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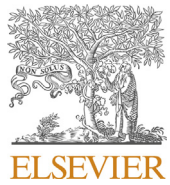

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Borders, geography, and economic activity: The case of China☆

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ABSTRACT

We document large economic discontinuities across the provincial borders separating coastal China from the inland. Using counties contiguous to the borders of four plains provinces, we find that manufacturing activity (output, employment, and exports) increases abruptly as one crosses from the inland to the coastal side of the border. The counties on the coastal side of the border also have higher urban population shares and higher shares of output produced by foreign firms. The economic discontinuities are larger for non-state sectors than for the state sector, and are robust to including measures of local public goods and infrastructure. Because there is no geographic barrier associated with the border in the plains provinces, and because geography and culture are fairly continuous at the border, these large economic discontinuities are unlikely to be explained by geographic or cultural differences. We argue that policy differences between the coastal and inland provinces explain much of the discontinuity, and find that differences in preferential policies can account for a large part of the coastal/inland divide.

1. Introduction

The idea that political borders can generate economic discontinuities is not new (Pinkovskiy (2017)). At the beginning of *Why Nations Fail*, Acemoglu and Robinson (2013) use the stark contrast between two towns on the U.S.–Mexico border to illustrate the importance of national institutions. The satellite night light map of the Korean Peninsula is also often used to show the effect of country borders on economic development, with North Korea obscured in darkness while South Korea shines brightly. However, economic discontinuities within countries have received less attention. In this paper, we document large economic discontinuities across the coastal/inland provincial borders in China, and show that these discontinuities are correlated with preferential policies at the provincial level.

China is a particularly interesting setting for examining within-country economic discontinuities for at least two reasons. First, China is a diverse country with substantial variations in local government policies. China's economy is highly decentralized, and subnational governments actively participate in economic development (Xu (2011)). Thus, subnational policies could have large effects on the local economy, and the effects of different policies are most evident at the borders between provinces. Second, China's economic reform began from the coastal provinces, and coastal provinces have received preferential policies in international trade and economic development. Since the beginning of economic reform, coastal provinces have grown faster than inland provinces, and the coastal/inland gap has increased. The incremental reform policy of China provides an opportunity to examine how subnational policies affect regional inequalities.

For the main focus of this paper, we study four plains provinces in China: two coastal provinces and two adjacent inland provinces. There is no geographic barrier such as a mountain range between the four provinces. We show that there are significant discontinuities in manufacturing activities across the provincial borders. Counties in the coastal provinces have significantly higher manufacturing employment, production, and exports than those in the inland. Using only counties that are contiguous to the coastal/inland provincial borders, which are similarly distant from the coastline, and controlling for culture and geography, we find that the coastal counties have 80% higher manufacturing

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production and 114% higher manufacturing exports than the inland counties.[1] The coastal counties also have a higher urban population share, a higher exporting share, and a higher share of manufacturing output by foreign firms. More generally, the gaps between these border counties are a significant portion of the gaps between the coastal and inland provinces overall.

Next, we show that the border effects are larger for non-state sectors than for the state sector. Firms in the non-state sector, including foreign-owned firms, are likely to be more responsive to differences in provincial policies than are firms in the state sector. The state sector is under the direct control of the national government, and China's pre-economic reform policies favored inland over coastal regions, so state-owned firms are less likely to be affected by provincial-level reforms and policy. Thus, our findings that economic discontinuities are smaller in the state sector are expected. We expand our sample beyond the four plains provinces to the entire coastal/inland border, and show that there is only a slight difference in the border effect between the plains and mountain regions.

Furthermore, we show that local (county-level) variables such as local human capital and local infrastructure do not explain the economic discontinuities across the provincial border. This suggests that the discontinuities are not caused by local variables, but by policy differences at the provincial level. We also perform falsification tests by shifting the borders further toward the coast and further inland, and show that discontinuities do not exist across these false borders. This provides further support that the large economic discontinuities are indeed caused by provincial borders.

