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China's Internal Borders

Evidence from Business-Cycle Correlations Across Chinese Cities

Abstract: *We measured the business-cycle correlations of the real gross domestic product (GDP) growth rates of two cities to capture the degree of segmentation across China's provincial and regional borders. This type of segmentation can be caused by local protectionism as well as other economic and geographic factors. After controlling the other factors, we zeroed in on the administrative border effect that is due to local protectionism. We found that the interprovincial administrative border effect rose and then gradually declined in the period between 1991 and 2007. Its increase coincided with the introduction of the Tax-Sharing System reform, which started in 1994. Our analysis shows that China's reform path did not create a persistent provincial "administrative border effect" that would debilitate market forces.*

China's tremendous economic transformation from a planned regime to a market system has brought record-breaking growth in the past few decades. Economists often measure the degree of market integration to assess the success of these institutional transformations. If the shift to a

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market mode is successful and market forces prevail in the end, then one should expect to see a strong degree of market integration.

<<body text>>China's transition to a market system started with gradual experimentation on issues like price reforms (Fung, Kummer, and Shen 2006). During this process, the central government gave local (provincial) government unprecedented authority to manage local economies. Montinola, Qian, and Weingast (1996**<<1995 on References list?>>**) used the term "market-preserving federalism" to designate this approach. Many argue that the competition among provinces in this federalism framework is the key to China's success in moving toward a market system. However, the types of organizations that helped propel the move toward markets can also hinder the function of market forces, eventually becoming a roadblock to market development. Lyons (1985) argued that Chinese administrative organizations seemed to have created a "cellular economy" in which provincial governments not only had independent rights to distribute administrative and economic resources, but also had tremendous influence over the business environment. As reforms deepened, local protectionism emerged as well.

With forces that on one hand deepened market reforms, but on the other hand acted as a catalyst to create segmentation, it is uncertain whether the trend of market integration was unidirectional.[1] Given China's administrative organization, did reforms improve the degree of market integration? Is the market stronger than the barriers resulting from local protectionism? Recent academic studies have not reached a consensus. Some find that market fragmentation has worsened as reforms deepened (Poncet 2003, 2005; Young 2000). Others agree that although market segmentation still exists in China, the trend toward market integration is nevertheless improving (Bai, Du, Tao, and Tong 2004; Fan and Wei 2006; Holz 2009; Naughton 2003; Qi 2010; Tang 1998; Xu 2002).

This article will use the new approach of border effect to examine the dynamic trend of market integration in China. Borders are generally defined either as boundaries between different administrative units such as provinces or as geographic borders of different countries. Since our study focuses on domestic market integration, we use the term "borders" in the sense of boundaries of the administrative units (provinces). The border effect not only affects trade volumes between various regions/countries, but also is manifested in the correlations of business cycles between regions/countries (McCallum 1995). In general, strong border effects lead to a low correlation of business cycles (and thus a lower de-

gree of market integration) in different regions. For example, Clark and Wincoop (2001) examined the correlations of output (or employment) to measure business synchronization within the United States and among European countries. They discovered that the within-country correlations of business cycles are much higher than the intercountry correlations among European countries, thus demonstrating lower market integration as a result of the border effect in Europe.

Using the methodology developed by Clark and Wincoop (2001), we measured the border effect among the different provinces within China and investigated specific factors that affect the magnitude of border effects. We calculated the pairwise GDP growth rate correlation coefficients among 204 Chinese cities, and obtained the weighted averages of the correlation coefficients of cities *within* a province as well as of cities *across* provincial borders.

The differences between these two correlations are defined as the overall border effect across provinces. This approach has several advantages. First, it allows us to report the *dynamic trend* of border effect in different time periods, unlike previous studies that could draw only a binary conclusion (i.e., integrated vs. not integrated). Second, some existing studies attempting to measure integration based on the law of one price had to use the Consumer Price Index (CPI), as opposed to the prices of specific commodities, due to lack of data. However, the use of the CPI does not truly embody the principle of the law of one price. Finally, our approach allows us to decompose the overall border effect we defined in order to pin down the specific causes of market segmentation (or the lack of correlations in business cycles). The mere presence of segmentation does not automatically indicate local protectionism. Besides local protectionism, other geographic and economic factors can also affect business synchronizations among various regions.

