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The spirits that I've cited my commands ignore: how does Chinese regional policy affect the agglomeration process?

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Wirtschaftswissenschaftliche Fakultät

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Wirtschaftswissenschaftliche Beiträge
des Lehrstuhls für Volkswirtschaftslehre,
insbes. Wirtschaftsordnung und Sozialpolitik
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Abstract

Regional GDP per capita disparities between the coastal and interior provinces of China seem to be a bugaboo the Chinese government cannot get rid of. This paper shows that there are agglomerative forces within China which emerge from the unbalanced growth strategy and lead to a considerably west to east migration of workers. Instead of reducing the disparities, migration actually worsens the problem. The knowledge that an agglomerative process takes place should have a decisive impact on regional policy. Therefore we examine whether the policy measures taken within the last years were appropriate to reduce regional inequity within China. We show that in the case of agglomerative forces the hukou system can reduce disparities while a reduction of trade costs between the interior and the coastal provinces leads to more inequity.

1 Introduction

For nearly twenty years the regional disparities between China's provinces have been one of the most striking problems the Chinese government has to deal with. It all started in the late 1970s, when the Deng Xiaoping decided to allow inequality in order the raise the wealth in some areas: "We must make full use of regional comparative advantage, enhance the strong points and avoid the weak points, so we must allow the imbalance".[1] Already in 1979 the communist party decided to launch four Special Economic Zones which reaped the benefits of more economic autonomy. The following two Five-Year-Plans (1881-1985 and 1986-1990) implemented this unbalanced growth strategy by using a regional policy which favoured mainly the coastal area. Overall 14 "open cities" which are all placed in the coastal region were set up. These areas were characterized by numerous privileges, which included promoting exports and FDI, special tariffs as well as more autonomy to local politicians. This new policy turned out to be very successful. As a result the income in the promoted regions increased rapidly. But on the other hand the disparities between the favoured regions and the hinterland also increased at the same time. This huge income gap was an incentive for many people to migrate from the hinterland into the richer coastal provinces.[2] The number of migrating workers was immense and therefore caused a lot of economic and social problems in the coastal cities. Besides that, regional disparities also have a political meaning because

[1] Zhang et al. (1992) p.879 in Fujita and Hu (2001) p.19.

[2] Following Fujita and Hu (2001) we also consider Beijing as a coastal province because it is located next to the port city of Tianjin.

large imbalances could strengthen centrifugal forces and could therefore jeopardize the unity of the country. The former Soviet Union like the former Yugoslavia are hortative examples.[3] Thus the Ninth Five-Year Plan (1996-2000) focussed on the economic development of the non-coastal provinces, with the aim to reduce the inequity between the Chinese provinces. The policy measures taken included public investment in infrastructure, increasing transfers to the hinterland or promoting the utilization of FDI. That the results of this policy were not satisfying is reflected in the fact that both the Tenth-Five-Year-Plan (2001-2005) and the Eleventh-Five-Year-Plan (2006-2010) still aim for reducing regional inequity. It seems that like the Sorcerer's Apprentice the Chinese government cannot control the forces once set free. But it is not only the Chinese government that has to deal with this problem: In many countries regional concentration of economic activity leads to an uneven regional income distribution which lasts for decades, despite of attempts by government to fight these forces. The Italian government for example tries to develop the rural south (Mezzogiorno), the German government makes an enormous effort to stimulate economic activity in the eastern parts (the New Länder) and Canada hands out immense subsidies to its Eastern Maritime Provinces.[4] One reason for the remaining inequity in all these countries is agglomerative forces. They lead to a concentration of economic activity within one region, the so called "core".

Agglomerative forces can have many causes, for example technological or pecuniary externalities and have proved to be extremely strong. The effects of technological externalities are regionally limited and occur basically among companies of the same branch of economic activity. Pecuniary externalities however can be observed over a wide area and over different industries. Due to the fact that the coastal area in China is nearly as big as Western Europe and contains several different industries we will focus on the latter. These pecuniary externalities can have two basic effects: First they lead to a higher density of firms in one region and second real wages tend to be higher in this region. The wage differences are an incentive for people from the periphery to migrate into the core.[5] Under certain circumstances this migration can worsen the problem by leading to even more unequally distributed living conditions within one country.

The basic models of the New Economic Geography can simulate this phenomenon.[6] They show that economic agglomeration might lead to regional income disparity, because the

[3] See Wang and Hu (1999).
[4] See Berthold et al. (2005) and McKinnon (1997).
[5] See Poncet (2006).
[6] See Krugman (1991).

agglomeration process crucial depends on the mobility of labour. If labour is perfectly mobile, economic concentration indeed does not lead to inequity because all economic activity and hence all mobile workers are concentrated in one region. In Our case that means that all workers live in the coastal provinces, and hence there are no income differences between the coast and the interior provinces. Referring to the case of China, many authors therefore blame the hukou system (a system of civil status registration) as one source of regional inequality. But the assumption of perfect mobility is often restrictive and unrealistic. In reality not everybody will move from one region to another only to achieve a small income gain. We therefore refer to *Ludema and Wooton (1997)* and add imperfectly mobile workers to the basic Krugman model. After implementing imperfectly mobile workers a full agglomeration in one region is considerably harder to achieve. With using this specific model we can analyze the effects of reducing trade barriers among China's provinces and barriers to labour mobility at the same time. We will see that in our more realistic case the hukou system can be used to prevent greater inequity. The aim of this paper is to examine whether Chinese regional policies are able to reduce inequity between the coastal area and the interior provinces and we provide some solutions as to how to reduce the income differences among costal provinces and the hinterland.

