-2000) their new conceptions. Priority was given to industrializing industries with high consumption of intermediary inputs. These "pillar industries" were expected to have high income elasticities, significant technological (learning by doing) content and spillover effects in economic development. These activities were judged capable of absorbing excess local raw material productions and redundant labor force induced by agricultural reforms. This strategy contrasted with the industrial policy of 1990 which focused overwhelmingly on capital intensive basic industries such as energy and steel (Naughton, 1999).

The last three columns authorize a differentiated process of industry localization (and notably the influence of domestic protectionism) depending on the degree of international openness policy. More specifically, we

estimate our model on three different sub-samples of provinces. The three sub-samples correspond to low, medium and high international preferential policy on the basis of the indicator developed by Démurger et al. (2002) (see Appendix 2 for the detailed presentation of the variable). The construction of this index relies on available information on designated open economic zones across China, gathered from different sources, as well as a subjective classification based on their importance in terms of special treatment given to investors and industrial enterprises.

Results evidence that the greater the international preferential policy, the more demand linkages matter and the lower the importance of supply linkages (dependence on intermediary inputs) in the determination of the localization of activities. These variables are not significant in the case of the most internationally opened provinces. Authorities in provinces characterized by low advancements in reforms, weak liberalization and low degree of international openness have given priority to upward vertical integration of production. Access to suppliers turns out in these provinces to have a greater influence on output location decisions than access to consumers.

The influence of natural resources endowments (that comprise oil, coal and ferrous and non-ferrous mining) on industry localization is magnified among provinces that are less outward-looking internationally. On the opposite, the influence is negative in the three provinces for which stronger international preferential policy. It underlines that industries that depend greatly on these natural resources are under-represented in these provinces. It is in line with the economic structure of these provinces and with the importance of foreign-owned companies there. Indeed, international firms produce mainly light manufactured goods that are intensive in labor and hardly use inputs from the four natural resources that we considered. They mostly process plastic and textile inputs. Outward-looking provinces are specialized in industries (such as electronics, instruments, textile and transport equipment) that do not rely on natural resources as shown in Appendix 3. In other provinces, especially the least internationalized ones, the pres-

ence of natural resources is a significantly positive determinant of the localization of activities. Findings of high influence of the capital variable on the location of activities in least internationally opened provinces appear quite coherent. Indeed, these provinces are often backward and characterized by a greater importance of capital intensive extraction activities and heavy industries as well as by a larger share of the public sector.

Impediments to domestic trade flows do not seem to matter for production structure of most internationally extrovert provinces (Shanghai, Fujian, Guangdong). In these three provinces, economic activities tend to locate in relation with market mechanisms and the free play of competition. On the opposite, domestic protection policies implemented by local authorities significantly influence location decisions of industries in provinces with lower international openness. We moreover find a significant growing influence (at the confidence level of 5%) of local protection on localization in the case of province with intermediary international preferential policy.

Our regression results are coherent with the identification of a negative influence of industry-level specialization on value-added growth (Batisse, 2002; Mody and Wang, 1997). It appears logical that output structure fails to promote value-added growth if it at least in part results from local protectionism instead of the free play of competition. Protectionism policies may well favor the least expanding and least productive industries. Poncet (2002) studies the determinants of trade domestic border effects. The author confirms the pertinence of applying the framework of endogenous protection to explain the level of impediments to trade between Chinese provinces.

Chinese local governments, whose economic powers have expanded with the decentralization, pursued a dual strategy of socio-economic instability minimization and tax revenues extraction. Consequently, protection from inter-provincial competition is granted in priority to big tax payers and highly labor intensive industries. This strategy is disconnected from the objectives of rationalization of output and growth promotion.

7 Conclusion

This paper investigates the driving forces behind industry localization in China between 1992 and 1997, paying particular attention to the role of regional protectionism. This analysis is motivated by the evidence of a negative relation between concentration and value-added growth of industries and of reduced regional specialization in a context of rapid international opening and liberalization.