In this study, we used a regression model in which the independent variable is the correlation between the GDP growth rates of two cities, and the explanatory variables are a series of economic and geographic factors that may affect this correlation between cities (such as the geographic distance between the cities and the size of each city). Further, we include factors that could affect the volume of trade between provinces, such as differences in industrial structure between two cities, differences between the cities' ratios of fiscal expenditure to GDP, and differences in the amount of FDI each city receives, among others. By controlling the factors that decompose the business-cycle synchronization between

cities, the residual border effect is an estimate of the magnitude of segmentation due to barriers set by local government policies, namely, the administrative border effect.

We find that the interprovincial administrative border effect rose and then gradually declined in the period between 1991 and 2007. The increase of this type of border effect coincided with the introduction of the Tax-Sharing System reform in 1994. This border effect declined steadily in recent years as the tax reform was fully instituted. Our analysis shows that China's reform path (under market-preserving federalism) did not create a persistent provincial "administrative border effect" that debilitated market forces. In fact, we discovered that other economic factors that decrease market integration are just as strong (or even stronger in some cases) as the administrative border effect.

Border Effect within China

Using historical GDP data on 204 Chinese cities for the period from 1990 to 2007, we converted nominal GDP growth rates to real terms using CPI data for the same time period (*China Economic Information Network*; *China Urban Statistical Yearbook***<<include these references on the References list.>>**). After taking the natural log of these real GDP growth rates, we applied the Hodrick-Prescott (1997) filter to remove any long-term trends from the growth rates. Our data cover 30 of 31 provinces and municipal cities in China (the only exception being Tibet). Table 1 shows the number of cities included in our data set for each province.

We calculated pairwise correlation coefficients of the real GDP growth rates between two cities. This generated 20,706 correlation coefficients, of which 902 are correlations between two cities located within the same province; the remaining 19,804 correlation coefficients are between cities located in different provinces. We defined the overall border effect dummy variable as 1 if two cities are located in the same province, and 0 if they are not. The overall border effect is represented as the estimated coefficient in the regression Equation (1):

$$\text{Corr}_{ij} = \alpha_{ij} + \beta_{ij}\,\text{Border}_{ij} + \varepsilon_{ij} \qquad (1)$$

where Corr_{ij} is the correlation coefficient of the real GDP growth rates between city i and city j, Border_{ij} is the border effect dummy variable, and β_{ij} is the overall border effect.

Table 1

Number of Cities Included in Data Set (by Province)

Province	Number of cities		Province	Number of cities		Province	Number of cities	
	GDP growth rate	Regression on decomposing segmentation		GDP growth rate	Regression on decomposing segmentation		GDP growth rate	Regression on decomposing segmentation
Beijing	1	1	Zhejiang	9	9	Hainan	2	2
Tianjin	1	1	Anhui	11	11	Sichuan	12	12
Hebei	9	9	Fujian	8	8	Chongqing	1	1
Shanxi	6	6	Jiangxi	6	6	Guizhou	3	2
Inner Mongolia	4	4	Shandong	14	14	Yunnan	2	1
Liangning	13	13	Henan	14	13	Shannxi	7	7
Jilin	6	6	Hubei	8	8	Gansu	5	3
Heilongjiang	10	10	Hunan	11	10	Ningxia	2	2
Shanghai	1	1	Guangdong	15	15	Qinghai	1	1
Jiangsu	13	11	Guangxi	7	5	Xinjiang	2	1

Table 2

Simple and Weighted Average Real GDP Growth Rate Correlation Coefficients of Cities in Same Province (intraprovincial correlation) **vs. Cities in Different Provinces** (interprovincial correlation)

Time period	Intraprovincial correlation		Interprovincial correlation		Estimated overall provincial border effect βij	
	simple	weighted	simple	weighted	simple	weighted
1991–2007	0.18*	0.21	0.11*	0.14	0.07*	0.08
1991–1998	0.24*	0.35	0.17*	0.24	0.07*	0.10
1999–2007	0.17*	0.13	0.06*	0.03	0.11*	0.10

Note: *denotes 1% significance level.

Table 2 demonstrates the growth correlations between cities located in the same province (i.e., intraprovincial correlation) as well as cities located in different provinces (i.e., interprovincial correlation), and the magnitude of the estimated overall border effect in various time periods. We also plotted the results in Figure 1 to show the trend of these coefficients.

