Provincial migration dynamics in China: borders, centripetal forces and trade

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Protectionism and industry localization in Chinese provinces

Abstract

The present article aims at estimating the workers' motion law in China using internal migration data for 29 provinces over two sub-periods 1985-90 and 1990-95. Our data is exceptional in that it reports flows of migrants not only between provinces but also within provinces. We are able to study the fluidity of inter-provincial migration in China based on the comparison of the densities of intra- and inter-provincial migration flows. This approach relates to the literature on border effects for migration. We thus measure additional costs that apply to migrants who move out of their province.

Our study of provincial migration dynamics pays particular attention to the influence of access to market on migration flows and through it to the strength of the centripetal forces which affect the geography of China as a whole. We furthermore investigate the relationship between domestic migration and trade.

Migration costs are high and are found to increase significantly with distance between origin and destination locations. Our results highlight that extra costs apply to inter-provincial migrations compared to intra-provincial migrations. Moreover, moving particularly far from the departure involves additional costs. The interesting point however is that all these migration costs decline between our two periods of observations 1985-90 and 1990-95.

We show that access to market plays an important role in migrants' location choice, emphasizing that migration patterns in China respond to centripetal forces. Domestic migrations moreover respond to international trade opening. In contrast, when studying the relation between internal migration and domestic trade barriers, we find that they are substitutes.

These results confirm the relaxation of migration restrictions in China with reforms advancements.

Recent measures taken by central authorities to fight against provincial trade protectionism should contribute to loosen the pressure of migration and therefore should facilitate the further relaxation of labour mobility restrictions inside China. We therefore forecast the reinforcement of agglomeration dynamics within China.

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

Keywords: China, borders, migration, market potential.

1 Introduction

China strongly restricts internal labor mobility. The prime instruments of control is the household registration or *hukou* system. Au and Henderson (2002) argue that despite some recent relaxations of restrictions in particular provinces, the restrictions on migration remain tight. The authors claim that these migration restrictions lead to insufficient agglomeration of economic activity within urban sectors. Migrations are indeed necessary to the emergence of an agglomeration process or at least relate closely to it as they follow the same forces as that of the location of economic activities.

As described in New Economic Geography (NEG) models, agglomeration emerges based on a cumulative causation. Scale economies and positive transports costs encourage firms to locate in largest markets as they can meet a higher potential demand. Simultaneously, workers are attracted to these locations since they can not only enjoy greater employment opportunities but also minimize the transport costs included in the goods they consume, thus maximizing their real wages. The new migrants further increase demand addressed to firms, therefore reinforcing the attraction of the region. The cumulative dynamics of agglomeration rest on the fundamental role of market potential. An agglomeration process can only occur if migrants follow market potentials in the same way as firms[1].

The present article aims at estimating the workers' motion law in China using internal migration data for 29 provinces over two periods 1985-90 and 1990-95. Our investigation is based on a unique panel data set extracted from population censuses of 1990 and 1995.

Our data is exceptional in that it reports not only flows of migrants between provinces but also within provinces. We are thus able to study the fluidity of inter-provincial migration in China based on the comparison of the densities of intra- and inter-provincial migration flows. This approach allows us to measure additional costs that apply to migrants who move out of their province. The method relates to the literature on border effects for migration[2]. The border effect (dummy variable equal to one for migrations

between different provinces and 0 for intra-provincial migrations) answers the following question: For every immigrant in a Chinese province who came from another district of the province within the last 5 years, how many immigrants came from another province of similar size, distance, market potential and real income per capita.

Our study of provincial migration dynamics pays particular attention to the influence of access to market on migration flows and through it to the strength of the centripetal forces which affect the geography of China as a whole. We focus on market potential functions originally defined by both Isard (1954) and Harris (1954)[3].

We estimate a multi-regional model derived from the New Economic Geography (based on Krugman 1992) that rests on the logic that workers move in order to obtain greater real incomes. The model is estimated on rural-urban migration flows within and between Chinese provinces. Other types of migrations (rural-rural, urban-rural and urban-urban) are thus not considered for several reasons. First, rural-urban migrations respond mainly to the logic of real wage maximization that we wish to concentrate on. Migrants of other types may follow different objectives: urban-rural migrants may seek better amenities or better life quality while rural-rural migrations often occur in relation to mariage and family reunion (Zhu, 2003). Second, migrations restrictions put in place by Chinese authorities specifically aimed at curtailing rural-urban migrations in order to restrict urbanization. Finally, the model estimates the extra-cost of crossing provincial borders for migrants based on the comparison of inter-provincial and intra-provincial migration flows. Looking at rural-urban migrations allows to retain a difference between the origin (rural) and destination (urban) revenue even for intra-provincial migration.

As a last step, we investigate the relationship between domestic migration and trade. We study the importance of international trade opening as an attraction factor for potential migrants. We also ascertain whether domestic trade and internal migration are complements or substitutes in

China. We rely on province-level indicators of market fragmentation that correspond to border-related additional costs of arbitrage based on price dispersion (Poncet (2003)).

Section 2 briefly presents stylized facts on internal migrations and economic reforms in China. Section 3 develops the multi-regional model we rely on to estimate the workers' motion law in China. Section 4 presents the data sources and proceeds to the empirical estimations. Section 5 concludes.

2 Migration restrictions and reforms

Before the 1980s, interprovincial migrations were strongly restricted by Chinese authorities (Liang and White, 1996). Spatial displacement of population, especially that of rural workers, was heavily controlled. The strict differentiation between rural and urban zones has been implemented following the famines of the years 1959 to 1961. The original objective of impediments to rural-urban mobility was to limit the size of urban population that authorities were in charge of feeding. Urbanization in China has been since then and until recently strongly restricted. Urban sector's share of national population consequently declined reflecting the bias against urbanization and its association with capitalism, western moral pollution and potentially counterrevolutionary forces (Au and Henderson (2002)). The government resorted to two complementary measures. First, a high opportunity cost is imposed to those who leave rural areas through a link between personal income and participation in the daily work in the collective farm. Second, a system of civil status registration (*hukou*) is put in application. As described in Chan (1994), the *hukou* system in China is similar to an internal passport system. It establishes a tight relation between place of residence and access to consumer goods, employment opportunities and social protection. Au and Henderson (2002) explain that a person's local "citizenship" and residence is initially defined for a child as a birth right, traditionally by the mother's place of legal residence.

The system differs in terms of entitlements and details for urban and rural residents. In a city, legal residence entitles one to local access to permanent jobs, regular housing, public schooling, public health care and until the early 1990s, to rations of essentials such as grain and kerosene.

