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State and market integration in China: A spatial econometrics approach to 'local protectionism'

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Abstract

In the past two decades, controversial evidence has been produced supporting the case for local protectionism in China. This paper overviews the most important contributions and presents a new approach which applies spatial econometrics on prefectural-level data. The main advantage of this method is to rely on a theoretically less biased and internal benchmark for assessing the impact of provincial borders on spatial interdependences, as we compare within province and across province growth spillovers for neighbouring prefectures. We show that provincial borders exert a strong impact on spillovers. Further, we also analyze spillovers of local public expenditures, which could be interpreted as proxies for government interventions. Again, provincial borders matter. Yet, we are cautious in interpreting this as evidence for local protectionism, and propose the notion of 'cellularity' as an alternative explanation. Cellularity results from a confluence of different factors, such as administrative structure, institutional changes and regional culture.

Key words: domestic market integration in China: local protectionism; spatial econometrics; growth spillovers; expenditure spillovers; cellularity

JEL classification: H7; O18; P23, P26; R11

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Content

1 The strange story about China's transition to a less integrated market system

Since Alwyn Young (2000) published his influential research on economic fragmentation in China, the issue has received much attention in the literature. It is of central importance for the assessment of the Chinese transition to the market. For example, in the context of the WTO the question is contentious whether local governments undermine transnational agreements by interfering locally into domestic trade. However, it is extremely difficult to establish this as an empirical fact, because direct information on local interventions is patchy and inconclusive in all dimensions, reaching from the forms of interventions to the level of government on which they are supposed to occur (Holz 2009). Therefore, a reliable quantitative approach to assess the general level of market integration is necessary.

In the recent decade, much progress was achieved in this field by broadening the scope of data and by applying more sophisticated econometric tools. However, the literature suffers from the time gaps in data availability, so that most published research so far does not apply for the period after WTO entry. Further, increasing degrees of sophistication also come with complex assumptions about causalities, which sometimes also increase the difficulties of interpreting the data, in spite of often strong statements by the researchers. These problems spring to the eye if one considers the fact that different methodologies arrive at different conclusions, as we shall see in more detail below: For example, research based on the measurement of trade barriers across provinces does not concur with results about business cycle synchronization.

This state of the art shows that there is much scope for improvement. In this paper, we present a new approach. Novelty mainly refers to our data base: We move beyond the unit of the province and analyse prefectural level integration. The main advantage of this approach is that we do not need to refer to external theoretical benchmarks or to inter-temporal comparisons to establish results about integration. Our benchmark is extracted from the current Chinese conditions. We argue that the effects of administrative borders between neighbouring prefectures should not differ substantially between the cases of intra-provincial prefectures and the cases of neighbouring prefectures belonging to different provinces. So, our benchmark is intra-provincial integration. As to the indicator, we choose growth spillovers which can be estimated via spatial econometrics techniques. These techniques are relatively free from theoretical presumptions about the underlying economic process (e.g. economies of scale) and include the standard growth determinants in the controls. This selection is certainly theoretically informed, but does not make strong commitments to the underlying model of growth.

We also think that given the limited knowledge about actual policy interventions, we should be very careful with drawing conclusions about local protectionism, also in consideration of the potentially strong impact on external economic policies of partner countries of China. As we will discuss in the next section, there is a long way to go from certain measures of integration to the claim that local protectionism is the most significant determinant. We have to distinguish neatly between 'inward orientations' in general and all border effects which are created intentionally by policy interventions. For this reason, our study includes one series of statistical estimations that consider one clear-cut policy variable: local public expenditures. Again, this variable is free from strong theoretical presumptions. It seems reasonable to assume that local expenditures exert a positive impact on local growth, and under normal conditions one would also expect an impact on growth in neighbouring spatial units. So, again, our benchmark is an internal one: We compare growth effects of public expenditures in different sets of neighbourhoods. If these are limited to an 'unnatural' degree, we regard this as a strong hint at local protectionism.

The paper proceeds as follows. In section 2 we present a brief analytical assessment of the literature. Section 3 introduces our methodology and data set. Section 4 is the main part of the paper and reports about a series of spatial econometric tests. Section 5 concludes. We are able to show that China manifests a strong impact of provincial borders on spatial interdependence of growth. This is also true for local expenditures. Even the most liberalized Eastern coastal provinces reveal a low degree of cross-provincial integration. So, China appears to be an economic federation of provincial economies and less a highly integrated economic system with a strong central government fostering and even enforcing economic integration. Yet, we remain careful in interpreting this as an equally strong evidence for local protectionism, because there are also convincing reasons why a stronger inward orientation of provincial economies may be a normal feature at this stage of China's development.

2 The state of the art: Increasing methodological sophistication, but no clear-cut conclusions

Since the early analysis by the World Bank (1994), the issue of market integration has been the object of numerous contributions applying different methodologies. Basically, we can distinguish between four approaches:

- Structural convergence of industries across provinces;
- Inter-provincial trade and trade barriers;

- Convergence of prices;
- Synchronization of business cycles.

Of these, the first two approaches are closely related, because the underlying theory is the same: Intra-regional and external trade flows cause structural adaptations of industries, and industrial structure reflects comparative advantages of provinces. Further, these approaches also show the most sophisticated pattern of reasoning because they commonly also try to include indirect measures of local government behaviour. This is possible because in the literature on the political economy of Chinese transition, the argument is commonplace that local protectionism is directly determined by certain incentives which are industry-specific. For example, some authors argue that certain industries have a higher tax plus profit margin, so that incentives for local protectionism are stronger (Bai et al. 2004). So, if perceived distortions of industry structure fit into the pattern of tax-for-profit-margins, a case for local protectionism is made.

The methodological challenges of market integration research are most evident from comparing Young's seminal paper with a recent comprehensive criticism by Holz (2009). This is also a worrying example about the possible contradictions between the speed of academic publishing and its possible impact on politics. Holz' paper goes back on research in the mid-2000's, published for the first time in a working paper of 2006. In his original contribution, Young presents a combination of most of the methodologies that we have listed above. His conclusions were stark and far-reaching: Starting out from a collection of observations on local interventions in inter-provincial trade, he based his case for local protectionism firstly on data about structural convergence of industries, next on data about price convergence and finally on data about productivity differentials and sectoral specialization, especially in agriculture. Young makes strong claims to be able to show that the story about Chinese marketization between 1978 and the late 1990s is based on a delusion, and that in fact only the locus of government control was shifted from the central to the local governments. His empirical arguments mainly rests upon: firstly, the demonstration that sectoral output shares converged, thus violating comparative advantage, secondly, that price dispersion as measured in standard deviations of log prices increased or showed irregular fluctuations, thus in any case violating the Law of one Price as a measure of market integration, and thirdly, that Chinese provinces have become more dissimilar in terms of productivities, which is especially true for agriculture, which, again, violates neoclassical trade theory.

Young's paper was based on earlier working papers that certainly exerted a strong impact on the informed public, especially taking into consideration that the World Bank (1994) had already pointed at similar observations. Criticism also set in immediately, as, for example, ventilated by Barry Naughton (2003), one of the world's leading experts on the Chinese economy. Up to now,

Holz' assessment is the most comprehensive one. According to Holz, the major difficulties with the Young approach are:

- The argument of the sectoral composition exclusively depends on neoclassical trade theory on a very high level of aggregation. If the level of industries is considered, there is much more diversification across Chinese provinces, and there is also an increasing importance of intra-industry trade which would not affect the sectoral composition on the highest level of aggregation.
- The price dispersion argument is methodologically less sophisticated than state of the art tests of the Law of one Price. The Young data can be easily explained by considering the different policy changes in the 1980s and 1990s which strongly affected the price system, and this differentially across the years. Furthermore, there is no unequivocal relation between price convergence/divergence and local government interventions. Local governments may also impose similar prices for similar goods, for many reasons.
- The data on productivities are inconclusive and depend, among others, on industries chosen; in the special case of agriculture Young confuses movements of yields with movements of excess supply, which only could explain price movements, and which, however, is not observable. Further, Young's measurements are strongly influenced by the performance of less developed Western provinces, in which the relation between yield increases and growth of labour input may be determined by high barriers to exit from agriculture.

Overviewing the entire literature on market integration in China, we can say that the results provide a very complex picture, which is a far cry from Young's pretensions.

To begin with the field where the mist seems less thick, there are relatively strong results about price convergence in China. In comparison with Young, these are based on panel data unit root tests and non linear mean reversion, which can take account of the fact that there are many reasons for absolute price convergence to fail exactly, so that relative price convergence is more powerful to test whether there are barriers to price arbitrage, especially in the longer run. Based on this methodology, Fan and Wei (2006) showed that China shows the expected patterns of the LOP, taking the impact of imperfect competition in certain industries into consideration. The data cover a period between 1993 and 2003, which clearly supports the view that China underwent market liberalization during that time (for a related result, with a different methodology testing for the impact of common shocks relative to province-specific determinants, see Xu and Voon, 2003).

There is even evidence that prices converge more in case of industries where there is an a priori suspicion of strong incentives for local government intervention (processed industrial materials and durable goods and vehicles).

On the other hand, some research on the LOP (Ritola 2008) also produces counterintuitive results, in particular on regional clustering: It seems that the most developed regions are less integrated internally than the less developed regions. This observation shows that a possible explanation of integration patterns may be that in less developed regions, there is still a stronger impact of administrative procedures, which also support price convergence, whereas in the developed regions market dynamics (imperfect competition, growing diversification of demand, etc.) supports price divergence, at least temporarily (i.e. the medium-run). This flatly contradicts the local protectionism story which builds on the assumption of strong administrative interference, which is supposed to result into price divergence.

The other strand of literature which produces relatively clear-cut results is on macroeconomic interdependences. This is also an example for the impact of the choice of level of aggregation, and the impact of the chosen methodology. Golley and Groenewold (2007) analyse the long-run interdependence of growth across Chinese macroregions and confirm the standard result that the Western regions are less integrated with the rest of China than the more developed regions. However, as they use a vector autoregressive model, they need to rely on a full series of data mixing the pre-reform and post-reform period, which does not allow identifying changes in the recent years. Further, a lower degree of integration of less developed regions is certainly what can be easily explained by gaps in infrastructure development and related factors such as communication, and does not point towards policy variables necessarily. Indeed, the business cycle approach implicitly would make very strong assumptions about the benchmark for full integration, which is basically the optimum currency area (such as perfect mobility of capital and labour). Only in this case, asymmetric external shocks would trigger perfectly synchronous business cycles. As long as the Chinese economy remains in some distance from these conditions, one would expect regional groupings in the correlation of cycles as natural outcome, which has been demonstrated empirically by Tang (1998).