The average intraprovincial correlation is 0.18 for the period from 1991 to 2007, while the interprovincial correlation is 0.11. Thus the overall border effect for this period is 0.07. We then separated our sample into two periods, 1991–1998 and 1999–2007, because, in general, 1998 marked the beginning of further deepened market reforms in China. In the early period of 1991–1998, the estimated overall border effect is 0.07, but segmentation seems to increase to 0.11 for the later time period.

The simple averages do not reflect the relative importance of each city in China's economy. We calculated the ratio of a city's GDP to the overall combined GDP figure of all 204 cities in our data set, and use that ratio to weight the correlation coefficients among cities. Table 2 and Figure 1 also report these weighted average results.

The overall border effect with the weighted average approach is 0.08 for the whole sample period (1991 to 2007), while the overall border effect in both subperiods is approximately 0.10, contrary to the increasing trend for the later period, shown by the simple average approach. In

Table 3

Simple and Weighted Average Real GDP Growth Rate Correlation Coefficients of Cities in Same Province (intraprovincial correlation) **vs. Cities in Different Provinces** (interprovincial correlation)**—Rolling Window of 10 Years**

Time period	Intraprovincial correlation		Interprovincial correlation		Estimated overall regional border effect βij	
	simple	weighted	simple	weighted	simple	weighted
1991–2000	0.22	0.27	0.15	0.20	0.07	0.08
1992–2001	0.21	0.26	0.15	0.18	0.06	0.08
1993–2002	0.19	0.21	0.12	0.15	0.07	0.06
1994–2003	0.15	0.18	0.07	0.08	0.09	0.10
1995–2004	0.19	0.21	0.11	0.11	0.08	0.11
1996–2005	0.16	0.17	0.07	0.07	0.08	0.10
1997–2006	0.16	0.13	0.06	0.02	0.09	0.10
1998–2007	0.17	0.14	0.07	0.03	0.10	0.11

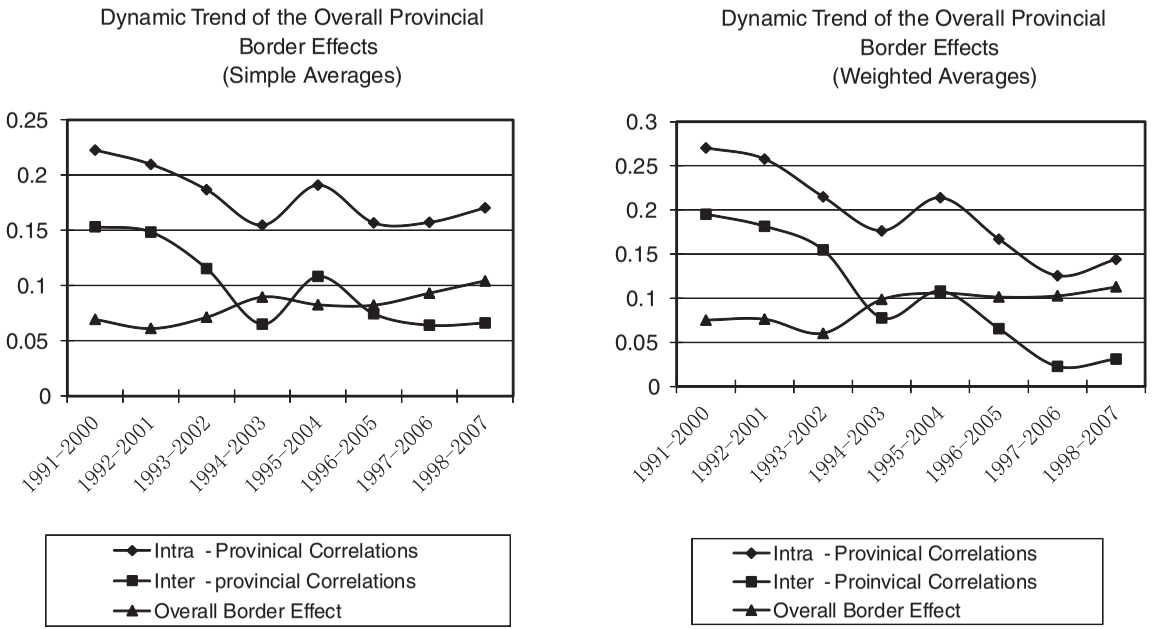
Note: All data presented in this table are 1% statistically significant.

order to describe the dynamic trend of both the simple average and the weighted average border effects, we calculated the overall border effect with a rolling window of ten years starting from 1991. The results are presented in Table 3. Both tables show a trend of increasing segmentation, especially in the two "rolling windows" that are most recent. Figure 1 demonstrates the same trend.

