Available online at www.sciencedirect.com
SCIENCE DIRECT®
Regional Science and Urban Economics 36 (2006) 385–398
regional SCIENCE & urban ECONOMICS
www.elsevier.com/locate/econbase

Provincial migration dynamics in China: Borders, costs and economic motivations

Sandra Poncet *

CEPII TEAM (Université Paris 1), Maison des Sciences Economiques, 106-112, bd de l'Hôpital 75647 Paris Cédex 13, France

Accepted 4 November 2005
Available online 10 March 2006

Abstract

The present article investigates the workers' motion law in China using internal migration data for 29 provinces over two sub-periods 1985–1990 and 1990–1995. We analyze the magnitude of impediments to Chinese workers mobility and the impact of its evolution on labor migration dynamics. We find that migration restrictions decline over time. This evolution is associated with a greater responsiveness of mobility decisions to economic factors, underlining the reinforcement of labor market efficiency.

JEL classification: R23; F16; P21
Keywords: China; Borders; Migration; Integration

1. Introduction

Interregional labor mobility is one of the key issues in China's transition to a market economy. To move away from the industrial structure inherited from its planned economy,[1] China must relocate its activities. The lack of mature and integrated capital markets and the persistence of impediments to inter-provincial trade flows make labor mobility even more vital to achieve a successful transition to a market economy. In China, internal labor migration is strongly restricted. Since the mid 1980s, barriers to migration have been relaxed in line with the deepening of reforms and the subsequent rapid growth and vast demand for labor in urban areas. Au and Henderson (2002) however argue that restrictions on migration remain tight.

* Tel.: +33 1 44 07 82 65; fax: +33 1 44 07 82 67.
E-mail address: sandra.poncet@univ-paris1.fr.
[1] Refer to Young (2000) and World Bank (1994) for evidence of low economic integration within Chinese provinces.

0166-0462/$ - see front matter © 2006 Elsevier B.V. All rights reserved.
doi:10.1016/j.regsciurbeco.2005.11.003

The present article aims to study how migratory forces evolved between 1985 and 1995 in China. To analyze the determinants of the Chinese workers' internal motion law, we estimate a multi-regional model that rests on the logic that workers move to increase their incomes. We focus on how mobility decisions respond to the costs of migration and labor market conditions.[2] Specifically, we want to determine whether relaxed restrictions decreased the importance of migration costs in the mobility decision and enhanced responsiveness to economic factors (such as labor market conditions). Such an evolution is crucial to improve labor market efficiency and sustain successful economic transition.

Our estimations explain the costs of migration in three ways. First we take into account costs that are proportional to the distance between the departure and destination locations. Second, we specifically consider migration between provinces that share a common border to compute the additional cost of moving to a province further away than that of a neighbor. Third, we measure the added-cost of engaging in inter-provincial migration compared with that of intra-provincial migration.[3]

We find migration costs to be high, reflecting the persistence of impediments to Chinese labor market integration. Specifically, we find that these costs increase significantly along with the distance between origin and destination locations. Moving particularly far from home involves extra costs. Inter-provincial migrations appear to be more costly than intra-provincial migrations. The interesting point, however, is that aggregate migration costs decline between our two periods of observation 1985–1990 and 1990–1995, along with the relaxation of migration restrictions. We verify that this trend is associated with a greater responsiveness of mobility decisions to economic factors such as income and unemployment characteristics. As a final step we check whether internal migration flows are affected by impediments to domestic trade. We rely on indicators of the trade dampening effect of provincial borders, and find that migrants are attracted to provinces that are more domestically integrated. Thus, internal migration in China appears to be a complement to domestic trade. We predict that the recent measures by Chinese central authorities to fight provincial trade protectionism should contribute to increased pressure on rural migration to cities. Of course, this is likely to be on a limited scale compared to that expected from lower migration costs. Overall, labor mobility will remain limited as long as migration costs remain at such high levels.

The remainder of the paper is organized as follows. Section 2 briefly presents some stylized facts on internal migration in China. Section 3 develops the multi-regional model we employ to estimate the workers' motion law in China. Section 4 presents our data and empirical estimations. Section 5 concludes.

2. Migration restrictions: evolutions and economic impacts

Since the 1960s, inter-provincial migration, especially that of rural workers, has been decidedly restricted by Chinese authorities along with urbanization (Liang and White, 1996).

[2] The paper focuses on gross migration and not on net migration since our interest is on the individual migratory decision determinants. Net migration models are particularly appropriate if concern is on the stable population structure (Greenwood et al., 1991). They are less pertinent in our case since we do not focus on the equilibrium-seeking tendency of the population system.

[3] 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.

