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NON-TECHNICAL SUMMARY

Low labor costs is held as one of the main explanations for China's success in capturing world export markets. Some observers assert that this situation is temporary, since labor costs are increasing rapidly. Others sustain a different and more permanent scenario. They assert that a population in excess of one billion people represents an extensive labor force. Migration across provinces may thus increase competition on the labor market of export-intensive provinces and allow firms to keep low wages for many years.

One would expect, in coherence with findings of the New Economic Geography (NEG), wages to be higher in central locations, with higher economic activity and demand, and lower in peripheral locations. There is some evidence to support this prediction in China (Lin, 2005), since wages in coastal provinces with good market access, like Fujian, Guangdong and Shanghai, are twice higher than the national average. This upward trend may erode the once unbeatable China price. A potential phenomenon compensating this evolution is the internal migrant labor supply, i.e. the additional labor supply each entity faces due to internal migration across provinces. Formally, internal migration is restricted through the hukou system of household registration (see Au and Henderson, 2004). In practice, the system has largely broken down due to more relaxed migration policies (Shen, 1999) and the coastal provinces have suggested its abolition to stimulate labor migration from poor regions.

This paper attempts to shed some light on the debate over wage dynamics in China. We investigate the respective importance of the upward push of world demand and the downward pressure of migration. Our econometric specification relates wages to a transport cost weighted sum of demand in the surrounding locations and to migratory inflows. We estimate the maximum wage a firm is willing to pay given its market access to world demand and its internal migrant labor supply. Market access measures the export demand each entity faces given its geographical position and that of its trading partners. We build on the models of the New Economic Geography (NEG) to derive a structural approach. This economic structure makes it possible to estimate the effect on wages of both the market access and the internal migration. Controlling for these two factors relates our paper to two different strands of the economic literature: the NEG and labor economics. Using a data set covering 29 Chinese provinces between 1995 and 2004, we investigate the respective contribution of our constructed market access and internal migration as determinants of the average provincial manufacturing wage. We construct a complete version of the province's market access, consisting of three parts: its local market access (intra-provincial demand), its national market access (demand from other Chinese provinces), and its world market access. It is based on a preliminary estimation of a gravity model of bilateral trade flows across Chinese provinces and international countries. The rate of change of labor supply due to immigration is given by the ratio of internal migrants (non-residents) over residents.

Our results highlight that holding other factors constant provincial wages increase on average by about 17 percent per year between 1997 and 2004 (up 121% in total over the period), due to common trends like total factor productivity growth and national rise in prices. Most of the wage increase experienced by Chinese provinces corresponds to a national phenomenon. The impact of province specific forces such as improved access to markets and intensified gross internal migration though statistically and economically significant is of less importance. We can compute the average impact of the relaxation of migration restrictions over the 7 year period of our sample. Since on average the gross immigrant share increased from 5 to 9% between 1997 and 2004, we can infer that more intense internal migration slowed

down wage growth by 2 percent per year (14% in total). The average provincial access to national and international markets increased but at a much lower pace (a little less than 20%) on average thus inducing a further wage rise of 5%. The wage increasing impact of market access is thus three times smaller in magnitude than the effect of migration (on the opposite direction).
Overall our results highlight that rapidly increasing wages in China correspond to a common national trend possibly pertaining to productivity growth and price rises which is only marginally affected by local-specific forces such as internal migration and market access. These latter two determinants did not vary a lot between 1997 and 2004 but this may change in the future. It is possible that the further relaxation of migration restrictions in parallel to productivity slow-down leads to a new scenario. As an illustration, in the extreme case where the Guangdong migrant share doubles to reach 30% (the value in 2004 for Beijing (province with the highest share)), the downward pressure on wages could be as high as 60%.

ABSTRACT

Over the last fifteen years, China's export performance has been phenomenal but some observers assert that this situation is temporary due to rising labor costs. However, large migration across provinces may increase competition on the labor market of export-intensive provinces and allow firms to keep low wages for many years. This paper attempts to shed some light on this debate over wage dynamics in China. We investigate the respective importance of the upward push of world demand and the downward pressure of migration. This investigation is conducted on a sample of 29 Chinese provinces between 1997 and 2004. We find, holding other factors fixed, that provincial wages increase by about 17 percent per year, due to common trends possibly like total factor productivity growth and national increase in prices. Our results show that besides this general trend, market access and internal migration have statistically and economically significant effects on the provincial wage level but of much less importance. We estimate that on average over the 7 year period of our sample, more intense internal migration has slowed down wage growth by 2 percent per year. The wage increasing impact of market access is three times smaller in magnitude.

JEL classification: F12, F15, R11, R12.
Keywords: Wage, China, Immigration, Economic geography.

RÉSUMÉ NON TECHNIQUE

La faiblesse des coûts du travail est souvent considérée comme l'une des principales explications du succès à l'exportation de la Chine. Mais certains analystes estiment que les coûts du travail devraient rapidement augmenter sous l'effet de la pression de la demande. D'autres, au contraire, estiment qu'avec une population supérieure à un milliard d'individus, la Chine dispose pour longtemps d'une force de travail à bas coûts : la migration en provenance des provinces pauvres devrait durablement maintenir la concurrence sur le marché du travail des provinces exportatrices et exercer une pression à la baisse sur leurs salaires.

En cohérence avec les prédictions de la Nouvelle Economie Géographique (NEG), on s'attend à trouver des salaires plus élevés dans des localisations centrales, caractérisées par une forte activité économique et une forte demande, que dans des localisations périphériques. De fait, en Chine, les salaires dans les provinces côtières dotées d'un bon accès au marché, comme Fujian, Guangdong ou Shanghai, sont deux fois supérieurs à la moyenne nationale. Cet écart peut être contenu par l'apport de travailleurs issus de la migration interne entre les provinces chinoises. Formellement, la migration intérieure est restreinte en Chine par le système Hukou d'enregistrement des ménages ; mais, en pratique, le système a perdu de son emprise avec l'assouplissement des politiques migratoires et les provinces côtières ont proposé son abolition pour pouvoir alimenter leurs usines en travailleurs migrants.

Ce travail s'attache à éclairer ce débat en étudiant les impacts respectifs sur la dynamique des salaires de la pression à la hausse exercée par la demande mondiale et de la pression à la baisse exercée par la migration interne. Nous nous appuyons sur les modèles de la nouvelle économie géographique (Fujita et al., 1999). L'étude des déterminants des salaires est menée sur une base de données portant sur 29 provinces chinoises entre 1995 et 2004. Notre spécification économétrique relie les salaires à un indicateur d'accès au marché ainsi qu'à une mesure des flux d'immigration. L'accès au marché prend en compte l'intégralité du potentiel de demande, à savoir ses composantes locale, nationale et internationale en tenant compte des coûts de transports (nous utilisons les résultats d'estimations préalables d'un modèle de gravité sur des flux bilatéraux de commerce pour les provinces chinoises et leurs partenaires internationaux). L'offre additionnelle de travailleurs est mesurée par le rapport des migrants intérieurs (non-résidents) sur les résidents.

Nos résultats soulignent que toutes choses égales par ailleurs, les salaires provinciaux progressent en moyenne de 17% par an entre 1997 et 2004 (plus 121% au total sur la période), tirés par des phénomènes nationaux comme la croissance de la productivité ou la progression des prix. Une grande partie de la croissance des salaires connue par les provinces chinoises correspond ainsi à ce phénomène national. L'impact de facteurs provinciaux spécifiques tels que l'amélioration de l'accès aux marchés ou l'intensification de la migration intérieure, même s'il est statistiquement et économiquement significatif, est d'importance moindre. Il est possible de calculer l'impact moyen du relâchement des restrictions à la migration sur la période de 7 années de notre étude. L'intensification de la migration, qui s'est traduite par une hausse de la part moyenne des migrants sur les résidents de 5 à 9% entre 1997 et 2004, a ralenti la progression des salaires de 2% par an (14% en total). L'accès au marché s'est amélioré mais à un rythme moins soutenu (un peu moins de 20%), entraînant une croissance supplémentaire des salaires de 5%. L'ampleur de l'influence à la hausse sur les salaires de l'accès au marché est ainsi trois fois inférieure à celle de l'effet en sens inverse de la migration.