The article overcomes several limits of previous studies of output structure in China. It exploits a unique data set from 1992 and 1997 provincial input output tables that decompose output and use of factors and intermediary inputs for agriculture, 20 industrial and 10 service activities. Based on the new dataset, we find economic specialization of Chinese provinces to have decreased between 1992 and 1997.

Results emphasize that the principal driving forces behind industry localization correspond to the dynamics of resources-endowments and to the forces of the new geographic economy. We find greater geographic concentration in industries that enjoy significant comparative advantages, strong supply linkages and high market potential.

These findings emphasize that activities location decisions in China are in part disconnected from the logic of comparative advantages exploitation and fair competition. The influence of resources endowments, market linkages and domestic protectionism differ in intensity depending on provincial international openness. In particular, while domestic protectionism does not seem to matter in the most internationally extrovert provinces (Shanghai, Fujian, Guangdong), it has a significant influence of activities location in least opened provinces. Its impact is moreover found to increase significantly between 1992 and 1997 in provinces with intermediary international preferential policy. This evolution raises in the longer run the issue of maintaining economic competitiveness and high growth in Chinese provinces.

APPENDIX I

INDICATORS OF CONCENTRATION AND SPECIALIZATION

Sectors	1992	1997	Provinces	1992	1997
Electricity & hot water	1.051	1.153	East:	1.151	1.107
Agriculture	1.061	1.182	Beijing	1.173	1.063
Building Materials	0.890	0.931	Tianjin	1.148	1.151
Metal Products	0.809	0.812	Hebei	1.246	1.066
Paper and printing	0.847	0.776	Shanghai	1.217	1.135
Coal Mining	1.316	1.343	Jiangsu	1.108	0.998
Oil extraction	1.036	1.411	Zhejiang	1.075	1.061
Sawmills and furniture	0.908	0.900	Fujian	1.161	1.120
Textile	0.736	0.726	Shandong	1.116	1.161
Apparel	0.743	0.651	Guangdong	1.180	1.218
Electric equip. & machinery	0.720	0.685	Guangxi	1.017	1.039
Instruments	0.852	0.720	Liaoning	1.211	1.158
Food manufacture	0.978	1.022	Center:	1.159	1.103
Non-metal mineral mining	1.023	1.059	Shanxi	1.346	1.262
Transport equip.	0.926	0.965	Jilin	1.117	1.084
Machinery & equip.	0.829	0.810	Jiangxi	1.151	1.101
Chemicals	0.868	0.884	Henan	1.116	1.115
Metal ore mining	1.158	1.156	Hubei	1.062	1.050
Oil processing & Coking	1.032	1.215	Hunan	1.171	1.112
Metals smelting & pressing	1.029	1.188	Inner Mongolia	n.a.	1.067
Electronic & telecom	0.739	0.735	Anhui	1.147	1.025
Other manufacturing	0.797	0.920	Heilongjiang	1.405	1.336
Finance & Insurance	1.123	1.047	West:	1.109	1.099
Commerce	1.099	1.057	Sichuan	1.066	0.983
Freight & telecommunication	1.097	1.116	Guizhou	1.013	0.919
Other services	1.004	1.038	Yunnan	0.963	0.964
Maintenance & repair of machinery	0.908	0.947	Shaanxi	1.270	1.186
Construction	1.043	1.089	Gansu	1.116	1.190
Restauration	0.951	1.004	Qinghai	1.039	1.138
Education, health and scientist research	1.039	1.097	Ningxia	1.061	1.048
Passenger transport	1.028	1.233	Xinjiang	1.043	1.124
National Average	0.957	0.996	National Average	1.139	1.103

Provincial specialization is defined as: $spec.i = \sum_k \frac{y_i^k / y_n^k}{y_n^k / y_n}$ where y_i^k is the output of sector k in province i and n characterizes the whole nation. Sectoral concentration is defined as:

$$conc.^k = \sum_k \frac{y_i / y_n^k}{y_n^k / y_n}$$

APPENDIX 2: CONSTRUCTION OF VARIABLES

Industrial Localization: $\ln \frac{y_i^k}{y_i y^k}$, where y_i^k corresponds to the output value of industry k in province i . It is the logarithm of industry output level in province i , expressed relative to both the province i 's and the industry k 's output values. This indicator is calculated from the production data from the provincial input output tables for each of the 21 sectors.