The urban sector's share of national population has consequently declined, reflecting the bias against urbanization and its association with capitalism, as well as what the Chinese see as western moral pollution and a buildup of potential counterrevolutionary forces (Au and Henderson, 2002). The original objective of barriers to rural–urban mobility was to limit the size of the urban population. To accomplish this goal, the government resorted to two complementary measures: first, a high opportunity cost was imposed on those who left rural areas by linking personal income to participation in daily work on rural collective farms; second, through the system of civil status registration (*Hukou*) the government allocated housing and jobs, rationed food and other necessities. The tight relationship between place of residence and access to consumer goods, employment opportunities and social protection made it almost impossible for people without local Hukou to live in urban areas (Zhao, 1999).

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 migration: first, it significantly raised agricultural output and grain supply, which enabled purchases of essentials such as grain on the free market without the urban *Hukou*, leading to the abandonment of the rationing system. Second, the HRS brought greater freedom to rural workers for choosing their occupations. Disparities between rural and urban incomes encouraged farmers to leave rural areas and seek better job opportunities in urban areas. Movements of the rural population progressively eased constraints on migration.

Despite all these changes, the basics of the *Hukou* system remain intact. Some provinces and cities are starting to reform the Hukou system, though official restrictions on migration still exist. All these restrictions sharply reduce the benefits and raise the costs of migration, particularly to large cities. Moreover, as Whalley and Zhang (2004) assert, migratory restrictions support large regional wage differentials that labor markets do not compete away. The evolution of the institutional barriers for rural to urban migration can be decomposed into three periods since the mid 1980s (Cai et al., 2001; Huang and Pieke, 2003). First, after 1985, farmers were allowed to enter urban areas on the condition that they provided their own food. For a number of years, migration was not a significant social phenomenon and, as such, did not attract much attention from the government. The second period began in 1989 with an enormous number of rural migrant travelers. Following this so-called "rural migrant wave" in 1989, the government felt the need to interfere and restrict migration. Over the first half of the 1990s, the central government in some degree encouraged the rural–urban migration to accommodate the high growth rate of the economy and the huge demand for labor force in urban areas. For instance, with the development of small towns, a series of policy changes were made to approve residence registration in towns for candidates fulfilling certain conditions such as giving up contracted land in home village, and finding a stable job and housing. The final period, beginning in 1995, came out of unemployed workers becoming a social issue in urban areas, and resulted in a number of major cities tightening their control on the migration. Our data set covers the first two periods, and allows us to verify the extent and implications of the evolution of migration policy. We focus specifically on the responsiveness of Chinese migration dynamics to costs and other macroeconomic factors.

3. The model

Our model of migration follows that of Tabuchi and Thisse (2002) and Crozet (2004). We consider a mobile worker k from province j and his location decision among R provinces (including j). Migrants choose their destination through the comparison of the perceived quality

of life in the various locations.[4] Migration decisions are based on: migration costs, expected real income, and the probability of finding a job in the destination.[5] This macro-economic simplification is sensible in our case, as our focus is specifically on the investigation of the responsiveness of Chinese migration dynamics to costs and other macro-economic factors. Indeed, our intention is not to identify the various micro-economic determinants of migration.[6] Following Crozet (2004), we consider that migration decisions are designed to maximize the following objective function:

$$\pi_{ji}^{k} = V_{ji}^{k} + \epsilon_{i}^{k} = \ln\left[\omega_i \rho_i \left[d_{ij}\left(1 + bF_{ij} + cI_{ij}\right)\right]^{-\lambda}\right] + \epsilon_{i}^{k} \qquad i \in [1, R] \tag{1}$$

where ρ_i is the probability of finding a job in destination location i, ω_i is the real income in i, $[d_{ij}(1+bF_{ij}+cI_{ij})]^{-\lambda}$ corresponds to migration costs and ϵ_i^k is a stochastic component capturing k's personal perception's of the characteristics of province i. This specification allows us to investigate the various cost components that discourage migration with d_{ij} denoting the distance between home and host locations, F_{ij} being a dummy variable equal to one if the origin and destination provinces share a common border, and zero otherwise while I_{ij} is a dummy variable equal to one if i and j are in the same province. Proportional distance costs typically include the physical 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 (Helliwell, 1998).[7] We test whether these migration costs are mitigated if the two locations belong to neighboring provinces, that is if financial and moral costs which affect migrants' income and satisfaction are lower in the case where the destination province shares a common border with the province of origin. Moreover we allow for extra costs to apply to migrants that move out of their province, thereby engaging in inter-provincial rather than in intra-provincial migrations. We anticipate that the extra costs of moving out of and further away from the departure location, b and c are thus expected to be strictly negative coefficients.

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 borders and that networks supporting migration can be expected to be similar. Provincial borders are found to have large trade impeding effects in China.[8]

Individual k will choose to locate in province i if $V_{ji}^{k} > V_{jr}^{k}$, $\forall r$. With convenient assumptions on the distribution of ϵ_i^k, the probability of choosing province i is given by the logit function:

$$P(M_{ji}) = \frac{e^{V_{ji}^{k}}}{\sum_{r=1}^{R} e^{V_{jr}^{k}}}. \tag{2}$$

The expected migration flow from province j to i is $\text{migr}_{ji} = L_j P(M_{ji})$, with L_j the population of province j.