Globalement, nos résultats soulignent que la croissance rapide des salaires en Chine correspond principalement à un phénomène national sur lequel les forces spécifiques aux provinces

comme la migration intérieure et l'accès au marché ont un impact limité. Ces deux derniers déterminants n'ont pas beaucoup varié au cours de la période d'analyse, mais cela pourrait changer. Il est ainsi possible que le démantellement futur des restrictions à la migration en parallèle à un ralentissement de la productivité conduise à un scénario différent. En guise d'illustration, dans le cas extrême où la part des migrants dans la population de Canton doublerait pour atteindre 30% (qui correspond au niveau en 2004 à Pékin, province au taux le plus élevé), la pression à la baisse sur les salaires de cette province pourrait atteindre 60%.

RÉSUMÉ COURT

Au cours des quinze dernières années, la performance exportatrice chinoise a été phénoménale mais certains observateurs considèrent que cette situation est temporaire en raison de la hausse des coûts du travail. Pourtant la migration massive à l'intérieur de la Chine pourrait renforcer la concurrence sur le marché du travail des provinces exportatrices et permettre aux entreprises de conserver des salaires bas pour de nombreuses années. Ce travail s'attache à éclairer le débat existant sur la dynamique des salaires en Chine. Nous étudions l'importance respective de la pression à la hausse exercée par la demande mondiale et de la pression à la baisse exercée par la migration interne. Nous nous appuyons sur les modèles de la nouvelle économie géographique (NEG) (Fujita et al., 1999) pour dériver une approche structurelle. Nous estimons ainsi le salaire maximum qu'une entreprise peut payer, étant donné son accès aux marchés mondiaux et la migration interne. L'étude des déterminants des salaires est menée sur la base de données portant sur 29 provinces chinoises entre 1995 et 2004. Nos résultats soulignent que toutes choses égales par ailleurs, les salaires provinciaux progressent en moyenne de 17% par an entre 1997 et 2004 (plus 121% au total sur la période), tirés par des phénomènes nationaux comme la croissance de la productivité ou la progression des prix. Une grande partie de la croissance des salaires connue par les provinces chinoises correspond ainsi à ce phénomène national. Jusqu'ici la migration intérieure et l'accès au marché n'ont joué qu'un rôle limité (respectivement négatif et positif) dans la croissance des salaires. L'intensification de la migration a ralenti la progression des salaires de 2% par an tandis que l'accès au marché exerce une influence à la hausse mais d'ampleur trois fois inférieure.

Classification *JEL* : F12, F15, R11, R12.
Mots Clefs : Salaire, Chine, Immigration, Economie géographique.

HOW ARE WAGES SET IN BEIJING?

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1 Introduction

Over the last fifteen years, China's export performance has been phenomenal. Its share of world merchandise exports jumped from 1.8% in 1990 to 5% in 2004. Imports are also growing but China's trade balance is substantially positive. This imbalance is a matter of concern for its main trade partners. Between 2000 and 2004, exports to the USA, EU and Japan have been multiplied by a factor 2.4, 2.6 and 1.7 respectively.[3] The latest figures may aggravate the growing discontent among China's trading partners. According to the EU trade commissioner Peter Mandelson, "the EU's trade deficit with China is growing $20 million an hour," (June 12 2007, Wall Street Journal).

Low labor costs constitute one of the main explanations of the Chinese success in capturing world export markets. On the one hand, some analysts assert that this advantage is temporary since labor costs are increasing rapidly (Adams *et al.*, 2006; Lett and Banister, 2006).[4] This upward trend may erode the once unbeatable China price. On the other hand, some analysts sustain a different and more permanent scenario. They assert that a population in excess of one billion people represents a large reservoir of labor. Migration across provinces may thus increase competition on the labor market of export-intensive provinces and allow firms to keep low wages for many years.[5]

This paper attempts to shed some light on this debate. We estimate the maximum wage a firm can afford to pay given its *market access* to world and internal demand and its *internal migrant labor supply*. Market access[6] measures the demand each entity faces given its geographical position and that of its trading partners (Harris,

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[3] Source: Authors' calculations using data from the World Trade Organization (www.wto.org/).

[4] Chinese wages in dollars have been increasing by 15% per year in 2001 and 2002 (Adams *et al.*, 2006). Lett and Banister (2006) evaluate that total hourly compensation costs of manufacturing employees in China increased nearly 18%, between 2002 and 2004. See also *China's competitiveness 'on the decline'*, Financial Times, March 22, 2006. Using our data set on the period 1996-2004, we confirm an upward trend of the average real manufacturing wage in China (Figure 1, in Appendix A).

[5] While hourly compensation costs in China's manufacturing sector increased rapidly, the Chinese's average hourly manufacturing compensation in 2004 was only U.S.$0.67, about 3% of the USA's average (U.S.$22.87)(Lett and Banister, 2006).

[6] The literature also refers to market potential (Harris, 1954; Hanson, 2005) or real market potential (Head and Mayer, 2006).

1954; Redding and Venables, 2004). Wages are predicted to be higher in central locations, receiving higher demand, than in peripheral areas. There is some evidence to support this prediction in China (Lin, 2005), since wages in coastal provinces with good market access, like Fujian, Guangdong and Shanghai, are a factor two higher that the national average.[7] Internal migrant labor supply represents the additional labor supply each entity faces due to internal migration across provinces. Such migration is restricted through the *hukou* system of household registration and costly. Provinces can impose various hurdles to getting the registration (Au and Henderson, 2006). However, the system progressively breaks down due to more relaxed migration policies (Shen, 1999). Moreover, the coastal provinces have proposed its abolition to encourage labor migration from poorer regions.

We build on the models of the New Economic Geography (NEG) (Fujita *et al.*, 1999) to derive an econometric specification. This economic structure makes it possible to estimate the effect on wages of both the market access and the internal migration.

The growing empirical literature on the NEG supports the evidence that regional wages are an increasing function of the region's market access (Redding and Venables, 2004; Hanson, 2005).[8] However, by focusing on such demand forces, part of the literature lets aside labor supply factors. For instance, Redding and Venables (2004), Head and Mayer (2006) and Breinlich (2007) explicitly assume that workers are immobile across regions.[9] Introducing labor mobility is a more realistic assumption but does not alter the main result of the literature stating that income per capita is higher in places enjoying better market access (Hanson, 2005). The free migration equalizes real wages across regions (see Puga, 1999). Consequently, firms in agglomerated regions, with high market access, must pay higher nominal wages, relative to outlying areas, to compensate for higher congestion costs (e.g. higher housing and land prices). This endogenization rules out the estimation of the *direct* effect of migration on wages. Thus, in a seminal contribution, Hanson (2005) controls for the *indirect* impact of labor mobility, through the effects on the housing

[7] Note that China implemented a labor contract system in the mid-1980s, and energetically promoted it in the 1990s. In 1993, the Chinese government began to reform the social relief system, at the same time trying out a minimum living standard security system. To date, all China's 31 provinces, except the Tibet Autonomous Region, have issued a minimum wage, with Shenzhen boasting the highest monthly level of 600 yuan (US$73), Shanghai 570 yuan (US$69) and Beijing 495 yuan (US$60).

[8] Using the trade liberalization process in Mexico in the 80's as a natural experiment, Hanson (1996, 1997) has pioneered works on the assessment of the relationship between market access and factor prices. Based on a non-structural approach, he documents that regional nominal wages are decreasing in transport costs to industry centers.

[9] Head and Mayer (2006) and Breinlich (2007) focus on the European context. Since migration between regions in different EU nations is quite small, the immobility of the labor factor seems a reasonable assumption. This hypothesis is much of a concern in Redding and Venables (2004) who analyze cross-country variation in per capita income. However, even if international flows of people are actually large and growing, they remain smaller than international trade and capital flows (Freeman, 2006).

sector, and finds that wages are associated with proximity to consumer markets.[10]

To work out the direct effect of migration on wages, we exploit a particular Chinese feature. Based on the migration restrictions observed in China (Au and Henderson, 2006), we assume that in short-run labor is immobile.[11] Then, we derive a short-run equilibrium à la Redding and Venables (2004) and depart from this equilibrium by assuming an immigrant labor supply shock.

Investigating the impact of such a shift on wages relates our work to labor economics. Recent papers document a negative effect of immigration on the wages of competing native workers, with mixed magnitudes (Card, 2001, Borjas, 2003). [12] While most of the papers on this strand highlight the importance to control for labor shifts and education, they mostly assume that demand remains constant over time. We relax this assumption and control for a varying market access, capturing the evolution of internal and world demand. To this end, we estimate a theoretical trade equation and construct a complete version of each Chinese province's market access, consisting of three parts: its own provincial demand, its national demand and its world market access.