In a village or rural township, legal residence entitles one to land for farming, township housing, job opportunities in rural industrial enterprises and access to local health and schooling facilities. Residents also have some degree of "ownership" in local enterprises. Again, until recent years, legal residence in a township also entitled a "peasant" to some share in locally produced (or allocated from the outside) grain and other essentials.

Permanently leaving a village is therefore costly as it means abandoning ownership claims without compensation to long-detained agricultural land and to the profits of local rural industries which are distributed in-kind, such as township housing. Temporary migrations also involve costs. Au and Henderson (2002) explain that temporary migrants to larger cities typically have no, or very high priced access to health care and schooling facilities and regular, "legal" housing. Living and social conditions for migrants and their families are often extremely difficult: not only it is hard for them to find decent housing, but also children face no or high priced access to schooling and health care. Other restrictions encompass hurdles to getting the compulsory permit in order to be a legal immigrant (necessary permission from the home location, proof of guaranteed job and specific housing..), job restrictions and various additional expenses. Indeed, migrants may still have to pay taxes to their rural home village for services they do no use and on land left fallow as well as license fees to work outside the home township. Finally, migrants can be required to pay in the city of destination diverse fees such as for city management, for "being a foreign worker", for crime fighting, for city construction... The authors argue that although most of these fees were officially abolished in 2001, unofficially a number persist.

All these restrictions sharply reduce the benefits and raise the costs of

migration, particularly in large cities.

Reforms initiated at the end of the 1970s, in particular the implementation and generalization of the Household Responsibility system (*HRS*) in rural areas, have brought increased freedom of choice to farmers in terms of job. The HRS had two effects on the control of migrations. First, it greatly raised agricultural output and grain supply, which enabled purchases of essentials such as grain on free markets without the urban *hukou* and thereby led to the abandonment of the rationing system. Second, the HRS brought back greater freedom to rural workers for them to choose their occupation. Large disparities between rural and urban incomes encouraged farmers to leave the rural areas and seek better job opportunities in cities. These spontaneous movements of rural population progressively eased constraints on migration.

However, although famine is no longer at issue, authorities continue to control migration by various direct and indirect measures because on the one side, urban infrastructure can not sustain a massive exodus to cities. On the other side, urban areas are confronted to important unemployment in relation to the restructuration of state-owned enterprises. Finally, urban residents balk at sharing their relatively higher living standards with newcomers from rural areas.

Economic reforms also gave rise to regional disparities. Chinese authorities broke with policies of relatively balanced regional development. A strict spatial hierarchy was put in place to favor the development of largest coastal cities. Preferential treatment of the coastal regions beside prompting modernization, efficiency and economic growth, materialized in increasing divergence in income and consumption levels within the country and especially between rural and urban areas (Bhalla (1990), Chen and Fleisher (1996)).

In coastal provinces of South-East China, successful international opening, rapid economic development and massive inflow of foreign investment prompted urbanization and migration (Sit and Yang (1997), Li (1997)).

Particularly, Special Economic Zones were created to grant special treatment to foreign investors and industrial enterprises. Activities in these zones are dominated by foreign-oriented sectors. These labour-intensive activities greatly raised employment demand and provoked an increase in wages, thus attracting even more workers from other regions. According to Chen and Fleisher (1996), wage differentials between coastal and interior provinces significantly surged over the period 1978-1993. Zhu (2003) argues that inter-provincial migration is essentially motivated by socio-economic disparities in conjunction with unbalanced development strategy.

3 The Model

We follow the multi-regional model of economic geography proposed by Crozet (2002) to study the workers's motion law in China. In this model, the motion law of mobile workers is a central relation of the short-term dynamic (Krugman, 1992)) . It reflects the idea that workers move in order to get greater real wages. They thus leave small and peripheral regions (*i.e* with low market potential) to more central ones in order to maximize their utility.

Trans-regional migrations, however, like international ones, involve financial and moral costs which affect migrants' income and satisfaction. We assume these permanent costs to be proportional to the indirect utility in the destination region[4]. We consider that these costs increase with the distance between the departure and destination locations. Moreover, as a large part of these costs is moral, we assume that they vary between individuals (Faini (1996)). This approach is coherent with findings of estimated negative effects of distance on migration that are far greater than could be accounted for by reasonable estimates of the direct costs of moving. Helliwell (1998) explains that the inference is that there must be other reasons for nonmigration that are correlated with distance. He explains that key candidates are physic costs of moving that increase with distance, reductions in the quality and amount of information as distance increases and

networks of contacts and support based on past migration flows. Migration costs are lower for those who "follow the paths blazed by others and replanted their roots in communities in which they had many connections based on previous flows of family and friends".

We therefore take into account the potential non-linearity of these costs with respect to distance of migration. We allow for extra costs to apply on migrants that move out of their provinces, thereby engaging in inter-provincial rather than in intra-provincial migrations. We furthermore the possibility that these inter-provincial migrations are less costly when the destination province shares a common border with the province of origin. These hypotheses relate to the inference that many of the networks of knowledge, institutions and shared values that tend to facilitate trade are at least partly determined by national borders and that networks supporting migration can be expected to be quite alike. Provincial borders are found to have large trade impeding effects in China. Poncet (2003) relies on the border effect method (McCallum, 1995; Helliwell, 1998; Head and Mayer, 2000) and compares the intensity of inter-provincial and intra-provincial trade flows in 1987, 1992 and 1997 in China. The author follows Results evidence rising border related trade barriers over time.

For each potential migrant l_j from location j, the cost of migration to location i is defined as:

$$A_{ji}(l_j) = (dist_{ij}(1 + bNeighbor_{ij} + cIntra_{ij}))^{\lambda} \theta_{l_j} \quad (1)$$

Where $dist_{ij}$ is the distance between origin and destination locations, λ is strictly positive. We hypothesize that migration costs are mitigated if both locations i and j belong to the same province ($i.e$ for intra-provincial migrations) and if the two locations belong to neighboring provinces. In (1), $Neighbor_{ij}$ is a dummy variable which equals one if origin and destination provinces share a common border and zero otherwise while $Intra_{ij}$ is a dummy variable which equals one if i and j are in the same province[5]. As such b and c are expected to be strictly negative coefficients.