In addition to interprovincial overall border effect, we also examined the interregional overall border effect among the eastern, central, and western regions.[2] Most of the eastern provinces are located on the coast. We performed the same correlation tests on the GDP growth rates between every pair of two cities, in which 7,723 are intraregional correlations (i.e., east to east, west to west, and central to central), and 12,983 are interregional correlations. Table 4 shows that the average intraregional correlation in the period from 1991 to 2007 is 0.13, while the average interregional correlation is 0.1. Therefore, the regional border effect is 0.03.

We further divide the sample into two subperiods: before 1998 and after 1998. We find that the overall border effect in the period between 1991 and 1998 is 0.06. Interestingly, however, the border effect basically

Figure 1. Dynamic Trend of Overall Provincial Border Effects



<<AU: Correct spelling of Provincial in both legends.>>

<<AU: here and in the other figures, make it Intraprovincial, Interprovincial, etc., to conform to spelling in tables and in the article text>>

Table 4

Simple and Weighted Average Real GDP Growth Rate Correlation: Intraregional vs. Interregional

Time period	Intraregional correlation		Interregional correlation		Estimated overall regional border effect βij	
	Simple	weighted	simple	weighted	simple	weighted
1991–2007	0.13*	0.21	0.10*	0.15	0.03*	0.06
1991–1998	0.21*	0.33	0.15*	0.22	0.06*	0.11
1999–2007	0.06*	0.02	0.07*	0.05	–0.01	–0.03

Note: *denotes 1% significance level.

disappears in the later period (1999–2007), dropping to –0.01 and becoming statistically insignificant. The weighted average results of regional overall border effect demonstrate the same trend. Table 4 shows a rather high border effect (0.11) from 1991 to 1998, but the border effect becomes statistically insignificant in the later period, decreasing to –0.03. Table 5 and Figure 2 present the dynamic trend of the regional overall border effect using the same rolling window methods used for Figure 1. The declining trend of the regional border effect is apparent in these figures. In fact, in the last two windows (1997–2006 and 1998–2007), the regional border effect becomes close to zero or negative (and also turns out to be statistically insignificant).

Overall, we find that the interprovincial border effect increases with time and has accelerated in recent years, thus indicating that market segmentation has risen as reforms deepened. On the other hand, the interregional border effect has been decreasing, and has nearly disappeared in recent years. The declining trend of the interregional border effect is not surprising. In 2000, China started a policy to "Develop the West." This policy significantly boosted infrastructure investment in underdeveloped areas, injecting large amounts of government funds. It also aimed at attracting large amounts of private capital to China's interior provinces. Such efforts have helped close the economic growth gap between the Eastern region and the Middle and Western regions, which will increase the interregional correlation. Moreover, the regional distinction is more of a geographic concept. It has no connection to administrative or jurisdictional boundaries. Interestingly enough, however, among provinces

Table 5

Simple and Weighted Average Real GDP Growth Rate Correlation: Intraregional vs. Interregional—Rolling Window of 10 Years

Time period	Intraregional correlation		Interregional correlation		Estimated overall regional border effect βij	
	simple	weighted	simple	weighted	simple	weighted
1991–2000	0.18*	0.29	0.14*	0.22	0.05*	0.08
1992–2001	0.17*	0.28	0.14*	0.21	0.04*	0.07
1993–2002	0.14*	0.24	0.10*	0.17	0.04*	0.07
1994–2003	0.08*	0.14	0.06*	0.10	0.02*	0.04
1995–2004	0.12*	0.17	0.10*	0.12	0.02*	0.04
1996–2005	0.09*	0.07	0.07*	0.05	0.01*	0.02
1997–2006	0.07*	0.02	0.07*	0.05	0.00	–0.03
1998–2007	0.07*	0.02	0.07*	0.05	0.00	–0.02

Note: *denotes 1% significance level.