More recently, Poncet and Barthélemy (2008) have applied a more sophisticated approach to identify also the determinants of desynchronization. But firstly, the good news needs emphasis: China experienced a steady increase of the degree of synchronization, and at the time of WTO entry China did not appear to differ from other large integrated economies such as the US. This general result is sometimes overshadowed by the strong effects of institutional change on business cycle dynamics: Thus, the degree of synchronization itself shows fluctuations, because in the second

half of the 1990s provinces showed more divergent paths in institutional change (e.g. privatization). Further, there is a strong impact of the external economic factor, which even contributes to a larder desynchronization among the developed Eastern provinces as compared to the Western provinces.

It is important to notice that the business cycle approach also leads to some conclusions that contradict with other measures of integration. This is a clear demonstration for the strong dose of theory that is always inside the apparently empirical analysis. A common argument, based on neoclassical conceptions of comparative advantage, states that increasing integration should lead towards increasing spatial specialization of the location of industries. That is, measurement of specialization is an indicator of integration (e.g. Bai et al. 2004). However, this implies that external shocks will be more asymmetric, so that cycle desynchronization will increase. So we would conclude that the economy is less integrated, again, with reference to the standards of the optimum currency area.

The business cycle literature is also connected with the research about domestic trade integration because in a Keynesian macroeconomic framework to business cycles demand pull would appear to be a force of synchronization. This implies that domestic barriers to trade would support desynchronization. The difficulty with this, as with all other arguments on domestic trade, is that we do not have data about bilateral trade flows. So, Poncet and Bartélemy use freight traffic data as a proxy, which is certainly very unreliable, especially through time.

To summarize, the research about business cycles and the previously abstracted research about the law of one price do not support the hypothesis that China is an exceptionally fragmented country. Almost all observations about a certain lack of integration can be easily explained as normal phenomena in the process of economic development of an area of the geographical size and complexity as China. There is no unequivocal hint at government intervention as a cause. So, why is the opinion so widespread that local protectionism has been even increasing during the transition to the market economy?

Clearly, one would need to distinguish between domestically oriented policies in general and the more narrow meaning of protectionism which would normally refer to trade flows. That is, Chinese provinces might be units that, for example, pursue partly autonomous technology policies, for sure, but do not necessarily block inter-provincial trade. Separating these different aspects is as difficult as it is on the level of global trade policy. The most advanced approaches in determining this more specific policy context have been developed by Sandra Poncet's prolific writings in the recent years. Poncet is more cautious than Young, but basically falls into his line of thinking about a 'fragmented China' (Batisse and Poncet 2004; Poncet 2005). Poncet analyzes the aggregate do-

mestic trade performance in the 1990s based on two Input-Output tables of 1992 and 1997 which allow to measure the provincial absorption and to distinguish between international trade of provinces and their domestic trade with the 'rest of China'. In that period, a relative decrease of the domestic trade volume is an established fact. Poncet use endogenous trade policy as a methodological framework to explain this observation. One central component is the estimation of border effects between Chinese provinces. Facing the lack of bilateral trade data, this has to be done by considering average distances to all other provinces for every province. This is only one example that shows that in this sort of research a lot of effort has to be spent on processing data in order to make them compatible with the methodology. Since alternatives are rarely available, there is no way to check the robustness of those procedures relative to the benchmark of using the most appropriate data.

Based on her painstaking work, Poncet reaches the conclusion that border effects became stronger between 1992 and 1997 and that they compare with cross-national border effects internationally. Her results receive additional support from the observation that for different industries and goods, different border effects match with the expectations (for example, border effects are particularly strong for agricultural goods). That is, the pattern of border effects corresponds with what we know about the preferences of local governments with regard to the support and protection of particular industries. This impression can be further supported by a direct estimation of an endogenous policy model. So, Poncet can show that labour intensity and fiscal contribution are a determinant of the level of protection granted to an industry. The idea behind this is that local governments wish to avoid unemployment and aim at maximizing tax revenue.

We have discussed Poncet's work in some more detail because it is certainly state of the art. However, the limitations are also evident. Firstly, as it came out from Poncet's own work on business cycles that we mentioned previously, the observation period might be simply special (in both years, for instance, with regard to the macroeconomic environment, whereas the business cycle research covers many more years). We cannot extrapolate these results to the new millennium. Secondly, the concept of border effects depends on many assumptions. One that deserves special attention is the notion of distance, which is treated as a proxy of trade costs. This is by no means evident, because trade costs include all sorts of transaction costs (for a survey of the literature, see Anderson and van Wincoop 2004). There are reasons to believe that transaction costs are not homogenous and correlate linearly with distance in China. Thirdly, there are also economic reasons why provinces might show an increasing inward orientation during the current stage of development in China.

The last point relates with the general observation that more advanced methodologies are also higher loaded with theoretical assumptions. One relevant assumption is the possibility of increasing returns to scale. In a scenario with institutional change and increasing returns it can be the case that over a certain period transaction costs increase because of higher uncertainty of markets and business, and at the same time one can expect that consumer demand diversifies because of rapid innovation of new products. Both factors influence important parameters of the border effect estimation. Now, if strong economic growth opens up scope for local increasing returns to scale, a picture becomes plausible where over a certain period domestic absorption increases and is covered by increasingly efficient domestic production within a province.

This is only one example for theoretical ambiguities. Ambiguities are especially strong also with reference to the political economy story of local protectionism. This is evident from one substantial contribution, namely by Bai et al. (2004) and (2008). The argument has already been made by Naughton (2003) that there is no necessary and unequivocal connection between the profitability of local enterprises and protection. This is related to the hard budget constraint under which most local governments operate and the generally high importance of performance indicators for the career of their top officials. So they will at least be reluctant to protect inefficient enterprises that might be costly to support, whereas profitable enterprises might also export into other regions. This has to be seen together with the career patterns of local cadres. Here, again, the term 'local' is especially confusing, when it comes to local protectionism. There are reasons to believe that officials on lower levels of the hierarchy have stronger incentives to protect their turf, because they have few opportunities to move up. But on this level there are also relatively limited means of protectionism available. Higher up in the hierarchy, and especially on the provincial level, career patterns are more diversified and not necessarily linked to the province where an official is currently located. In sum, the political economy story can offer plausible accounts both in favour and against local protectionism.

So we end up with an argument that is partly circular. In the more sophisticated approaches to local protectionism, the alleged distortions are seen as evidence for government interference, because this interference as such cannot be proven directly. However, the distortions themselves are not directly observable, but depend on the theoretical framework, which includes certain assumptions about the incentives for local protectionism. These conceptual problems are reinforced by the observation that the different approaches that we have overviewed do by no means result into a clear-cut account of local protectionism in China. Overall, the case for it seems weak.

3 Approaching 'cellularity' with spatial econometrics

Considering the many difficulties of the local protectionism argument, we wish to introduce a new approach. With reference to China studies, we begin with neutralizing the hypothesis by substituting 'local protectionism' by 'cellularity' (Donnithorne 1972). The notion that China is a cellular economy has been coined for understanding the Maoist period, in particular. It refers to a mix of factors that contribute to a markedly inward orientation of spatial units in China. In the pre-reform period, this was mostly the effect of the planning system (Lyons 1985). In post-reform China, this might be the result of complex developmental factors and institutional changes which include devolution of administrative tasks from the center to the regions. This is not the place to consider this complicated story, which has been translated into a number of specific models of the Chinese (political) economy, such as the regional property rights model (Herrmann-Pillath 1994, extending on Granick 1990) on the quasi-federalism model (Qian and Weingast 1996). By using the term 'cellularity' we avoid any pre-commitment to the idea that inward orientation is the result of deliberate policies, because it can also result from a confluence of a manifold of determinants.

So we think that we need a methodology that can target this phenomenon as close as possible. This is the methodology of spatial econometrics (for a survey, see Abreu et al. 2005). Spatial econometrics is mainly used for the analysis of growth, but is also increasingly applied in the analysis of spatial effects in policies of compound governments, such as federations (for a survey, see Brueckner 2003).

The idea is simple, but powerful. Firstly, space matters. In the analysis of growth, space matters, for example, because there are geographical determinants of development which have been neglected for long. This, however, is a story of absolute location in space. Secondly, relative location also matters, that is, the relative location of spatial units, such as simple neighbourhood or distance. This aspect is clearly important to understand all sorts of diffusion processes in growth, such as the diffusion of technologies. Diffusion processes, at a closer look, include the possibility of feedback mechanisms, which stay at the centre of spatial econometrics. That is, for instance, if a technology diffuses across spatial units, there are also feedbacks on the use of the technology in the originating units. The same applies for growth: If growth spills over from one unit to the other, increasing growth in the latter will spill over back to the originating unit. The important insight is that econometric estimations of convergence of growth that do not include this endogeneity will present a distorted view on the determinants of growth.

So far, this is also the research question that has been pursued with reference to China (e.g. Ying 2003; Sandberg 2004). Standard convergence analysis neglected those spatial interdependences, and thus might end up with overestimating factors such as FDI or the role of TVEs. Spatial

econometrics can therefore present a more exact view on issues such as whether China divides into different 'convergence clubs'.

In our context, we see another application of spatial econometrics. This is to define another measure of market integration. Without strong theoretical assumptions, spatial econometrics allows to directly identify the strength of spatial dependences across spatial units. We regard this as the most straightforward indicator of the 'cellularity' of spatial units in the Chinese economy. Since we are not interested into the more complex questions such as how to determine growth determinants, we can also rely on two different approaches to measuring spatial interdependence. In spatial econometrics, spatial interdependence as such is measured by the Moran's I test, which already suffices to identify interactions on the global and the local level by means of purely descriptive statistics. The econometric estimation of growth can further support the results of this test and can distinguish between growth factors and the role of interdependences, thus, according to our focus, identifying the role of the latter.

The novelty of our approach mainly results from the unique data base that we use. So far, all the research on market integration in China uses the province as a basic spatial unit. This is legitimate, but one certainly needs to consider the simple fact that Chinese provinces are of the size of an average European nation, which is, as we have seen, a fact that counts, for example, in assessing the increasing returns argument. Therefore, it seems advisable to deepen our understanding of spatial dependences in moving one level down, which is the level of the prefecture. Our data bases are the digitalized data that are published biannually in the "China Urban Statistical Yearbook" by the National Bureau of Statistics, Department for Urban Statistics. This is part of a decade long cooperation with the NBS and the China Economic Information Network, in which prefecture level data have been used to analyse regional disparities in China (Herrmann-Pillath et al., 2002a,b, 2006; for a more detailed discussion of prefecture level data, see the first article).