Without loss of generality, we suppose following Crozet (2002) that rural

migrants l_j are uniformly distributed on the rural population and set $\theta_{l_j} = l_j$. The model does not consider migration decisions based on amenities demand. As all individuals are workers, we only study decisions driven by spatial job opportunity search. Potential rural migrants determine their expected real income as a function of migration costs, real wage and the probability of finding a job in the urban destination location. If we note ρ_i the probability of finding a job in destination location i, an individual l_j will migrate from j to i if:

$$\frac{\omega_i \rho_i}{A_{ji}(l_j)} > \omega_j \tag{2}$$

The marginal worker l_j^* relative to the total rural population of origin province which satisfies the equality of equation (12), represents the share of rural workers in j who choose to migrate to cities in i in the total rural population of j.

We obtain the expression of the migration flow between i and j in terms of total rural population of j:

$$\frac{migr_{ji}}{rural\ pop_j} = \frac{\omega_i}{\omega_j} \left(dist_{ij}\left(1 + bNeighbor_{ij} + cIntra_{ij}\right)\right)^{-\lambda} \rho_i \tag{3}$$

Equation (3) represents the rural-urban migratory flow between two locations i and j relative to total rural population of j in a very succinct manner. It retains the main motivations of workers' moves: potential migrants seek to maximize their working conditions and thus look for the highest real wages and best opportunities[6].

The real wage of mobile workers in region i is the nominal income divided by the price index of goods in i, P_i.

$$\omega_i = \frac{w_i}{P_i} \tag{4}$$

We follow Krugman (1992) and Crozet (2002) in noting that the price index of goods for a given location i, P_i, is an increasing function of its remoteness as people in peripheral regions import a large part of their consumption and consequently their consumption price index is inflated by transport costs.

We assume transport costs that apply to manufactured goods to take the "iceberg form" introduced by Samuelson (*i.e* a fraction of any manufactured good shipped from location i to j melts away en route). Specifically, we consider transport costs τ_{ij} to be an increasing function of the bilateral distance $dist_{ij}$ between i and j. We adopt the specification of Hummels (1998) so that:

$$\tau_{ij} = dist_{ij}^{\delta} \quad \forall\ i,\ j \in [1, R], \delta > 0 \tag{5}$$

Where R covers all Chinese provinces. The price index in i thus depends on a weighted sum of purchasing power at all locations j, with the weights inversely related to distance between i and j. It is defined as (see Krugman (1992) for greater details):

$$P_i \quad = \quad \left[\Sigma_{k=1}^{R} n_k \left(dist_{ik}^{\delta} p_k\right)^{1-\sigma}\right]^{\frac{1}{1-\sigma}} \tag{6}$$

Where σ is the elasticity of substitution between any pair of varieties, p_k is the fob price of goods and n_k is the number of varieties in province k.

The price index essentially corresponds to the one originally developed by Harris (1954). The difference is that the true prices p_k also enter into the index. As explained by Krugman (1992), this essentially reflects the effect of competition from producers in other locations, which is missing from the usual market potential approach.

We use GDPs to proxy the number of varieties[7] and average wage to proxy the fob prices. We compute $MP_i = \Sigma_{k=1}^{R} GDP_k \left(dist_{ik}^{\delta} w_k\right)^{1-\sigma}$ using traditional values of δ, the elasticity with respect to distance[8], and of σ, the elasticity of substitution between manufacture varieties[9]. Thus:

$$\frac{migr_{ji}}{rural\ pop_j} = \frac{w_i}{w_j}\left(\frac{MP_i}{MP_j}\right)^{\frac{1}{\sigma-1}} \left(dist_{ij}\left(1 + bNeighbor_{ij} + cIntra_{ij}\right)\right)^{-\lambda} \rho_i \tag{7}$$

Despite its apparent complexity, equation (7) corresponds to a rather simple gravity-type equation of migration. The share of rural migrants from j relative to total rural population of j that choose to go to cities in i, given the relative expected wage, increases with the relative market potential and decreases with the migration costs to move to i from j.

4 Empirical estimation

4.1 Estimation

To ensure that equation (7) is estimated correctly, we follow Crozet (2002) in controlling for the bias resulting from a possible significant difference in region size. Indeed, everything else equal, a large province should attract more migrants than a smaller one. We therefore introduce the relative size of destination and origin surface areas $Surf_i$ and $Surf_j$ respectively in the regression to correct the potential heterogeneity.

The probability of finding a job in destination location i, ρ_i, is defined as a function of the unemployment rate in i, U_i and of the size of the services in i proxied by the GDP of the tertiary sector GDP_i^{ter}. Indeed, the majority of the rural migrants who move to urban areas find jobs in services (peddler, domestic staff, construction employee)[10]. As we focus on rural-urban migrations, we use rural nominal income for wages in origin province j and urban nominal income to proxy for wages in destination province i.

We also take into account for the fact that mobile workers do not react immediately to provincial real wage differentials and need time to compare job opportunities and take their decision. Migration flows are thus determined by past relative expected utility. We therefore use average value for all explanatory variables over 1985-89 and 1990-94 to explain migrations flows that occur within or two sub-periods 1985-90 and 1990-1995.

After log-linearization, we obtain and estimate the following equation:

$$\ln \frac{migr_{ji}}{rural\ pop_j} = \alpha_1 \ln \frac{w_i^{urban}}{w_j^{rural}} + \alpha_2 \ln \frac{MP_i}{MP_j} + \alpha_3 \ln dist_{ij} + \alpha_4 Neighbor_{ij} + \alpha_5 Intra_{ij} + \alpha_6 \ln U_i + \alpha_7 \ln GDP_i^{ter} + \alpha_8 \ln \frac{surf_i}{surf_j} + \epsilon_{ij} \quad (8)$$

Where ϵ_{ij} represents an error term.

4.2 The Data

Migration data

We use data from the *National Population Census of 1990* (National Bureau of Statistics of China, NBSC, 1991)[11] and the *1995 National Population Survey* based on a sample size of 1/100 (National Bureau Statistics of China, NBSC, 1997).

The data report the place of residence at the time of the survey (1990 and 1995 respectively) as well as the answer of the respondents to the question "What was your place of residence at the 1st of July 1985 and 1990 respectively (that is five years before the survey)?". We consider those who change their place of residence (even within the same province) to be migrants[12].

We focus here exclusively on rural-urban migrations, that is individuals that within the previous 5 years of the survey, left rural communes (villages) to go to urban districts or small towns.

We obtained complete matrices of aggregated rural-urban migrations between and within the provinces over the two periods 1985-1990 and 1990-1995.

Maps reporting major rural/urban migration flows over these two subperiods appear in Appendix.

The dataset has three shortcomings.