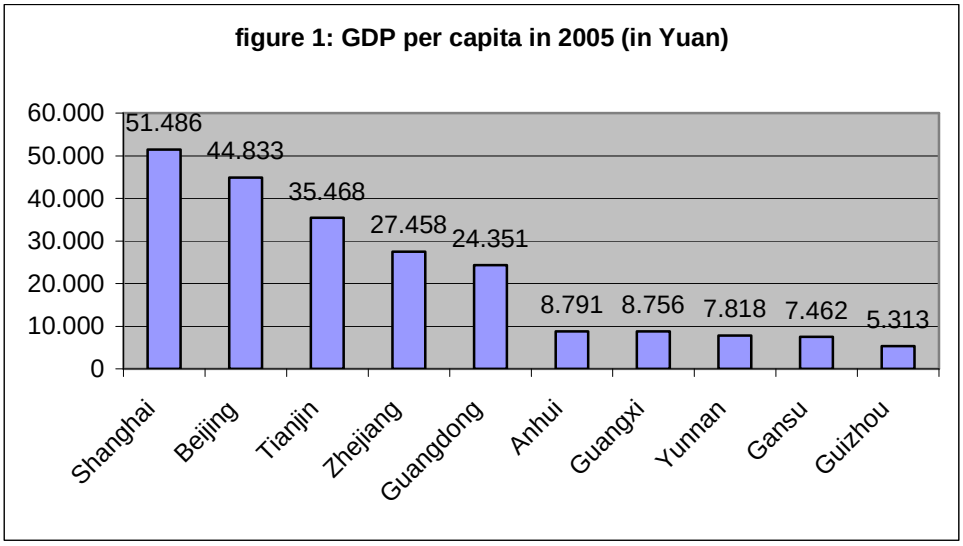
2 Regional Disparities and Migration in China

China's economic development is still astonishing. In the year 2005, the GDP was ten times as high as 15 years before. With a GDP per capita of 1404 Euro in 2005, China is still a developing country. This classification also remains when we consider that the Chinese currency is highly undervalued.[7] Not everybody can participate in the rapid growth in the same manner, because the welfare gains are unevenly distributed. There are huge differences between urban and rural areas, on the one hand. On the other hand you can see an erratic development between Chinas provinces. In our paper we will focus on the latter. Disparities between regions are not unusual for countries which are in the process of catching up. Many of them choose the so-called "unbalanced growth strategy".[8] This theory recommends that the efforts of developing industries should be concentrated in some fields. By creating development zones in the coastal area in the late 70s and early 80s the Chinese regional policy implemented this theory.

Since that time, many studies have examined the regional disparities in China. *Fujita and Hu (2001)* show that the coastal area is booming, displaying an average annual growth rate of real

[7] See Prasad and Wei (2005).
[8] See Hirschmann (1958).

GDP of 12 percent, while the interior also grows, but at a slower pace of 9% per year. So, while the "open" provinces grow faster, the interior ones are lagging behind. Figure 1 shows the differences in GDP per capita between the five richest and the five poorest provinces in China. The per capita GDP in the poorest province (Guizhou) is smaller than in Côte d'Ivoire, while the GDP in Shanghai, the richest province, is nearly 10 times as high. In this respect we have to add, that the richest two provinces Shanghai and Beijing mainly consist of the two big cities and that they include hardly any rural area. This limitation partly holds true for Tianjin. Therefore it may be helpful to compare the difference between Shanghai, Beijing and Guizhou with the differences among German federal states which have the same bias. In Germany, Hamburg and Bremen are the federal states with the highest GDP per capita (49.200 Euro respectively 38.100 Euro in 2006).[9] Similar to Shanghai and Beijing, the settlement structure in both Hamburg and Bremen is predominantly urban. The federal state with the lowest GDP per Capita in Germany is Mecklenburg-Western Pomerania (19.000 Euro in 2006). So while GPD per capita in Shanghai is 10 times as high as in Guizhou the GDP in the richest federal state, Hamburg, is 2.5 times as high as in the poorest one. This difference is considered unbearable by most German politicians. Compared to China it seems marginal.

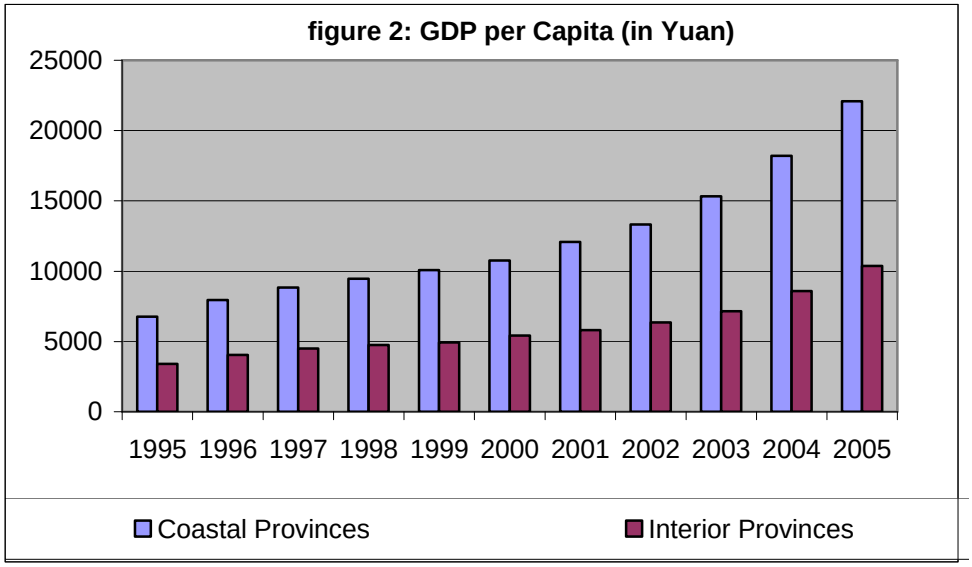


Source: National Bureau of Statistics of China.

Figure 2 shows the disparities between the coastal area and the interior over time. As can be seen from the data, the reforms which strengthened the market forces were successful. In both

[9] See Arbeitskreis VGR der Länder.