Primary factors: We consider the relative use by industry and province for four primary factors: capital, labour, skilled labour and natural resources.

Industry-level dependence on *capital* of Chinese provinces is the share of gross formation of fixed capital by industry and province in the total formation of the province and the total formation of the industry in the whole country: $\ln \frac{capital_i^k}{capital_i capital^k}$.

Industry-level dependence on *labour* in Chinese provinces is the importance of workers by industry with respect to the total of workers in the province and that employed in the industry across China: $\ln \frac{labour_i^k}{labour_i labour^k}$.

Input-output tables do not provide information in the decomposition of labor supply into skilled and unskilled workers. No data on the intensity of *skilled labor* use is available with the double dimension industry and province. They are disaggregated only to the level of industry for the nation and to the level of province across sectors (for year 1995 exclusively). We thus measure the intensity in qualified labor for a given industry in a given province as the product of the provincial share of population with superior education with the average national intensity of utilization of workers with this level of education of the industry in 1995. We consider superior education as college or higher level. Since the importance of qualified workers varies across provinces and the intensity of skilled labor varies across industries, skilled-labor intensive industries are expected to locate in priority in provinces where educated workers abound ("labor market pooling" argument of Marshall (1920)).

Our measure of provincial industry-level *dependence on natural resources* is computed accordingly as the product of the endowment in natural resources in the province with the share of these resources in the total intermediate consumption of the industry in the province. We consider natural resources to include the four x sectors of oil, coal and ferrous and non ferrous minerals. Provincial endowments in these resources is evaluated with respect to output.

Natural resources $s_i^k = \sum_{x=1}^4 \frac{IC_{x_i}^k}{IC_i^k} y_i^k$, avec $\frac{IC_{x_i}^k}{IC_i^k}$, the share of inputs from one of the four natural resource sector x in the total intermediary consumption IC_i^k of industry k in province i .

Intermediary supply: access to suppliers:

We capture the impact of the access to suppliers through a ratio inspired from Davis and Weinstein (2001). This indicator combines the intensity of utilization of intermediate inputs in the final production with the local availability of these inputs:

$suppliers\ linkages_i^k = \sum_j^R \frac{\sum_k \left[\frac{IC_i^k}{IC_j^k} y_j^k \right]}{dist_{ij}}$, avec $\frac{IC_i^k}{IC_j^k}$, the share of inputs from industry k in the total intermediary consumption IC_i^k of industry k in province j .

This share is weighted by the importance of industry k in the considered province, y_j^k . We obtain an indicator specific to a province i and industry k through the summation of this ratio on all input sectors including itself and for all provinces. The strong local presence of suppliers is beneficial to downstream industries that enjoy cheaper inputs of production. They save in transport costs and benefit from stronger competition between their upstream suppliers.

Market potential

As described in the model, demand linkages in industry k and province i are apprehended through a market potential indicator computed as:

$market\ potential_i^k = \sum_{j=1}^R Demand_j^k d_{ij}^\delta$, where $Demand_j^k$ is the final demand in goods from industry k in province j and δ is the elasticity with respect to distance. Its value is set to -1 (for all sectors) in line with estimates from gravity models of trade and from the geographical tradition of market potential (Midelfart-Knarvik et al. (2001a)). Hence we retrieve the original Harris' formulation for market potential.