[4] 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.

[5] Baldwin (2001) shows in the context of sufficiently high migration costs that allowing for forward-looking expectations does not significantly alter the theoretical predictions.

[6] Refer to Fan (1999), Liang and White (1996, 1997), Ma et al. (1997), Ma and Liaw (1997) and Zhu (2002) for specific micro-economic studies of inter-provincial migrations in China.

[7] Sunk costs of migration like moving expenses that should appear as an additional negative term in the wage equation are neglected without loss of generality since potential migrants are considered to have an infinite horizon.

[8] Poncet (2005) relies on the border effect method (McCallum, 1995; Helliwell, 1998; Head and Mayer, 2000) and measures the intensity of inter-provincial and intra-provincial trade flows over the reforms. Results evidence rising border-related trade barriers over time.

Similarly, the total outflow from j (including intra-provincial migration in j) is $L_j[1-P(M_j)]$, with $P(M_j)$ the probability of residents of j to stay immobile. We obtain the share of emigrants from region j moving to i (including $i=j$):

$$\frac{\text{mig}_{ji}}{\sum_i \text{migr}_{ji}} = \frac{e^{V_{ji}^k}}{\sum_{r=1}^{R} e^{V_{jr}^k} - e^{V_j^k}}. \tag{3}$$

Using the definition of V_{ij}^k, this share can be rewritten as:

$$\ln\frac{\text{mig}_{ij}}{\sum_i \text{migr}_{ji}} = \ln\omega_i + \ln\rho_i + \ln\left[d_{ij}\left(1 + bF_{ij} + cI_{ij}\right)\right]^{-\lambda} + \tilde{a}_j, \tag{4}$$

with $\tilde{a}_j = -\ln(\sum_{r=1}^{R} e V_{jr}^k - e_j^{V^k})$.

Eq. (4) formalizes the tradeoff potential migrants are confronted with when they choose among several potential destinations. The share of migrants from a given province who decide to move to province i is explained by the expected income in the province, which is a positive function of the real income and of the probability of being employed there and a negative function of mobility costs.

4. Empirical estimation

Despite its apparent complexity, Eq. (4) corresponds to a rather simple gravity-type equation of migration.

The term $\tilde{a}_j$ of the equation is specific to each location of origin j. We can therefore overcome the problematic estimation of this term by replacing it with a fixed effect specific to the province of origin j.

The equation to be estimated is:

$$\ln\frac{\text{mig}_{ji}}{\sum_i \text{migr}_{ji}} = \beta_1\ln\omega_i + \beta_2\ln\rho_i + \beta_3\ln d_{ij} + \beta_4 F_{ij} + \beta_5 I_{ij} + a_j + \epsilon_{ij} \tag{5}$$

where a_j is a full set of home province fixed effects standing for variables $\tilde{a}_j$ and ϵ_{ij} is an error term.

4.1. The data

4.1.1. Migration data

We use data from the fourth National Population Census of 1990 and the 1995 National Population Survey based on a sample size of 1/100.

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.[9]

We focus 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

[9] Migrations within counties or within municipalities are not taken into consideration. In general, the capital city of the county is the closest urban center. Short-distance migration within each county is much more frequent than that outside of the county. In China, the county (or municipality) is relatively independent and autonomous administrative unit. Migrations outside of the county correspond to more formal and more permanent mobility. For extensive presentation of the question, tabulation plans of the surveys, refer to Zhu (2002).

consider rural–urban rather than other types of migration (rural–rural, urban–rural and urban–urban) for several reasons. First, rural–urban migrations respond mainly to the logic of wage maximization, a factor that we wish to concentrate on. Migrants of other types may follow different objectives: urban–rural migrants may seek better amenities or better quality of life, while rural–rural migrations are often the product of marriage and family (Zhu, 2002). Second, we wish to focus on the migration restrictions specifically aimed at curtailing rural–urban migrations in order to restrict urbanization. Finally, our 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 us to retain a difference between the origin (rural) and destination (urban) revenue even for intra-provincial migrations.

We obtained complete matrices of aggregated rural–urban migrations between and within Chinese provinces over the two periods 1985–1990 and 1990–1995.[10] The data set has three shortcomings. First, Xizang (Tibet) province was not covered in the 1990 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. Moreover, data on unemployment are unavailable for Xizang over the period 1990–1995, so that Xizang intra-provincial migrations and Xizang inflows are not covered in the empirical part.

Second, we know the provincial origin of the migrants, but we do not know the exact location. As such, we consider 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 migration exactly took place; it may have occurred any time within the 5-year periods. Since potential migrants do not react immediately to provincial wage differentials and need time to compare job opportunities to make their decision, we use the average of determinants of relative expected utility over the past 5-year periods.