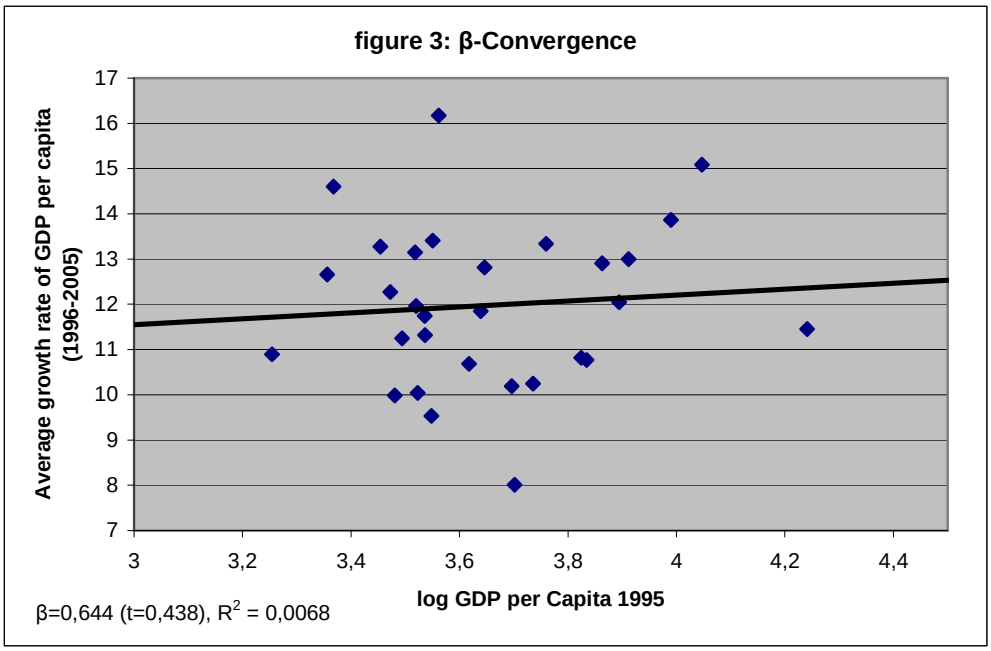
regions, wealth rose during the period under consideration, but in the coastal area GDP grew even faster than in the rest of China. While in 1981 GDP per Capita in the coastal provinces was only 1.5 times as high as in the interior provinces, this ratio rose up to 1.7 within the following three years. This divergent development is not surprising, because the open areas which could attract FDI were all situated in the coastal provinces. Since 1990, the communist party allowed more and more inland cities to promote FDI and participate in international economy. But instead of reducing the income gap between the coastal area and the interior regions, the gap grew even wider. Until 1998 the relative disparity rose up to 2.0 and has now reached 2.1. That means that people who live in the coastal region are on average twice as rich as the rest of the population.[10]



Source: National Bureau of Statistics of China.

Following *Barro and Sala-I-Martin (1995)* we examine regional convergence between the Chinese provinces by measuring the β-convergence for the years between 1995 and 2005. We regress the average annual growth rate of GDP per capita of every province on the initial level of the GDP per capita. If there is a converging process, the coefficient should be negative and statistically significant. The results in figure 3 show however that there is an insignificant positive effect. The positive coefficient rather is a sign for an increasing disparity between Chinese provinces.

[10] See National Bureau of Statistics of China.



Source: National Bureau of Statistics of China.

Many authors have examined the reasons for the stable disparities among Chinas provinces. They mainly agree that spatial concentration of industry is the reason for the imbalance.[11] But the explanations as to why the industrial production is concentrated in the coastal area are versatile. *Gao (2004)* shows that exports and FDI have a strong positive effect on regional industrial growth. *Ge (2006*) confirms these finding by using aggregate labour productivity. Furthermore, he shows that cross-regional differences in the production structure are an important source of regional disparity. *Fujita and Hu (2001)* find that the biased open-door-policy also has a significant effect on the increasing disparity. Beyond that, they show that government investment has no significant effect on the economic concentration. *Ng and Tuan (2006)* examine the high local and foreign investment in the Pearl River Delta region. They show that spatial agglomeration and strategic interaction between local and foreign firms have a decisive impact when it comes to attracting FDI. Furthermore they find that local manufacturing agglomeration has created strong industry forward linkages and has a significant positive effect on GDP. All these results indicate that industries which are export-oriented or rely on FDI are tending to locate in the coastal provinces. The WTO membership in 2001 therefore should increase the regional imbalance.

The regional GDP disparities lead to higher wages for staff and workers in the coastal area. In 2005 the average wage in the coastal provinces was 20.249 Yuan, while in the hinterland a

[11] See Bai et al. (2004), Gao (2003) and Wen (2004).