Indicator of provincial protectionism

Industry-level border effects of Chinese provinces for the years 1992 and 1997 are taken from Poncet (2002). They are computed based on domestic trade flows extracted from input output tables. The author follows the model proposed by Head and Mayer (2000) who measure trade integration between European countries. Their specification is now probably the cutting-edge implementation in that it develops the estimating equation from first principles and takes into account that prices of third nation goods can affect bilateral trade flows. Industry-level border effects of Chinese provinces are computed based on a gravity equation. They correspond to all-inclusive measures of impediments to cross-border trade.

Imports m_{i-roC}^k by province i of goods of industry k from the rest of China roC ³² are fonction of the partners' activities y_i^k and y_{roC}^k , distance between them, production price of the supplier $price_{roC}$ and the border effect.

The gravitational relation is expressed into relative terms with respect to intra-provincial trade flows (considered to be free), m_{i-i}^k . It leads to:

$$\ln \frac{m_{i-roC}^k, t}{m_{i-i}^k, t} = \ln \frac{y_{roC}^k, t}{y_i^k, t} + \delta \ln \frac{distance_{i-roC}, t}{distance_{ii}, t} + \sigma \ln \frac{price_{roC}^k, t}{price_i^k, t} - Border\ Effect_{i, t}^k$$

The residual from the equation estimated without a constant term measures the global border effect of province i and industry k . It represents the deviation of observed inter-provincial trade flows from their predicted value in absence of barriers by the model, based on intra-provincial trade. It constitutes all-inclusive summaries of trade barriers on imports from the rest of the country that is specific to each province and each industry. We

take the absolute value of the border effect in our estimation. Higher border effects reflect greater protectionism.

Indicator of international integration

Data available on international trade do not enable us to compute an indicator of international trade liberalization in a similar way that we computed indicators of domestic trade liberalization³³. The absence of international trade data with the double dimension industry-partner also prevents us from computing a measure of trade discrimination following Gaulier (2001).

Observed international exports and imports are the only data available that are disaggregated to the industry-level by province. However observed openness rates do not constitute reliable measures of trade policy as they also reflect structural trade potential. We need to give up the idea of introducing an indicator of preferential international trade policy of Chinese provinces directly as a determinant of industry localization. We prefer to use international trade liberalization as a discriminant factor in the determination process of localization of activities. We differentiate our estimations depending on the degree of international preferential policy of provinces measures by Démurger et al. (2002).

The construction of this index relies on available information on designated open economic zones across China, gathered from different sources, as well as a subjective classification based on their importance in terms of special treatment given to investors and industrial enterprises (Démurger et al. (2002)). Provinces have different weights given the various degrees of preferential policies that open economic zones offer³⁴:

- 3: Special Economic Zones (ZES) and Shanghai Pudong New Area
- 2: Economic and Technological Development Zones (ETDZs) and Border Economic Cooperation Zones (BECZs)
- 1: Coastal Open Cities (COC), Coastal Open Economic Zones (COEZs), the Open Coastal Belt (OCB) in 1988, new open economic zones which were officially started in Major Cities along the Yangtze River (MC), Bonded Areas (BA) and Capital Cities of inland provinces and autonomous regions (CC).