Finally, we provide some direct evidence that preferential policies at the provincial level can account for a large part of the coastal/inland divide. We use the number of national development zones (NDZs) in a province as a measure of preferential policies the province receives in trade openness,[2] and show that a higher level of trade openness is associated with higher manufacturing densities. We also examine the border gap before and after China's accession to the World Trade Organization (WTO), and find that the gap in manufacturing production increased while the gap in exports decreased.

This paper documents economic discontinuities across the coastal/inland provincial borders in China, and points to the importance of provincial policies, or "local institutions." In related work, Acemoglu and Dell (2010) document substantial within-country (and cross-municipality) differences in output and standards of living for countries in Latin America. They argue that the large within-country income differences can be explained by local institutions that influence how local and regional collective decisions are made, how the lower level of government interacts with the national government, and how political power is distributed at the local level. Dell and Olken (2020) also focus on cross-regional variation, finding significant differences in modern Javanese development between areas where the Dutch colonizers established sugar factories and comparable areas where they did not.[3] Both of these papers focus on cross-regional variation in institutions rather than border discontinuities, which are the focus of this paper.

For countries as diverse as China, it seems that local policies are important for explaining regional differences. Studies on central-local relations in China (Zhou (2007), Li and Zhou (2005), Jin et al. (2005), and Xu (2011)) have emphasized the regional decentralization of economic affairs in understanding China's economic growth and regional inequalities. Since in China many economic decisions are delegated to subnational governments, different provinces can, and do, adopt different development strategies. Combined with local protectionism (Shen and Dai (1990); Bai et al. (2004)) and significant barriers to inter-provincial trade and migration (Poncet (2005)), provincial-level policy differences may result in economic discontinuities at provincial borders.

One significant policy difference between the coastal and the inland region is that the coastal region received many preferential policies in international trade and economic development. Démurger et al. (2002b) and many earlier works have shown that preferential policies received by coastal provinces are important in explaining the faster growth of the coastal region. Recent research such as Wang (2013) and Alder et al. (2015) has examined directly the effects of "place-based policy" on local economic development. This paper takes a different approach by comparing counties contiguous to the coastal/inland provincial borders, where the counties in coastal provinces have preferential policies of openness and trade, but are nearly as far from the actual coast as the neighboring inland counties. Our empirical approach estimates the magnitude of the border effect caused by these policy differences.

The paper is also related to the literature on China's coastal/inland divide, and how regional inequality is related to China's economic reform and openness. China's opening-up policy has proved successful in many ways. However, the incremental opening-up policy has also been criticized for increasing regional inequalities between the coast and the inland (Démurger et al. (2002a); Kanbur and Zhang (1999)). Studies examining the relationship between preferential policies and regional inequalities must control for geographic factors, since the coastal provinces have better geographic conditions (e.g., infrastructure, location, global market access) than inland provinces. It is difficult to find good measures of geographic factors that contribute to local development. We avoid this difficulty by comparing counties with similar geographic conditions (and culture), so the difference across the border is unlikely to be due to geographic or cultural differences.

The idea of using a political border to identify policy effects is not new, and has been particularly popular since the pioneering work of Holmes (1998), which looked at changes in manufacturing activity at U.S. state borders with and without right-to-work laws. However, when applying the border approach to study the regional inequalities between coastal and inland regions of China, it is important to note that we are not identifying the effect of a specific policy, but a general political border effect. The border effect is not explained by geographical or cultural factors; we argue that the abrupt change of manufacturing activities across the coastal/inland provincial borders can be attributed to differences in provincial-level economic policies.