Using a data set covering 29 Chinese provinces between 1997 and 2004, we investigate the respective impact of our constructed market access and internal migration on average provincial manufacturing wage. Moreover, we control for various endogeneity issues by using an instrumental variable approach. Our derived econometric specification explains approximately 80 to 90 percent of the variation in average provincial wages. We find, holding other factors fixed, that provincial wages increase by about 15 percent per year, due to common shocks possibly like total factor productivity growth and national rise in prices. Our results show that besides this general trend, market access and internal migration have statistically and economically significant effects on the provincial wage level but of much less importance. We estimate that on average over the 7 year period of our sample, more intense internal migration has slowed down wage growth by 2 percent per year. The wage increasing impact of market access is three times smaller in magnitude.

The paper is organized as follows. In the next section, we outline the theoretical framework from which the econometric specification used in the subsequent sections is derived. In section (3), we describe the data sources and discuss some estimation issues. In section (4), we investigate econometrically the respective contribution of market access and internal migration as determinants of wages in China. In section (5), we conclude.

[10] Hanson's methdology has been replicated using Italian (Mion, 2004) or German (Brakman, *et al.*, 2004) data. Recently, Ottaviano and Pinelli (2006) extended the Redding and Venables (2004) set-up by introducing labor mobility à la Hanson (2005). However, their wage estimation does not explicitly control for labor mobility factors.

[11] See Amiti and Javorcik (2007) for a similar assumption in a different setting.

[12] See Ottaviano and Peri (2006) for challenging results.

2 Theoretical framework

The theoretical framework underlying the empirical analysis borrows from a standard New Economic Geography model (Fujita *et al.*, 1999). Based on this model, we introduce workers' skill heterogeneity across regions and implement a strategy to estimate the impact of migration on wages.
The economy is composed of $i = 1, \ldots, R$ regions and two sectors: an agricultural sector (A) and a manufacturing sector (M) interpreted as a composite of manufacturing and service activities.

2.1 Demand side

The agricultural sector produces an homogeneous agricultural good, with constant returns and perfect competition. The manufacturing sector produces a large variety of differentiated goods, with increasing returns and imperfect competition. Each consumer of region j shares the same Cobb-Douglas preferences for the consumption of both types of goods (A and M):

$$U_j = M_j^{\mu} A_j^{1-\mu}, \quad 0 < \mu < 1, \tag{1}$$

where μ denotes the expenditure share of manufactured goods. M_j is defined by a constant-elasticity-of-substitution (CES) sub-utility function of v_i varieties:

$$M_j = \sum_{i=1}^{R} \left(v_i q_{ij}^{(\sigma-1)/\sigma} \right)^{\sigma/(\sigma-1)}, \quad \sigma > 1, \tag{2}$$

where q_{ij} represents demand by consumers in region j for a variety produced in region i and $\sigma > 1$ is the elasticity of substitution. Given expenditures of region j (E_j) and the $c.i.f$ price of a variety produced in i and sold in j (p_{ij}), the standard two-stage budgeting procedure yields the following CES demand q_{ij}:

$$q_{ij} = \mu \, p_{ij}^{-\sigma} \, G_j^{\sigma-1} \, E_j, \tag{3}$$

where G_j is the CES price index for manufactured goods, defined over the c.i.f. prices:

$$G_j = \left[\sum_{i=1}^{R} v_i p_{ij}^{1-\sigma} \right]^{1/1-\sigma}. \tag{4}$$

2.2 Supply side

Delivering manufactured products from one region to another is costly. The iceberg transport technology assumes that p_{ij} is proportional to the mill price p_i and shipping costs T_{ij}, so that for every unit of good shipped abroad, only a fraction ($\frac{1}{T_{ij}}$) arrives. Thus, the demand for one variety produced in i and sold in j (eq. 3) can be written as:

$$q_{ij} = \mu \, (p_i T_{ij})^{-\sigma} \, G_j^{\sigma-1} \, E_j. \tag{5}$$

To determine the total sales, q_i, of a representative firm of region i we sum sales across regions, given that total shipments to one region are T_{ij} times quantities consumed:

$$q_i = \mu \sum_{j=1}^{R} (p_i T_{ij})^{-\sigma} G_j^{\sigma-1} E_j T_{ij} = \mu p_i^{-\sigma} MA_i, \tag{6}$$

where

$$MA_i = \sum_{j=1}^{R} T_{ij}^{1-\sigma} G_j^{\sigma-1} E_j, \tag{7}$$

represents the market access of each exporting region i (Redding and Venables, 2004: 59). Each firm i has profits π_i, assuming that the only input is labor:

$$\pi_i = p_i q_i - w_i \ell_i, \tag{8}$$

where w_i and ℓ_i are the wage rate and the labor demand for manufacturing workers, respectively.[13] We follow Head and Mayer (2006) in taking into account workers' skill heterogeneity.[14] We assume that labor requirement, ℓ, depends on both output, q, and workers' education level, h, as follows:

$$\ell_i = (F + cq_i) \exp(-\rho h_i), \tag{9}$$

where F and c represent fixed and marginal requirements in "effective" (education-adjusted) labor units. ρ measures the return of education and indicates the percentage increase in productivity due to an increase in the average enrollment rate in institutions of higher education. Replacing (9) in (8) and maximizing profits gives the familiar mark-up pricing rule:

$$p_i = \frac{\sigma}{\sigma - 1} \, w_i \, c \, \exp(-\rho h_i), \tag{10}$$

for varieties produced at region i. Given the pricing rule, profits are:

$$\pi_i = w_i \left[cq_i \left(\frac{\exp(-\rho h_i)}{\sigma - 1} \right) - F \exp(-\rho h_i) \right]. \tag{11}$$

We assume that free entry and exit drive profits to zero. This condition implies that equilibrium output of any firm is:

$$q^* = \frac{F(\sigma - 1)}{c}. \tag{12}$$

[13] Perfect competition in the agricultural sector implies marginal cost pricing so that the price of the agricultural good p^A equals wages of agricultural laborers w^A. We choose good A as a numeraire, so that $p^A = w^A = 1$.

[14] The importance of spatial differences in the skill composition of the work force as an explanation for spatial wage disparities is analyzed in detail in Combes *et al.* (2007).

Using the demand function (6), the pricing rule (10) and the output equilibrium (12), we determine the manufacturing wage equation when firms break even:

$$w_i = \frac{\sigma - 1}{\sigma c \exp(-\rho h_i)} \left[\mu M A_i \frac{c}{F(\sigma - 1)} \right]^{1/\sigma}. \quad (13)$$

2.3 Deviation from the short-run equilibrium

Even if the model lacks any explicit dynamics, it is useful to consider that wage equation (13) is determined in a short-run equilibrium, which takes as given the allocation of workers in each region.[15] This equilibrium is consistent with the existence of short-run frictions in labor mobility across Chinese provinces.[16] The associated equilibrium labor demand for workers in province i is given by:

$$\ell_i^* = \sigma F \exp(-\rho h_i). \quad (14)$$

We now aim to work out the effects of an immigrant labor supply shock on wages, given that in the long-run migration is endogenized. To this end, we turn equation (14) around and express fixed requirements as:

$$F = \frac{\ell_i^*}{\sigma \exp(-\rho h_i)}. \quad (15)$$

Replacing (15) in the wage equation (13) gives:

$$w_i = (\sigma - 1)^{\frac{\sigma-1}{\sigma}} (\mu M A_i)^{\frac{1}{\sigma}} [c\sigma \exp(-\rho h_i)]^{\frac{1-\sigma}{\sigma}} \ell_i^{*-\frac{1}{\sigma}}. \quad (16)$$

We take logs and rearrange equation (16):

$$\ln w_i = \alpha_0 + \alpha_1 \ln M A_i + \alpha_2 h_i + \alpha_3 \ln \ell_i^* + \epsilon_i, \quad (17)$$

where $\alpha_0 = \frac{\sigma-1}{\sigma} \ln(\sigma - 1) + \frac{1}{\sigma} \ln \mu + \frac{1}{\sigma} \ln c\sigma$, $\alpha_1 = \frac{1}{\sigma}$, $\alpha_2 = \frac{\sigma-1}{\sigma}\rho$, $\alpha_3 = -\frac{1}{\sigma}$. Estimating this equation, we expect, first, that the elasticity of substitution (σ) between traded goods exceeds unity and second that both the elasticities of the market access and the labor supply are equal in absolute values.