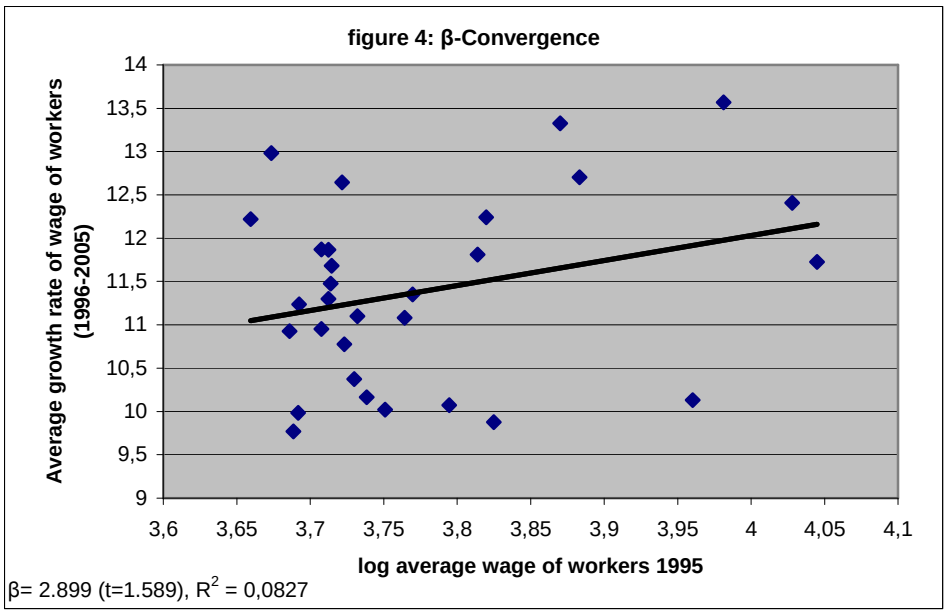
worker on average earned only 15.188 Yuan a year. The wage difference becomes dramatic if one compares Shanghai (the province with the highest average wage) and Jiangxi (the province with the lowest average wage). While a worker in Shanghai earned 34.345 Yuan the average wage in Jianxi was considerable lower (13.688 Yuan). Neoclassical theory suggests that the huge wage differences give incentive to workers to migrate from the area with low wage to the area with higher wages. Indeed, one can observe a widespread migration in China, although migration is restricted by the hukou system which aims at limiting the size of urban population.[12] This restriction lead to higher opportunity costs of migration.[13]

Zhao (1999) estimates 50 million migrants for the mid-1990's. Most of this migration is intra-provincial for two reasons. For one thing the wage differences between the rural and urban areas within a province are considerable. For another, empirical research shows that the opportunity cost of migration increase with distance.[14] For explaining the wage disparities between the Eastern part of China and interior provinces we focus only on the inter-province migration which makes up for about 30% of all migration.[15] Among these, 75% migrate to the coastal provinces. *Cai et al. (2005)* report that the number of people migrating to another province increased from 21 to 40 million between 1999 und 2003. *Johnson (2003)* estimates migration among the provinces of China by comparing the provincial populations of the years 1990 and 2000. He shows that nearly all coastal provinces attracted migrants, while most of the interior provinces lost population due to migration. There are only four provinces which do not fit into the pattern: Guangxi lost 5.6% of its population through migration although it is located on the coast and therefore has a good access to the world market. And the three interior provinces Hubei, Yunnan and Xinjiang gained population due to immigration. The migration-loss in Guangxi becomes plausible when looking at the adjacent province Guangdong. After the two mega-cities Shanghai and Beijing, Guangdong was the most attractive aim for inter provincial migrants. So with the exception of Fujian every province bordering on Guandong lost population due to migration.

Wang (2000) examines interregional rural to urban migration over time. She compares three periods (1982-87, 1985-1990 and 1995-2000) and finds out that the number of migrants over all periods grew. Compared to the first period the number of migrants in the last period was more than three times as high. Following neoclassical theory one would expect that this considerable migration should lead to an income convergence due to the increasing labour

[12] See Poncet (2006), p.386.
[13] For a more detailed description of the hukou system see Au and Henderson (2002), p.3.
[14] See Poncet (2006), p.393.
[15] See Zhao (2005), p.290.

supply in the coastal provinces and the decreasing supply in the hinterland. Measuring the β-convergence shows that there is again a positive correlation which indicates that the wage disparities get wider instead of smaller (figure 4). With a probability of error of 12% the positive correlation is almost significant. Instead of getting smaller, the wage gap seems to grow with increasing migration. This result is surprising if one considers the regional policy of the Chinese government, as within the last years the communist party tried more than ever to encourage economic and wage growth in the interior provinces. The coexistence of growing wage disparities and increasing migration suggests the existence of agglomerative forces in China, which are driven by the migration of labour. This suggestion is corroborated by empirical research which shows that migration and trade are complementary in China.[16] That means that migration flows are attracted to provinces that are more domestically integrated than the home province. Du et al. (2005) show that low population density and high transportation costs hamper industrial growth in some provinces. Both results fit to the conclusions of the models of the New Economic Geography and hence are further indications for agglomerative forces within China.



Source: National Bureau of Statistics of China.

We therefore use a model of the New Economic Geography to analyse the regional wage convergence between the hinterland and the coastal area. In contrast to the neoclassical theory, the New Economic Geography states that once an imbalance occurred, it remains stable if labour is mobile among regions. For migration from the interior provinces to the coastal areas the wage differences are the main driving force.

[16] See Poncet (2006), p.395.

3 The Basic Model

To depict the case of China we use a model of economic geography, which was developed by Paul Krugman.[17] We choose this model because it only focuses on pecuniary externalities. This is necessary due to the fact that the Chinese coastal areas are home to many different industries. Our basic model consists of several regions, two sectors (agriculture and manufacturing) as well as two homogenous and sector specific factors of production L^M and L^A.[18] The agricultural sector produces a homogenous good according to constant returns to scale and under the condition of perfect competition. The production is tied to the land hence the agricultural workers (L^A) are immobile between the different regions. In contrast manufacturing workers (L^M) are interregionally mobile. The agricultural product can be traded within and among the regions free of charge, so the price of the agricultural product p^A and hence the wage of each agricultural worker w^A is the same in both regions. Therefore the price of the agricultural good is given by the marginal costs:

$$p^A = w^A c^A , \tag{1}$$

whereas c^A is the constant input required to produce one unit of the agricultural good (q^A). The manufacturing sector produces differentiated products with increasing returns-to-scale within the framework of monopolistic competition.[19] Due to the increasing returns in production each firm produces a variant of its own. The interregional trade of differentiated goods causes transportation costs of the Iceberg-type.[20] So if a unit is shipped from region *r* to region *s*, only a fraction $1/T_{rs}$ of the original unit arrives, while the rest $(T_{rs} - 1)$ melts on its way. We assume that price elasticity is constant. Due to this assumption and the proportionality of the transportation cost to the marginal costs, firms pass the entire transportation costs to the consumers (mill-pricing). The price for a shipped manufacture therefore is:

$$p_{rs}^M = p_r^M T_{rs}^M , \tag{2}$$

whereas p_r^M is the price in the region the manufactures is produced in. To minimise transportation costs, manufacturing firms tend to produce in the region where demand is greater.