The paper proceeds as follows. In Section 2, we explain the choice of the four plains provinces included in the main analysis, and provide evidence that there is no meaningful geographic or cultural discontinuity across the borders. In Section 3, we present regression discontinuity graphs based on counties' distance from the border. Section 4 includes regressions on counties contiguous to the border allowing for a fixed effect for the coastal side of the border. In Section 5, we discuss the heterogeneity of this border effect, and we provide some robustness checks, including falsification tests, in Section 6. We consider some possible explanations for the border effect in Section 7, and examine the effect of WTO accession on the provincial border gap in Section 8. We conclude in Section 9.

2. Geography and culture

We study economic discontinuities across the coastal/inland provincial border. Provinces are the first-level administration divisions in China. Provinces are divided into prefectures, which are divided into counties. There are 34 provincial-level administration units, 333 prefectures-level divisions, and 2851 county-level units in China. Traditionally, China is not a coastal country, but the east of China faces the

[1] These estimates are from Table 2. The gaps are larger when we do not control for anything; see Table 1.

[2] NDZs are special areas that are given preferential policies in international trade and economic development.

[3] Similarly, Dell and Querubin (2018) use an algorithm that determined villages bombed by U.S. air strikes in the Vietnam War to compare areas that just missed being targets to those that were bombed; they find weaker local institutions in the areas that were bombed.

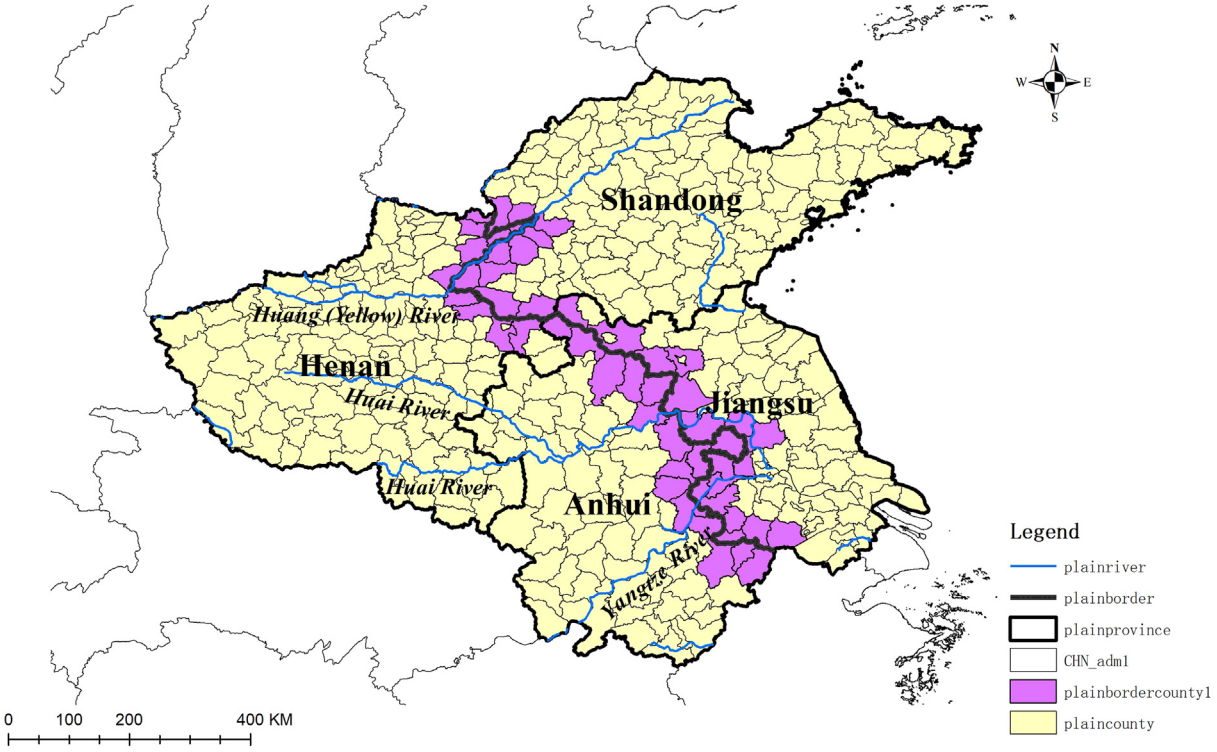

Fig. 1. Counties in the plains provinces and counties contiguous to the borders.