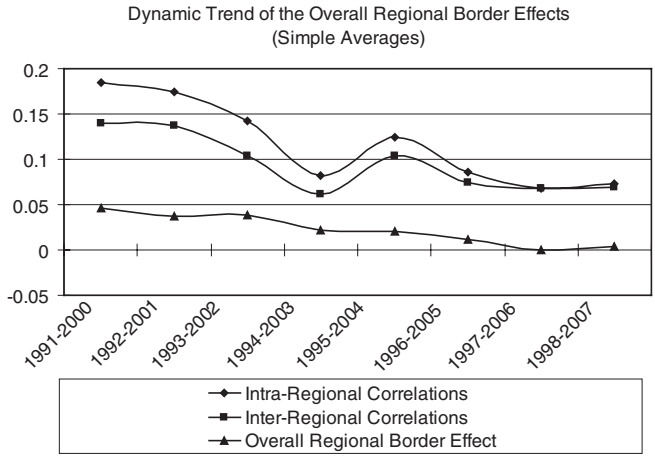
(which have independent rights to administer and distribute resources) the overall border effect (segmentation) has increased steadily as economic reforms deepened. What, then, contributes to the increase in the overall provincial border effect?

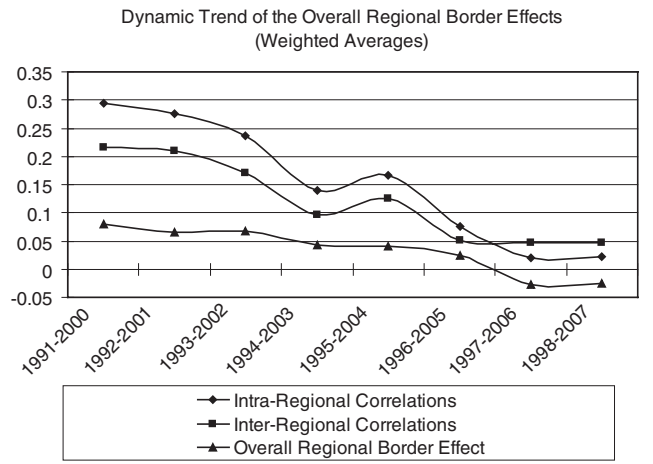
Decomposing Market Segmentation: Factors Affecting the Border Effect

Business-cycle theories attribute the correlation of economic growth in two areas mainly to the volume of trade between the two areas (Frankel and Rose 1998; Wynne and Koo 2000). Therefore, all the factors that affect trade across borders would be manifested directly or indirectly in the border effect. For this reason, we cannot interpret the magnitude of the overall border effect described above as segmentation caused by local protectionism, because we have not controlled for the other factors that also affect the overall border effect.

Trade theory and literature generally hold that the volume of trade between cities is affected by both the geographic distance between the cities and the size of the cities (Anderson and Wincoop 2003; Clark and

Figure 2. Dynamic Trend of Overall Regional Border Effects





<<AU: change to Intraregional and Interregional.>>

Wincoop 2001; Helliwell 1996; McCallum 1995; Okubo 2004). We used Google Earth to obtain the longitude and latitude of each city and then calculated the distance between any two cities with Equation (2):

$$Distance = 6378.7 * (\ ) \left(\arccos \left[\begin{array}{l} \sin\left(\frac{latitude_i * \pi}{180}\right) * \sin\left(\frac{latitude_j * \pi}{180}\right) + \cos\left(\frac{latitude_i * \pi}{180}\right) \\ * \cos\left(\frac{latitude_j * \pi}{180}\right) * \cos\left(\frac{longitude_j * \pi}{180} - \frac{longitude_j * \pi}{180}\right) \end{array} \right] \right) \quad (2)$$

where *distance* is the geographic distance between city *i* and city *j*. The unit of *distance* is kilometers, and $longitude_i$, $latitude_i$, $longitude_j$, and $latitude_j$ represent each city *i* and *j*'s longitude and latitude. Our data set yields 18,336 pairs of city-distance measures.[3] We use the definition proposed by Clark and Wincoop (2001) to calculate the size of cities, that is, the natural log of the sum of the population in each pair of cities.

In addition to distance and city size, we also controlled other factors that could potentially affect the correlation of real GDP growth rates between any two cities. These include: (1) differences in industrial structure between the two cities; (2) differences between their fiscal expenditures; and (3) differences between the amounts of foreign direct investment (FDI) each city receives.