Following Friedberg (2001) and Borjas (2003)'s methodology on the effect of immigration on wages, we depart from the market equilibrium situation ℓ_i^* and assume an exogenous influx of immigrant labor supply m_i in region i. The resulting rate of change of labor supply due to immigration is given by $m_i/\ell_i \approx \ln(\ell_i + m_i) - \ln(\ell_i)$. Using this information, we work out the temporary effect of an exogenous inflow of immigrants by estimating the following equation:

[15] This assumption defines a Marshallian short-run equilibrium (see Krugman, 1991).

[16] Even if the volume of internal migration has been increasing in China due to more relaxed migration policies, the hukou system of household registration still restricts labor mobility across regions (Au and Henderson, 2006). Such frictions are also documented in the Indonesian (Amiti and Cameron, 2007) and European contexts (Puga, 1999; Head and Mayer, 2006).

$$\ln w_i = \alpha_0 + \alpha_1 \ln MA_i + \alpha_2 h_i + \alpha_3 \frac{m_i}{\ell_i} + \epsilon_i. \tag{18}$$

Equation (18) relates regional manufacturing wage to its market access, its educational attainment, the rate of change of labor supply due to immigration and the usual error term ϵ_i. The exogeneity of our labor supply shock may be a concern, since it may depend on other variables in the model, like wage variations. To deal with this problem we empirically use an instrumental variable approach (see below).

3 Data and estimation issues

Using equation (18), the core empirical part of this paper explains the variance of the average provincial manufacturing wages in China. Before proceeding to estimations, we first describe data sources and then discuss estimation issues.

3.1 Data sources

We explain here how dependent and independent variables are constructed. Appendix B.1 provides greater details about the data sources. Table (4) in Appendix D gives summary statistics on the variables.

3.1.1 Explained variable

The set of regions under investigation includes 29 Chinese provinces between 1997 and 2004.[17] Our explained variable is the average annual nominal wage rate of manufacturing workers and staff. It is defined as the ratio of the total wage bill to the number of manufacturing workers and staff by province and year.

3.1.2 Explanatory variables

We detail here the construction of the market access and the immigrant labor supply (see Appendix B.1 for details about other explanatory variables).

Construction of market access

We compute the market access of province i by following a strategy, pioneered by Redding and Venables (2004), that exploits the information from a bilateral trade estimation. However, Redding and Venables (2004) simply assume that shipping costs depend on bilateral distance. We instead allow for differentiated trade cost measures depending on whether trade occurs within province/country, between provinces or between countries.

[17] The entire country is divided into 27 provinces plus four province-status "super-cities" – Beijing, Chongqing, Shanghai and Tianjin. Our analysis covers all provinces but Tibet. Chongqing and Sichuan are considered together.

Summing (Eq. **??**) over all products produced in location i, we obtain the total value of exports of i to j:

$$X_{ij} = \mu n_i (p_i T_{ij})^{1-\sigma} \, G_j^{\sigma-1} \, E_j = sc_i \, \phi_{ij} \, mc_j, \tag{19}$$

where n_i is the set of varieties produced in country i, $sc_i = n_i (p_i)^{1-\sigma}$ measures the "supply capacity" of the exporting region, $mc_j = G_j^{\sigma-1} E_j$ the "market capacity" of region j, and $\phi_{ij} = T_{ij}^{1-\sigma}$ the "freeness" of trade (Baldwin *et al.*, 2003).[18] Freeness of trade is assumed to depend on bilateral distances ($dist_{ij}$) and a series of dummy variables indicating whether provincial or foreign borders are crossed.

$$\phi_{ij} = dist_{ij}^{-\delta} \, exp\left[-\varphi B_{ij}^{f} - \varphi^{*} \, B_{ij}^{f*} + \psi Contig_{ij} - \vartheta \, B_{ij}^{c} + \xi \, B_{ij}^{i} + \zeta_{ij}\right], \tag{20}$$

where $B_{ij}^{f} = 1$ if i and j are in two different countries with either i or j being China and 0 otherwise, $B_{ij}^{f*} = 1$ if i and j are in two different countries with neither i nor j being China and 0 otherwise, $Contig_{ij} = 1$ if the two different *countries* i and j are contiguous, and 0 otherwise, $B_{ij}^{c} = 1$ if i and j are two different Chinese provinces and 0 otherwise, $B_{ij}^{i} = 1$ if $i = j$ denotes the same foreign country and 0 otherwise, and ζ_{ij} captures the unmeasured determinants of trade freeness. Consequently, this specification allows for impediments to domestic trade to be different from impediments to international trade[19] (see Appendix C for details).

Substituting (20) into (19), capturing unobserved exporting ($\ln sc_i$) and importing ($\ln mc_j$) country characteristics à la Redding and Venables (2004) with exporting and importing fixed effects (cty_i and ptn_j) and taking logs yields the following trade regression:

$$\ln X_{ij} = cty_i + ptn_j - \delta \ln dist_{ij} - \varphi B_{ij}^{f} - \varphi^{*} \, B_{ij}^{f*} + \psi Contig_{ij} - \vartheta \, B_{ij}^{c} + \xi \, B_{ij}^{i} + \zeta_{ij}. \tag{21}$$

Recall from equation (7) that the market access variable is defined as the trade cost-weighted sum of the market capacities of all partner countries, such as $MA_i = \sum_{j=1}^{R} \phi_{ij} \, mc_j$. Using our complete dataset of trade (see Appendix B.2 for details), we estimate (21) on a yearly basis from 1995 to 2002 to construct predicted values for the market access. Equation (21) allows also to construct empirical predictions for the supplier access, SA_j, defined as $SA_j = \phi_{ij} sc_i$. However, since market access and supplier access variables tend to be highly correlated (see Amity and Javorcik, 2007, in the Chinese context), we follow most of the NEG literature and concentrate on market access forces. Our market access variable consists of three parts: the local market access (intra-provincial demand), the national market access

[18] $\phi_{ij} \in [0, 1]$ equals 1 when trade is free and 0 when trade is eliminated due to high shipping costs and elasticity of substitution (σ).

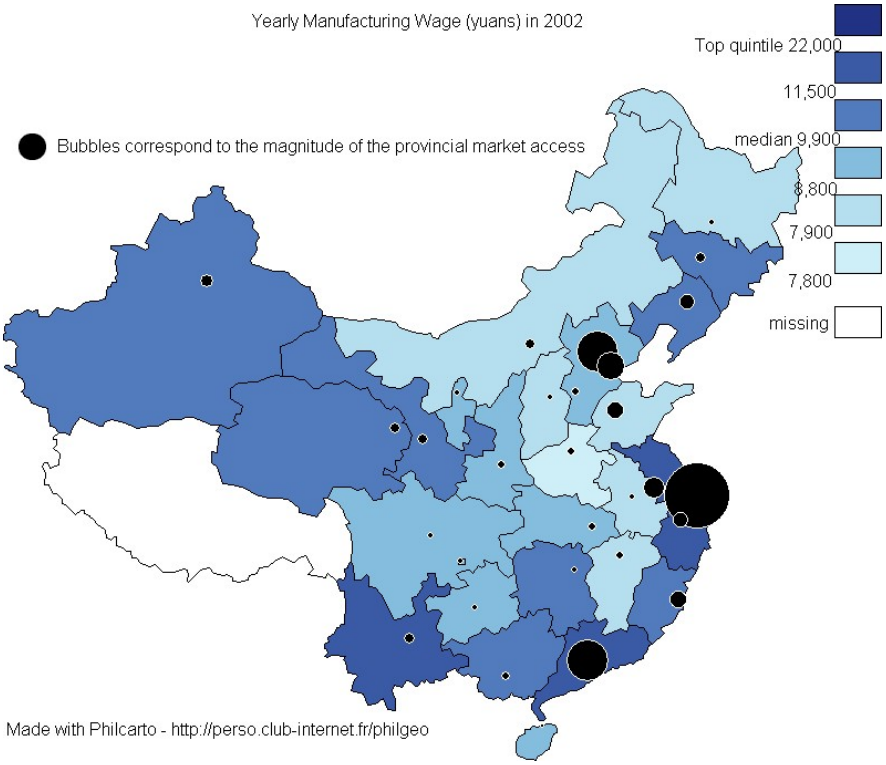
[19] This is in line with empirical evidence in China (Poncet, 2003).