[17] See Krugman (1991) and Krugman (1992).
[18] For a detailed description of the model see Fujita et al. (1999), p.45-59.
[19] See Dixit and Stiglitz (1977) for the basic model.
[20] See Samuleson (1952).

Consumers in all regions are assumed to share the same utility function of the form:

$$U = M^{\mu} A^{1-\mu}, \qquad 0 \le \mu \le 1 \tag{3}$$

where A is the consumption of the agricultural good and M is the aggregated consumption of the varieties of manufactures. Therefore consumers will spend the share $1-\mu$ of their expenditure on the agricultural product and the share μ on manufactures. The manufactures aggregate M is defined by a CES function:

$$M = [\int_0^n m(i)^{\rho} di]^{\frac{1}{\rho}}, \qquad 0 < \rho < 1 \text{ and } \rho = 1 - \frac{1}{\sigma} \tag{4}$$

$m(i)$ denotes the consumption of each available variety i. n is the number[21] of available varieties and σ is the constant elasticity of substitution among these varieties. As one can see the utility rises with an increasing number of varieties. Therefore we can say that consumers appreciate diversity. Consider the Iceberg transport costs and that all varieties which are produced in a particular location have the same price, we define G_s, the price index in region s as:[22]

$$G_s = \left[\sum_{r=1}^{R} n_r (p_r^M T_{rs}^M)^{(1-\sigma)} \right]^{\frac{1}{(1-\sigma)}} \text{ with } s = 1,...,R, \tag{5}$$

whereas R denotes the number of different regions. The price-index displays the minimum average costs for one unit of M. To maximise the total utility U of a representative consumer we have to maximise M for a given p^A, a given price for a variant of manufactures $p^M(i)$ and a given income Y_s of a representative consumer in region s ($Y_s = GM + p^A A$). Minimising the budget constraint for a given M leads to the compensated demand for each variety of manufactures:

$$m(j)_s = \frac{\left(p_r^M (j) T_{rs} \right)^{-\sigma}}{G^{-(\sigma-1)}} M . \tag{6}$$

In the second tier we have to maximise U subject to $Y_s = GM + p^A A$. As a result we get the uncompensated demand for the agricultural good: $A = (1-\mu)\frac{Y}{p^A}$ and for the

[21] Due to the following normalizations the expression "number" is not correct. n is rather the range of varieties produced. In order to provide a suggestive approach we stick to the term number.
[22] For a detailed derivation of the price index see Fujita et al. (1999), p.45-50.

manufactures: $M = \mu \frac{Y}{G}$. Replacing M in equation (6) leads to a consumer demand for each variety of manufactures:

$$m(j)_s = \mu Y_s \frac{(p_r^M T_{rs}^M)^{-\sigma}}{G_s^{-(\sigma-1)}} \tag{7}$$

In equation (7) Y_s is not the income of a single consumer in region *s* but the aggregated income in region *s* that is $Y_s = L_s^M w_s^M + L_s^A w_s^A$. This slight redefinition is possible, because *M* is homothetic in *m(j)*. Concerning that, due to the Iceberg transportation cost, produced and consumed quantity is different, the aggregated demand for a single variety of manufactures and the transportation costs lead to a production volume:

$$q_r^M = \mu \sum_{s=1}^{R} Y_s \frac{(p_r^M T_{rs}^M)^{-\sigma}}{G_s^{-(\sigma-1)}} T_{rs}^M \tag{8}$$

The production of a quantity q^M of a variety of the manufactured good requires a fixed input of *F* and a marginal input of c^M. Due to the assumption that the fixed input is relevant also in the long-run, a new firm will always produce a new variant of the manufactures good. The required worker input for q^M is given by:

$$l^M = F + c^M q^M \tag{9}$$

Therefore the profit function of a representative firm is given by:

$$\Pi_r = p_r^M q_r^M - w_r^M (F + c^M q_r^M), \tag{10}$$

whereas w_r^M is the wage rate for manufacturing workers in region *r*. Facing a constant elasticity of substitution (σ), the profit-maximising price of a representative firm in region *r* can be determined with the help of the Amoroso-Robinson-Relation. The maximisation will lead to a price with a mark-up over marginal costs:

$$p_r^M = c^M w_r^M \left(\frac{\sigma}{\sigma - 1} \right), \tag{11}$$

Replacing p_r^M in equation (10) with equation (11), the profit of a firm in region *r* is:

$$\Pi_r = \frac{c^M w_r^M}{\sigma - 1} \left(q_r^M - \frac{F}{c^M} (\sigma - 1) \right). \tag{12}$$

Due to free market entry, firms' profits are competed to zero ($\Pi_r = 0$). Hence the equilibrium output of any manufacturing firm is:

$$q^* \equiv \frac{F(\sigma - 1)}{c^M}, \tag{13}$$

which means that the output per firm is the same in each region and not influenced by wage rates or relative demand. The equilibrium labour input therefore is $l^* \equiv F\sigma$ (equation 13 in 9). If L_r^M is the number of manufacturing workers in region *r*, and n_r is the number of varieties of the manufactured good produced in region *r*, then the amount of produced varieties in region *r* is:

$$n_r = \frac{L_r^M}{l^*} = \frac{L_r^M}{F\sigma} \tag{14}$$

Taking equation (8) and defining $q_r^M = q^*$ as well as replacing p_r^M by equation (11) leads to the nominal wage in a manufacturing firm:

$$w_r^M = \left(\frac{\sigma - 1}{\sigma c^M}\right)\left[\left(\frac{\mu}{q^*}\sum_{s=1}^{m} Y_s (T_{rs}^M)^{1-\sigma} G_s^{\sigma-1}\right)\right]^{\frac{1}{\sigma}} \tag{15}$$