We adopted the Absolute Value Index developed by Krugman (1991) to measure the industrial structure differences between any two cities. Thus, S_{in} (where $n = 1, 2,$ or 3) represents the ratio of the output by the primary (or secondary or tertiary) industry to total output in city *i*. The Absolute Value Index that describes the industrial structure difference between city *i* and city *j* is represented by Equation (3).

$$AVI_{ij} = \left|S_{i1} - S_{j1}\right| + \left|S_{i2} - S_{j2}\right| + \left|S_{i3} - S_{j3}\right| \tag{3}$$

Controlling for the industrial structure difference is important because different industries will react differently when there is a common fiscal shock or a common monetary policy shock. On the other hand, one can also argue that the causal effect can run both ways between market integration and the geographic distribution of primary, secondary, and tertiary industries. For example, under the condition of economies of scale and the agglomeration effect, market integration could lead to specialization, which will then affect industry structure. In order to control for this potential issue, we used the average values of the industrial structural difference indexes to reduce the endogeneity in our regression.

We used the standard deviations of the differences between the ratios of a city's fiscal expenditure to its GDP to measure the differences in fiscal expenditure. We defined F_{it} as the ratio of city *i*'s fiscal expenditure to its GDP where *t* represents years. Thus, the difference between the fiscal expenditures of city *i* and city *j* is the standard deviation of ($F_{it} - F_{jt}$), where $t = 1, 2, \ldots, T, \ldots$. Other things being equal, the difference between two cities' fiscal expenditures will lower the correlation of real GDP growth rates between these two cities.

We calculated the differences in the amount of FDI each city receives with an approach similar to the one adopted for the fiscal expenditure differences. Instead of using the ratio of fiscal expenditure to GDP, we used the ratio of FDI to GDP. Attracting more FDI accelerates economic growth in a region. Therefore, higher differences in FDI are likely to create a lower correlation of economic growth between cities.

Our regression model is Equation (4):

$$Corr_{ij} = \alpha + \beta_{ij}^{1} Border_{ij} + \beta_{ij}^{2} Ln(Distance) + \beta_{ij}^{3} Size(Population) + \beta_{ii}^{4} Industrial + \beta_{ii}^{5} Fiscal + \beta_{ii}^{6} FDI + \varepsilon_{ii} \quad (4)$$

where

$Corr_{ij}$ is the correlation of the real GDP growth rates between two cities,

$Border_{ij}$ is the dummy variable to indicate whether the paired cities are in the same province,

ln (*Distance*) is the natural log of the distance between two cities,

Size (*Population*) is the size of a city,

Industrial is the difference in industrial structure between two cities,

Fiscal is the difference in fiscal expenditure between two cities,

FDI is the difference in the amount of FDI the two cities receive.

After controlling these economic and geographical factors in the regression, the coefficient of the variable $Border_{ij}$ will approximately reflect the market segmentation due to local protective administrative policies (i.e., the administrative border effect as opposed to the "overall" border effect).

Table 6 presents the regression results. The estimate for the administrative border effect between 1991 and 2007 is 0.05 and statistically significant. In the two subsample periods, this border effect is 0.04 for the early period (1991–1998) and increases to 0.06 in the later period (1999–2007). Thus local protectionism (built upon local administrative powers) seems to worsen as the economic reforms deepen, resulting in higher market fragmentation.

We further analyzed the dynamic patterns of the administrative border effect using samples under "rolling windows." Actually, we find that it first increased but then declined gradually, starting in the window of 1995 to 2004. Our estimates for the administrative border effects of a ten-year rolling window are:

Table 6

Regression Results on Decomposing Correlation Coefficients—Provincial and Regional Border Effects