4.1.2. Distances

Distance is measured as real distance by road in kilometers following the quickest route based on detailed maps. Inter-provincial distances correspond to distances between their capital cities. Intra-provincial distances correspond to average city-to-rural area distances within provinces, d_{ii}. They are computed following Helliwell and Verdier's (2000) logic that assumes that urban zones are in the center of the geometric shape representing the province. For example, if we hypothesize a disk-shape and a homogeneous distribution of population, the average distance will be equal to $\frac{2}{3}\sqrt{\text{surface area}/\pi}$ (Head and Mayer, 2000). As a robustness check, we also compute the intra-provincial distance d_{ii} as the GDP-weighted geometric mean of bilateral distances between prefectures of provinces.[11]

4.1.3. Other determinants of expected utility

Since our focus is on rural–urban migrations, we use urban nominal income to proxy for wages in the destination province i. We use the average value for all explanatory variables over 1985–1989 and 1990–1994 to explain migratory flows that occur within the two sub-periods 1985–1990 and 1990–1995 respectively.

[10] A complete description of the sources of the data used in the empirical part is given in the appendix.

[11] See Poncet (2003) and appendix for greater details.

Table 1
Migration dynamics

Dependent variable: $\ln \frac{migr_{ji}}{\sum_i migr_{ji}}$, OLS with fixed effects by departure province (within) regression

Columns[a]	1	2	3	4	5	6	7	8	9	10	11	12
Specification	Benchmark				Exclusion of outliers							
Migration period	1985–1990	1990–1995	1985–1990	1990–1995	1985–1990	1990–1995	1985–1990	1990–1995	1985–1990	1990–1995	1985–1990	1990–1995
Income difference	1.72***	2.44***	1.64***	2.35***	1.52***	2.45***	1.51***	2.45***	1.81***	2.31***	0.85***	2.18***
	(0.30)	(0.21)	(0.29)	(0.20)	(0.27)	(0.20)	(0.27)	(0.20)	(0.30)	(0.23)	(0.26)	(0.22)
Test 1985–1990= 1990–1995[b]	$t=1.97$**		$t=2.02$**		$t=2.77$***		$t=2.77$***		$t=1.64$		$t=3.91$***	
Unemployment rate	−0.27***	−0.35**	−0.26***	−0.35**	−0.20***	−0.35**	−0.21**	−0.35**	−0.29**	−0.30**	−0.15**	−0.44***
	(0.09)	(0.15)	(0.09)	(0.14)	(0.08)	(0.14)	(0.08)	(0.14)	(0.09)	(0.15)	(0.08)	(0.15)
Test 1985–1990= 1990–1995[b]	$t=-0.45$		$t=-0.54$		$t=-0.99$		$t=-0.99$		$t=-0.06$		$t=-1.70$*	
Distance	−1.07***	−0.93***	−1.02***	−0.87***	−1.06***	−0.85***	−1.05***	−0.84***	−1.08***	−0.82***	−0.98***	−0.92***
	(0.10)	(0.10)	(0.10)	(0.10)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.10)	(0.09)	(0.10)
Test 1985–1990= 1990–1995[b]	$t=-0.99$		$t=-1.07$		$t=-1.65$*		$t=-1.65$*		$t=-1.93$*		$t=-0.45$	
Neighboring province	1.18***	0.92***	1.21***	0.96***	1.09***	0.97***	1.10***	0.99***	1.05***	1.02***	0.96***	0.80***
	(0.15)	(0.15)	(0.15)	(0.14)	(0.14)	(0.15)	(0.14)	(0.14)	(0.14)	(0.15)	(0.14)	(0.15)
Test 1985–1990= 1990–1995[b]	$t=1.26$		$t=1.18$		$t=0.76$		$t=0.76$		$t=0.15$		$t=0.78$	
Intra-province			3.07***	3.22***	2.96***	3.26***	3.43***	3.66***	2.86***	3.36***	2.97***	3.02***
			(0.33)	(0.32)	(0.31)	(0.32)	(0.28)	(0.29)	(0.31)	(0.33)	(0.31)	(0.33)
Test 1985–1990= 1990–1995[b]			$t=0.32$		$t=0.70$		$t=0.57$		$t=1.24$		$t=0.11$	
Municipal provinces									−0.37***	0.24		
									(0.18)	(0.16)		
Domestic trade barriers											−0.29***	−0.21***
											(0.04)	(0.05)
Obs. no.	820	652	849	681	841	680	841	680	840	680	729	594
R^2	0.38	0.36	0.55	0.55	0.57	0.55	0.57	0.55	0.56	0.55	0.61	0.57

Heteroskedastic consistent standard errors in parentheses, with ***, ** and * denoting significance at 1%, 5% and 10% confidence level.
From column 5 onwards, outliers are excluded. Outliers are defined as observations for which the absolute value of the residual exceeds three times the average standard deviation of the regression residual. Columns 7 and 8 use an alternative measure of intra-provincial distances (see text).
Columns 9 and 10 include a dummy variable for the three municipalities while columns 11 and 12 introduce an indicator of border-related trade impediments.