Pacific Ocean and has good access to the world market. Western China is surrounded by mountains and deserts. China is adjacent to Mongolia and Russia in the north and southeast Asia in the south. Its coastline only lies in the east. Economic activities are concentrated in the coastal region, and the majority of international trade is through seaports in the east.

In the main analysis, we choose four adjacent provinces in the plains region of China: Anhui, Henan, Jiangsu, and Shandong (shown in Fig. 1). Jiangsu and Shandong are coastal provinces in the east; Anhui and Henan are neighboring provinces in the inland. Fig. 1 also identifies the counties contiguous to the provincial borders, on both the coastal and inland sides; these are shaded darker and are the primary counties we focus on. We choose these four plains provinces because we want to study the political border effect, and we do not want confounding factors such as geography or culture to obscure our analysis. As we show in the following, there are few geographic or cultural barriers at this border. While we concentrate on these plains provinces, in Section 5.2 we expand our analysis to the entirety of the coastal-inland border.

The four provinces we study are mainly plains, and there is no mountain range between the inland provinces Anhui and Henan and the coastal provinces Jiangsu and Shandong. As shown in Fig. 1, three large rivers run through these provinces, and all of them flow from the west to the east. The Yellow River runs through Henan and Shandong Province, the Huai River runs through the south of Henan, and the north of Anhui and Jiangsu province. The Yangtze River runs through the south of Anhui and Jiangsu province. Although a small part of the Henan-Shandong border is along the Yellow River, in general, the border between Anhui-Henan and Jiangsu-Shandong is not along the rivers.

Fig. 2 shows elevations of the counties in these four plains provinces. Most of the counties have an average elevation below 100 m. The coastal counties have relatively low average elevations, and the inland counties have relatively high elevations. Although the coastal provinces have lower average elevation, counties contiguous to the provincial borders are all in the plains and their elevations are below 100m; there is no abrupt change in elevation across the provincial border. Figs. 1 and 2 show that geographic conditions do not change discontinuously across the border.

The province as the first-level administration unit under the central government came into shape in China in the Yuan Dynasty (13th century). Anhui and Jiangsu in the south once belonged to the same province[4] in the Ming and Qing dynasties (14th–17th centuries), and its size was equivalent to today's Jiangsu and Anhui combined. In 1666, Emperor Kangxi divided the Jiangnan province into Anhui and Jiangsu province, and their boundaries were very similar to today's boundaries (Tan (1987)). However, the Qing dynasty did not divide Jiangnan province based on geography or cultural similarities, but out of concern for maintaining political stability. At that time, China's economic center had already moved to the Yangtze river valley from the Yellow river valley, and the south of Jiangnan province was more prosperous than the north. The economic and cultural differences between the north and the south are much greater than the differences between the east and the west. Jiangnan province was divided into an eastern province and a western province, so that both provinces have a rich south and a poor north part. As a result, counties contiguous to the provincial border between Jiangsu and Anhui are similar in cultural and economic conditions.

The northern provinces Henan and Shandong provinces were established in the Ming dynasty, and their boundaries have been relatively stable. Although the borders between the two provinces have changed, this has usually been done as an attempt to control the Yellow River, which floods frequently.

Since the boundaries of the four provinces were established long before China's industrial development began, there is little reason to worry that the borders were set to separate regions with different levels of industrial development. However, there is also a concern that culture might differ across the provinces, and cultural differences could

[4] The province was called Nan Zhili in the Ming dynasty and Jiangnan in the Qing dynasty.