APPENDIX 3

SUMMARY STATISTICS¹

Industry	Labor intensity		Capital intensity		Suppliers linkages		Demand linkages		Natural resources	
	1992	1997	1992	1997	1992	1997	1992	1997	1992	1997
Electricity & water	1.6	2.2	10.2	64.7	17.1	27.9	981	964	79	103
Agriculture	315	330	91	89	52.2	129	6 544	6 395	2	3
Building Materials	1.5	3.9	2.8	4.4	25.1	49.4	1 204	1 148	25	32
Metal Products	2.6	2.5	8.0	7.7	27.4	55.1	2 524	2 452	3	5
Paper & printing	4.4	3.4	1.9	1.5	33.4	72.4	1 096	1 077	9	10
Coal mining	5.0	5.7	6.1	17.5	22.8	40.6	905	889	17	20
Oil extraction	0.6	1.2	6.3	11.7	23.3	40.57	402	389	8	11
Sawmills & furn.	1.1	1.4	2.7	3.7	23.3	47.4	285.8	128	27	29
Textile	8.6	7.3	29.0	23.0	50.2	107.5	1 546	1 503	3	3
Apparel	3.3	3.8	10.1	7.2	38.1	80.4	577	569	1	1
Electric eq. & mach.	2.7	3.0	12.1	1.8	32.9	69.4	705	651	2	2
Instruments	0.7	0.9	1.8	2.4	25.7	157	85.1	79.7	3	3
Food industry	4.7	5.6	30.9	24.9	658	139.6	2 417	2 353	3	4
Non-metal mining	1.4	3.9	2.8	4.4	29.8	55.8	168	622.7	12	17
Transport equip.	3.1	4.1	15.4	19.2	27.9	63.9	692	652	2	3
Machinery & equip.	9.1	8.0	26.7	13.7	32.7	64.7	1 027	960	4	5
Chemicals	7.9	8.9	38.0	50.3	148	96.2	981	958	12	14
Metal mining	0.3	1.0	0.6	3.4	20.4	37.1	314.1	300.9	15	21
Oil proc. & Coking	0.7	0.8	9.9	11.7	22.6	149	981.1	9858	140	164
Metals smelting	3.1	4.6	20.8	38.6	27.4	55.1	2 523	2 452	16	22
Electron. & telecom.	1.7	1.9	9.3	10.6	22.6	57.8	466	456	1	1

Labor use is expressed in millions of workers. Capital use is expressed in millions of yuans.

APPENDIX 4

INDICATORS OF DOMESTIC AND INTERNATIONAL TRADE POLICY²

By industry	Domestic Border effects		By province	Domestic Border effects		International Preferential pol.	
	1992	1997		1992	1997	1992	1997
Electricity & hot water	-5.8***	-5.5***	East:				
Agriculture	-4.4***	-5.0***	Beijing	-3.0***	-3.3***	2	2
Building Materials	-4.0***	-4.3***	Tianjin	-2.4**	-2.9***	2	2
Metal Products	-3.7***	-4.5***	Hebei	-1.7	-1.6***	2	2
Paper and printing	-3.4***	-3.4***	Shanghai	-1.9	-2.8***	3	3
Coal Mining	-3.3***	-4.0***	Jiangsu	-1.1	-1.7	2	2
Oil extraction	-3.3***	-2.6***	Zhejiang	-3.5***	-4.6***	2	2
Sawmills and furniture	-3.2***	-4.0***	Fujian	-4.6***	-6.3***	3	3
Textile	-3.1***	-3.3***	Shandong	-3.2***	n.a.	2	2
Apparel	-3.0***	-3.1***	Guangdong	-1.9	-1.7	3	3
Electric equip. & machinery	-3.0***	-3.1***	Guangxi	-3.0***	-2.7***	2	2
Instruments	-2.9***	-2.8***	Liaoning	-2.8***	-3.0***	2	2
Food manufacture	-2.8***	-3.6***	Center:				
Non-ferrous mineral mining	-2.7***	-3.4***	Shanxi	-4.3***	-4.3***	1	1
Transport equip.	-2.7***	-3.0***	Jilin	-1.4	-2.4***	2	2
Machinery & equip.	-2.6***	-2.7***	Jiangxi	-3.3***	-2.9***	1	1
Chemicals	-2.5***	-3.0***	Henan	-2.8***	-3.3***	1	1
Metal ore mining	-2.3***	-3.0***	Hubei	-2.3*	-3.2***	1	2
Oil processing & Coking	-2.3***	-2.7***	Hunan	-2.6***	-3.1***	1	1
Metals smelting & pressing	-2.3***	-2.5***	Inner Mongolia	n.a.	-3.5***	2	2
Electronic & telecom	-1.9***	-1.7***	West:				
			Sichuan	-3.5***	-4.3***	1	2
			Guizhou	-3.8***	n.a.	1	1
			Yunnan	-4.1***	-3.4***	2	2
			Shaanxi	-3.0***	-3.0***	1	1
			Gansu	-3.6***	-3.6***	1	1
			Qinghai	-5.6***	-5.3***	1	1
			Ningxia	-3.8***	-4.0***	1	1
			Xinjiang	-3.6***	-3.4***	2	2