First, Xizang (Tibet) province was not covered in the 1995 census, so that we only know the number of migrants from Xizang that live in other provinces in 1990 but not the number of migrants from other provinces that moved to Xizang. In the same manner, we do not have information on migration within Xizang. We observe from the 1995 survey that flows of migrants to Xizang from the rest of China are almost negligible. Results should therefore not be affected by this caveat.

Second, we know from which province the migrants come from but do not have precise indications on the exact location. As such we will consider

that the distance between departure and arrival locations to be the distance between the capital cities of the respective provinces for inter-provincial migrations. For intra-provincial migrations, we will use proxies of intra-provincial distances as detailed below.

Third, no data are available on when the migration exactly took place; it may have occurred any time within the five year-periods. As argued in the previous section, potential migrants do not react immediately to provincial real wage differentials and need time to compare job opportunities and take their decision. We will use average of determinants of relative expected utility over the five year-periods.

Distances

Bilateral distances between provinces are measured on the basis of real distance by road in kilometers between their capital cities following the quickest route. This measure which takes into consideration the reality of geographical space (mountains, lakes, density and quality of road infrastructures) is surely a better proxy than Great Circle distance that is generally used in economic geography or trade studies.

Apart from inter-provincial distances (d_{ij}, $i \neq j$), we need a proxy of internal distances d_{ii}. Indeed, the dataset also provides information of intra-provincial migrations. The market potential term also incorporates the transport costs for goods produced and consumed locally in addition to those for goods consumed in other provinces. In China, provinces are administratively sub-divided into prefectures. We compute the intra-provincial distance d_{ii} as the production-weighted geometric mean of bilateral distances between prefectures of provinces:

$d_{ii} = \prod_{l \in i} d_{il}^{\frac{v_l}{v_i}}$ with $d_{il} = \prod_{m \in i} d_{lm}^{\frac{v_m}{v_i}}$.

Data on GDP of provincial prefectures are taken from *Cities China 1949-1998 (1999)*. Bilateral distances between prefectures l and m are measured on the basis of real distance by road in kilometers between their capital cities[13].

Other determinants of expected utility

Provincial GDP figures and urban and rural income per capita are extracted from *China Statistical Yearbooks* published by the National Bureau of Statistics. We compute average of these determinants over the five years preceding the survey: that is over 1985-1989 for migration flows which occurred between 1985 and 1990 and over 1990-1994 for migration flows which occurred between 1990 and 1995. Unemployment rates are directly taken from census of 1990 and the survey of 1995 since China Statistical Yearbooks do not systematically report data on unemployment.

4.3 Results

We estimate equation (8) by ordinary least squares (with fixed effects relative to departure regions and year). The Huber/White/sandwich estimator of variance is used to correct potential heteroskedasticity.

Borders and centripetal forces

Regressions results are reported in table 2 in Appendix. The first two columns report estimations only on inter-provincial migration flows, in 1985-90 and 1990-95 respectively. The two others add intra-provincial migrations in 1985-90 and 1990-95 respectively.

The explanatory power of our estimations is quite high as R^2 lie above the figure of 50% when only inter-provincial migration flows are examined. It rises over the 65% once intra-provincial flows are included.

Coefficients on distance appear with the expected negative sign. Migration flows decrease significantly with inter-provincial distances. The influence of distance is quite high as coefficients are close to one in absolute value. These results confirm the overall small degree of mobility of Chinese workers. It is moreover directly comparable to the value obtained by Crozet (2002) for intra-national migrations for several Europec countries. The author finds valued ranging between -0.5 (Great Britain) and -0.9 (Netherlands).

Migration costs turn out to be even more important for long distance migrations (*i.e* for between non-adjacent provinces). Indeed, the dummy variable which takes the value of one for neighboring province enters with a positive sign, underlining that there are extra-cost of moving particularly far from the departure location. The impact of the two determinants of migration costs (distance and contiguity dummy) decreases between the two sub-periods. This pattern is in line with the easing of inter-provincial migration restriction described in section 2. Migration costs therefore appear to have decreased since the mid of the 1980s in China.

The size of the tertiary sector and the market potential of the destination province appear also as fundamental determinants of its attractiveness, which confirms that migration patterns reveal centripetal dynamics. The importance of the services sector in the city of destination is an significant motivation for rural migrants as corresponds to a larger capacity of absorption of newcomers and thus to greater job opportunities. In accordance with NEG models prediction, access to goods do influence workers' motion law. The influence of market potential is moreover reinforced between the two sub-periods 1985-90 and 1990-95. These results highlight the existence of a self-reinforcing agglomeration process at work in China.

The estimation of the influence of expected wages is also close to the one given by the model. It increases between the two sub-periods, attesting to a growing importance of wage differential in migration decisions. The rate of unemployment also enters with the expected negative sign. The simultaneous significance of revenue and unemployment variables is quite exceptional, as in most estimations these variables fail to enter significantly in a simultaneous way[14]. Our results emphasize that everything else equal, migrants tend to favor destinations where they expect to find better job finding probability based on the observation of past values of unemployment, nominal income and capacity of absorption of the services sector.

The introduction of intra-provincial migration flows beside inter-provincial migration flows (columns 3 and 4) highlights that extra-costs apply to mi-

grants who leave their province in comparison to intra-provincial migration (that is migration between districts on the same province). Coefficients on other variables are not significantly affected. Border effects turn out to be very large as their influence are higher than that of all the other variables. Their magnitude do not significantly evolve between the two periods, therefore emphasizing that on average for every immigrant surveyed in a Chinese province who came from another district of the province within the previous five years, the number of immigrants who came from another province of similar size, distance and market potential and income per capita remains constant between 1985-90 and 1990-95. This global stability however masks different evolutions between provinces.

Table 3 in Appendix reports the individual coefficient of each provincial border. We have re-estimated columns 3 and 4 of the previous table decomposing the common border effects into specific border effect for each of the 29 destination province.

Border effects vary greatly between provinces. Border effects are non-significant for Beijing, Tianjin, Shanghai and Zhejiang. Interestingly, the three first provinces are the three coastal municipalities (Shanghai, Beijing and Tianjin). Zhejiang lies also on the coast and shares a common border with Shanghai. In China, the coastal dimension not only encompasses more developed transport infrastructure but also higher engagement in economic liberalization and restructuring. Our results tend to suggest that more liberalized coastal provinces display lower impediments to migration. This feature will be confirm below by the positive coefficient found on the indicator of international trade openness in the migration equation.