(demand from other Chinese provinces), and the world market access.

$$\begin{aligned}\widehat{MA}_i &= \widehat{\phi}_{ii}G_i^{\sigma-1}E_i + \sum_{j\in P}\widehat{\phi}_{ij}G_j^{\sigma-1}\,E_j + \sum_{j\in F}\widehat{\phi}_{ij}G_j^{\sigma-1}E_j \qquad (22)\\ &= \exp(ptn_i)\times dist_{ii}^{-\widehat{\delta}} + \sum_{j\in P}\exp(ptn_j)\times dist_{ij}^{-\widehat{\delta}}\times\exp(\vartheta)\\ &+ \sum_{j\in F}\exp(ptn_j)^{\widehat{\lambda}}\times dist_{ij}^{-\widehat{\delta}}\times\exp(\widehat{\varphi}+\widehat{\psi}Contig_{ij}),\end{aligned}$$

where P and F stand for Chinese provinces and foreign countries, respectively. Results for various years are reported in Table 3 in Appendix C.
Figure (1) shows that coastal provinces exhibit high market access and nominal wages in manufacturing in 2002. One exception is the Shandong province, with high market access and below median wages.

Map 1: Nominal manufacturing wage and constructed market access in China (2002)



Immigrant share

The rate of change of labor supply due to immigration is given by the internal migration share ($\frac{m_i}{\ell_i}$). We rely on the annual Sample Survey on Population Changes

to compute this share as non-residents over population.[20] We actually assume that the number of non-residents in a province is a good proxy for the immigrant labor supply (m_i). Non-residents in a province are defined as population living in "township, towns and street communities with permanent household registration elsewhere, [and] having been away from that place for less than one year".

3.2 Estimation issues

A first estimation issue relates to the use of average annual earning per worker to measure wages. In fact, "cross-region variation in worker characteristics may reflect regional characteristics that are constant over the sample period" (Hanson, 2005). However, as in Hanson (1996), we cannot control for fixed provincial effects by including dummy variables for provinces. It would introduce perfect multicolinearity into the regression. First-differencing is another method to eliminate province effects from the regression but it is not without problems. It can exacerbate potential problems with noise (Altonji, 1986) or measurement errors in the data (Griliches and Hausman, 1986). We thus estimate Eq. (18) in level with additional controls. These controls help to mitigate the omitted variable bias. Thus, we account for the province-status of "super-cities" (*municipality*),[21] the number of Special Economic Zones (*SEZ*)[22], the features of coastal and western provinces compared to interior regions[23] and a set of year-specific intercepts.[24] This specification fits well the data and explains a large part of the variance of provincial wages.

A second estimation issue relates to the endogeneity of the migration shock. As mentioned earlier, we use an instrumental variable approach. The reliability of this method lies on the identification of instruments correlated with the inflow of immigrants but uncorrelated with the error term, i.e. with the unobserved component of wage variation. A first source of exogenous variation of emigrants may be found in climate variables (see Roback, 1982). We argue that unfavorable climate conditions in provinces of origin may reinforce the probability of departure of potential

[20] Results remain unchanged if we use the number of permanent residents in a province as a proxy for (ℓ_i). They are available upon request. Permanent residents are defined as population "residing in township, towns and street communities with permanent household registration there", i.e. in province i.

[21] The three province-status cities (Beijing, Shanghai and Tianjin) may display very specific features such as smaller surface area, more developed transport infrastructure but also higher proximity to administrative power. $Municipality_i$ is a binary variable which is unity if i is one of the three province-status cities.

[22] Three SEZ were opened in 1980 in Guangdong province and one in Fujian province in 1981. These open areas adopted preferential policies so that they played the role of windows in developing the foreign-oriented economy, generating foreign exchanges through exporting products and importing advanced technologies. SEZ_i is computed as the number of Special Economic Zones in a province (0, 1, 2 or 3).

[23] $Coastal_i$ is a binary variable which is unity if i is a coastal province and $West_i$ is a binary variable which is unity if i is a western province.

[24] We also introduced the distance to Hong-Kong as an additional regressor to check if our market access is related to the export processing trade with Hong-Kong. The distance estimate turned to be statistically insignificant in all regressions. Results are available upon request.

migrants. We consider two complementary dimensions of the climate conditions, annual *temperature* and annual *precipitations* of major cities. Relying on the 1990 Census (National Bureau of Statistics of China, 1991), we compute for each dimension an annual weighted average of climate conditions in the provinces of origin. The weight is the share of a province of origin j in the total immigration received by province i between 1985 and 1990. More precisely, each instrument, related to the destination province i, is computed as:

$$Imig_{climate_i^t} = \sum_{j \neq i} climate_j^t \frac{migration_{ij}}{\sum_{j \neq i} migration_{ij}},$$

with $climate$ being base on the temperature ($Imig_{temp_i^t}$) or the rainfall ($Imig_{rain_i}^t$) data. To reinforce the exogeneity of these indicators, we exclude from their computation information on the province i. Moreover we introduce in the wage equation the annual averages of temperature and precipitations of major cities of the province i as additional control variables. We thus ensure that the instruments do not simply proxy the climate conditions of the destination province. Since we do not have any a priori on the appropriate specification of the relationship between climate indicators and the share of immigrants in the population of destination, we allow for a quadratic relationship in the instrumental equation. A second source of exogeneity may be found in geographic variables. The surface area of the province of destination, measured in squared kilometers, may influence the extent of immigration and is employed as our third instrument.

A third estimation issue relates to the market access, on the right hand side of the estimated equation (18). It represents a weighted sum of regional expenditures. Those expenditures depend on incomes, and therefore on wages, raising a concern of reverse causality. A positive shock to w_i will raise E_i and consequently increase MA_i (Head and Mayer, 2006).[25] To deal with this problem we first follow Redding and Venables (2004) and lag the market access variable two years to abstract from contemporaneous shocks that affect both left- and right-hand side variables. Then, we devise an instrumental variable strategy. The literature so far has attempted to resolve this simultaneity problem by isolating variations in market access through geographic variables. While Redding and Venables (2004) use the distance to the nearest central place (Brussels, New York City, or Tokyo), Head and Mayer (2006) use measures of "centrality" of locations obtained by dividing the surface of the globe in approximately 11,700 squares. Both measures can reasonably be assumed to be exogenous to potential shocks on wages since they do not incorporate any information on market sizes of regions. However, they have the disadvantage of being time invariant and as such only explain the cross-section dimension of the market access. Our interest is to account for both within and cross-sectional dimension of our sample. We therefore follow a different approach and rely on an instrument of demand in location i at time t based on the weighted average of yearly variations

[25] This will be all the more problematic since $\phi_{ij} < \phi_{ii}$. In case of extremely high inter-provincial and international transport costs ($\phi_{ij} = 0, \forall\, i \neq j$), only the local expenditure enters MA_i.

of the nominal exchange rate (NER) of importing partners. The instrument for the market access of a Chinese province i is computed as:

$$I_{ma_{ti}} = \sum_j \Delta NER_{tij} \frac{1}{Distance_{ij}},$$

with ΔNER being the first difference of the nominal exchange rate between the partner j's currency and the Chinese yuan. The weighting of the NER_{ij} variation is the distance of country j to j.[26]. Since the bilateral exchange rates are similar across Chinese provinces, our instrumentation procedure relies entirely on the heterogeneity of import partners across Chinese provinces. We argue that a nominal devaluation (appreciation) of the country j's currency vis-à-vis the Chinese yuan translates in a reduction (rise) of j's demand (market capacity) for products from China. The impact of that change differs across Chinese provinces depending on an exogenous factor: the distance to the partner j.

4 Estimation results

We now proceed to the estimation of the wage equation derived in section (2.3). We run Eq. (18) for 29 provinces and the period (1997-2004). Table (1) reports the results of this baseline specification, which explains 80 to 90 percent of the variance of provincial wages.

Column (1) reports the OLS estimation of Eq. (18) without the immigrant share but with additional controls and a two-year lagged market access (cf.*supra*).[27] The estimates are worth interpreting. Holding other factor constant, a 10% increase of market access raises wages on average by about 1%. Besides, a point increase in the ratio of the number of students enrolled in institutions of higher education to the population raises wages roughly by 28%.[28] All additional controls enter positively and significantly, attesting to the wage premium that characterizes the three province-status "super-cities", the two provinces hosting SEZs and the coastal and western provinces compared to interior regions.[29] Year dummy estimates also deserve attention. They are significantly increasing over time suggesting the influence of an upward pressure on wages common to all provinces, like total factor productivity

[26]Our results are robust to the use of a different weight, defined as the share of country j in the exports of province i to j in the year 1995.

[27]Since the predicted values for market access are generated from a prior trade regression, we checked the sensitivity of our results to bootstrap techniques. Results remained unchanged. Bootstrapped standard errors (500 replications) are available upon request.

[28]In terms of beta coefficients, a one standard deviation increase in the higher education ratio raises wages roughly by .06 standard deviation.