APPENDIX 5: RESULTS

DETERMINANTS OF INDUSTRY LOCALIZATION

Dependent Variable: Industry localization by province $\ln \frac{y_i^k}{y_i y^k}$									
Fixed effects (within) IV regression industry-year and province-year									
Bootstrap estimation of standard errors									
	1992-1997		1992-1997 ³		1992	1997	1992-1997		
							P=1	P=2	P=3
Labor	0.45*** (0.05)	0.45*** (0.05)	0.39*** (0.05)	0.39*** (0.05)	0.04 (0.07)	0.62*** (0.06)	0.35*** (0.12)	0.43*** (0.07)	0.45*** (0.17)
Capital	0.32*** (0.05)	0.33*** (0.05)	0.42*** (0.07)	0.42*** (0.07)	0.62*** (0.07)	0.24*** (0.07)	0.47*** (0.09)	0.31*** (0.07)	0.29** (0.15)
Natural Resources	-0.008 (0.02)	-0.009 (0.02)	0.01 (0.02)	0.01 (0.02)	0.01 (0.02)	-0.02 (0.03)	0.09* (0.04)	0.06** (0.02)	0.06 (0.05)
Suppliers Linkages	0.47*** (0.18)	0.47*** (0.18)	0.74*** (0.19)	0.71*** (0.19)	0.32 (0.21)	0.61*** (0.26)	1.24** (0.52)	0.62** (0.24)	0.23 (0.35)
Demand Linkages	0.62*** (0.11)	0.62*** (0.11)	0.36*** (0.09)	0.35*** (0.09)	0.77*** (0.12)	0.46*** (0.17)	0.49** (0.26)	0.48*** (0.11)	0.62** (0.27)
Domestic Protectionism	0.08*** (0.02)	92: 0.05*** (0.02)	0.06*** (0.01)	92: 0.04** (0.01)	0.07*** (0.02)	0.09*** (0.02)	92: 0.08** (0.03)	0.04** (0.02)	0.002 (0.07)
		97: 0.10*** (0.03)		97: 0.09*** (0.02)			97: 0.12** (0.05)	0.12*** (0.03)	0.07 (0.04)
Obs. Nb.	959	959	754	754	498	461	382	466	110
R squared	0.75	0.75	0.77	0.78	0.81	0.74	0.79	0.80	0.95
Overid. χ^2 test	3.11	1.09	1.19	1.53	0.19	4.40	9.47	1.66	9.93
Exog. F-test	0.54	0.83	0.04	0.54	0.16	0.07	0.7	1.71	1.35

Heteroskedastic consistent standard errors in parentheses,
with *** ** and * denoting the significance at 1, 5 and 10% level

Footnotes

1. Various measures are used to quantify patterns of regional specialization. Refer to Amiti (1999) for a critical review of the different indicators.

2. The private sector has taken on an important share of the economic activity. Price controls have almost completely disappeared. Progress in domestic reforms however lag behind that of external reforms. The increase in international integration has been impressive. Chinese trade openness rate has more than doubled between 1987 and 2002, rising from 14% to almost 40% of GDP. These figures are computed based on data from *China Statistical Yearbooks*, State Statistical Bureau (SSB). Financial openness (attractiveness of Foreign Direct Investments) has undergone the same spectacular rise.

3. The author extends studies of Glaeser et al. (1992), Henderson et al. (1995) and Combes (2000) to the context of China.

4. Refer to Lee (1998), Yang (1997) and the special issue of Chinese Economic Studies (1993).

5. At the annual session of the National People's Congress in March 2000, Wang Zhongfu, director of the State Administration for Industry and Commerce, pointed out that "administrative monopolies, forced deals and market blockades have become a cancer in China's market" (People's Daily July 1st, 2000). More recently, in April 2001, the State Council issued a directive to outlaw regional blockades in market activities.