The three provincial-level cities are important harbors and privileged exchange places (stock exchange in Shanghai). It is furthermore necessary to understand that the borders of these provincial-level cities are artificial in the sense that these cities are separated administratively from their periphery (Hebei province for Beijing and Tianjin) and Jiangsu and Zhejiang for Shanghai). The natural influence zone of these cities, which are important

industrial and consumption centers, go well further than their administrative borders. As a matter of fact, the area covering the south of Jiangsu, the north of Zhejiang, and the city of Shanghai constitutes a coherent economic zone that corresponds to the Yangtze delta. The three municipal cities as well as their neighboring provinces rank among the provinces with low border effects. Their arbitrary administrative borders that separate artificially the city core from their periphery induce no additional costs on inter-provincial migrations in comparison to intra-provincial ones.

On the opposite, largest border effects are found for landlocked and depressed western provinces such as Inner Mongolia, Qinghai, Gansu and Hainan. These provinces appear less attractive to rural migrants of other provinces even after the expected real income and distance-related migration costs are taken into consideration. As a matter of fact, the attraction power of these provinces turn out to be geographically limited to the local rural population, failing to extend over the rest of the country.

These results are in line with the greater attractiveness of coastal provinces in comparison of remote and poor provinces. In terms of evolution over time, eleven of the provinces experience an increase of the border effects against eighteen that have decreasing border effects.

Migration and trade

As described in section 2, international trade opening prompted rapid economic development and wage rise that reinforced the attraction of rural migrants. We verify this feature by introducing the relative international trade openness between province i and j that is $\ln \frac{Int.\ Open_i}{Int.\ Open_j}$ directly in the estimations performed above. We reproduce table 1 adding this new variable. We measure international trade openness as the ratio of international exports and imports to GDP[15].

Results are reported in table 4. They emphasize that inter-provincial migrations respond positively to international trade opening. Given migration costs, expected wage effects and market potential, migrants choose in

priority to move towards internationally opened regions. The introduction of indicators of international trade openness does not affect the estimated coefficients on other variables with the exception of the income differential. Coefficients on the rural/urban income difference are significantly reduced. They even loose its significance for the sub-period 1985-90. This result may correspond to the fact that international openness goes hand in hand with the development of foreign-owned companies that tend to offer higher wages. Moreover as argued earlier, these firms are specialized in labor-intensive activities. Their development increased demand for labor thereby pushing wages up. As such, income differentials and international openness may be correlated.

Another important issue, is the existing relation between migration and domestic trade in China. It is well known that trade and factor mobility are substitutes in the 2*2*2 Heckscher-Ohlin framework, in the sense that either achieves the equalization of prices among regions and that an increase in one lowers the other. Mundell (1957) provides a clear prediction: trade barriers stimulate mobility of labor the same way barriers to migration stimulate commodity trade[16].

We investigate the influence of impediments to domestic trade on internal migrations flows in China. We rely on province-level indicators of market fragmentation estimated in Poncet (2003) based on the methodology pioneered by Engel and Rogers (1996) and recently expanded by Parsley and Wei (2001). Specifically, the market fragmentation indicators correspond to the additional costs of arbitrage induced by provincial border-related trade barriers. They are computed based on price dispersion[17], relying on a three-dimensional data set of monthly prices on 7 agricultural goods, between 1987 and 1997 across 170 cities of 28 provinces. The author argues that in integrated economies, inter-market price deviation from the Law of One Price should not depend on the relative position of markets. A province is deemed to be poorly integrated when inter-market price dispersion is greater for markets that lie on different side of its border than for

markets that locate within the province, after distance and market specificities are controlled for. Yearly provincial border effects are obtained that are considered to be all-inclusive indicators of impediments to price arbitrage and thus of lack of market integration. Unfortunately, indicators of goods market fragmentation are not computed for Hainan and Qinghai due to price data unavailability.

Missing proxies of trade barriers for these two provinces reduce our sample size. Table 5 reproduces estimations of table 2 after introducing the ratio of market fragmentation MF indicators for province i and j that is $\ln \frac{MF_i}{MF_j}$ directly in the regressions. Columns 5 and 6 correspond to columns 3 and 4 of table 4. Results emphasize that the higher the trade barriers (proxied by indicators of market fragmentation) in the destination province relative to the departure province, the greater the migration flows. The significant positive sign highlights the existence of a substitution relation between trade and migration within China. These results emphasize that migration flows are attracted to provinces that are less domestically integrated than the province of origin. Size and significance of other explanatory factors remain unmodified with the exception of the income differential and market potential variables, whose coefficients are reduced and even loose significance for the sub-period 1985-90.

Columns 5 and 6 emphasize that our findings are robust to the simultaneous introduction of international trade openness indicators.

5 Conclusion

In this paper, we estimate the workers' motion law in China using internal migration data for 29 provinces for two periods 1985-90 and 1990-95.

Our data is exceptional in that it reports not only flows of migrants between provinces but also within provinces. We are thus able to study the fluidity of inter-provincial migration in China based on the comparison of the densities if intra- and inter-provincial migration flows. This approach relates to the literature on border effects for migration.

Migration costs are found to be high and increasing significantly with distance between origin and destination locations. We identify extra costs of moving out of the origin province in comparison to intra-provincial (inter-districts) migrations. We find border effects to vary greatly between provinces and to be the lowest for the three municipal cities of Beijing, Tianjin and Shanghai. We furthermore observe that moving further away, that is to a non-neighboring province, also brings about additional expenses.

All types of migration costs are found to have declined between our two periods of observations 1985-90 and 1990-95. These results confirm the relaxation of migration restrictions in China and thus forecast the reinforcing of agglomeration dynamics within China.

We pay specific interest to the importance of access to market on China's internal migrations dynamics. We show that market potential plays an important role in migrants' location choice. Results emphasize the existence of centripetal dynamics in migration patterns and thereby attest to a self-reinforcing process of agglomeration that affect the geography of China. Given migration costs and expected wage effects, migrants choose in priority to move towards regions with greater market potential.

We investigate the impact of market fragmentation on migration flows. Results emphasize that migration flows are attracted to provinces that are less domestically integrated than the province of origin. Internal migrations thus appear to be substitute for domestic trade in China. These findings predict that recent measures taken by central authorities to fight against provincial trade protectionism should contribute to loosen the pressure of migration and therefore should facilitate the further relaxation of labour mobility restrictions inside China. We therefore forecast the reinforcement of agglomeration dynamics within China.

Notes

1- Batisse and Poncet (2003) emphasize the relevance of demand and supply linkages for the location of economic activities.