The prefecture (diqu) always was a sort of regional branch of the provincial government, thus having very few independent administrative functions, although it always was a unit in economic statistics. A prefecture includes both urban areas and counties. During the reforms, this system underwent many changes which were mainly pushed by the urbanization process (overview in Chung and Lam 2004). Increasingly, larger cities fused with surrounding rural areas, and furthermore, administrative upgrading in the territorial hierarchy also would improve access for many resources. As a result, the system gradually changed into a state were 'prefecture level cities' (diji shi) also obtained a more important role in administrative and policy terms. Beginning in 2002, this was also reflected in the statistics, which from now on did no longer list 'prefectures', but instead cities with the status of a prefecture, and distinguishes between the 'entire city' (quan shi)

and the 'urban districts' (shi xia qu). Generally speaking, there is a relatively close continuity between the prefectures and the prefecture level cities. There have been more changes in the composition of the prefecture level units, because often rural counties have been merged with the city proper, so changing from 'county' into 'urban district'. This boosts the size of the 'city' as compared to the 'prefecture', and might even end up with the identity of the 'shi' and the former 'diqu'.

In our context, as we consider a more recent and limited period, the prefecture or prefecture level city is a relatively stable unit in the spatial statistics, especially with reference to the provincial borders. Therefore, the many administrative changes below that level do not affect our argument. However, there are exceptions for this general rule. Unfortunately, we were forced to drop 36 prefectures, where "administrative change" was reported, since the variables for these prefectures are not compatible over time. This omission is not entirely harmless, since it can cause a selection bias: these prefectures had gross regional product significantly below average. On the other hand, most of these prefectures are clustered in particular provinces, so that the impact of omission on spatial spillovers, as measured in this paper may be not so large. Anyway, this issue calls for caution in the interpretation of our results. Moreover, as it is usual in growth regressions, given a relatively short period of our sample, we estimate a cross-section and take the averages of all dependent and independent variables to avoid potential impact of short-term business cycle fluctuations on our results.

The basic idea of our approach is the following. If we distinguish between the provincial level and the prefectural level, we can distinguish between different patterns of spatial dependence. Growth in a prefecture can be influenced by a neighbouring prefecture. Some neighbours, however, belong to another province, so that a part of the border is a provincial border. So we can check for different border effects on spatial interdependence: We can look at the entire set of prefectures and measure interdependence, or we can look at intra-provincial borders only, or cross-provincial borders only. This allows identifying different border effects without the help of a theoretical model of spatial dependences: We just compare relative effects on different levels of the spatial hierarchy. We consider this as the major methodological advantage of our approach to all others that we have reported in section 2: We operate with a minimum of theoretical presumptions, and we do not need external comparisons, as we extract our benchmark from the Chinese setting, just comparing different sets of prefectures which also are located in geographical proximity, but differ only in the feature of sharing a provincial border or not.

We have four combinations of the features of dependence and internal/external which can be combined in different ways.

Table 1: Patterns of spatial dependence

	dependence	no dependence
Within province	1	2
Across province	3	4

- 1 plus 3: If there are spatial dependences between prefectures both within and across provincial borders, this is evidence in favour of market integration and against cellularity on the provincial level.
- 2 plus 4: spatial dependences may be absent both within and between provinces. This would be a very strong support for the 'cellular economy' hypothesis even on the prefectural level.
- 1 plus 4: In this case there are spatial dependences between prefectures, if they are located in the same province. At the same time, there are no dependences across provincial borders. This would support the 'cellular' hypothesis on the provincial level.
- 2 plus 3: This case would possibly correspond to a scheme in which there is a strong command economy on the national level which supports integration on the provincial level, but a 'cellular' structure on the level below the province. This could be a plausible interpretation of the Maoist time, but would probably be caused by data problems today, because it seems highly contradictory to the established fact of market liberalization.

Now, a central piece in the spatial econometrics approach is the matrix **W** that fixes the spatial structure. There are different possibilities here, such as considering the distances between a single prefecture and all other prefectures, which would be reasonable approach if we were interested in the diffusion of growth. As our main interest focuses on the identification of border effects, we can do with a much simpler neighbourhood matrix. In this quadratic matrix of the prefectures, we assign "1" to the case that two prefectures share a border and "0" if not. We then construct two other variants of the **W** matrix. In the second variant we assign "1" only to borders between prefectures, which do not coincide with provincial borders – and therefore measure only "internal" spatial dependences within provinces. In the third variant "1" is assigned only to borders between prefectures, which coincide with provincial borders in order to measure the "external" dependences between provinces. As it is necessary in the spatial regressions, we had to exclude all pre-

fectures, which have no neighbours (or where all neighbours have been excluded because of missing data or administrative change).

Unfortunately, it also means that the sample used to estimate internal, external and total spillovers is different; for example, for external spillovers all prefectures have to be dropped, which have no borders with prefectures outside the province. Thus, we use 234 prefectures to estimate total spillovers, 223 prefectures for internal spillovers and 138 prefectures for external spillovers. For Shanghai, Beijing, Tianjin and Chongqing we treat the borders of the cities as provincial borders. For the island prefectures (on Hainan) we also take the "sea borders" to the closest continental prefecture (as it is specified in the Chinese administrative system).

4 The spatial econometrics evidence on 'cellularity' of the Chinese economy

We will now report the main results of our spatial econometrics exercises. We will begin with the standard Moran's I test which checks for spatial dependences in the descriptive statistics. We will then present two results on growth spillovers: one for the prefectures, and another for the urban areas in the prefectures. Finally, we consider the growth spillovers of public expenditures across prefectures. Our results are robust, reliable and precise: China appears to be a country that consists of relatively insulated provincial economies.

4.1 Results of Moran's I test

We apply the descriptive statistics from the spatial analysis and concentrate on the local Moran's I's, which indicate whether growth rates of a particular jurisdiction are positively or negatively influenced by the growth rates of the neighbouring territories.

To start with, we compute the "global" Moran's I's, which, as the *Table 2* shows, are highly significant and positive in for the whole sample and the sample with "internal" borders, and not significant (and negative) for the sample of cross-provincial "external" borders. This is the most simple and straightforward evidence that provincial borders matter.

Table 2: Global Moran's I

Specification	**(1)**	**(5)**	**(9)**	**(13)**	**(17)**	**(21)**	**(30)**	**(36)**	**(43)**
Moran's I	**3.982*****	**5.123*****	-1.874	**2.391****	**2.484****	-0.159	**3.877*****	**4.676*****	-1.856

Note: Moran's I is calculated for particular specifications of regressions from Tables 3-7 with numbers corresponding to the numbers in these tables, The term "specification" refers to the set of control variables and sample of observations.

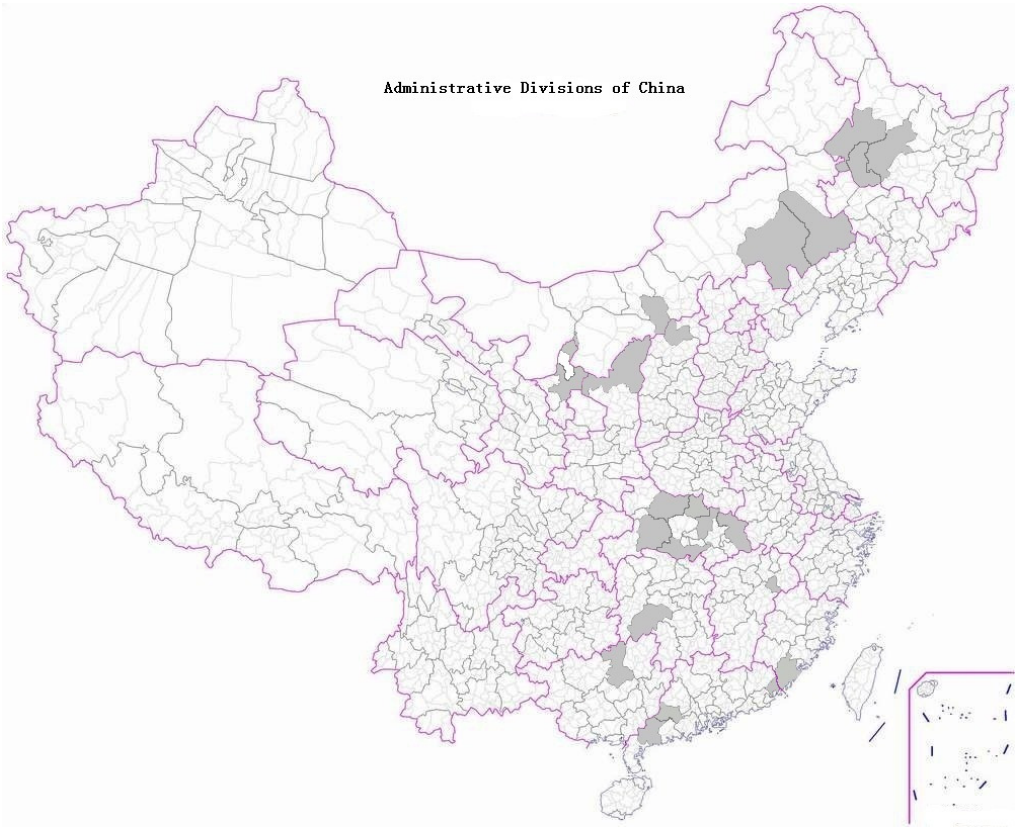
Specifications (1), (13) and (30): all borders

Specifications (5), (17) and (36): only internal borders

Specifications (9), (21) and (43): only external borders

In the next step, we "decompose" these indicators, looking at the local Moran's I's for each of the prefectures of the total sample. *Table A1* (appendix) summarizes the local Moran's I's for all prefectures in the sample, sorting them according to the size of the *z*-values. Although using *p*-values for inference for local spatial autocorrelation is problematic (Sokal et al., 1998), for simplicity we concentrate our analysis on prefectures with significant Moran's I's. This sample includes 39 prefectures, specifically five with negative Moran's I's (i.e. where growth is negatively correlated to the growth in the neighbouring jurisdictions), and the rest with positive Moran's I's (as it could be expected, this is a majority, since the global Moran's I is also positive).