[29]The wage differential between western and interior provinces may be explained by employment opportunities in industries offering high wages and salaries in western China, such as oil and gas companies, as well as border trade companies with Central Asian countries. Note however that this difference is not robust to the instrumental variable estimates (Col. 2-6).

growth.[30]

In columns (2) to (6), we include the immigrant share variable. Estimations are based on the instrumental variable (IV) approach, which allows to control for a potential simultaneity between wages and immigration. As described above, we use a set of three instruments.

The small p-value of the Durbin-Wu-Hausman test, in all IV estimations, confirms that the OLS estimator is not consistent and that IV technique is required. As a precondition for the reliability of the procedure, we check the validity of our instruments with the Hansen test of overidentifying restrictions. Insignificant test statistic indicates that the orthogonality of the instruments to the error term can not be rejected, and thus that our choice of instruments is appropriate. Both tests statistics are reported at the bottom of our results Table (1). The Shea partial R^2 is a measure of instrument relevance and takes into account the collinearity between the endogenous variables (Shea, 1997). The Shea R^2 is quite low in specification (2) but this was expected since the endogenous migration variable is already well explained by the included instruments, i.e. the exogenous variables of the second stage regression.[31] Moreover, we include the Stock and Wright (2000) statistic that provides weak-instrument robust inference for testing the significance of the endogenous regressors. We reject the null hypothesis which tests that the coefficients of the excluded instruments are jointly equal to zero.

Estimates confirm a positive influence of market access and education on wages. The structural derivation of our market access variable from theory provides us with a theoretical interpretation of its coefficient. Theoretically, this figure corresponds to $1/\sigma$, with σ being a measure of product differentiation, increasing returns to scale and the degree of competition on the market (Head and Mayer, 2004). Our estimates of the elasticity of substitution between traded goods are greater than unity and range between 4 and 6.7, depending on the IV specification used. This is consistent with theory and roughly in line with recent estimates in the NEG (Hanson, 2005) or international trade literature (Head and Ries, 2001). Hanson's (2005) estimates of σ ranged in value between 4.9 and 7.6. Further, also consistent with theory, we find that in absolute value the estimate of the labor supply is roughly equal to the estimate of the market access.

Our results underline that an increase of the immigrant share, defined as non-residents over population, imposes a downward pressure on the destination region's wage. The effect is statistically and economically highly significant. On average, given a one point increase of the immigrant share, average wages decrease by approximately 4% (col. 2). As a consequence, in a context of high immigration flows, a manufacturing firm, given its access to markets and other regional characteristics, can afford to pay lower wages.

[30] Recent estimates document that China's total factor productivity growth has increased at an annual rate of 4% during the period 1993-2004 (Bosworth and Collins, 2006).

[31] This might raise a concern for multicolinearity but the auxiliary R^2 of the first stage regression, with or without the excluded instruments, is lower than the overall R^2 of the second stage.

Table 1: Manufacturing wage equation

	Dependent Variable: ln(Manufacturing wage)					
Column:	(1)	(2)	(3)	(4)	(5)	(6)
Method:	OLS	IV	IV	IV	IV	IV
Lagged ln(Market Access)[a]	0.10	0.16	0.16	0.15	0.16	0.25
	(0.01)***	(0.03)***	(0.03)***	(0.02)***	(0.03)***	(0.07)***
Higher Education Ratio	0.28	1.12	0.72	0.66	0.77	0.83
	(0.10)***	(0.40)***	(0.27)***	(0.25)***	(0.29)***	(0.31)**
Immigrant Share		-0.04	-0.03	-0.03	-0.03	-0.04
		(0.01)***	(0.01)***	(0.01)***	(0.01)***	(0.01)***
Population			-0.00	-0.00	-0.00	-0.00
			(0.00)***	(0.00)***	(0.00)***	(0.00)**
Municipality-dummy	0.30	0.48	0.38	0.38	0.37	0.20
	(0.05)***	(0.09)***	(0.07)***	(0.07)***	(0.07)***	(0.15)
Special Economic Zones	0.06	0.10	0.08	0.08	0.08	0.04
	(0.02)***	(0.03)***	(0.02)***	(0.02)***	(0.02)***	(0.04)
Coast-dummy	0.06	0.02	0.01	0.02	-0.01	-0.07
	(0.02)***	(0.04)	(0.03)	(0.03)	(0.04)	(0.07)
West-dummy	0.12	0.04	0.05	0.06	0.05	0.01
	(0.02)***	(0.05)	(0.04)	(0.04)	(0.04)	(0.06)
Rain		0.00	0.00	0.00	0.00	0.00
		(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***
Temperature		-0.00	-0.00	0.00	0.00	0.00
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Year 1998-dummy[b]	0.17***	0.17***	0.17***	0.17***	0.17***	0.18***
Year 1999-dummy	0.28***	0.29***	0.29***	0.29***	0.29***	0.31***
Year 2000-dummy	0.41***	0.70***	0.63***	0.61***	0.64***	0.73***
Year 2001-dummy	0.49***	0.67***	0.63***	0.62***	0.64***	0.69***
Year 2002-dummy	0.59***	0.69***	0.67***	0.66***	0.67***	0.71***
Year 2003-dummy	0.72***	0.81***	0.80***	0.80***	0.80***	0.84***
Year 2004-dummy	0.84***	0.94***	0.93***	0.93***	0.93***	0.97***
Obs. Nb	232	232	232	232	232	232
Adj. R-squared	0.92	0.80	0.87	0.87	0.86	0.79
Durbin-Wu-Hausman test		17.01	18.07	18.00	18.05	29.90
$[p-value]$		[0.00]***	[0.00]***	[0.00]***	[0.00]***	[0.00]***
Hansen J Statistic		5.94	3.74	4.25	3.51	0.59
$[p-value]$		[0.20]	[0.44]	[0.37]	[0.47]	[0.96]
Stock-Wright S Statistic		22.27	24.14	24.14	24.14	23.99
$[p-value]$		[0.00]***	[0.00]***	[0.00]***	[0.00]***	[0.00]***
Shea Partial R^2 (%)						
Immigrant Share		3.31	6.16	6.79	5.67	6.38
Population			73.29	70.50	76.30	46.72
Lagged ln(Market Access)						8.42

Notes: Heteroskedastic consistent standard errors in parentheses, with ***, ** and * denoting the significance at 1, 5% and 10% level, respectively. [a]Market access is two-year lagged to abstract from contemporaneous shocks that affect both left- and right-hand side variables. [b]To save some space, we do not report the constant term and the standard errors of year dummies. Standard errors vary between 0.03 and 0.09 and are available upon request. Col. (1) estimates Eq. (18) without the immigrant share but with additional controls. Columns (2) to (6) include the immigrant share, defined as non-residents over population in col. (2) (3) and (6), as female non-residents over population in col. (4) and as male non-residents over population in col. (5). Instrumented variables (depending on the specification): *Immigrant Share*, *Population*, two-years lagged *ln(Market Access)*. Instruments (depending on the specification): *area*, *climate* variables ($Imig_{temp}$ and $Imig_{rain}$) and their square, two-years lagged *population* and two-years lagged *Ima*. See text for more details.

To ease the interpretation of the results and compare the effects of market access and internal migration on wages, we compute their standardized (beta) coefficients using estimates of Table (1). They are the regression coefficients obtained by first standardizing all variables to have a mean of 0 and a standard deviation of 1. Results are reported in Table (2).

Table 2: Manufacturing wage equation - Standardized coefficients

Dependent Variable:	ln(Manufacturing wage)				
Column:[a]	(2)	(3)	(4)	(5)	(6)
Method:	IV	IV	IV	IV	IV
Lagged Ln(MA)[b] [I]	0.554	0.538	0.523	0.549	0.844
	(0.106)***	(0.084)***	(0.079)***	(0.088)***	(0.252)***
Immigrant Share [II]	-0.612	-0.447	-0.421	-0.462	-0.607
	(0.231)***	(0.143)***	(0.134)***	(0.151)***	(0.222)***
Obs. Nb	232	232	232	232	232
Wald Statistic (H_0: I+II=0)	0.14	1.04	1.40	0.86	2.48
$[p-value]$	0.704	0.309	0.236	0.354	0.115

Notes: [a] The column numbers refer to the corresponding columns in Table (1). [b] Market access is two-year lagged. Beta coefficients are computed using estimates of Table (1). Heteroskedastic consistent standard errors in parentheses. See text for details.