[a] Columns 1 and 2 report estimations only on inter-provincial migration flows. In the following columns, intra-provincial migrations are also introduced.

[b] *T*-test are reported to determine whether coefficients significantly evolved over the two sub-periods (1985–1990 and 1990–1995) with ***, ** and * denoting that hypothesis H0 of no evolution between the two sub-periods is rejected with significance at 1%, 5% and 10% confidence level.

4.2. Results

Our estimations reflect the costs of migration through three indicators. The first indicator corresponds to the migratory distance and reflects the costs proportional to the distance between the departure and destination locations.

The second indicator is a dummy variable that equals one when the origin and destination provinces share a common border. It captures the extra cost of moving further away from the departure province than to a neighboring province.

The third indicator relates to the literature on border effects for migration.[12] Our data set allows us to measure additional costs that apply to migrants who move out of their province since we are able compare the fluidity of inter-provincial migration with that of intra-provincial migration. The border effect, captured by a dummy variable equal to one for migrations between different provinces and zero 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 economic conditions and migration costs. This variable measures the extra cost of engaging in an inter-provincial migration in comparison to an intra-provincial migration.

We estimate Eq. (5) on a panel of migratory flows between and within 29 Chinese provinces with fixed effects relative to departure regions to control for their specific features. We checked that results based on the within-estimator were robust to alternative specifications of the error structure.[13] Specifically, we applied the Heckman selection model (full maximum-likelihood) procedure to account for the existence of 21 and 205 null migration flows respectively for the two sub-periods. Coefficient estimates remain virtually unchanged. The Huber/White/Sandwich estimator of variance is used to correct for potential heteroskedasticity.

Regressions results are reported in Table 1.

We run estimations separately for each data subset 1985–1990 and 1990–1995 separately, since the LR test rejects at the 1% confidence level the null hypothesis of equal joint coefficients over the two sub-periods.[14] We test whether coefficients significantly evolved over time through linear hypotheses tests. *T*-test values associated with the probabilities of accepting the hypothesis H0 of no evolution between the two sub-periods are reported under the variable of interest.[15]

The first two columns report estimations only on inter-provincial migration flows, in 1985–1990 and 1990–1995 respectively. In the following columns, intra-provincial migrations in 1985–1990 and 1990–1995 respectively are also introduced.

[12] 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.

[13] The dependent variable is the log of the share of migrants from a given province j who decide to move to province i over the total number of emigrants that is bounded between 0 and 1. Although this feature is inconsistent with the normality hypothesis that is necessary to run OLS estimations, there is plenty of Monte Carlo evidence that OLS nevertheless performs well in such regressions (Robinson, 1982).

[14] The observation number varies over the two sub-periods due to several null values for flows over the period 1990–1995.

[15] Since the two samples are independent, the (asymptotic) variance of the difference between coefficients is the sum of their respective variances, while the asymptotic standard deviation of the difference is the square root of the sum of standard errors.

Robustness checks are performed to ensure the reliability of our estimates. From column 5 onwards, outliers are excluded from the sample. We define outliers as observations for which the absolute value of the residual exceed three times the average standard deviation of the regression residual.[16] Columns 7 and 8 rely on the alternative measure of intra-provincial distance presented above. Columns 9 and 10 include a dummy variable for the three municipalities (Beijing, Tianjin and Shanghai). We believe 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). Moreover the three cities have specifically suffered from the anti-urbanization bias. The last two columns introduce an indicator of border-related trade impediments to investigate whether migration flows respond to market fragmentation in addition to lack of market integration.

The explanatory power of our within panel estimations is quite high as R^2 lies just below the figure of 40% when only inter-provincial migration flows are examined, but it rises to around 60% once intra-provincial flows are included.

Distance enters with the expected negative sign: migration flows decrease significantly with the distance between departure and destination locations. The influence of distance is quite high as the coefficients are close to one in absolute value.

Migration costs turn out to be extremely important for long distance migrations (i.e. for migrations between non-adjacent provinces). The dummy variable which takes the value of one for neighboring province enters with a positive and significant sign, underlining that extra costs apply to migrants who move particularly far from their departure location. The impact of the two indicators of migration costs (distance and contiguity) decreases between the two sub-periods. The decrease in the distance coefficient is significant at the 10% confidence level. This pattern is in line with the easing of inter-provincial migration restrictions.