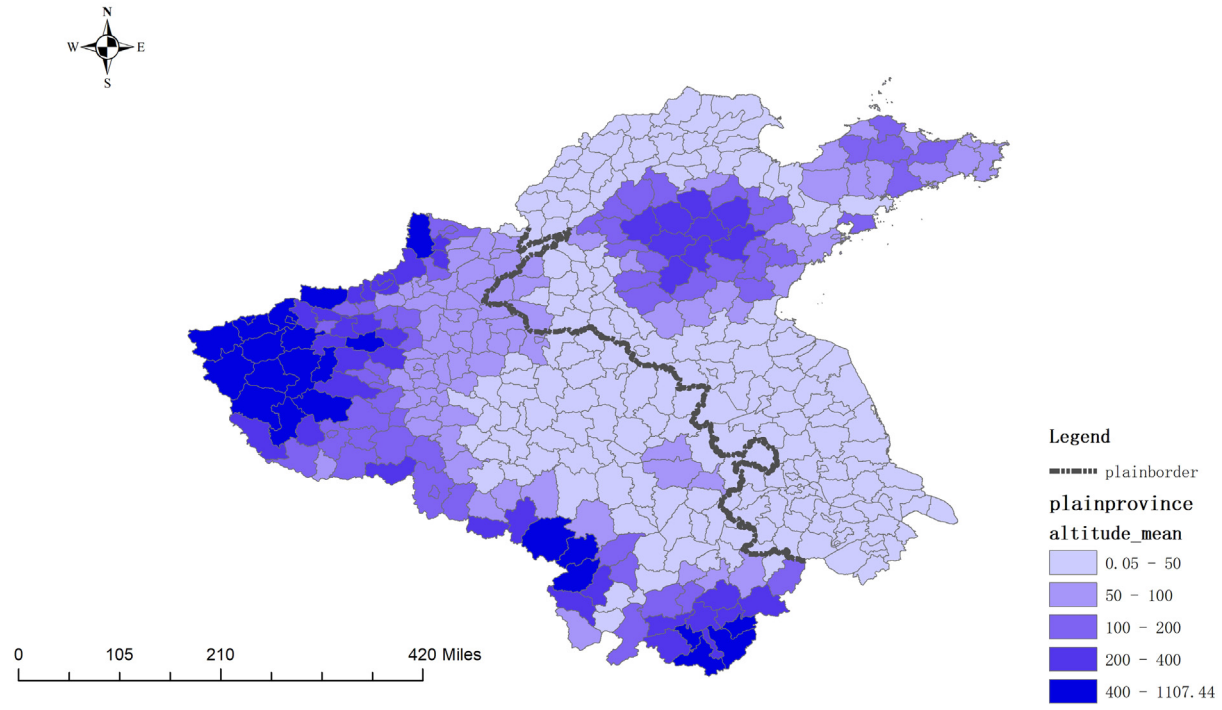

Fig. 2. Elevations of the plains counties.

also lead to economic discontinuities at the border.[5] While we do not have a direct measure of culture, there are several reasons to believe that cultural differences across these provincial borders are small. First, culture tends to develop and transmit along the river. All three large rivers in this region run from the west to the east. So the culture in north Henan is similar to the culture in Shandong; the culture in the north of Anhui is similar to that in the north of Jiangsu; and the culture in the south of Anhui and Jiangsu provinces are also similar. Second, provincial borders were not set according to economic or cultural similarities, especially in the case of Anhui-Jiangsu border. There is no reason to believe that culture changes suddenly across the border.

To partially address this, Fig. 3 shows the dialect map of the plains provinces.[6] A dialect is spoken by a group of people with similar culture, so it can be used as a proxy for cultural similarities. Looking at the dialect map in these four provinces, people in most places north of the Yangtze River speak Mandarin, while people in the south of the Yangtze River speak other dialects. The cultural difference between the north and the south is greater than the cultural difference between the east and the west. The Mandarin speaking region can be further divided into several sub-dialect regions (Zhongyuan, Jianghuai, Liaojiao, and Jilu Mandarin region). Even the borders of these subgroup dialects do not overlap with provincial borders. This gives us more confidence that even if there is a cultural difference between provinces, it does not occur at the provincial borders.