Map 1: Significant cross-provincial spatial dependences in China

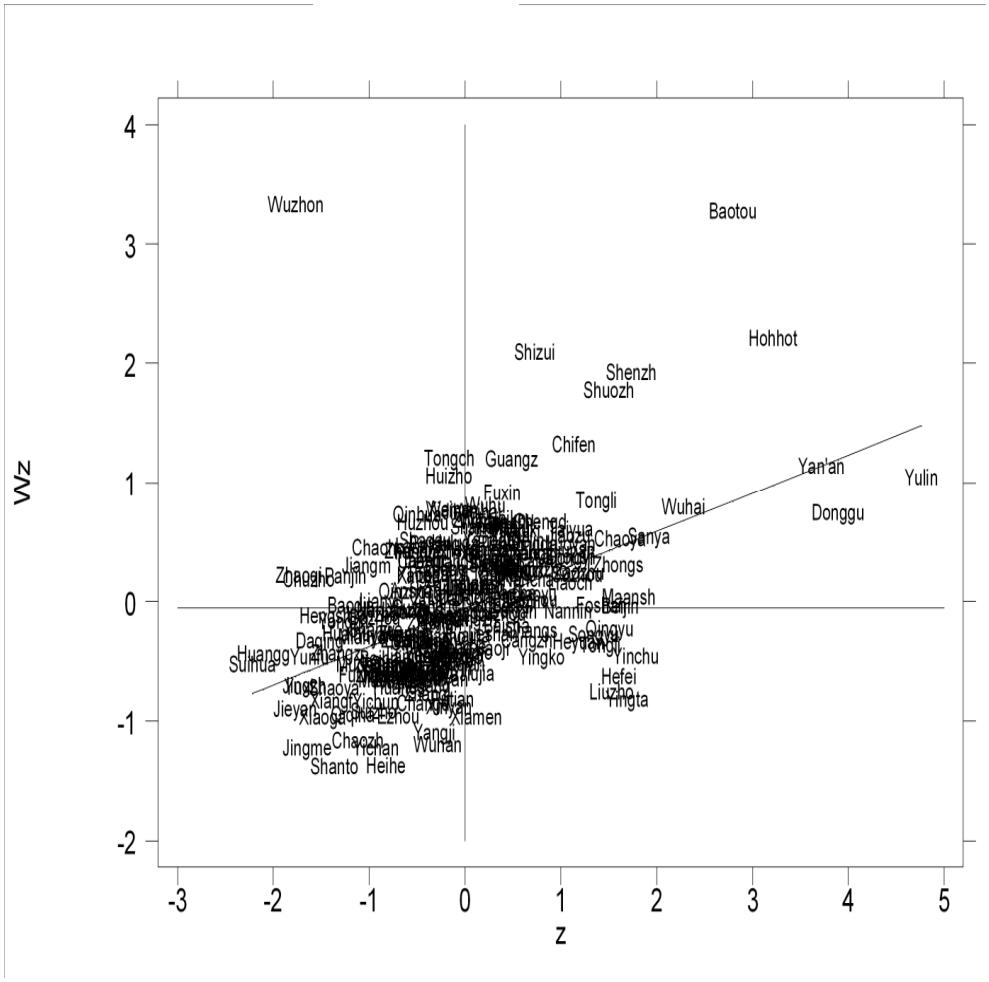


In what follows we consider the borders between these 39 prefectures. First, we allocate them according to three groups we have used so far: only internal borders, internal and external borders and only external borders. One can see that about two third of the prefectures have both external and internal borders, while one third has only borders within provinces. Second, we look at the group with internal and external borders (24 prefectures) and locate them on the map of China. Our main idea is to find out all pairs of prefectures, where both jurisdictions exhibit significant Moran'I, share a common border and are located in different provinces. The more of these pairs are there, the more problematic our results are. However, in the whole sample of 234 prefectures we find only 8 (!) where this is the case: Shizuishan (Ningxia Province) and Wuhai (Neimenggu Province), Zhangzhou (Fujian Province) and Chaozhou (Guangdong Province), Hohhot (Neimenggu Province) and Shuozhou (Shanxi Province), Yulin (Shanxi Province) and Wuzhong (Ningxia Province). Moreover, not a single prefecture of the list has to "external" neighbours with significant spillovers. All 24 regions are marked on *Map 1*.

We consider this result a cautious confirmation of our main claim: cross-provincial spatial dependences seem to be rather exceptions than rule in China. We do however urge for caution: first, because of the purely statistical reasons (indicated above), and second, since these pairs measure only the "bilateral" interdependence: it is possible, however, that the large and wealthy centre influences the growth in the surrounding prefectures, while these territories are too small to matter for the metropolitan region (Shanghai is probably the most obvious example). There is no straightforward statistical way to solve this problem: however, we address it partially by looking at the spillovers in the Yangzi River Delta and Pearl River Delta. These two regions are also interesting from the general point of view, since it is often claimed that the degree of cooperation achieved there is higher than in China in general, but, as we have seen in section 2, some results of related research shows that the degree of integration might be less than expected. Indeed, not a single prefecture of the list of 39 significant spatial spillovers is located in the Yangtse River Delta (Shanghai, Jiangsu and Zheijang Provinces); 7 are in the Pearl River Delta (Guangdong Province), but of these 7 only 2 share borders with other provinces, 5 are purely internal. Generally speaking, *Map 1* also does not indicate strong clustering of the regions with cross-border dependences in the rich eastern part of the country. In fact, 6 of 24 are located in the Hubei province.

Map 1 is also interesting in terms of the Moran scatterplot (*Figure 1*). Roughly speaking, the Moran scatterplot regresses the economic performance of the regions on the economic performance of their neighbours (to be more precise, it compares the z-values with the product of z and the weighting matrix $\mathbf{W}$). One can see that the overall mass of the prefectures is concentrated in the "high-high" and "low-low" segments of the diagram (which indicate positive correlation). The most obvious outlier from this perspective is Wuzhong, which demonstrates very low growth as opposed to the neighbourhood and is in "low-high" segment. But what is particularly important, we can also find a number of outliers in the "high-high" segment, with very high own growth and growth of the neighbourhood. One can see that of four pairs of the prefectures with significant cross-provincial dependences described above three include these outliers. So, one possible interpretation can be that in case of particularly good economic performance one observes positive effects across provincial borders, which cannot be "tamed" even by the forces of cellularity. If the performance is more moderate, cellularity becomes strong enough to prevent spillovers from emerging.

Figure 1: Moran scatterplot, full sample



To conclude, we believe that the analysis of local spatial autocorrelation provides initial support for the 'cellularity' hypothesis. We can provide further evidence by means of analyzing growth spillovers across Chinese prefectures.

4.2 Growth spillovers across Chinese prefectures: Provincial borders matter

We will now look for the presence of the growth spillovers between individual jurisdictions. In a highly cellular economy these spillovers should be very weak, i.e. growth in one jurisdiction should not influence the performance of the neighbouring jurisdiction. There are different channels through which spillovers can happen, among others:

- Linkages via trade and investment
- Imitation of policies and technologies

- Migration and knowledge diffusion
- Demand pull.

This list shows that normally we can expect spillovers, such as in the interesting case of Russia, which is also a large country with many regional subunits (Boccatello 2007).

Empirically, we apply the tools of the spatial econometrics to find out the possible spillovers. Particularly, we estimate the following regression

$$GROWTH_i = \beta_0 + \beta_n CONTROLS_i + \rho \sum_{j \in Nj} w_{ij} GROWTH_j + \varepsilon_i$$

where sub-index i indicates a particular prefecture, *GROWTH* indicates the growth rate, N^j is the set of all prefectures where $j \neq i$, while w_{ij} comes from the weighting matrix **W** describing the "neighborhood" of prefectures. In particular, we use the most obvious matrix, where all entries for prefectures sharing common borders are set to be equal to "1", and all other entries are "0". The term ρ describes the spatial spillovers: if it is significant and positive, growth in neighbouring prefectures increases growth in the prefecture; if it is negative vice versa, if it is insignificant, no spatial spillovers can be established. The estimation of this regression is likely to be subject to the problem of endogeneity, hence we apply the ML-estimator as described by Anselin (1988) to cope with this issue. In addition, we have to separate between a spatial lag model as described above and a spatial error model, where spatial correlation is present in the error term, i.e. $\varepsilon_i = \lambda W \varepsilon + v$. In this case in order to obtain predictions for the spatial spillovers one has to estimate the λ, which measures the spatial spillovers in the error term. For the purpose of robustness we estimate both spatial lag and spatial error model, although the results never change.

We include the following control variables in all regressions: GRP in the year 2000 ("initial level of the gross regional product"), total investments in fixed assets, share of medical doctors in the population (to evaluate the quality of the health system), share of students in the secondary education system in the population (to evaluate the quality of the educational system) and population growth rate. Both GRP and population growth rates are calculated as GRP (population) of the year t divided over the GRP (population) of the year t-1. GRP is corrected for inflation using provincial-level CPI. It seems obvious that several covariates may also be subject to endogeneity. For example, investments, health and medical systems may be in fact strongly influenced by the economic growth. Even the population growth may be subject to reverse causality if migration is taken into account (but also indirectly – if fertility rates are influenced by human well-being).

Hence, we face the problem of endogenous controls, which can as well bias the estimation of the spatial effect. Since it is not the primarily objective of this paper to establish the influence of the control variables on the economic growth, we use a "shortcut": estimate an additional specification where all controls are excluded and look at the results in terms of growth spillovers; then only robust results are interpreted (note that the estimations of λ and ρ in these models are expected to coincide). Summary statistics and additional information for all variables are provided in *Table A2,* appendix.

The main results are reported in *Table 3,* which shows the different estimations for the cases that we distinguished previously, i.e. including all prefectures, prefectures with internal borders only, and prefectures with external borders. Equations (1) – (4) report the spatial spillovers for different models and specifications, if all borders between prefectures are taken into account. We find a strong and robust positive spillover for both spatial lag and spatial error models, as well as exclusion and inclusion of endogenous controls. In the same way, regressions (5) – (8) report the results, when only internal borders are taken into account. In this case the positive spillovers are also present. Basically, we find that for these regressions growth in a prefecture is causing positive effects on the growth in the neighbouring jurisdictions.

The situation changes dramatically if one looks at the regressions (9) - (12), where only external borders (i.e. borders between provinces) are taken into account. For three of four regressions we find no spillovers, in one case spillovers are negative and marginally (10%) significant. So, it is reasonable to conclude that we find ourselves in the situation with strong internal spillovers, but no external spillovers, which, as mentioned above, is indicative specifically for the case of the provincial protectionism.

There is a number of further interesting observations to be discussed from the results of *Table 3.* As it is commonly the case, we find negative and significant impact of the initial GRP on the growth rates, suggesting that poorer prefectures experience faster growth. Our timeframe is certainly too short to establish the conditional β-convergence result, but it is still providing some evidence in this direction. We also find positive and significant impact of investments and healthcare system on the growth rates of the GRP; for the total sample and sample with internal spillovers there is also positive and significant impact of the population growth and education on the growth rates of the GRP (although the latter are only marginally significant). These results are consistent with the common predictions for the economic growth models; however, as mentioned, due to the reverse causality problem they should rather be interpreted as correlations than as causal links.