The dummy variable that differentiates between intra- and inter-provincial migrations enters with the expected negative sign and is highly significant. The introduction of intra-provincial migration flows beside inter-provincial migration flows (columns 3 to 12) highlights the extra costs that apply to migrants who leave their province in comparison to migrants engaged in intra-provincial migrations (that is migration between districts in the same province). Coefficients on other variables are not significantly affected, and their magnitude does not significantly evolve between the two periods. This emphasizes that on average, for every immigrant surveyed in a Chinese province who came from another district of the province within the previous 5 years, the number of immigrants who came from another province of similar economic conditions and for similar migration costs remains at a lower level, constant between 1985–1990 and 1990–1995.

The two variables that relate to traditional economic determinants of migration enter with the expected signs and are significant, that is positive for real income and negative for unemployment. The rate of unemployment enters with the expected negative sign. The simultaneous significance of the revenue and the unemployment variables is exceptional, as in most estimations these variables fail to enter significantly in a simultaneous way (Crozet, 2004). The influence of both factors appears to increase between the two sub-periods, attesting to the growing importance of an expected income differential in migratory decisions. The coefficient on real income increases significantly (at the 5% confidence level) between the two sub-periods.

[16] One observation is excluded in the second sub-period against eight in the first.

Our results emphasize, that all else equal, migrants tend to favor destinations from which they expect more favorable probabilities of finding employment and higher income differentials. This feature underlines the greater responsiveness of mobility decision of rural workers to economic conditions and points to the improvement in efficiency of the labor market.

Columns 7 and 8 reproduce the estimation of columns 7 and 8 relying on a different measure of intra-provincial distance. In this case, we use the production-weighted geometric mean of bilateral distance between prefectures. The coefficients on the explanatory variables remain unchanged. Only the coefficient on the border effects is affected upward. This evolution is logical, as a decrease in intra-provincial distance translates automatically into an increase in the border effect (see Head and Mayer, 2000 for a discussion on this matter). Our results confirm the existence of time invariant, border-related, added costs of migrating out of the province of origin for rural workers.

Columns 11 and 12 run the estimations after including a dummy variable to capture the potential specific features of the three municipalities—Beijing, Tianjin and Shanghai. Our previous findings were unaffected. While the dummy enters with a negative and significant coefficient in the estimation for the first sub-period, it fails to be significant in the second. These results are in line with the relaxation of the anti-city bias. While migrations to the three municipal cities appear less likely (or more prevented) during the first sub-period, they are not significantly different from the average in the beginning of the 1990s.

We can measure the impact of the border on the mobility of rural workers to urban areas. This is a pure statistical exercise, which, despite its lack of rigor, allows us to improve our understanding of the importance of the border-related impediments to migration. Computations relate to the method used by McCallum (1995) to measure the trade-impeding impacts of borders. The average market share of province i in migrants from j, $\ln\frac{migr_{ji}}{\sum_i migr_{ji}}$, is $\exp(3)=20$ times lower when j is located in a non-contiguous province compared to intra-provincial migrations. We can deduce that, in the absence of additional border-related costs that apply to migrations out of and further away from the departure province j to i, the average market share of province i in migrants from j, would have increased 20-fold over the studied period 1985–1995. This ratio falls to 3 ($\exp(1)$) when intra-provincial migrations are compared to immigrations from border-sharing provinces.

In the last two columns we investigate the existing relationship between migration and domestic trade barriers 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. To the extent that barriers to trade are eliminated and commodity trade increases, the exchange of factor services will also expand and thus the incentive for factors to move should diminish (Mundell, 1957). Trade integration could therefore reduce the propensity of workers to migrate. The effectiveness of trade liberalization as a way to alleviate migratory pressure is not unquestioned (Faini et al., 1999). First, historical evidence suggests that periods of greater trade liberalization were also characterized by large population flows (in the 1960s). Second, theory does not provide an unambiguous answer on the link between trade and migration. Several trade-theoretic papers show that if some of the assumptions underlying the Heckscher-Ohlin model are changed, trade and migration may be complements (Schiff, 1996; Markusen, 1983; Ghatak et al., 1996). As a matter of fact, whether trade and migration are substitutes or complements in China cannot be determined a priori.

We investigate the influence of impediments to domestic trade on internal migrations flows in China. We rely on indicators of the trade dampening effect of provincial borders. The border

effects of Chinese provinces for 1992 are taken from Poncet (2005). They are computed based on domestic trade flows extracted from provincial input–output tables.[17] They represent the deviation of observed inter-provincial trade flows from their predicted value in the absence of barriers by the model, based on intra-provincial trade. As such, border effects constitute all-inclusive summaries of trade barriers on imports from the rest of the country that is specific to each province.

Results reported in columns 11 and 12 emphasize that the lower the trade integration of the destination province relative to the departure province, the lower the migratory flows. The significant positive sign highlights the existence of a complementary relationship between trade and migration within China. These results emphasize that migration flows are attracted to provinces that are more domestically integrated than the province of origin.