Because of transportation costs and mill-pricing, the prices of manufactures differ in the two regions and hence the cost of living will be relevant for a worker's decision on where to live. The real wage of manufacturing workers in region r is given by:

$$\omega_r^M = w_r^M G_r^{-\mu} (p_r^A)^{-(1-\mu)} \tag{16}$$

In our case, it is enough to restrain the model to two regions *coastal provinces* (which is indicated by subscript 1) and *hinterland* (which is indicated by subscript 2). Doing some normalisations for the case of two regions ($p^A = w^A = c^A = 1$, $L_1^M = \lambda\mu$, $L_2^M = (1-\lambda)\mu$ and $L_1^A = L_2^A = \mu/2$) the regional income $Y_r = L_r^M w_r^M + L_r^A w_1^A$ is:

$$Y_1 = \lambda\mu w_1^M + \frac{1-\mu}{2} \qquad \text{in the coastal provinces and}$$

$$Y_2 = \lambda\mu w_2^M + \frac{1-\mu}{2} \qquad \text{in the hinterland,} \tag{17}$$

whereas λ is the proportion of all manufacturing workers which is live in the coastal provinces. Hence $(1-\lambda)$ is the proportion of all manufacturing workers which live in the interior provinces. Doing some further normalizations ($q^* = 1^* = \mu$ and $p_1^M = w_r^M$), the price

index (equation (5)) in the coastal area becomes simply:

$$G_1 = \frac{1}{\mu}\left[L_1^M (w_1^M)^{(1-\sigma)} + L_2^M (w_2 T_{21}^M)^{(1-\sigma)}\right]^{\frac{1}{1-\sigma}} \quad \text{and}$$

$$G_2 = \frac{1}{\mu}\left[L_2^M (w_2^M)^{(1-\sigma)} + L_1^M (w_1 T_{12}^M)^{(1-\sigma)}\right]^{\frac{1}{1-\sigma}} \quad \text{in the interior provinces.} \qquad (18)$$

And hence the nominal wage (equation (15)) in the coastal provinces becomes:

$$w_1^M = \left[Y_1 G_1^{(\sigma-1)} + Y_2 (T_{12}^M)^{(1-\sigma)} G_s^{(\sigma-1)}\right]^{\frac{1}{\sigma}} \quad \text{and}$$

$$w_2^M = \left[Y_2 G_2^{(\sigma-1)} + Y_1 (T_{21}^M)^{(1-\sigma)} G_1^{(\sigma-1)}\right]^{\frac{1}{\sigma}} \quad \text{in the hinterland.} \qquad (19)$$

The set of equations (16)-(19) may be regarded as a system that determines ω_r^M (given σ, μ, λ and T_{rs}) and the distribution of manufacturing workers across both regions.[23]

Following *Ludema and Wooton (1997)* we now drop the assumption of perfectly mobile manufacturing workers by implementing partly mobile workers. This extension of the original Krugman model allows us to predict the consequences of increasing or decreasing mobility costs within China more precisely. We do this by differentiating between labour demand and labour supply. The original Krugman model (with perfectly mobile workers) displays the labour demand curve. For the labour supply curve we assume that mobile workers face different mobility costs. Most of the mobility costs arise from non-pecuniary benefits that individuals enjoy from living in one country e.g. cultural background or they can be caused by the institutional setting. I.e., the differences in real wage between the two regions that have to occur to induce workers to migrate depend on the individual mobility cost. These costs are modelled with the help of a discount factor. We assume that γ_u is worker *u*'s discounting of the real wage paid in the coastal provinces whereas the same worker *u* discounts the real wage paid in the hinterland with $(1-\gamma_u)$. Hence worker *u* is indifferent between the two regions when the discounted real wages are equal:

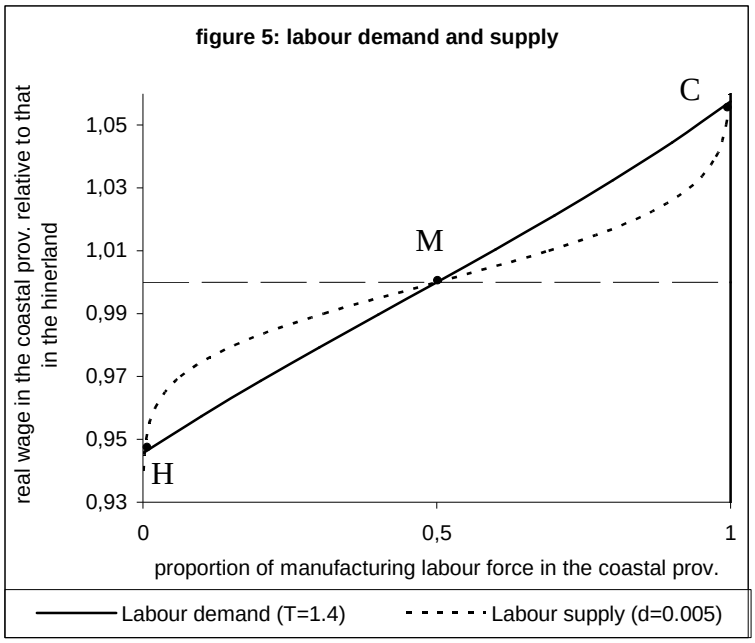
$$\gamma_u \omega_1^M = (1-\gamma_u)\omega_2^M \qquad \text{with } 0 < \gamma_u < 1 \qquad (20)$$

Thus γ_u indicates how much the real wage influences the migration decision. When γ_u is 0.5 only the real wage matters for the migration decision. When it is smaller than 0.5, the worker prefers to live in the hinterland, while when γ_u is bigger than 0.5 the worker prefers the

[23] In addition one has to respect the so called "No-Black-Hole-Condition" which states that (σ-1)/σ>μ . This condition makes sure that the economies of scale are rather small. Without that restriction there would be always a full agglomeration in one region.

coastal provinces. We also assume that the aggregated preferences of all workers are distributed normally across the interval $[0,1]$, whereas 0.5 is the mean and the standard deviation is indicated with *d*. The bigger the difference of γ_u to 0.5, the higher are the individual costs of leaving the preferred region.