The above analysis shows that the coastal/inland provincial borders are not determined by geographic barriers and were established long before China's industrial development. Furthermore, culture does not change significantly at the coastal/inland border. Thus, if we see significant discontinuities in manufacturing activities across the provincial border, it is unlikely to be due to geographic or cultural differences.

3. Economic discontinuities across the provincial border

3.1. Data

In this section, we introduce the data used throughout our analysis. In China, county-level administration units include county, county-level city, and prefecture city district.[7] However, to keep our counties comparable, we exclude all county-level units of provincial capital cities and vice-provincial level cities, since they are usually regional economic centers.[8] After dropping these economic centers, we have 48 county-level units on the coastal/inland provincial border, and 361 county-level units overall in the four plains provinces; we will refer to all of them as "counties."

Since our unit of observation is the county, we obtain county-level data from various sources. We use the Census County Yearbook (2000–2007) to obtain county-level demographic variables such as population and rural population. Rural population is defined as those who live in rural regions, including migrant workers. We define the urban population share as one minus the ratio of rural population over total population, and use this variable to measure the level of urbanization. The Census County Yearbooks also have data on grain production, which we use to measure agricultural production. Unfortunately, the County Yearbooks only include data for counties and county-level cities, but not prefecture-city districts, resulting in some missing data.

We use the Annual Survey of Industrial Firms (ASIF) (2000–2007) to construct county-level economic variables, including manufacturing output, manufacturing employment, manufacturing exports, export share, and production share of foreign firms. The ASIF surveys all state-owned firms and other firms with annual revenue over 500 million yuan (about US $605,000). It records information on firm ownership, location, production, exports, and many other variables. We aggregate the firm-level data to the county level (by adding up all surveyed

[5] For example, Ma (2017) uses dialect as a proxy for culture and finds that regions that speak the same dialects as Hong Kong, Macau, and Taiwan receive more foreign direct investment (FDI) from these regions, and have higher productivities due to technology spillovers from the FDI.

[6] Dialect data are obtained from Liu et al. (2015), who collect the county-level dialect data using Xu et al. (1999).

[7] City districts, county-level cities, and counties are effectively the same administrative level, so we refer to them as "counties".

[8] Vice-provincial level cities are directly administrated by the central government and are usually important economic centers.