Table 3: Spatial spillovers for prefectures, dep. var.: average GRP growth rate (inflation-corrected), 2001-2007

	(1) ML (spatial lag)	(2) ML (spatial error)	(3) ML (spatial lag)	(4) ML (spatial error)	(5) ML (spatial lag)	(6) ML (spatial error)	(7) ML (spatial lag)	(8) ML (spatial error)	(9) ML (spatial lag)	(10) ML (spatial error)	(11) ML (spatial lag)	(12) ML (spatial error)
Initial GRP	**-0.000*** **	**-0.000*** **			**-0.000*** **	**-0.000*** **			**-0.000*** **	**-0.000*** **		
	(0.000)	**(0.000)**			**(0.000)**	**(0.000)**			**(0.000)**	**(0.000)**		
Population growth	**0.346*** **	**0.317*** **			**0.304*** **	**0.259** **			0.147	0.029		
	(0.100)	**(0.111)**			**(0.115)**	**(0.126)**			(0.232)	(0.230)		
Investments	**0.000*** **	**0.000*** **			**0.000*** **	**0.000*** **			**0.000*** **	**0.000*** **		
	(0.000)	**(0.000)**			**(0.000)**	**(0.000)**			**(0.000)**	**(0.000)**		
Education	**0.437***	**0.496***			**0.462** **	**0.471** **			0.322	0.470		
	(0.247)	**(0.275)**			**(0.213)**	**(0.218)**			(0.471)	(0.422)		
Healthcare	**0.001*** **	**0.001*** **			**0.001*** **	**0.001*** **			**0.002*** **	**0.003*** **		
	(0.000)	**(0.000)**			**(0.000)**	**(0.000)**			**(0.001)**	**(0.001)**		
Constant	0.328**	0.766***	0.620***	1.135***	0.347**	0.826***	0.572***	1.134***	0.991***	1.035***	1.131***	1.130***
	(0.128)	(0.115)	(0.103)	(0.005)	(0.149)	(0.128)	(0.080)	(0.005)	(0.259)	(0.215)	(0.109)	(0.004)
ρ	**0.366*** **		**0.454*** **		**0.385*** **		**0.496*** **		-0.050		-0.000	
	(0.087)		**(0.091)**		**(0.078)**		**(0.071)**		(0.086)		(0.096)	
λ		**0.339*** **		**0.454*** **		**0.387*** **		**0.496*** **		**-0.214***		-0.000
		(0.110)		**(0.091)**		**(0.103)**		**(0.071)**		**(0.116)**		(0.096)
External borders	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Yes
Internal borders	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No
Observations	234	234	234	234	223	223	223	223	138	138	138	138
Variance ratio	0.426	0.274	0.093	0.000	0.473	0.257	0.146	0.000	0.346	0.396	0.000	0.000
LM test ρ=0	30.045***		43.674***		39.565***		61.818***		0.449		0.000	
LM test λ=0		13.778***		43.674***		23.580***		61.818***		4.000**		0.000

Notes: numbers in parentheses are robust standard errors. * 10% significance, ** 5% significance, *** 1% significance. Significant results are marked bold

Now, in addition to the main model, we re-estimate all regressions using just the data for the prefectural capital instead of the whole prefecture. Given a very strong difference between the city and the countryside in China, it could be reasonable to exclude the impact of the rural area, since spillovers can be limited just to the cities and urban population. *Table 4* reports the results of this specification. Basically, it confirms the results of the previous regressions. We find positive spillovers both for the whole sample and within provincial borders (although their significance level is lower than in case of the *Table 3*), which survive all specifications and omission of endogenous controls. For the spillovers across provincial borders, if controls are included, both λ and ρ are

insignificant; after exclusion of controls they become significant, but LM-test cannot reject the null hypothesis (absence of spatial correlation). As for controls, we still find a negative correlation between the initial GRP and GRP growth and a positive correlation between the population growth and the GRP growth (which is now present in all three samples) and the total investments and the GRP growth. Education and healthcare do not demonstrate any significant correlation with growth, probably indicating a much higher quality of public services in cities, when simple improvements in the number of doctors and secondary education pupils does not have any impact on growth any more.

Table 4: Spatial spillovers for Chinese prefectural capitals, dep. var.: average GRP growth rate (inflation-corrected), 2001-2007

	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
Initial GRP	**-0.000*** **	**-0.000*** **			**-0.000*** **	**-0.000*** **			**-0.000*** **	**-0.000*** **		
	(0.000)	**(0.000)**			**(0.000)**	**(0.000)**			**(0.000)**	**(0.000)**		
Population growth	**0.554*** **	**0.560*** **			**0.532*** **	**0.542*** **			**0.514*** **	**0.516*** **		
	(0.105)	**(0.104)**			**(0.100)**	**(0.099)**			**(0.087)**	**(0.087)**		
Investments	**0.000*** **	**0.000*** **			**0.000*** **	**0.000*** **			**0.000*** **	**0.000*** **		
	(0.000)	**(0.000)**			**(0.000)**	**(0.000)**			**(0.000)**	**(0.000)**		
Education	0.376	0.417			0.428	0.459			0.209	0.219		
	(0.286)	(0.291)			(0.288)	(0.294)			(0.290)	(0.292)		
Healthcare	0.000	0.000			-0.000	-0.000			0.000	0.000		
	(0.000)	(0.000)			(0.000)	(0.000)			(0.000)	(0.000)		
Constant	0.402***	0.540***	0.937***	1.162***	0.439***	0.557***	0.921***	1.161***	0.651***	0.599***	1.283***	1.153***
	(0.115)	(0.110)	(0.081)	(0.007)	(0.101)	(0.105)	(0.076)	(0.007)	(0.105)	(0.085)	(0.072)	(0.005)
ρ	**0.127***		**0.193*** **		**0.113***		**0.207*** **		-0.042		**-0.112***	
	(0.066)		**(0.069)**		**(0.061)**		**(0.064)**		(0047)		**(0.062)**	
λ		**0.189** **		**0.193*** **		**0.169** **		**0.207*** **		-0.023		**-0.112***
		(0.085)		**(0.069)**		**(0.077)**		**(0.064)**		(0.096)		**(0.062)**
External borders	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Yes
Internal borders	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No
Observations	234	234	234	234	223	223	223	223	138	138	138	138
Variance ratio	0.648	0.635	0.013	0.000	0.664	0.650	0.021	0.000	0.566	0.562	0.024	0.000
LM test ρ=0	4.749**		5.929**		5.363**		9.144***		0.467		2.057	
LM test λ=0		4.869**		5.929**		5.327**		9.144***		0.063		2/057

Notes: see Table 3

We can now draw our first conclusion: The spatial econometrics of growth spillovers clearly leads to the same result as the descriptive statistics of Moran's I test. The Chinese economy manifests a stark difference in the degrees of integration within provinces and across provinces. In other

words, the possible channels of growth diffusion are blocked by provincial borders. The Chinese economy is 'cellular'. However, this observation does not necessarily imply that the blockade is erected by provincial governments intentionally, as the suspicion of 'local protectionism' suggests. Therefore, we turn to one possible approach to identify local protectionism directly.

4.3 Prefecture-level public expenditures: Targeting the local economy

We now look at one particular channel of the growth spillovers, which can exist in across Chinese prefectures: the effect of public expenditures of the prefectural budgets on the growth rates in the neighbouring provinces. Basically, we look at possible spillovers of public activity implemented at the prefectural level (for example, public goods) on the performance of neighbouring prefectures. Since expenditures are done by the prefectures, and not by provinces and the central government, their main focus is obviously on the economic performance of the own prefecture; however, given sufficient market integration and interregional mobility, these expenditures have to impact also the neighbouring territories (although the direction of impact can be different, representing both positive expenditure spillovers or, possibly expenditure competition across jurisdictions – in this case the sign should be negative). However, if mobility and market integration are restricted across provincial borders, no spillover should be present. Thus, we confirm the existence of the provincial protectionism, as above, if there are spillovers of public expenditures within provinces, but not across provincial borders.

Technically, we use the following approach: we estimate a simple OLS regression for the growth rate, where we add two additional control variables (among other mentioned above). First, we add the *own expenditures of the prefecture*; it is possible that own expenditures and expenditures of the neighbours are correlated, for example, if there is any clustering of regions according to their level of development and economic policy (what is not unlikely for China), and therefore this variable is necessary for our analysis. Second, we also add the *neighbouring expenditures:* sum of expenditures of all neighbouring prefectures. We use three definitions of the "neighbouring prefectures" for three specifications: first, we consider as "neighbours" all prefectures, which share common borders with a particular prefecture, then we exclude prefectures from other provinces ("neighbouring internal expenditures"), and then we exclude prefectures from the own province ("neighbouring external expenditures") to once again obtain an estimate of the spillovers within and across provincial borders. It should be noted that in this case the endogeneity problem is acute for own expenditures, although probably less pronounced (but also not to be excluded) for neighbouring expenditures – so, our results should be interpreted as correlations rather than causal links. Finally, we also estimate spatial models with own and external expenditures as described

above to see whether the results survive this approach and whether the neighbouring expenditures capture all the external effects across the borders of the prefectures.

Table 5 reports the results for the whole sample, when both intra-provincial borders and borders between provinces are taken into account. Regression (25) simply reports the growth equation; (26) adds the domestic expenditures; (27) includes just the neighbouring expenditures; and (28) controls for both domestic and neighbouring expenditures simultaneously. The results are interesting: we find a positive spillover from the neighborhood expenditures, but no impact of the domestic expenditures on the own growth rates. This result, however, crucially depends on the presence of Beijing in the sample, as it will be discussed in what follows. For all OLS regressions we implement two types of outlier control. First, we check the distribution of residuals, and if the normal distribution is rejected by the Jarque-Bera test, exclude outliers with large residuals as long as the test remains significant. Then only robust results are interpreted. This approach, however, does not yield any changes in terms of sign and significance of the own and neighbouring expenditures. Second, we also look at prefectures with particularly large values of expenditures, but small residuals, which could thus turn the slope of the regression line. The most interesting candidate in this context is Beijing. After exclusion of the Chinese capital city (regression (29)) both domestic and neighbouring expenditures provide positive and significant impact. The explanation for this result is straightforward: the expenditures of Beijing are too high for its growth rates, probably, because of the capital city status and functions implemented.[1] Regression (30) and (31) re-estimate the regression (28) using spatial lag and spatial error models. In both cases the expenditure spillover effect disappears, but ρ and λ are highly significant and positive once again. This is, on the one hand, a reason to be more cautious with the interpretation of our results with respect to the expenditures, but also an indication that the expenditure spillovers do not exhaust all spillovers between the Chinese prefectures.[2]

[1] Yet another outlier according to the total size of expenditures seems to be Dongguan; its exclusion from regression (29) does not change the results.