Sample period	Border		Distance		Size (population)		Production		Fiscal		FDI	
	provincial	regional	provincial	regional	provincial	regional	provincial	regional	provincial	regional	provincial	regional
1991–2007	0.05*	0.03*	–0.01*	–0.02*	0.00	0.00	0.00*	–0.00*	–0.83*	–0.82*	0.15*	0.15*
1991–1998	0.04**	0.05*	–0.02*	–0.02*	0.02*	0.02*	0.00*	–0.00*	–0.37*	–0.38*	0.34*	0.33*
1999–2007	0.06*	–0.01**	–0.02*	–0.04*	–0.02*	–0.02*	0*	–0.00*	–0.03	–0.04	0.06	0.06
1991–2000	0.03**	0.04*	–0.02*	–0.02*	0.01	0.01	0*	–0.00*	–0.51*	–0.51*	0.27*	0.25*
1992–2001	0.04**	0.04*	–0.02*	–0.02*	0	0.00	0*	–0.00*	–0.68*	–0.68*	0.26*	0.25*
1993–2002	0.05*	0.04*	–0.01*	–0.02*	0.01	0.01	0	–0.00	–1.08*	–1.07*	0.19*	0.18*
1994–2003	0.10*	0.02*	0	–0.01**	0	0.00	0**	–0.00**	–0.85*	–0.82*	0.07	0.07

(*continues*)

Table 6 (*continued*)

Sample period	Border		Distance		Size (population)		Production		Fiscal		FDI	
	provincial	regional	provincial	regional	provincial	regional	provincial	regional	provincial	regional	provincial	regional
1995–2004	0.09*	0.02*	0	–0.01**	0	–0.00	0*	–0.00*	–0.88*	–0.86*	–0.05	–0.05
1996–2005	0.06*	0.01**	–0.02*	–0.02*	0	–0.00	0**	–0.00**	–0.85*	–0.83**	0.10**	0.10**
1997–2006	0.05*	–0.01	–0.02*	–0.03*	–0.02*	–0.02*	0*	–0.00*	–0.76*	–0.74*	0	0.00
1998–2007	0.05*	–0.01	–0.03*	–0.04*	–0.02*	–0.02*	0*	–0.00*	–0.36**	–0.35**	0	0.01

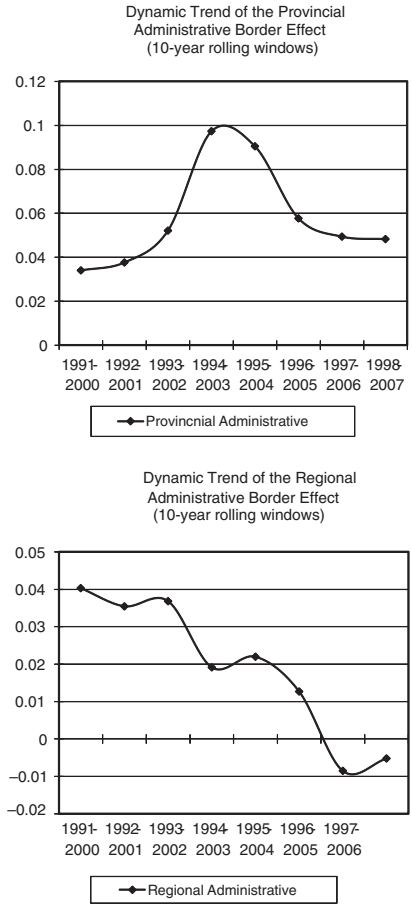
Note: *denotes 1% significance level, **denotes 5% significance level.

1991–2000: 0.034
1992–2001: 0.038
1993–2002: 0.052
1994–2003: 0.097
1995–2004: 0.090
1996–2005: 0.060
1997–2006: 0.050
1998–2007: 0.050

After a dramatic increase between the periods (1993–2002) and (1994–2003), the administrative border effect dropped significantly in the last ten years in the data set, to about 0.05. This trend is presented in Figure 3. All estimates for this border effect are positive and statistically significant in our analysis. Interestingly, we find that the timing of the initial rapid increase of this kind of border effect coincides with the beginning of the tax reforms introduced in 1994, namely the Tax-Sharing System (TSS). Before the TSS, the fiscal contracting system (*caizheng chengbao zhi*) was used, under which local governments had more authority and control. They had great incentives to collect tax revenues and develop local economies by obtaining an increased share of fiscal resources, because the most important contracts of shared revenue between central and local governments were fixed in nominal terms, thus giving local governments an incentive to conceal their revenue capacities.