6. In absence of a direct indicator of trade barriers, Bai et al. (2002) fail to study the role of local protectionism as a determinant of regional specialization in a direct manner. The authors conjecture that authorities tend to protect industries that yielded high profits and/or tax in the past and industries with high percentages of employment in state-owned enterprises and test the impact of these two dimensions on industry-level concentration at the national level.

7. The dataset extracted from *China Industrial Statistical Yearbook* used in Bai et al. (2002) and Batisse (2002) only accounts for industry sectors. Moreover, we argue as explained later in section 3 that its coverage of enterprises is incomplete.

8. For more on the industrial policies in China, refer to Démurger et al. (2002).

9. The opening-up policy first materialized on the coast with the creation of five Special Economic Zones (SEZ), fourteen opened cities and the establishment of an open coastal belt. Since, these different economic zones have been extended to the entire territory.

10. Refer to Hanson (2001) and Overman, Redding and Venables (2001) for most recent survey.

11. Studies however differ in the choice of their indicator of specialization, heterogeneity of data, level of disaggregation and spatial coverage.

12. Models of trade with constant returns to scale and perfect competition predict that economic activities will be dispersed across different locations. Increasing returns to scale (i.e. strong indivisibilities in the production process) and imperfect competition turn out to be essential for explaining the uneven geographical distribution of economic activities and understanding why very similar regions have very different production structures on the basis of their different access to markets (Ottaviano and Puga (1998)).

13. These two strands of literature differ in their predictions about the impact of economic integration on economic structure. In HOV models, economic integration (i.e. lowering transport costs of goods and factors) will sharpen existing comparative advantages leading to a division of labor across locations. Under free trade, local economic activity is shaped only by local comparative advantage. NEG models in turn predict an inverted U-shaped relationship between trade costs and agglomeration.

14. A review of the recent empirical literature combining comparative advantages and NEG models is available in Altomonte and Bonassi (2002).

15. He argues that some changes that contribute to measured convergence in China are efficiency enhancing. The author refer to changes in production in China during the reform era that sometimes reflect movement away from inappropriate patterns of regional specialization imposed under the planned economy. As such, measured convergence should not always be considered as ominous.

16. They can be obtained for 32 industries in 29 provinces for 1985-1995 and 1997 to investigate China's industrial production. These data are extracted from different statistical yearbooks, China Statistical Yearbook, China statistical Yearbook on Industrial Economy and China Industrial Census of 1995. The authors argue that though coming from different sources, "the data are all compiled by the same national Bureau of Statistics (NBS) and are supposed to follow a common set of statistical criteria".

17. This evolution is confirmed by Batisse (2002). The author computes an Isard index of localization based on Value Added data coming from the exact same yearbooks as Bai et al. The computed index of localization for 30 sectors over the period 1988-97 shows a general increasing trend in concentration of industrial sectors.

18. They hypothesize and validate that (1) industries with heavy employment of immobile resources are geographically concentrated (in concordance with the resource-endowment theory of regional specialization), that (2) geographic concentration is more likely in industries that exhibit increasing returns to scale (in coherence with the increasing-returns-to-scale theory), that (3) regional specialization is predicted for industries that enjoy significant external economies (as predicted by Marshall's external-economies theory (1920)).

19. In what follows, super-scripts will denote industries, while province-specific variables will be sub-scripted.

20. Midelfart-Knarvik et al. (2001) exclude capital from their estimation on the grounds that it is internationally mobile and has the same price throughout the EU countries that they study. We argue following World Bank (1994) that capital market in China is far from being integrated. As such, capital is considered as an immobile factors in our estimation.