2- The literature on border effects was pioneered by McCallum (1995). The author estimates a gravity equation of trade flows between and within Canada and the US. He introduces a dummy variable equal to one for international trade to measure the trade-diminishing effects of the Canada-US border. This method was then adapted to apply to migration flows. Refer to Helliwell (1998) for a summary of the evidence of border effects on the patterns of migration, both within and between countries.

3- These authors define the market potential function as a simple measure of access to market from a given location i: $MP_i = \sum_{j=1}^{R} \frac{GDP_j}{distance_{ij}}$ where R is the number of locations in the relevant area and $distance_{ij}$ is the geographical distance between locations i and j. It corresponds to the fact that the demand arising in a given region i not only derives 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 on the delivery of goods from province i, where they are produced, to the other provinces j.

4- They include moral costs of separation, additional expenses of migrants are that proportional to their income such as travel or phone as well as the extra costs of health care, schooling and housing described in section 2. Sunk costs of migration like moving expenses that should appear as additional negative in the real wage equation are neglected without loss of generality since potential migrants are considered to have an infinite horizon.

5- This specification allows to take into account the extra-cost of moving out of and further away from the departure location.

6- The expression in relative terms with respect to total rural population of j allows to overcome the traditional difficulty in migration model of explaining two-way bilateral flows and why migrants from a given location do not all move to the same destination but rather disperse all over the national space.

7 -This approach is grounded on the proportionality between production and the number of varieties yielded by the Dixit-Stiglitz (1977) model.

8- We set its value to -1 in line with estimates from gravity models of trade and from the geographical tradition of market potential (Midelfart-Knarvik et al. (2001)).

9- We consider results obtained by Head and Ries (2002): values of σ ranging between 7 and 11 and use $\sigma = 9$.

10 -Refer to Zhu (2003) and Duvry and Arneberg (2001) for detailed description of profiles and occupations of rural-urban migrants in China.

11 -The sub-sample of migrants contains 364 080 individuals that change residence with the 1985-90 period. This figure induce that the total number of migrants in China over the same period was roughly 36 millions people. Among the 364 080 migrants of the sample, 245 591 moved within the same province and 118 489 engaged in interprovincial migrations.

12- Migrations within counties or within municipalities are not taken into consideration. In general, the capital city if the county is the urban center that is the closer for the rural workers. Short-distance migrations within each county are much more frequent

then those to the outside of the county. In China, the county (or municipality) is an administrative unit relatively independent and autonomous with its specific complete administrative system. Migrations outside of the county correspond to more formal and more permanent mobility of workers.

13- See Poncet (2003) for a detailed explanation of the computation logic.

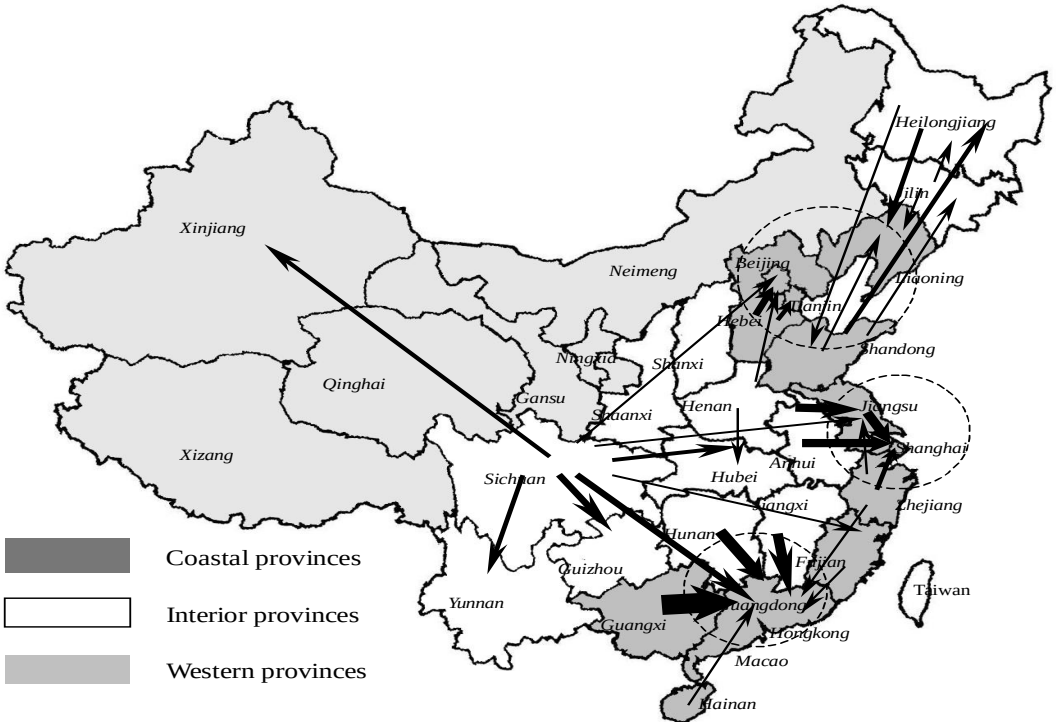
14- A primary reason is the very low variability of wage and employment rates across regions of a single country. Indeed, collinearity often exists between the probability of finding a job and the fixed effects of origin regions, therefore leading to non-robust estimation for these variables (Crozet (2002)). A second caveat found in some studies is that unemployment is often lower in large urbanized region than in a low-density rural one, thus this variable could reflect the size and dynamism of the regional labor market.

15- As for all the other explanatory variables of the regression, we compute average over the five years before the census.

16Several trade-theoretic papers show however that if some of the assumptions underlying the Heckscher-Ohlin model are changed, trade and migration may be complements. Schiff (1997) examines in great details the relationship between trade and migration and explains that complementarity between migration and trade is obtained if one imposes identical factor endowments in both regions but relaxes one of the following assumptions of the Heckscher-Ohlin model: (a) constant returns to scale, (b) identical technologies, (c) perfect competition and (d) no domestic distorsions (Markusen, 1983). Moreover, complementarity between migration and trade can be shown in a Heckscher-Ohlin with migration costs and financial constraints (see Schiff (1994, 1995) and Ghatak et al. (1996) for an examination of internal rural-urban migration under borrowing constraints). Schiff (1997) explains that the relationship between migration and trade depends on migration costs, credit constraints and the potential migrants' income and skills. He forecasts that the higher the costs of migration, the tighter the credit constraints, and the lower potential migrants's income and skills, the more likely it is that migration and trade will be complements. As such, complementarity is likely to dominate in the case of South-North migration (from Latin America to the US or from Africa to the EU) while substitution is likely to dominate in the case of migration from Eastern Europe to the EU. As a matter of fact, whether trade and migration are substitutes or complements in China can not be determined a priori.