To display the Chinese situation we first have to determine the labour demand which is influenced by the agglomerative forces. We assume that Chinese people spend most of their income for homogeneous no-name-products. Therefore we assume $\mu = 0.3$ which is the expenditure share for the heterogeneous manufactures. As in *Krugman (1991)* we assume the elasticity of substitution σ to be 4.[24] The crucial parameter in this model is the transportation costs T_{rs}. *Poncet (2005)* examines the inter-provincial trade barriers in China and finds that the market fragmentation along provincial borders is considerable. On the other hand China is one country which makes transportation cost considerably lower than cross border trade.[25] We therefore assume that transportation costs are $T = 1.4$ within China, which leads to strong agglomerative forces. Second we have to determine the labour supply which is influenced by migration costs. Bearing in mind that migration is constricted due to the hukou system we therefore assume high mobility costs $(d = 0.005)$. Now we can depict how partly immobile workers affect the agglomeration process.



There are three equilibriums in figure 5. Two stable ones (H and C) and one unstable equilibrium (M). Point M shows a symmetric solution. The workers are evenly distributed

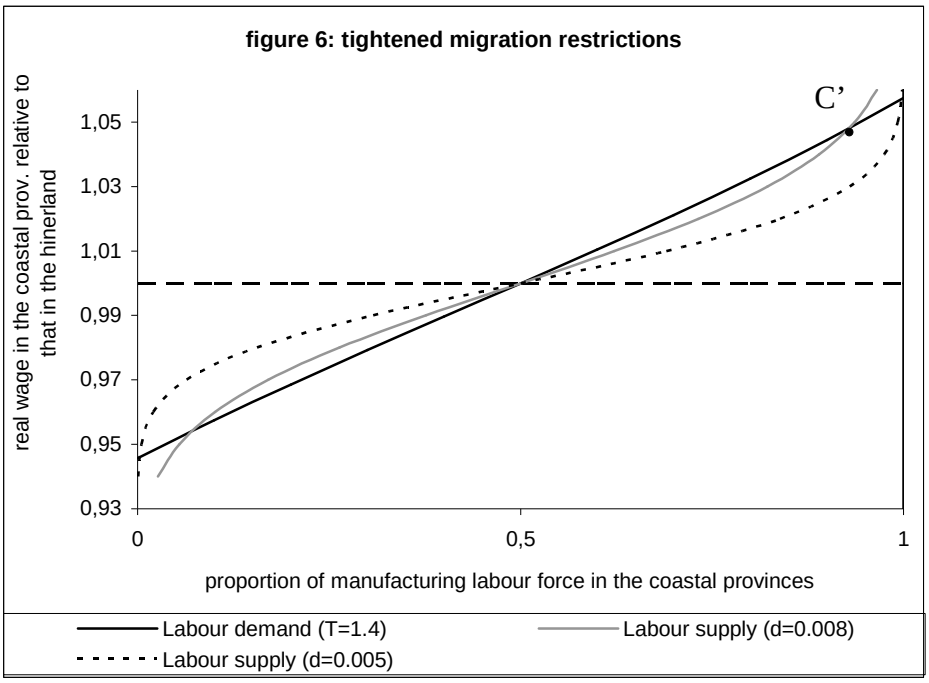
[24] See Krugman P. (1991).
[25] See McCallum (1995).

across the two regions and the real wages in the coastal provinces are the same as in the hinterland. This solution is not stable, because the migration of any worker starts an agglomeration process, which will end in point C or H. As beside these two points migration costs rise faster than the real wage in the in the agglomeration area, and the higher income cannot compensate the migration costs any longer.

4 The Case of China

Before the Chinese government decided to set up special economic zones the income disparities among the coastal and interior provinces were not dramatic. By promoting the coastal area, the communist party jump-started an agglomeration process. The wage in the coastal area rose, and more and more people tended to migrate into this area. This migration leads to additional investment in the coastal area. In figure 5 we can see that development by moving from point M to point C. The agglomerative forces were so strong that the Chinese government felt the need to interfere and restrict migration. Already in 1981 the State Council released some guidelines which restrict the employment of rural labourers in cities.[26] Above all, with the emergence of the "rural migrant wave" in 1989, the communist party tightened the migration restrictions.[27] In our model we can show the effects of this measure by raising the mobility costs *d* from 0.005 to 0.008. As one can see in figure 6, the policy action is appropriate. Without that measure, there would have been nearly a full agglomeration in the coastal provinces within the following years. In the new equilibrium C' the income differences between the coastal area and the hinterland are smaller and the share of mobile workers in the coastal provinces also declines to C'. Of course, this measure of the communist party was not an efficient one, but we do not focus on efficiency here. Au and Henderson (2004) show that the spatial agglomeration in China is insufficient in terms of efficiency. However we examine whether the regional policy leads to more equity among the provinces.

[26] See Ping and Pieke (2003), p.32.
[27] See Poncet (2006), p. 387.