21. Kim (1995) uses the cost of raw materials (value of all inputs) divided by total value added as the measure of resource intensity. As pointed out by Bai et al. (2002), all inputs are not equally immobile, thus Kim's measure fails to reflect the industry's true dependence on immobile resources. Bai et al. adopt another method and rely on the ratio of total consumption of standard coal (in tons) to total output by industry. The authors acknowledge the limits of this ratio. If coal is the most important energy source for Chinese industries, it only accounts for a small share of all natural resources. Moreover, their data on coal consumption relates to the year 1995 only and is disaggregated only to the level of industry, not to the level of industry by region.

22. It corresponds to the trade barriers put in place by authorities of province i on inter-provincial trade. It thus captures local protectionism of province i .

23. Chinese provinces produced square input output tables for 1992 and 1997. A few of them are published in provincial statistical yearbooks. We obtained access to final-demand columns of these matrices from the input output division in China's National Bureau of Statistics. In 1997, a total of 40 industries are considered against 33 in 1992. This study concentrates on industries of tradable products and thus excludes service sectors.

24. IO tables are available for 28 provinces as data are missing for Tibet, Hainan and Chongqing). Three provinces in 1992 (Anhui, Heilongjiang and Inner Mongolia) and four in 1997 (Anhui, Heilongjiang, Shandong and Guizhou) list only net outflows and are thus not useful for studying inter-provincial trade.

25. We do not include in our empirical work the ten service sectors that we considered in our descriptive analysis. The reason relates to our specific interest in the impact of regional protectionism. Border effects have not been computed for the service sectors because domestic trade in these sectors are mostly zeros.

26. Chen (2002) finds in a study of European trade flows that the size of the industry-level border effect is negatively related to an indicator of geographic concentration. The author relies on the localization index developed by Ellison and Glaeser (1997). The author argues that firms that are not attached to any specific location (low concentration) can be expected to choose their location of production so as to minimize cross-border transaction costs, and as a result border effects could be magnified. The use of instrumental variables allows consistent estimation of the parameters even in the presence of endogenous right-hand side variables.

27. Instruments to be valid need to be correlated with the potentially endogenous variable and uncorrelated with the error term. We rely on indicators of provincial unemployment and budgetary autonomy, industry-level size of the public sector as well fiscal contribution, profits and sales by sector and province.

28. Bootstrap method enables a better approximation of the real statistic law than that given by the asymptotic law. It moreover improves the quality of inference, notably in presence of measurement errors (Davidson and MacKinnon, 2001).

29. A rejection of the null hypothesis casts doubt on the validity of the instruments. See Davidson and MacKinnon (1993). In our case, the null-hypothesis of valid instruments can not be rejected.

30. The null hypothesis states that an ordinary least squares (OLS) estimator of the same equation would yield consistent estimates. In our estimation, the test never rejects the null-hypothesis of exogeneity of border effects with respect to the localization index.

31. See appendix 4. Provincial-level as well as industry-level indicators of domestic market integration increase between 1992 and 1997. Sectors subjected to high internal barriers are also characterized by relatively strong levels of concentration. This result appears in contradiction with the theory resulting from the new theories of the international trade and the NEG. Any liberalization of the internal and international trade by the diminution of the transaction costs which it involves, should lead to an increase in the sectoral concentration. It seems that the inverse mechanism is at work in China.

32. The rest of China, denoted by roC , differs for each province considered and can be thought of as a distinct country whose characteristics (production,

production price and distance to partners) can be generated on the basis of the characteristics of the provinces that make it up. We deduce the computation formula of rest of China's characteristics from the expression of m_{ij} (imports by province i from j) in the case where $j = roC$. Refer to Poncet (2002 and 2003) for greater details.

33. Input Output tables only report the industry-level imports and exports of Chinese provinces with the 'rest of the world' as a whole. No data on production, production price of that 'rest of the world' exists based on nomenclature comparable with that of the Chinese provinces.

34. This index tries to provide further evidence for the distinct roles of preferential-policy effects and pure geography effects such as coastal localization. The implementation of deregulation policies in coastal provinces have promoted the rapid integration into the international markets, large inflows of foreign direct investments and the development of modern industrial sectors in these provinces.

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