Estimates are now easily comparable in terms of standard deviation increase. Interestingly, we observe that a one standard deviation increase in the immigrant share, proxying the internal migrant labor supply, offsets a one standard deviation increase in the market access. The bottom of Table (2) reports the p-value of the Wald statistic indicating that the difference in both parameter estimates is statistically insignificant. In column (3) of Table (1), we follow Borjas (2003) and address the interpretation problem that arises because a rise in immigrant share can represent either an increase in the number of non-residents or a decline in population. Thus, we add the province's population level as regressor and the two-year lagged value of population as an additional instrument. Controlling for this size variable does not change much the results. A one standard deviation increase in the immigration share still offsets a one standard deviation increase in market access (column 3, Table 2), even if the former beta coefficient has been reduced.

Current international migration differs from the past mass migration, when immigrants where disproportionately men (Freeman, 2006). As in current international migration, nearly half of current immigrants in China are women (see Table 4 in Appendix D). Our results still hold if we take account of this new trend and redefine in Table (1) the immigrant share as female non-residents over population in column (4) and as male non-residents over population in column (5). In both cases, the effect of migration offsets the positive estimate of market access.

In the last column of Table (1), we address the simultaneity problem of market access and wages and devise an instrumental variable strategy (cf. *supra*). The high p-value of the Hansen test of overidentifying restrictions indicates that our instrumentation strategy seems appropriate. It is worth noting that the estimates of the market access variable is now much higher (column 6, Table 1). However, a one standard deviation rise in the immigrant share still offsets a one standard deviation rise in internal and world demand. The Wald statistic reported at the bottom of Table 2 indicates that the difference in both parameter estimates is statistically insignificant.

Results of column (6), controlling for the endogeneity of migration and market access, represent our preferred estimation. Based on the year dummy estimates, we find holding other factors constant that provincial wages increase on average by about 17 percent per year (up 121%)[32] between 1997 and 2004, due to common shocks possibly like total factor productivity growth and national rise in prices. Most of the wage increase experienced by Chinese provinces corresponds to a national phenomenon.[33] The impact of province specific forces such as improved access to markets and intensified internal migration though statistically and economically significant is of less importance. We can compute the average impact of the relaxation of migration restrictions over the 7 year period of our sample. Since on average the immigrant share increased from 5 to 9% between 1997 and 2004, we can infer that more intense internal migration slowed down wage growth by 2 percent per year (14% in total). The average provincial access to national and international markets appears to be more stable. It has improved but at a much lower rate (a little less than 20%) on average thus inducing a further wage rise of 5%. The wage increasing impact of market access is thus three times smaller in magnitude than the effect of migration (in the opposite direction).

Overall our results highlight that rapidly increasing wages in China correspond to a common national trend possibly pertaining to productivity growth and price rises which is only marginally affected by local-specific forces such as internal migration and market access. These two determinants did not vary a lot between 1997 and 2004 but this may change in the future. It is possible that the further relaxation of migration restrictions in parallel to productivity slow-down leads to a new scenario. In the extreme case where the Guangdong migrant share doubles to reach 30% (the value for Beijing in 2004), the downward pressure on wages could be as high as 60%.

5 Conclusion

This paper examines the importance of economic geography and migration in explaining the spatial structure of wages in China. Our econometric specification re-

[32] This figure is computed based on the various year dummies coefficients as 1.17*(1.28-0.17)*(1.41-0.28)*(1.49-0.41)*(1.59-0.49)*(1.72-0.59)*(1.84-0.72).

[33] This national phenomenon explains 90% of the observed nominal wage increase in China. Average provincial wages have more than doubled (up 130%) between 1997 and 2004.

lates wages to a transport cost weighted sum of demand in the surrounding locations and to migratory inflows. We estimate the maximum wage a firm can afford to pay, given its market access and immigrant labor supply. Investigations of the determinants of wage are made on a sample of 29 Chinese provinces between 1997 and 2004. Most of the wage increase (130% over the 7 year period) experienced by Chinese provinces corresponds to a national phenomenon possibly pertaining to productivity growth and prices rise. The impact of province specific forces such as improved access to markets and intensified internal migration though statistically and economically significant is of less importance. We find evidence that wages are increasing in part due to improved access to markets but also that internal migration slows down this evolution by 2% per year.

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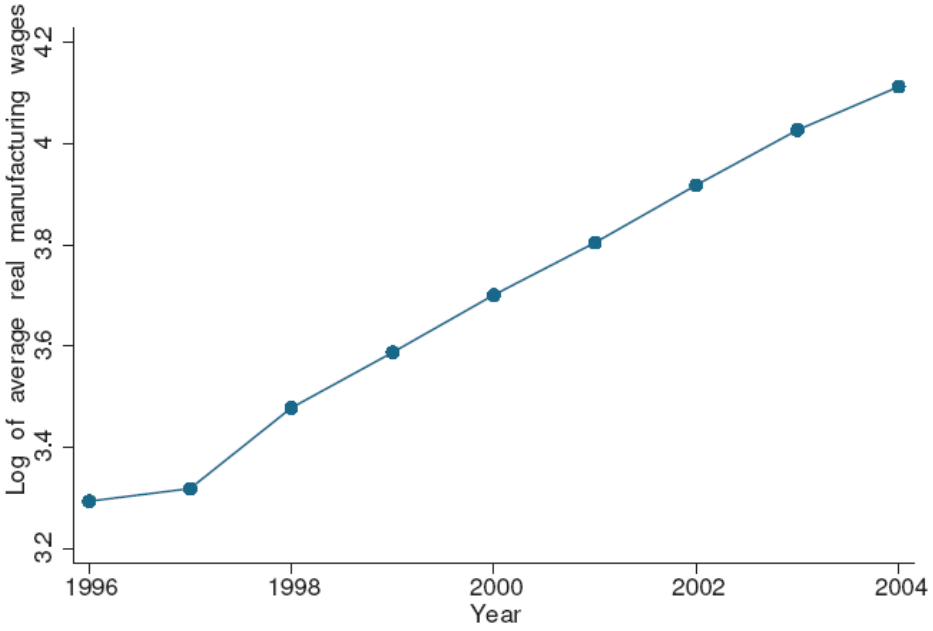
Appendix A: Wage growth

Figure 1: Average real manufacturing wage (1996-2004)



Appendix B: Description of Data

This appendix describes data sources and explains the construction of the indicators used in the estimations.

B.1. Province level data

The wage equation relies on various indicators built from the China Statistical Yearbooks which provide average nominal wage of formal employees, population, climate indicators and migration figures. All these economic indicators are at the provincial level, including the province-status municipalities.
The education level is computed as the ratio of the number of students enrolled in institutions of higher education to the population. Institutions of higher education refer to establishments set up according to government evaluation and approval procedures, enrolling graduates from high schools and providing higher education courses and training for senior professionals. They include full-time universities, colleges, and higher/further education institutes.

B.2. Trade data

Various data sources are used to estimate the trade equation on both international and intra-national trade flows for China and its foreign partners.

B.2.1. International Data

International trade flows are in current USD and come from the IMF Direction of Trade Statistics (DOTS).
Internal trade flows are in current USD and are calculated as the difference between domestic primary and secondary sector production minus exports.
Production data for OECD countries come from the OECD STAN database. For other countries, ratios of industry and agriculture output in percentage of GDP are extracted from Datastream. They are then multiplied by the country GDPs (in current USD) coming from the World Development Indicators 2005.

B.2.2. Chinese Data

The provincial foreign trade data are obtained from the Customs General Administration database, which recorded the value of all the import or export transactions through the customs. Provincial imports and exports are decomposed into up to 230 international partners. The background of this database has been discussed in Lin (2005) and Feenstra, Hai, Woo and Yao (1998).
Exchange rate is the average exchange rate of renminbi against the US dollar in the China Exchange Market. It comes from the China Statistical Yearbook.

Production data for Chinese provinces are computed as the sum of industry and agriculture output. Output in yuan are converted into current USD using the annual exchange rate. All statistics come from the China Statistical Yearbooks.

Provincial input output tables[34] provide the decomposition of provincial output, international and domestic trade of tradable goods. They are available for 28 provinces as data are missing for Tibet, Hainan and Chongqing.

[34]Most Chinese provinces produced square input output tables for 1997. A few of them are published in provincial statistical yearbooks. We obtained access to final-demand columns of these matrices from the input output division in China's National Bureau of Statistics. Our estimations assume that the share of domestic trade flows (that is between each province and the rest of China) in the total trade of provinces is constant over time.