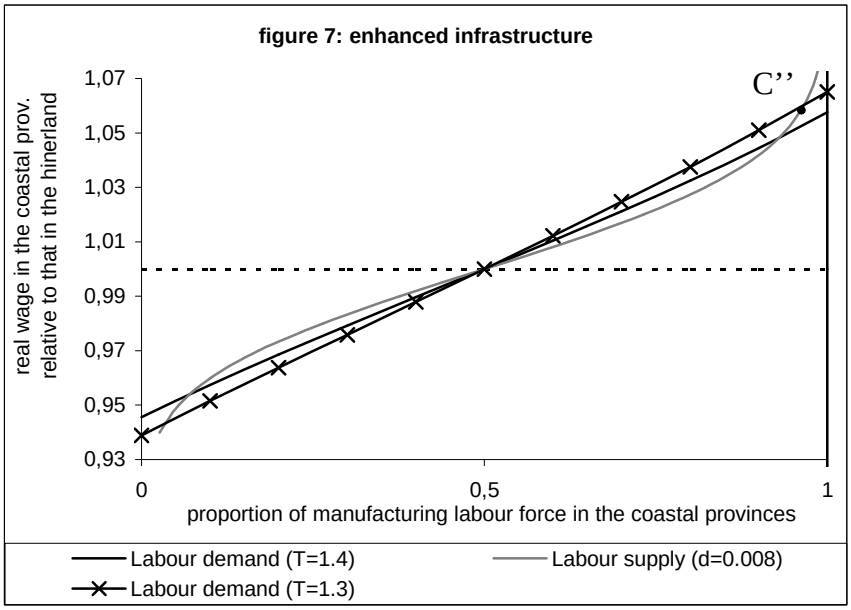


Many economists advise the Chinese government to lower migration hurdles in order to reduce disparities. We can see in our model that, as long as migration is restricted either by administrative hurdles or due to strong preferences to stay in the home region (the case of $d = 0.008$), inequities will occur among these regions. Only for low migration costs (less than $d = 0.005$) we get a corner-solution of complete agglomeration. That this kind of policy is successful in reducing income differences can be shown in the US.[28] On the one hand, income disparities in the US are very small, but on the other hand no mobile workers are left in states such as North Dakota. Many countries beside China try to prevent that sort of a scenario. The reasons to do this are more political than economic ones. Allowing migration would induce millions of workers to migrate into the coastal provinces. This mass migration would probably lead to slum-areas like the well-known "Zhejiang Village" in Beijing.[29] To reduce the agglomerative forces the communist party should develop the social security system, such as health- and unemployment insurances, especially in the rural areas of the interior provinces. This would lead to higher opportunity costs of migration and therefore lead to a higher value of *d*.

By improving the transportation infrastructure between the interior and the coastal area the Chinese government again strengthened the agglomerative forces. A well known example for such an infrastructure measure is the new railway line form Beijing to Lhasa. We can depict this case by reducing trade costs from $T = 1.4$ to $T = 1.3$. As one can see in figure 7, the

[28] See Braunerhjelm et al. (2000).
[29] See Zhao (2005) p. 305.

intersection between the labour supply $(d = 0.008)$ and the new labour demand curve $(T = 1.3)$ at point C'' describes the new equilibrium. It is obvious that in point C'' the relative real wage in the coastal area is higher than before. Therefore the disparities between the hinterland and the coastal provinces become even wider, and agglomerative forces get stronger. Instead of reducing the disparities between the hinterland and the coastal area, the above mentioned railway rather worsened the problem. Rather than enhancing the infrastructure between the coastal area and the hinterland the Chinese government should try to enhance the infrastructure within the hinterland. So the agglomerative forces within this region have to been strengthened. The same effect occurs if Chinese authorities try to reduce local protectionism to enhance inter-provincial trade. They should be prepared to be confronted with increased agglomerative forces and therefore increased migration pressure.



Last but not least China became a member of to the WTO in 2001, which favoured firms which rely on export, because international trade became cheaper.[30] The WTO accession can be interpreted as a larger market for exporting companies. The export industry is mainly located in the coastal provinces, due to the fact that the major trade partners of China are the Newly Industrializing Economies in East Asia, Japan, as well as the U.S. So coastal regions being advantaged compared to other parts of China and so the WTO accession strengthened the agglomerative forces. To reduce the disadvantage of the interior provinces the Chinese government built a port in Gwadar (Pakistan) in order to develop agglomerative forces in the western part of China. With the help of this policy measure it will be more likely that export-

[30] See Jiang (2001).

oriented companies will invest in the Western provinces and therefore migration pressure will be reduced.

5 Conclusions

The long-lasting income disparities among China's provinces stand in sharp contrast to the neoclassical theory which affirms that it would come to a harmonisation of factor income between different regions due to factor mobility. Despite huge labour migration, this effect cannot be observed in China. Referring to the GDP per capita as well as the average wage, we showed that instead of a convergence rather a divergent development can be observed among the Chinese provinces. The coexistence of increasing migration and increasing disparities suggests that agglomerative forces are at work. These forces influence the location of industrial production in China, and lead to higher wages in this area. In China most of the industrial production takes place in the core area. Higher wages in the coastal provinces are an incentive for workers from the hinterland to migrate into this area. The dimension of the agglomerative process depends crucially on transportation costs within China. The less trade costs the stronger the agglomerative forces. This link is supported by *Poncet (2006)* who finds out that migration and trade are complements in China. This result is again diametrically opposed to the neoclassical theory according to which trade and migration are substitutes.

Knowing that there is an agglomeration process, in progress, has an impact on regional policy, which aims for equal living conditions within a country. We show that in the case of agglomerative forces the hukou system can both reduce inequity, and at the same time achieve the government's aim of avoiding deserted provinces. The same effect can be reached with an increased social security standard in the disadvantaged regions. We also find out that the reduction of trade costs among the interior and the coastal provinces, e.g. due to better infrastructure, strengthens the agglomerative forces and therefore leads to higher migration pressure. The same effect can be observed as a result of Chinas WTO membership in 2001.

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