We compute the impact of impediments to trade induced by borders of i on the share of migrants it receives from j. We find that in the absence of border-related trade barriers for destination province i, its average market share of incoming migrants would be 12% higher. This figure is quite small and lies very far from the expected effect on migration of the reduction of migration costs. Together, these results point to the fact that if Chinese authorities truly want to tackle the issue of local protectionism, they should be prepared to be confronted by increased pressure of migration from rural to urban areas. However, this pressure is likely to remain limited as long as migration costs remain high.

Moreover, it is not possible to know if the complementarity relationship between trade and migration is temporary or not[18] and if this pressure will revert with deeper integration. The deepening of income disparities in China as well as the decrease in communication and transport costs leads us to predict an amplification of migration flows. This perspective is coherent with the efforts of Chinese authorities since the start of reform to mitigate migratory pressure by reinforcing the attractiveness of rural areas. The authorities clearly pursued improvements in rural wages and employment conditions to help accommodate trade liberalization.

5. Conclusion

In this paper we analyze the determinants of the Chinese workers' internal motion law by estimating a multi-regional model that rests on the logic that workers move to obtain higher incomes. We investigate how mobility decisions respond to migratory costs and labor market economic conditions over the period 1985–1995. We find migration costs to be high and increasing significantly with distance between origin and destination locations. These costs declined significantly between our two sub-periods, in line with the relaxation of migration restrictions in China. We identify the added costs of moving out of the origin province in comparison to intra-provincial (inter-districts) migrations. Further, moving further away, that is to a non-neighboring province, also brings about additional expenses.

[17] These tables report provincial outflows and inflows to and from the 'rest of China' for 21 comparable categories of tradable goods. Input–output tables are available for 28 provinces as data are missing for Tibet, Hainan and Chongqing. Three provinces (Anhui, Heilongjiang and Inner Mongolia) list only net outflows and as such are not useful for studying inter-provincial trade.

[18] Russell and Teitelbaum (1992) and Martin (1993) claim that migration and trade may be complements in the short run and substitutes in the longer run.

We find empirical evidence of increased responsiveness of migration decisions to economic conditions (income and unemployment) over time in China. This evolution corresponds to the improvement of labor market efficiency, a factor vital for the country to achieve a successful transition.

Migrants turn out to be attracted to provinces that are more domestically integrated than their province of origin. Thus, internal migrations appear to be a complement to domestic trade in China. These findings predict that recent measures taken by central authorities to fight against provincial trade protectionism would contribute to strengthen the pressure of rural migration to cities. However, this is on a limited scale compared to what is expected with lower migration costs. Labor mobility will remain limited as long as migration costs remain at such a high level.

Acknowledgments

My thanks go to Nong Zhu for sharing the migration data with me and for helpful discussions. I am also greatly indebted to Thierry Mayer and Matthieu Crozet. I have benefited from comments of participants at the 14th annual conference of the Chinese Economic Association (UK) and at the 43rd European Congress of the Regional Science Association (2003).

Appendix A. Data sources

Complete matrices of rural–urban migrations between and within Chinese provinces for the periods 1985–1990 and 1999–1995 are taken from the *National Population Census of 1990* (National Bureau of Statistics of China, NBSC, 1991) and the *1995 National Population Survey* based on a sample size of 1/100 (National Bureau Statistics of China, NBSC, 1997).[19]

Inter-provincial distances correspond to distances between their capital cities.[20] Intra-provincial distance are measured using the disk-shape formula $\frac{2}{3}\sqrt{\text{surface area}/\pi}$ (Head and Mayer, 2000) based on the provinces' surface area taken for *China Statistical Yearbooks*. As a robustness check, intra-provincial distances are also computed as the production-weighted geometric mean of bilateral distances between prefectures[21] that are indexed by l and m: $d_{ii} = \prod_{l\in i} d_{li}^{\frac{v_l}{v_i}}$ with $d_{li} = \prod_{m\in i} d_{lm}^{\frac{v_m}{v_i}}$. Bilateral distances between prefectures as well as those between provinces are measured on the basis of real distance by road in kilometers between their capital cities. They are computed following the shortest itinerary and the most rapid roads based on very detailed maps.

The relative wage indicator is computed based on data on urban nominal income in yuans by province taken from *China Statistical Yearbooks* published by the National Bureau of Statistics. Provincial labor force corresponds to the series entitled total employed persons and information on provincial unemployment derived from the series entitled Urban Registered Unemployment Rate by Region in *China Statistical Yearbooks*.

[19] These matrices as well as other data used for this study are available from the author on request.

[20] This data set on distance is downloadable on my website: http://team.univ-paris1.fr/teamperso/sponcet/.

[21] In China, provinces are sub-divided into prefectures. Data on GDP of prefectures are taken from Cities China 1949–1998 (1999).

References

Au, C.-C., Henderson, V., 2002. How Migration Restrictions Limit Agglomeration and Productivity in China. NBER Working Paper, vol. w8707.

Baldwin, R.E., 2001. Core-periphery model with forward-looking expectations. Regional Science and Urban Economics 31 (1), 21–49.