[2] In addition, one should notice that the expenditure spillovers found within a province are statistically significant, but economically relatively small, as well as the effect of the own expenditures on growth. Basically, increasing expenditures in the own jurisdiction by 10 bln. RMB (about 1 bln. EUR) in regression (29) increases the growth rates by 1.7 percent points (given the measurement units for the growth rates), what is relatively low. As for the spillovers, increase of spending in the neighboring prefectures by 10 bln. RMB increases growth by about 0.2 percent points. Given the real expenditures of Chinese prefectures (which on average made out 3 bln. RMB annually during the period of observation), even doubling public expenditures will just generate about 0.5 percent points of the economic growth – while the average annual growth rates during the period were about 13%.

Table 5: Expenditure spillovers for Chinese prefectures, both intra-provincial and provincial borders, dep. var.: average GRP growth rate (inflation-corrected), 2001-2007

	(25)	(26)	(27)	(28)	(29)	(30)	(31)
Initial GRP	**-0.000*** **	**-0.000*** **	**-0.000*** **	**-0.000*** **	**-0.000*** **	**-0.000*** **	**-0.000*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Population growth	**0.326*** **	**0.326*** **	**0.318*** **	**0.317*** **	**0.296*** **	**0.341*** **	**0.313*** **
	(0.106)	**(0.106)**	**(0.098)**	**(0.099)**	**(0.098)**	**(0.098)**	**(0.106)**
Investments	**0.000*** **	**0.000*** **	**0.000*** **	**0.000*** **	**0.000*** **	**0.000*** **	**0.000*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Education	**0.556** **	**0.556** **	**0.575** **	**0.575** **	**0.600** **	**0.447* **	**0.500* **
	(0.274)	**(0.274)**	**(0.274)**	**(0.275)**	**(0.273)**	**(0.247)**	**(0.274)**
Healthcare	**0.002*** **	**0.002*** **	**0.002*** **	**0.002*** **	**0.002*** **	**0.001*** **	**0.001*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Own expenditures		0.002		0.004	**0.017** **	0.003	0.007
		(0.011)		(0.012)	**(0.008)**	(0.009)	(0.009)
Neighbouring expenditures			**0.002* **	**0.003* **	**0.003** **	0.001	0.002
			(0.001)	**(0.001)**	**(0.002)**	(0.001)	(0.002)
Constant	0.745***	0.746***	0.749***	0.750***	0.770***	0.338***	0.767***
	(0.104)	(0.105)	(0.097)	(0.097)	(0.096)	(0.130)	(0.110)
ρ						**0.359*** **	
						(0.090)	
λ							**0.329*** **
							(0.113)
Internal borders	Yes	Yes	Yes	Yes	Yes	Yes	Yes
External borders	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Beijing	Yes	Yes	Yes	Yes	No	Yes	Yes
Observations	234	234	234	234	233	234	234
R^2	0.374	0.375	0.380	0.381	0.401		
J.-B. test	122.2***	121.0***	140.9***	138.6***	124.5***		
Variance ratio						0.428	0.284
LM test ρ=0						28.004***	
LM test λ=0							12.802***

Note: see Table 3. Outliers (Jarque-Bera test) are Yulin[3] and Yan'an in regressions (25)-(29). After exclusion of outliers education in regressions (25)-(28) becomes insignificant, but still has the same sign. Signs and significance of other variables do not change

[3] We refer in all tables to the Yulin prefecture in the Shanxi province (榆林市); hence both outlier prefectures are in the northern part of China in Shanxi, and also share a common border. Hence, the outliers are somewhat consistent, making our estimation approach more convincing.

Table 6: Expenditure spillovers for Chinese prefectures, provincial borders excluded, dep. var.: average GRP growth rate (inflation-corrected), 2001-2007

	(32)	(33)	(34)	(35)	(36)	(37)
Initial GRP	**-0.000*** **	**-0.000*** **	**-0.000*** **	**-0.000*** **	**-0.000*** **	**-0.000*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Population growth	**0.311*** **	**0.289*** **	**0.283*** **	**0.254*** **	**0.265*** **	**0.251** **
	(0.105)	**(0.101)**	**(0.090)**	**(0.081)**	**(0.102)**	**(0.105)**
Investments	**0.000*** **	**0.000*** **	**0.000*** **	**0.000*** **	**0.000*** **	**0.000*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Education	**0.576** **	**0.505* **	**0.601** **	**0.528* **	**0.427** **	**0.405* **
	(0.274)	**(0.272)**	**(0.273)**	**(0.270)**	**(0.216)**	**(0.223)**
Healthcare	**0.002*** **	**0.001** **	**0.002*** **	**0.001** **	0.001	0.001
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	(0.000)	(0.000)
Own expenditures		**0.059** **		**0.065** **	**0.050** **	**0.055** **
		(0.027)		**(0.028)**	**(0.024)**	**(0.023)**
Neighbouring internal			**0.006* **	**0.007** **	0.004	**0.006* **
			(0.003)	**(0.003)**	(0.003)	**(0.003)**
Constant	0.760***	0.794***	0.781***	0.823***	0.414***	0.838***
	(0.104)	(0.100)	(0.088)	(0.080)	(0.141)	(0.106)
ρ					**0.365*** **	
					(0.079)	
λ						**0.356*** **
						(0.108)
Internal borders	Yes	Yes	Yes	Yes	Yes	Yes
External borders	No	No	No	No	No	No
Observations	223	223	223	223	223	223
R^2	0.401	0.422	0.41	0.434		
J.-B. test	129.8***	104.0***	153.1***	131.7***		
Variance ratio					0.496	0.302
LM test ρ=0					36.210***	
LM test λ=0						19.146***

Note: see Table 3. Outliers (Jarque-Bera test) are Yulin and Yan'an in regressions (32)-(35). After exclusion of outliers education in regressions (32), (33), (35) becomes insignificant, but still holds its sign.

In the *Table 6* we re-estimate all equations, if only borders between provinces are taken into account. At this stage we use, for consistency, the sample identical to that applied for estimating growth spillovers within provinces in *Table 4.* Therefore we re-estimate all regressions, with the exception of that where Beijing is dropped (simply because Beijing is excluded from the sample, because all its borders coincide with the borders of provinces).[4] Our results are once again consistent with what was reported previously. We find positive effects from the own expenditures in all

[4] We checked for the exclusion of Dongguan in regression (35), and did not find any differences

specifications (both OLS and spatial models), but also establish positive expenditure spillovers in all OLS specifications, as well as in the spatial error model. Thus, it indeed looks like expenditures of prefectures do cause growth in the neighbouring prefectures, if they are in the same province.

Table 7: Expenditure spillovers for Chinese prefectures, only provincial borders, dep. var.: average GRP growth rate (inflation-corrected), 2001-2007

	(38)	**(39)**	**(40)**	**(41)**	**(42)**	**(43)**	**(44)**
Initial GRP	**-0.000*** **	**-0.000*** **	**-0.000*** **	**-0.000*** **	**-0.000*** **	**-0.000*** **	**-0.000*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Population growth	0.177	0.177	0.182	0.181	0.154	0.143	0.034
	(0.237)	(0.238)	(0.241)	(0.242)	(0.251)	(0.234)	(0.235)
Investments	**0.000*** **	**0.000*** **	**0.000*** **	**0.000*** **	**0.000*** **	**0.000*** **	**0.000*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Education	0.303	0.306	0.327	0.335	0.502	0.364	0.491
	(0.468)	(0.474)	(0.470)	(0.478)	(0.472)	(0.479)	(0.426)
Healthcare	**0.002*** **	**0.002*** **	**0.002*** **	**0.002*** **	**0.002*** **	**0.002*** **	**0.003*** **
	(0.001)	**(0.001)**	**(0.001)**	**(0.001)**	**(0.001)**	**(0.001)**	**(0.001)**
Own expenditures		0.002		0.005	**0.021** **	0.005	0.005
		(0.015)		(0.015)	**(0.010)**	(0.014)	(0.016)
Neighbouring external			0.002	0.002	0.003	0.003	0.002
			(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Constant	0.906***	0.907***	0.898***	0.899***	0.914***	1.006***	1.029***
	(0.235)	(0.236)	(0.239)	(0.240)	(0.250)	(0.262)	(0.220)
ρ						-0.065	
						(0.087)	
λ							**-0.211***
							(0.116)
Internal borders	No	No	No	No	No	No	No
External borders	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Beijing	Yes	Yes	Yes	Yes	No	Yes	Yes
Observations	138	138	138	138	137	138	138
R^2	0.343	0.343	0.347	0.347	0.387		
J.-B. test	123.3***	121.9***	133.7***	131.0***	96.49***		
Variance ratio						0.350	0.391
LM test ρ=0						0.732	
LM test λ=0							3.904**

Note: see Table 3. Outlier (Jarque-Bera test) is Yulin in regressions (38) – (41). No changes after exclusion of outliers in terms of sign and significance are observed

Finally, *Table 7* reports the estimates for borders between prefectures, which coincide with the provincial borders. Once again, we take the sample consistent with that used for cross-provincial spillovers in *Table 4.* In this case we find no spillover effects from the expenditures of the neighbouring jurisdictions regarding of the specification.

We have stressed several times that we always used the sample consistent with the spatial models for growth spillovers discussed above. This approach has advantages (since we test the expenditure and the growth spillovers in the same sample), but it is also necessary to look at expenditure spillovers in the full sample of 234 prefectures, since, unlike spatial models, OLS allows for including regions without any neighbors. *Table 8* provides respective estimates for spillovers within and across provincial borders (since estimates when all borders for this sample have already been reported in *Table 5*). We apply the variables of the neighbouring internal expenditures and the neighbouring external expenditures in the following way: if the prefecture has no borders, which coincide the provincial borders, we set neighbouring external expenditures to be zero, and if all borders coincide with provincial borders, neighbouring internal expenditures are set be zero. In the first four specifications we use just one of these two variables (each time, including and excluding Beijing); in the last two specifications both external and internal expenditures are present simultaneously (once again, with and without Beijing). The results confirm our expectations: we find a significant and positive spillover effect of the expenditures within provincial borders and no spillover effect across provincial borders, even if both variable are controlled for in the same regression.[5]

To conclude, the empirical results seem to confirm our prediction of the provincial protectionism. However, the confirmation is not entirely robust, since we find also no significant internal spillovers for (some specifications of) the spatial models, but also especially because of the problem of endogeneity, which makes the reported results correlations rather than causal links.