The new system, TSS, fundamentally changed how the central and local governments shared revenues. Most taxes were assigned to either the central or the local governments. The motivation for introducing TSS stemmed largely from the central government's concern about its fiscal decline. In that regard, a major goal of the new TSS system was to restore central control and strength. The changes introduced by TSS met with resistance from the provinces, who feared losing local revenues. In turn, the central government offered to return part of the shared revenues to ensure that provincial revenues would not drop below 1993 levels. The resistance subsided, and the system finally gained prominence after 1996, which again coincides with the declining administrative border effect in our regression results. Our analysis shows that China's reform path (under market-preserving federalism) did not create a persistent provincial administrative border effect that debilitated market forces. Indeed, the local governments practiced stronger protectionist policies in some periods, but it was mostly in reaction to a major nationwide tax reform. Under the current economic system and organization of administrative

Figure 3. Dynamic Trend of Administrative Border Effects



powers, protectionism eventually yielded to the stronger market forces. The interprovincial administrative border effect did exist to a degree, affecting market integration, but the magnitude of other economic and geographic factors that decreased market integration were just as strong (if not stronger in some cases) as the administrative border effect.

Table 6 also shows that most of the control variables not only turn out to be statistically significant, but also have the expected signs predicted by theory. For example, differences in industrial structure, fiscal expenditure, and FDI all affect the correlation of economic growth among cities. The first two factors (industrial structural diversity and fiscal

expenditure difference) negatively affect the correlation, indicating that higher differences reduce the correlation between cities. However, it is intriguing that more differences in FDI actually have a positive impact on the growth correlation, although the impact diminishes as we approach more recent years.

Table 6 decomposes the interregional segmentation to estimate border effect with similar controls on geographic and economic variables. The regression model is Equation (5):

$$Corr_{ij} = \alpha + \beta_{ij}^{1} Border_{ij} + \beta_{ij}^{2} Ln(distance) + \beta_{ij}^{3} Size(Population) + \beta_{ij}^{4} Industrial + \beta_{ij}^{5} Fiscal + \beta_{ij}^{6} FDI + \varepsilon_{ij} \quad (5)$$

where the dummy variable $Border_{ij}$ takes on the value 1 if two cities are located in the same region, and 0 if they are not. Using sample data with a rolling window of ten years, we find that the interregional administrative border effect had been declining steadily from the first year included in the data, even becoming negative during the periods from 1997 to 2006 and from 1998 to 2007. Figure 3 plots the estimates of the regional border effect. Moreover, the interregional administrative border effects are also not statistically significant, showing that there is essentially no interregional border effect in China.

Conclusion

We measured the correlations between two cities' real GDP growth rates (a measure of business-cycle correlations) to capture the degree of segmentation across China's provincial and regional borders. This type of segmentation can be caused by local protectionism as well as other economic and geographic factors that affect business-cycle correlations between two cities. After controlling these other factors, we were able to pin down the border effect that is due to local protectionism: the administrative border effect. We find that the interprovincial administrative border effect first rose and then gradually declined between 1991 and 2007. Further, its increase coincided with the introduction of the Tax-Sharing System reform in 1994. However, the situation of segmentation related to the administrative border effect has improved steadily in recent years, once the tax reform was fully instituted. Compared with the interprovincial border effect, the interregional border effect has declined continuously and has virtually disappeared in recent years.

The improvement of market integration implies a more dynamic and efficient economy. Indeed, a survey study involving firms in twelve Chinese provinces indicates a significant increase in expected economic profits with less local protectionism (Gong, Xu, and Tan 2003). A healthy competitive market also encourages firms to invest in research and development, resulting in a more innovative economy. Fierce competition in an integrated market is expected to bring allocative and productive efficiency gains, and realize economies of scale. In addition to these general benefits from an integrated market, recent studies also show that many motivational factors for local protectionism (such as considerations for local government fiscal revenue) did not lead to a high level of border effect or severely impede interprovincial trade (Xing and Li 2011). Our analysis shows that China's reform path (under market-preserving federalism) did not create a persistent provincial "administrative border effect" that debilitated market forces.

Notes

1. For example, Cao and Jiang (2010) analyzed how local protection caused redundant construction.

2. The Eastern region includes Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, Guangxi, and Hainan. The Middle region includes Shanxi, Inner Mongolia, Jilin, Xiangsu, Anhui, Jiangxi, Henan, Hubei, and Hunan. The Western region includes Chongqing, Sichuan, Guizhou, Yunnan, Tibet, Shaanxi, Gansu, Qinghai, Ningxia, and Xinjiang.

3. This comes from 192 cities in our data set. Although we had economic data on 204 cities, only 192 of them yielded complete data.

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