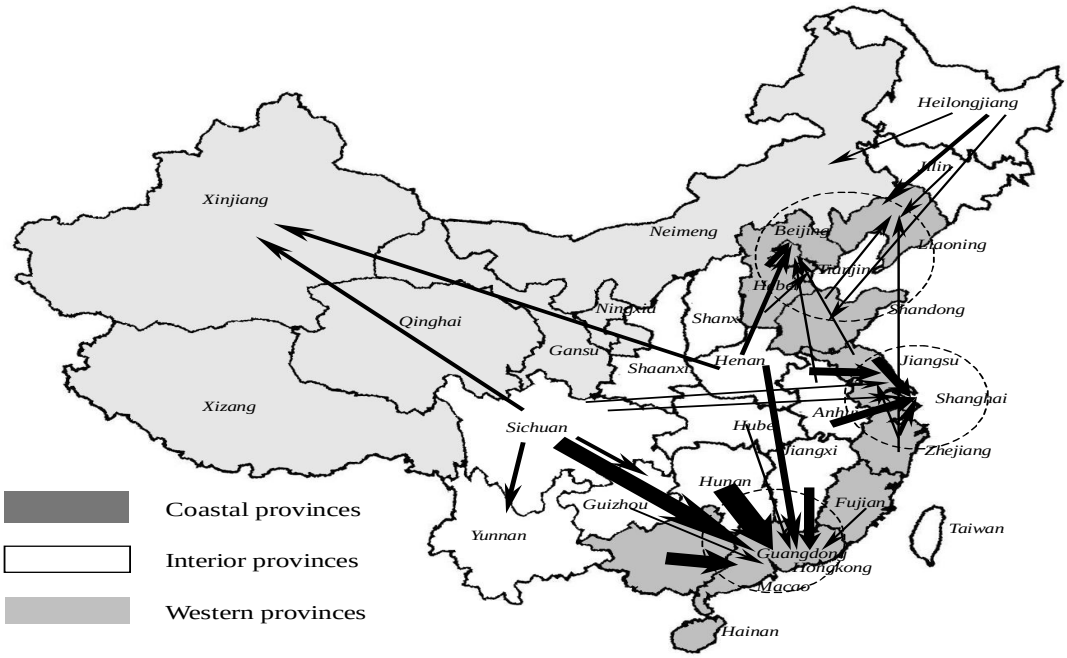
17 -As put forward by Parsley and Wei (2002), the study of cross sectional dispersion of common currency price differentials is a very useful way to measure goods market integration. It has a theoretical background and does not suffer from the classical limitations of trade flows-based approach. In the specific case of China, data on domestic trade flows are scarce. They are available for most of the provinces for 1992 and 1997. The use of price data offers the additional advantage of providing indicators of trade barriers that match the data on migrations. We compute average of market fragmentation over 1987-90 and 90-95 to introduce in the migration equations of 1985-90 and 1990-95 respectively.

MAJOR RURAL/URBAN INTER-PROVINCIAL MIGRATION



Arrows thickness approximatively corresponds to the migration intensity.
Source: Population Census Office under the State Council, 1991.

MAJOR RURAL/URBAN INTER-PROVINCIAL MIGRATION FLOWS, 1990-95



Arrows thickness approximatively corresponds to the migration intensity. Source : NBSC, 1997.

Table - Major rural/urban migration flows between Chinese provinces

	1985-1990			1990-1995		
	Province of origin	Province of destination	Number of migrants (1000 persons)	Province of origin	Province of destination	Nunmber of migrants (1000 persons)
1	*Guangxi*	*Guangxi*	298,6	*Hunan*	*Guangxi*	295,5
2	*Hebei*	*Beijing*	164,2	*Sichuan*	*Guangxi*	243,5
3	*Hunan*	*Guangxi*	150,4	*Guangxi*	*Guangxi*	206,6
4	*Jiangshu*	*Shanghai*	103,8	*Anhui*	*Jiangsu*	134,5
5	*Sichuan*	*Guangxi*	95,9	*Jiangxi*	*Guangxi*	121,5
6	*Anhui*	*Jiangsu*	82,4	*Jiangshu*	*Shanghai*	111,5
7	*Sichuan*	*Guizhou*	77,5	*Anhui*	*Shanghai*	106,9
8	*Sichuan*	*Yunnan*	73,1	*Hebei*	*Beijing*	95,8
9	*Sichuan*	*Xinjiang*	69,5	*Henan*	*Guangxi*	78,6
10	*Sichuan*	*Hubei*	67,8	*Zhejiang*	*Shanghai*	63,8
11	*Hebei*	*Tianjin*	66,0	*Henan*	*Beijing*	51,0
12	*Heilongjiang*	*Liaoning*	63,4	*Sichuan*	*Xinjiang*	50,6
13	*Zhejiang*	*Shanghai*	51,8	*Heilongjiang*	*Liaoning*	48,1
14	*Shandong*	*Heilongjiang*	46,8	*Sichuan*	*Yunnan*	46,4
15	*Henan*	*Hubei*	44,8	*Sichuan*	*Guizhou*	45,2
16	*Jilin*	*Heilongjiang*	42,9	*Shandong*	*Liaoning*	38,9
17	*Sichuan*	*Jiangsu*	42,0	*Jilin*	*Liaoning*	38,3
18	*Heilongjiang*	*Shandong*	41,2	*Guizhou*	*Guangxi*	37,6
19	*Jiangxi*	*Guangxi*	39,4	*Sichuan*	*Shanghai*	37,3
20	*Anhui*	*Shanghai*	39,0	*Hubei*	*Guangxi*	36,0
21	*Henan*	*Beijing*	38,8	*Henan*	*Xinjiang*	35,4
22	*Shandong*	*Liaoning*	38,3	*Fujian*	*Guangxi*	34,6
23	*Hainan*	*Guangxi*	37,1	*Heilongjiang*	*Shandong*	32,9
24	*Sichuan*	*Fujian*	36,3	*Anhui*	*Beijing*	31,6
25	*Zhejiang*	*Jiangsu*	35,0	*Zhejiang*	*Liaoning*	31,2
26	*Fujian*	*Guangxi*	33,9	*Zhejiang*	*Jiangsu*	29,5
27	*Jilin*	*Liaoning*	33,2	*Heilongjiang*	*Neimeng*	29,1
28	*Sichuan*	*Beijing*	32,2	*Jiangshu*	*Beijing*	28,2
29	*Shandong*	*Jilin*	32,1	*Hebei*	*Tianjin*	27,9
30	*Zhejiang*	*Guangxi*	32,1	*Sichuan*	*Jiangsu*	27,5