Cai, F., Yang, D., Meiying, W., 2001. Hukou system and labor market protection. Economic Research (12), 41–49.

Crozet, M., 2004. Do migrants follow market potentials? An estimation of a new economic geography model. Journal of Economic Geography 4 (4) (August), 439–458 (http://joeg.oupjournals.org/).

Faini, R., De Melo, J., Zimmerman, K.F., 1999. Migration the Controversies and the Evidence. Cambridge University Press.

Fan, C.C., 1999. Migration in a socialist transitional economy, heterogeneity, socioeconomic and spatial characteristics of migrants in China and Guangdong. International Migration Review 33 (4), 954–987.

Ghatak, S.P., Levine, P., Price, S.W., 1996. A migration theory and evidence, an assessment. Journal of Economic Surveys 10 (2).

Greenwood, M., Mueser, P., Plane, D., Schlottmann, A., 1991. New directions in migration research: perspectives from regional science disciplines. Annals of Regional Science 4, 237–270.

Head, K., Mayer, T., 2000. Non-Europe, the magnitude and causes of market fragmentation in the EU. Weltwirtschaftliches Archiv 136 (2), 284–314.

Helliwell, J.F., 1998. How Much Do National Borders Matter? The Brookings Institution, Washington, DC.

Helliwell, J.F., Verdier, G., 2000. Measuring internal trade distances, a new method applied to estimate provincial border effects in Canada. Canadian Journal of Economics 34 (4), 1024–1041.

Huang, P., Pieke, F.N., 2003. China migration country study (Paper Presented at the). Conference on Migration, Development and Pro-Poor Policy Choices in Asia, Dhaka, June 22–24, 2003.

Liang, Z., White, M.J., 1996. Internal migration in China, 1950–1988. Demography 33 (3), 375–384.

Liang, Z., White, M.J., 1997. Market transition, government policies and interprovincial migration in China, 1983–1988. Economic Development and Cultural Change 45 (2), 321–339.

Ma, Z., Liaw, K.L., 1997. Explaining hierarchical and interprovincial migrations of Chinese young adults by personal factors and place attributes, a Nested Logit analysis. Mathematical Population Studies 6 (3), 217–239.

Ma, Z., Liaw, K.L., Zeng, Y., 1997. Migrations in the urban–rural hierarchy of China, insights from the microdata of the 1987 National Survey. Environment and Planning 29, 707–730.

Markusen, J.R., 1983. Factor movements and commodity trade as complements. Journal of International Economics 14, 341–356.

Martin, P.L., 1993. Trade and Migration, NAFTA and Agriculture. Institute for International Economics, Washington, DC.

McCallum, J., 1995. National borders matter, Canada–US regional trade patterns. American Economic Review 85 (3), 615–623.

Mundell, R.A., 1957. International trade and factor mobility. American Economic Review XLVII, 321–335 (June).

National Bureau of Statistic, Cities China 1949–1998, 1999. Xin Zhongguo Chengshi 50 Nian, People's Republic of China. Xinhua Press, Beijing.

NBSC, 1991. 10 Percent Sampling Tabulation on the 1990 Population Census of the People's Republic of China. China Statistical Publishing House, Beijing.

NBSC, 1997. Figure of 1% Population Sample Survey in 1995. China Statistical Publishing House, Beijing.

Poncet, S., 2003. Measuring Chinese domestic and international integration. China Economic Review 14 (1), 1–21.

Poncet, S., 2005. A fragmented China, measure and determinants of Chinese domestic market disintegration. Review of International Economics 13 (3), 409–430.

Robinson, P.M., 1982. On the asymptotic properties of estimators of models containing limited dependent variables. Econometrica 50 (1), 27–42 (Jan.)

Russell, S., Teitelbaum, M., 1992. International Migration and International Trade. World Bank Discussion Paper, vol. 160. The World Bank, Washington, DC.

Schiff, M., 1996. South–North Migration and Trade, survey and policy implications. World Bank Policy Research Working Papers, vol. 9616. Development Research Group.

Tabuchi, T., Thisse, J.-F., 2002. Taste heterogeneity, labour mobility and economic geography. Journal of Development Economics 69, 155–177.

Whalley, J., Zhang, S., 2004. Inequality Change in China and (Hukou) Labour Mobility Restrictions. NBER Working Paper, vol. 10683.

World Bank,, 1994. China, Internal Market Development and Regulation. World Bank, Washington, DC.
Young, A., 2000. The razor's edge, distortions and incremental reform in the People's Republic of China. Quarterly Journal of Economics 115, 1091–1136.
Zhao, Y., 1999. Leaving the countryside: rural-to-urban migration decision in China. American Economic Review 89 (2), 281–286 (May).
Zhu, N., 2002. Analyse des migrations en Chine: mobilité spatiale et mobilité professionnelle, Thèse de Doctorat. Université Clermont-Ferrand 1. France.