[5] The result is also reassuring, since it could indicate that the outcomes of the growth spillover analysis are not driven just by differences in the sample composition

Table 8: Expenditure spillovers for Chinese prefectures, full sample, internal and external spillovers, dep. var.: average GRP growth rate (inflation-corrected), 2001-2007

	(45)	(46)	(47)	(48)	(49)	(50)
Initial GRP	**-0.000*** **	**-0.000*** **	**-0.000*** **	**-0.000*** **	**-0.000*** **	**-0.000*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Population growth	**0.297*** **	**0.275*** **	**0.328*** **	**0.310*** **	**0.299*** **	**0.277*** **
	(0.092)	**(0.091)**	**(0.107)**	**(0.108)**	**(0.093)**	**(0.091)**
Investments	**0.000*** **	**0.000*** **	**0.000*** **	**0.000*** **	**0.000*** **	**0.000*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Education	**0.569** **	**0.592** **	**0.562** **	**0.584** **	**0.576** **	**0.602** **
	(0.273)	**(0.270)**	**(0.275)**	**(0.273)**	**(0.274)**	**(0.271)**
Healthcare	**0.002*** **	**0.002*** **	**0.002*** **	**0.002*** **	**0.002*** **	**0.002*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Own expenditures	0.007	**0.020** **	0.002	**0.014***	0.007	**0.021** **
	(0.012)	**(0.009)**	(0.011)	**(0.008)**	(0.012)	**(0.009)**
Neighbouring internal	**0.005***	**0.006** **			**0.006***	**0.006** **
	(0.003)	**(0.003)**			**(0.003)**	**(0.003)**
Neighbouring external			0.001	0.002	0.001	0.002
			(0.002)	(0.002)	(0.002)	(0.002)
Constant	0.770***	0.791***	0.742***	0.759***	0.767***	0.787***
	(0.091)	(0.089)	(0.106)	(0.107)	(0.091)	(0.089)
Beijing	Yes	No	Yes	No	Yes	No
Observations	234	233	234	233	234	233
R^2	0.383	0.403	0.375	0.394	0.384	0.405
J.-B. test	139.9***	125.8***	125.2***	112.1***	145.1***	130.9***

Notes: see Table 3. Outliers are Yulin and Yan'an in all regressions. After the exclusion of outliers, education in regression (45), (47), (48), (49) becomes insignificant, but maintains its sign; own expenditures in regression (48) become insignificant, but maintain their sign. There are no further changes in terms of sign and significance.

5 Conclusion: Why cellularity?

Our results clearly establish the fact that provincial borders block economic spillovers. This also applies for spillovers of local public expenditures. Does that imply that we establish a case for local protectionism?

In the case of local public expenditures, the most straightforward argument refers to the demand side: Prefectures might block external suppliers of goods and services and favour domestic suppliers. In the many accounts of local protectionism, there is evidence on this, for sure. This does not only refer to investment, but maybe even more so for consumption. However, protectionism

may be evident if a city favours local car producers for public transport, but less so if local beer is served at dinners, because the latter may indeed reflect a local preference. Other effects of local expenditures are less clear-cut. For example, investment into roads might favour internal transport. But this argument seems short-sighted, because even in the protectionism story, local governments would love local companies to export to other locations. After all, transport is a two-way process. Finally, there are many effects of public expenditures that are emphasized in the fiscal competition literature that cannot be stopped by protectionist measures of any kind. The most straightforward one is not yet considered in this paper and will be the object of a follow-up: This is that local expenditures may induce expenditures in other places, which in turn foster local growth. That is, expenditure competition can be an indirect mechanism of growth spillovers.

This brief consideration shows that even in the case of local expenditures, the case for local protectionism is not as clear-cut as it seems on first sight. With regard to growth spillovers and spatial dependence in general, the story is even more opaque. One simple argument refers to the fact that local protectionism would not simply block spillovers, but might cause other spatial dependences. For example, if protectionism reduces exports of neighbouring provinces into the protectionist province, this would possibly cause reductions in growth that would feed back to the latter. Protectionism is not necessarily equal to spatial isolation, especially because it can only target particular industries or even companies. One can raise serious doubts whether local protectionist measures can accumulate such a strong force that aggregate macroeconomic effects on growth become visible. This simple argument might explain, why, as Holz (2009) demonstrates, the central government shows concern about local protectionism, but does not make great fuss about it.

Yet, our results are unequivocal: Chinese provinces are cellular units, viewed under the lense of spatial econometrics. We think that a cautious, but very interesting argument explaining this phenomenon has to refer to a complex mix of determinants:

Firstly, certainly we have to acknowledge the impact of administrative structure, with or without explicit protectionism. In the past 30 years, the legacy of the Chinese planning system has casted long shadows, which was designed as a matrix of vertical and horizontal structures (the so-called 'tiao-kuai'). The old system assigned a strong role to provinces in the allocation of many goods and services. Therefore, there is no need to assume a 'master mind' behind a large range of administrative practices that insulate the provincial economies from each other.

Secondly, this argument, however, does not explain why the effects are still strong even in the most developed and obviously liberalized provinces of China. This observation points towards a set of economic factors, which also have been ventilated in the literature in different contexts. One is the fact that over the past twenty years, the coastal provinces showed different patterns of ex-

ternal integration into the world economy. The other is that the provinces also manifested markedly divergent patterns of institutional change. Institutional change is interesting for two reasons. One is that different institutional contexts might favour certain economic interactions (e.g. public-public and private-private, but less public-private), which can result into aggregate patterns. The other is that in the past, institutional change certainly increased the level of transaction costs. So, one reason for the insulation might be that there is a steep increase of transaction costs cross-border. This is plausible if we consider the fact that business in China still heavily relies on government relations. Thus, for a businessman from Zhejiang province it might be much easier to do business within Zhejiang province that in neighbouring Jiangsu province.

Thirdly, the point about transaction costs can be seen in the broader context of the sociocultural differences across Chinese provinces. Chinese business practice heavily relies on social networks. There are strong feelings of separate social identities, for example, separating Shanghainese businesspeople from non-Shanghainese. One factor contributing to these are dialectal differences, which are especially pronounced across the coastal provinces (language has been identified as a determinant of trade costs in international trade many times). Shanghainese cannot be understood by people from other provinces. If social networks are an important medium to cope with uncertainty, then we can expect that there are strong border effects if provincial borders also reflect cultural borders. This is true for a substantial part of the coastal region (Guangdong, Fujian, Shanghai etc.), but much less so for the central and northern regions. Cultural identities also go far beyond this role of linguistic differences and include many aspects of business behaviour, in particular.

Fourthly, we have already mentioned that there is the possibility of an interaction between demand diversification and economies of scale during rapid growth. For example, in the past decade there were many efforts at creating brands in China, including many local brands. Even without protectionism, such brands might meet consumer demand which might evolve a strong local preference, resulting into a growing, not diminishing home market effect. Strong growth of disposable income will support this and allows exploiting economies of scale on part of local producers. That is, sociocultural and economic effects might play together and produce an increasing 'inward orientiation' of provincial economies.

To summarize, we think that the results of the spatial econometrics can be most cautiously, but perhaps even best explained as the reflection of a set of social, political and economic forces that conjointly produce a pattern of 'cellularity' in the Chinese economy. In this pattern, local protectionism plays a role, but cannot be assigned to the role of the dominant factor. From this we con-

clude that great care should be applied when blaming politics for certain difficulties in market access in China.

A final observation: One interesting aspect of the Chinese economy is the resilience of growth, concurrent with increasing disparities. This is a pattern that could be explained straightforwardly by the phenomenon of cellularity. Chinese provinces are relatively autonomous in terms of growth dynamics. That means, in turn, that they have to build on their internal capacities to foster growth. This implies that generic aspects of the Chinese transition (liberalization, business culture etc.) support a generic regime of high growth, which, however, translates into divergent growth if local capacities differ, and if growth spillovers are weak.

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Appendix

Table A1: Local Moran's I

Note: I denotes internal borders only, IE internal and external borders

Prefecture	Local Moran's I	z-statistics	p-value	Border
Wuzhong	-5.805	-8.313	0.000	IE
Hefei	-1.114	-2.259	0.012	I
Liuzhou	-1.266	-1.808	0.035	IE
Yingtan	-1.494	-1.507	0.066	IE
Yinchuan	-0.928	-1.324	0.093	I
Songyuan	-0.456	-1.224	0.111	
Qingyuan	-0.445	-1.105	0.135	
Heyuan	-0.475	-1.074	0.141	
Tongling	-0.604	-1.054	0.146	
Chaohu	-0.353	-1.011	0.156	
Yingkou	-0.427	-0.743	0.229	
Qinhuangdao	-0.337	-0.678	0.249	
Chuzhou	-0.205	-0.582	0.280	
Jiangmen	-0.247	-0.554	0.290	
Cangzhou	-0.246	-0.552	0.290	
Zhaoqing	-0.271	-0.544	0.293	
Huzhou	-0.265	-0.531	0.298	
Changsha	-0.215	-0.527	0.299	
Shaoguan	-0.189	-0.462	0.322	
Zhangjiakou	-0.215	-0.429	0.334	
Huizhou	-0.172	-0.419	0.338	
Beijing	-0.163	-0.397	0.346	
Langfang	-0.197	-0.393	0.347	
Fushun	-0.167	-0.371	0.355	
Foshan	-0.14	-0.367	0.357	
Tongchuan	-0.192	-0.329	0.371	
Panjin	-0.184	-0.317	0.376	
Puyang	-0.133	-0.293	0.385	
Nanning	-0.156	-0.266	0.395	
Baoji	-0.13	-0.256	0.399	
Xianyang	-0.109	-0.24	0.405	
Changchun	-0.12	-0.236	0.407	
Weinan	-0.097	-0.212	0.416	
Jiujiang	-0.084	-0.199	0.421	
Xingtai	-0.071	-0.167	0.434	
Xiamen	-0.121	-0.167	0.434	