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APPENDIX: REGRESSION RESULTS

Table 2: Migration dynamics

Dependent Variable: $\ln \frac{migr_{(ji,t)}}{rural\ pop_j}$				
Fixed effects by departure province (within) regression				
Migration period	1985-90	1990-95	1985-90	1990-95
Rural-Urban Income Differential	0.74**	1.13***	0.72**	1.12***
	(0.37)	(0.34)	(0.36)	(0.34)
Rel. Market Potential	0.10***	0.17***	0.09**	0.15***
	(0.03)	(0.04)	(0.03)	(0.04)
Services production	0.68***	0.59***	0.66***	0.58***
	(0.06)	(0.07)	(0.06)	(0.07)
Unemployment Rate	-0.33***	-0.91***	-0.32***	-0.87***
	(0.09)	(0.14)	(0.09)	(0.14)
Distance	-1.14***	-1.09***	-1.09***	-1.00***
	(0.10)	(0.12)	(0.10)	(0.11)
Neighboring Province	0.98***	0.72***	1.02***	0.79***
	(0.15)	(0.16)	(0.30)	(0.31)
Home Province			3.23***	3.23***
			(0.30)	(0.31)
Surface	0.08	0.02	0.08	0.03
	(0.05)	(0.05)	(0.05)	(0.05)
Obs. Nb.	796	645	825	674
R squared	0.52	0.48	0.66	0.65

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

Table 3: Migration Border Effects by province

	Provincial border effects	
Province	Period 1985-90	Period 1990-95
Beijing	1.11	1.34
Tianjin	0.94	1.18
Hebei	3.28***	3.35***
Shanxi	4.20***	4.32***
I. Mongolia	5.18***	5.59***
Liaoning	3.00***	3.84***
Jilin	3.26***	3.21***
Heilongjiang	3.44***	3.35***
Shanghai	1.34	0.56
Jiangsu	2.65**	3.74***
Zhejiang	1.43	1.35
Anhui	3.24***	2.93***
Fujian	2.83**	1.96*
Jiangxi	2.83**	2.65***
Shandong	2.63**	3.50***
Henan	2.45***	2.17*
Hubei	4.00***	3.46***
Hunan	3.22***	3.82***
Guangdong	3.64***	2.99***
Guangxi	3.88***	4.28***
Hainan	4.79***	3.63***
Sichuan	2.13*	2.51**
Guizhou	3.60***	3.13***
Yunnan	2.79**	2.46**
Shaanxi	2.96***	3.84***
Gansu	4.22***	3.78***
Qinghai	4.43***	4.21***
Ningxia	3.87***	2.49**
Xinjiang	2.89**	1.87

***denote significance at 1% level.
Coefficients are multiplied by 10^3.

Table 4: Migration dynamics

Dependent Variable: $\ln \frac{migr_{(ji,t)}}{rural\ pop_j}$				
Fixed effects by departure province (within) regression				
Migration Period	1985-90	1990-95	1985-90	1990-95
Rural-Urban Income Differential	0.49 (0.39)	0.85** (0.36)	0.44 (0.39)	0.83** (0.35)
Rel. Market Potential	0.08** (0.04)	0.13*** (0.04)	0.07* (0.04)	0.10** (0.04)
Services production	0.65*** (0.07)	0.53*** (0.08)	0.62*** (0.06)	0.51*** (0.07)
Unemployment Rate	-0.30*** (0.10)	-0.95*** (0.14)	-0.29*** (0.09)	-0.92*** (0.14)
Distance	-1.15*** (0.11)	-1.12*** (0.12)	-1.10*** (0.10)	-1.02*** (0.11)
Neighboring Province	0.97*** (0.15)	0.71*** (0.16)	1.01*** (0.14)	0.78*** (0.15)
Home Province			3.20*** (0.30)	3.18*** (0.31)
International Openness	0.17* (0.07)	0.26** (0.10)	0.18** (0.09)	0.27*** (0.10)
Surface	0.12*** (0.06)	0.09 (0.06)	0.14** (0.06)	0.11* (0.06)
Obs. Nb.	796	645	825	674
R squared	0.52	0.49	0.66	0.65

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

Table 5: Migration dynamics

Dependent Variable: $\ln \frac{migr_{(ji,t)}}{rural\ pop_j}$						
Fixed effects by departure province (within) regression						
Migration Period	1985-90	1990-95	1985-90	1990-95	1985-90	1990-95
Rural-Urban Income Differential	0.59 (0.41)	1.35*** (0.37)	0.59 (0.40)	1.32*** (0.36)	0.31 0.43	0.90** 0.36
Rel. Market Potential	0.09*** (0.04)	0.15*** (0.04)	0.07 (0.04)	0.13*** (0.04)	0.05 0.04	0.06 0.04
Services production	0.69*** (0.08)	0.54*** (0.09)	0.67*** (0.07)	0.54*** (0.09)	0.63*** (0.08)	0.40** (0.09)
Unemployment Rate	-0.35*** (0.15)	-0.79*** (0.16)	-0.35*** (0.09)	-0.75*** (0.15)	-0.32*** (0.10)	-0.72*** (0.15)
Distance	-1.05*** (0.15)	-1.07*** (0.13)	-0.98*** (0.11)	-0.96*** (0.12)	-0.99*** (0.11)	-1.00*** (0.12)
Neighboring Province	1.05*** (0.15)	0.77*** (0.17)	1.08*** (0.15)	0.85*** (0.16)	1.07*** (0.15)	0.83*** (0.16)
Home Province			3.35*** (0.31)	3.23*** (0.34)	3.33*** (0.31)	3.15*** (0.33)
Rel. Market Fragmentation	0.50*** (0.15)	0.30*** (0.09)	0.47*** (0.14)	0.31*** (0.09)	0.44** (0.15)	0.42** (0.10)
International Openess					0.16* (0.09)	0.46*** (0.11)
Surface	0.04 (0.06)	0.09 (0.06)	0.05 (0.06)	0.10* (0.06)	0.09 (0.06)	0.23*** (0.07)
Obs. Nb.	699	590	723	617	723	617
R squared	0.50	0.48	0.66	0.64	0.67	0.65

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

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