Appendix C: Construction of market access

Bilateral trade flows data

To get market potential measures for each region we rely on different types of relationships: intra-provincial flows, inter-provincial flows, international flows of Chinese provinces, international flows of foreign countries as well as intra-national flows of foreign countries. Thus, we rely on several data sources to cover (i) intra-provincial (or intra-national), (ii) inter-provincial and (iii) international flows. See appendix B.2. for details.

(i) Intra-provincial flows or foreign intra-national flows, i.e. exports to itself, are computed following Wei (1996) as domestic production minus exports.

(ii) Inter-provincial trade is computed as trade flows between provinces.

(iii) International flows comprise trade of provinces with around 200 foreign countries, as well as trade between foreign countries.

These relationships are all merged into a unique dataset which allows computing market capacities of provinces and foreign countries based on their exports to all destinations (domestic and international).

Freeness of trade

The freeness of trade (ϕ_{ij}) is assumed to depend on bilateral distances ($dist_{ij}$) and a series of dummy variables indicating whether provincial or foreign borders are crossed.

$$\phi_{ij} = dist_{ij}^{-\delta}\ exp\left[-\varphi B_{ij}^{f} - \varphi^{*}\ B_{ij}^{f*} + \psi Contig_{ij} - \vartheta\ B_{ij}^{c} + \xi\ B_{ij}^{i} + \zeta_{ij}\right],$$

We distinguish different cases, according to whether i and j are provinces or foreign countries. Literally this equation says that we allow for differentiated transport costs depending on whether trade occurs between a Chinese province and foreign countries ($-\delta \ln dist_{ij} - \varphi + \psi Contig_{ij}$), between two foreign countries ($-\delta \ln dist_{ij} - \varphi^{*} + \psi Contig_{ij}$), between a Chinese province and the rest of China ($-\delta \ln dist_{ij} + \vartheta$), within foreign countries ($-\delta \ln dist_{ij} + \xi$) or within Chinese provinces ($-\delta \ln dist_{ij}$). In these last two cases, only internal distance affects trade freeness. Accessibility of a Chinese province or a foreign country to itself is modeled as the average distance between producers and consumers in a stylized representation of regional geography, which gives $\phi_{ii} = distance_{ii}^{-\delta} = (2/3\sqrt{area_{ii}/\pi})^{-\delta}$, where δ is the estimate on distance in the trade equation.

Note that being neighbors dampens the border effect ($Contig_{ij} = 1$ for pairs of partners that are contiguous) and that ζ_{ij} captures the unmeasured determinants of trade freeness, which is assumed to be an independent and zero-mean residual.

Composition of market access

Table (3) reports estimation of the trade equation (21). Importer and exporter fixed effects are included in the regression so that the border effect within foreign countries ($-\delta \ln dist_{ij} + \xi$) is captured by their fixed effects. The reference category in the regression is within Chinese province trade.

The elasticity of distance and the impact of contiguity are in line with related literature. We also confirm that the border effect inside China is important (Poncet, 2003). Furthermore, we find impediments to trade to be greater between China and the rest of the world than between countries included in our sample (which are mostly members of the WTO and are therefore much more integrated in the world economy than China in the 1990s). To capture part of the large magnitude of border effects, we may introduce additional controls. However, this strategy will not affect much the predicted values for market access. In one hand, the border effects would be reduced, but on the other hand, market access values would be predicted taken into account the new controls, capturing part of the border effects.

Table 3: Trade equation estimations

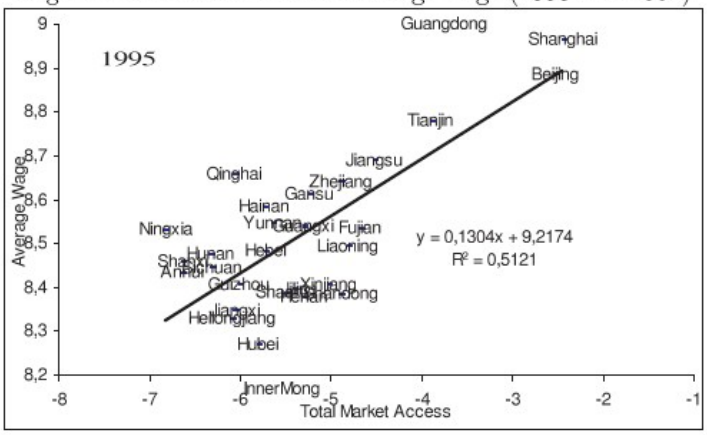
	Dependent Variable: Ln(Exports)		
Columns	(1)	(2)	(3)
	1995	1999	2002
Exporter fixed effects	yes	yes	yes
Importer fixed effects	yes	yes	yes
Ln(Distance)	-1.24	-1.28	-1.34
	(0.02)***	(0.02)***	(0.02)***
Chinese	-4.72	-4.79	-3.94
Border Effect (B_{ij}^{f})	(0.28)***	(0.31)***	(0.33)***
Foreign country	-2.82	-2.77	-2.28
Border Effect (B_{ij}^{f*})	(0.28)***	(0.30)***	(0.32)***
Contiguity	1.60	1.57	1.56
	(0.10)***	(0.11)***	(0.11)***
Provincial	-1.77	-3.05	-2.52
Border Effect (B_{ij}^{c})	(0.56)***	(0.61)***	(0.65)***
Observations Nb	21 442	24 143	23 146
R-squared	0.38	0.40	0.40

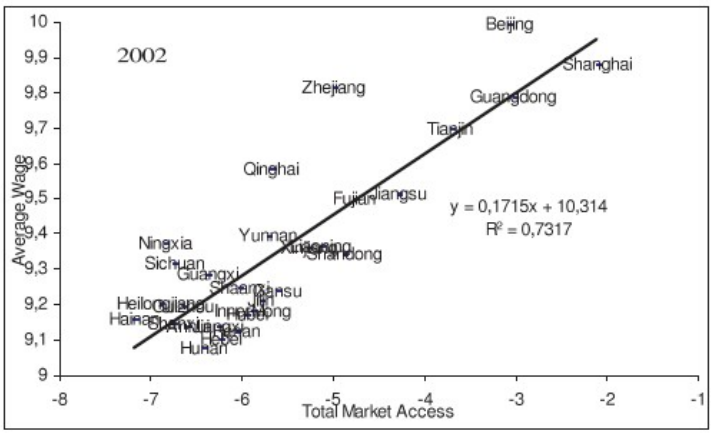
Heteroskedastic consistent standard errors in parentheses, with ***, ** and * denoting the significance at 1, 5 and 10% level.

Evolution of market access

Figure (2) plots market access of provinces as a function of their average log wage. This is done separately for the two extreme years of our available data (1995 and 2002). We observe high market access for high-wage provinces which is in line with the theoretical prediction of the NEG models.

Figure 2: Market access and average wage (1995 and 2002)





Appendix D: Summary statistics

Table 4: Summary Statistics on indicators, 1995-2004

	Obs	Mean	St. Dev.	Minimum	Maximum
Dependent Variable:					
Manufacturing Wage	232	9,431	3,714	3,903	27,456
ln(Manufacturing Wage)	232	9.08	0.36	8.27	10.22
Regressors:					
Market Potential[a]	232	0.01	0.02	0.0007	0.18
ln(Market Potential)[a]	232	-5.51	1.23	-7.22	-1.72
Education	232	0.06	0.07	0.01	0.37
Municipality	232	0.10	0.30	0	1
Special Economic Zones	232	0.14	0.57	0	3
Coast	232	0.38	0.49	0	1
West	232	0.28	0.45	0	1
Rain	232	886	530	134	2,679
Temperature	232	14.42	5.23	-7.8	25.4
Migration (10 thousands):					
Non-Residents (1)	232	336.8	299	12.64	2,530
Female non-Residents (2)	232	165.8	146	6.58	1,262
Male non-Residents (3)	232	171	154	5.96	1,268
Population (4)	232	4,324	2,804	482.30	11,847
Immigrant Share defined as:					
(1)/(4)	232	8.69	6.12	1.30	34.18
(2)/(4)	232	8.67	6.42	1.20	36.07
(3)/(4)	232	8.70	5.83	1.40	32.11
Instruments:					
Area	232	289,423	353,202	5,970	1,646,900
$\text{Imig}_{\text{temp}}$	232	15.53	2.33	10.25	21.18
$\text{Imig}_{\text{rain}}$	232	958	257	512	1,959
Population[a]	232	4,254	2,769	481	11,780
Ima[a]	232	0.035	0.007	0.023	0.054

Notes: [a]Two-year lagged variables.

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