Baishan	-0.113	-0.156	0.438
Kaifeng	-0.078	-0.151	0.440
Tianshui	-0.141	-0.138	0.445
Guigang	-0.071	-0.136	0.446
Leshan	-0.096	-0.132	0.447
Tonghua	-0.057	-0.131	0.448
Quzhou	-0.06	-0.113	0.455
Benxi	-0.05	-0.105	0.458
Nanjing	-0.034	-0.075	0.470
Fangchenggang	-0.057	-0.075	0.470
Maanshan	-0.045	-0.071	0.472
Dezhou	-0.035	-0.07	0.472
Shaoxing	-0.035	-0.07	0.472
Huludao	-0.043	-0.069	0.473
Jinan	-0.033	-0.065	0.474
Huangshan	-0.041	-0.064	0.474
Luohe	-0.043	-0.056	0.478
Zhenjiang	-0.03	-0.053	0.479
Xinxiang	-0.02	-0.046	0.482
Datong	-0.021	-0.029	0.489
Yangzhou	-0.015	-0.027	0.489
Anshan	-0.013	-0.025	0.490
Xuzhou	-0.014	-0.024	0.490
Qinzhou	-0.015	-0.024	0.490
Jilin	-0.009	-0.013	0.495
Nanchong	-0.009	-0.01	0.496
Jingdezhen	-0.013	-0.008	0.497
Hangzhou	-0.006	-0.005	0.498
Huainan	-0.004	0.001	0.499
Taizhou	0	0.008	0.497
Jinhua	0.001	0.01	0.496
Dandong	0	0.01	0.496
Liaoyuan	0.002	0.013	0.495
Liaoyang	0.002	0.013	0.495
Baicheng	0.003	0.015	0.494
Xuchang	0.008	0.026	0.490
Zhuzhou	0.008	0.028	0.489
Huaibei	0.012	0.033	0.487
Ganzhou	0.009	0.033	0.487
Dalian	0.016	0.035	0.486
Jinzhou	0.011	0.037	0.485
Suqian	0.02	0.061	0.476
Yancheng	0.029	0.075	0.470
Wenzhou	0.057	0.087	0.465
Nanchang	0.083	0.088	0.465
Lanzhou	0.084	0.089	0.465

Baiyin	0.084	0.089	0.465
Qujing	0.061	0.094	0.463
Weihai	0.091	0.097	0.461
Guang'an	0.045	0.101	0.460
Xi'an	0.051	0.112	0.455
Shangqiu	0.053	0.118	0.453
Yibin	0.066	0.123	0.451
Shanghai	0.066	0.125	0.450
Chenzhou	0.047	0.129	0.449
Hebi	0.089	0.133	0.447
Dazhou	0.061	0.134	0.447
Suzhou	0.055	0.135	0.446
Lianyungang	0.055	0.135	0.446
Taizhou	0.05	0.136	0.446
Nanyang	0.049	0.145	0.443
Zhuhai	0.07	0.15	0.440
Sanmenxia	0.083	0.154	0.439
Guiyang	0.156	0.162	0.436
Nantong	0.07	0.17	0.432
Putian	0.118	0.175	0.431
Ningbo	0.083	0.178	0.429
Zigong	0.086	0.184	0.427
Huai'an	0.078	0.188	0.426
Xiangtan	0.089	0.19	0.424
Pingdingshan	0.08	0.192	0.424
Jiaxing	0.073	0.195	0.423
Pingxiang	0.135	0.2	0.421
Yangquan	0.113	0.207	0.418
Shenyang	0.067	0.208	0.418
Anyang	0.088	0.21	0.417
Chengdu	0.233	0.24	0.405
Changzhou	0.103	0.244	0.404
Neijiang	0.138	0.25	0.401
Chongqing	0.091	0.259	0.398
Jining	0.11	0.26	0.397
Linyi	0.086	0.262	0.397
Jincheng	0.145	0.262	0.397
Handan	0.102	0.265	0.395
liuan	0.096	0.271	0.393
Liaocheng	0.108	0.281	0.389
Wuhu	0.157	0.284	0.388
Rizhao	0.157	0.284	0.388
Nanping	0.122	0.288	0.387
Bengbu	0.116	0.302	0.381
Baoding	0.11	0.311	0.378
Weifang	0.121	0.314	0.377

Suining	0.148	0.347	0.364
Hanzhong	0.169	0.352	0.362
Zhoushan	0.347	0.356	0.361
Laiwu	0.213	0.382	0.351
Zaozhuang	0.215	0.386	0.350
Xinyang	0.155	0.398	0.345
Liupanshui	0.41	0.419	0.338
Yulin	0.165	0.423	0.336
Zunyi	0.239	0.428	0.334
Yantai	0.239	0.428	0.334
Bozhou	0.186	0.434	0.332
Suzhou	0.188	0.439	0.331
Haikou	0.303	0.44	0.330
Jinzhong	0.172	0.44	0.330
Fuyang	0.213	0.442	0.329
Shuangyashan	0.253	0.452	0.326
Tangshan	0.225	0.466	0.320
Anqing	0.2	0.466	0.320
Zhangjiajie	0.33	0.479	0.316
Hegang	0.331	0.481	0.315
Yueyang	0.19	0.485	0.314
Dongying	0.337	0.489	0.312
Zibo	0.196	0.503	0.308
Longyan	0.217	0.504	0.307
Luzhou	0.226	0.525	0.300
Zhanjiang	0.254	0.526	0.299
Changzhi	0.227	0.528	0.299
Qingdao	0.298	0.533	0.297
Siping	0.212	0.542	0.294
Shijiazhuang	0.235	0.547	0.292
Deyang	0.323	0.576	0.282
Zhengzhou	0.226	0.577	0.282
Shanwei	0.279	0.578	0.282
Guizhou	0.25	0.58	0.281
Tianjin	0.281	0.581	0.280
Tai'an	0.229	0.585	0.279
Hengshui	0.268	0.62	0.268
Loudi	0.247	0.63	0.264
Yangjiang	0.37	0.659	0.255
Tieling	0.29	0.671	0.251
Fuxin	0.329	0.679	0.249
Yongzhou	0.294	0.681	0.248
Wuxi	0.331	0.682	0.247
Yiyang	0.307	0.71	0.239
Qitaihe	0.31	0.716	0.237
Guangyuan	0.403	0.717	0.237

Jiamusi	0.321	0.741	0.229	
Meizhou	0.27	0.743	0.229	
Shiyan	0.425	0.756	0.225	
Kunming	0.54	0.78	0.218	
Mianyang	0.391	0.805	0.210	
Zhongshan	0.394	0.811	0.209	
Beihai	0.477	0.846	0.199	
Taiyuan	0.603	0.871	0.192	
Harbin	0.291	0.911	0.181	
Wuhan	0.364	0.922	0.178	
Sanya	0.922	0.937	0.174	
Changde	0.401	1.016	0.155	
Jixi	0.579	1.026	0.152	
Quanzhou	0.421	1.065	0.144	
Ningde	0.607	1.075	0.141	
Luoyang	0.471	1.083	0.139	
Jiaozuo	0.532	1.092	0.137	
Sanming	0.482	1.109	0.134	
Hengyang	0.445	1.125	0.130	
Huaihua	0.415	1.136	0.128	
Mudanjiang	0.648	1.148	0.125	
Chengde	0.479	1.21	0.113	
Xianning	0.539	1.239	0.108	
Huangshi	0.54	1.241	0.107	
Wuzhou	0.506	1.279	0.101	
Ezhou	0.724	1.281	0.100	
Maoming	0.6	1.377	0.084	IE
Daqing	0.601	1.382	0.084	IE
Yuxi	1.367	1.387	0.083	I
Guangzhou	0.548	1.496	0.067	I
Zhangzhou	0.668	1.534	0.062	IE
Fuzhou	0.723	1.659	0.049	I
Wuhai	1.668	1.692	0.045	IE
Yichun	0.843	1.932	0.027	I
Chaoyang	0.75	2.043	0.021	I
Heihe	1.19	2.101	0.018	I
Shizuishan	1.485	2.134	0.016	IE
Suizhou	0.945	2.165	0.015	IE
Yunfu	0.863	2.17	0.015	IE
Qiqihar	1.192	2.436	0.007	IE
Shaoyang	1.076	2.465	0.007	IE
Yichang	1.208	2.467	0.007	IE
Chifeng	1.435	2.532	0.006	IE
Chaozhou	1.386	2.83	0.002	IE
Shantou	1.988	2.855	0.002	I
Xiangfan	1.249	2.858	0.002	IE

Huanggang	1.063	3.099	0.001	IE
Tongliao	1.074	3.13	0.001	IE
Jingzhou	1.291	3.243	0.001	IE
Suihua	1.309	3.289	0.001	IE
Jieyang	1.715	3.499	0.000	I
Xiaogan	1.538	3.518	0.000	IE
Shuozhou	2.58	3.704	0.000	IE
Shenzhen	3.238	4.647	0.000	I
Dongguan	2.66	4.687	0.000	I
Jingmen	2.137	4.883	0.000	I
Yulin	4.659	6.684	0.000	IE
Yan'an	4.013	8.177	0.000	I
Baotou	9.002	9.108	0.000	I
Hohhot	6.92	9.924	0.000	IE

TableA2: Summary statistics and description of variables

Variable	Description	Region	No. obs.	Mean	Std. dev.	Min	Max
GRP growth	Average growth rate of inflation corrected GRP (calculated as GRP_t / GRP_{t-1})	Whole prefecture	234	1.133	0.044	1.035	1.344
		Prefectural capital	234	1.162	0.089	0.937	2.033
Initial GRP	GRP of the year 2000 (RMB 10,000)	Whole prefecture	234	2.085,201	2,399,779	163,873.8	22,043,930
		Prefectural capital	234	1,054,551	1,991,835	67,428.63	19,852,150
Population growth	Average growth rate of the population (calculated as population / $population_{t-1}$)	Whole prefecture	234	1.011	0.030	0.956	1.341
		Prefectural capital	234	1.048	0.105	0.959	1.848
Investment	Average total investments in fixed assets, RMB 10,000	Whole prefecture	234	2,865,370	3,744,589	264,253.8	30,921,160
		Prefectural capital	234	1,783,986	3,301,368	67,689.57	30,318,940
Education	Average number of students in the secondary education facilities per person of its population	Whole prefecture	234	0.067	0.011	0.045	0.122
		Prefectural capital	234	0.076	0.019	0.037	0.157
Healthcare	Average number of medical doctors in the prefecture per person of its population	Whole prefecture	234	15.961	7.374	4.481	68.810
		Prefectural capital	234	28.516	10.983	4.570	85.543
Own expenditures	Average total public expenditures of a particular prefecture (values for 2002-2007 have been inflation-corrected using provincial CPI) (10 bln. RMB)	Whole prefecture	234	0.315	0.581	0.040	6.459
Neighbouring expenditures	Average sum of the total public expenditures of all prefectures sharing common border with this particular prefecture (10 bln. RMB)	Whole prefecture	234	1.437	1.437	0.061	10.238
Neighbouring internal expenditures	Average sum of the total public expenditures of all prefectures sharing common border with this particular prefecture, if this border does not coincide with the provincial border (10 bln. RMB)	Whole prefecture	223	0.931	0.801	0.047	5.719
Neighbouring external expenditures	Average sum of the total public expenditures of all prefectures sharing common border with this particular prefecture, if this border coincides with a provincial border (10 bln. RMB)	Whole prefecture	138	0.935	1.466	0.051	7.727

Note: all variables for the period of 2001-2007, reported by the National Bureau of Statistics of China. All variables (with the exception of the expenditures) have been calculated for the whole prefecture and for the prefectural capital, and hence, two sets of summary statistics are reported

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