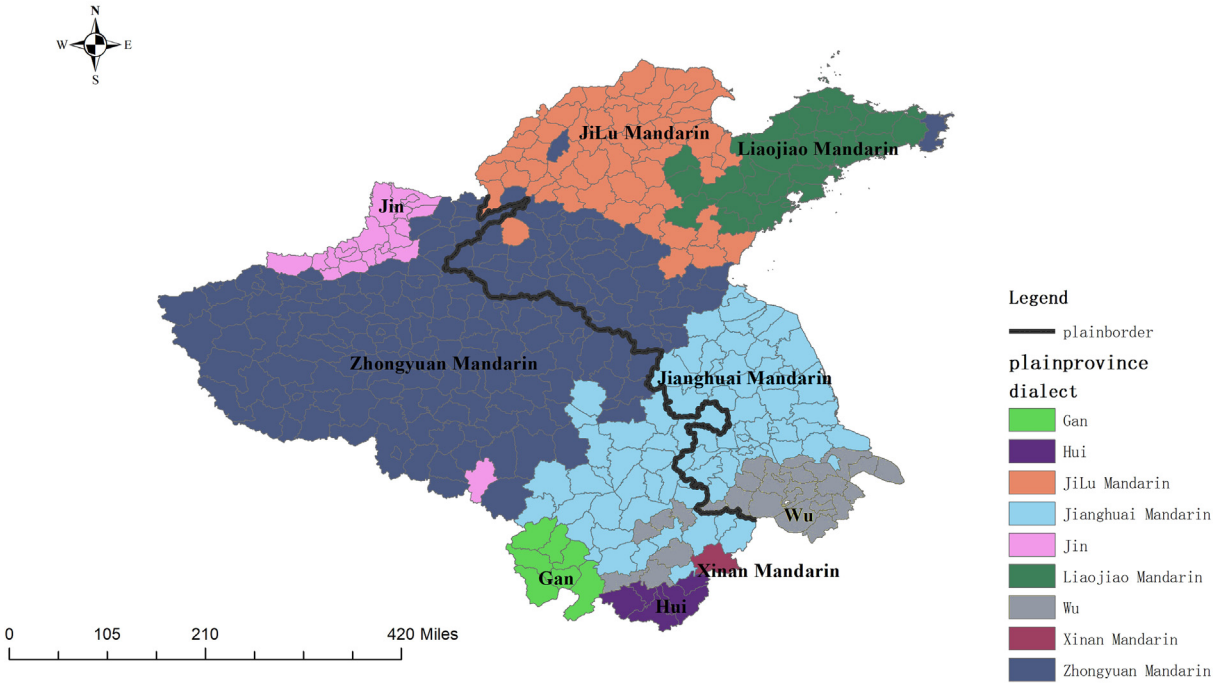

Fig. 3. Dialects in the plains provinces.

firms within the county) to obtain manufacturing output, manufacturing employment and manufacturing exports. Note that some counties have zero manufacturing exports in certain years. Export share is defined as the share of manufacturing production that is exported. The production share of foreign firms is defined as the share of manufacturing production produced by foreign firms.

We use China's county-level map and topographic map[9] to calculate variables indicating counties' geographic conditions. These variables are average elevation, the standard deviation of elevation, and distance of the county centroid to the provincial border. We also calculate the distance of the county centroid to the nearest seaport[10] as a measure of access to the world market, and distance to the provincial capital to measure distance to an economic center.[11]

We use dialect data as a proxy for culture in different counties. We obtained the data from Liu et al. (2015), who collect the county-level dialect data from Chinese Dialect Dictionary (Xu et al. (1999)).

We show the summary statistics of counties in the coastal and inland provinces, as well as counties countiguous to the provincial borders in Table 1. Panel A of Table 1 compares all counties in the coastal provinces (Jiangsu, Shandong) and inland provinces (Anhui, Henan), and panel B restricts the sample to counties contiguous to the border (on each side). Overall, the counties in the coastal and the inland provinces have similar areas and populations, although they differ somewhat in geographic conditions. For example, counties in the coastal provinces have lower average elevation, and the land is more flat (with a lower standard deviation of elevation). They are also closer to the seaport, with better access to world markets. Manufacturing employment and production are much higher in the coastal provinces than in the inland provinces: manufacturing employment in the coastal provinces is more than three times as high as that in the inland, while manufacturing production is more than five times as high. Manufacturing exports are nearly 20 times as high. Panel B compares only the contiguous counties on the two sides of the border. Population and areas are similar between the border counties on the coastal side and those on the inland side. They also do not differ much in the distance to the nearest seaport. The border counties on the coastal side have relatively lower elevation and are flatter. Despite these similarities in geographic conditions, there is a large gap in economic development. Manufacturing employment is nearly three times as high on the coastal side of the border as on the inland side of the border, production is nearly four times as high, and exports are more than five times as high. This is important; the counties on the coastal side of the border are nearly as far from the coast as the counties on the inland side, yet the levels of economic activity on the coastal side of the border are significantly higher.

Table 1 shows that there seems to be little difference in geographic conditions across the coastal/inland border, but there seem to be large economic discontinuities across the border. We next examine the economic (dis)continuities in the agricultural and industrial sectors.

3.2. Economic continuities in the agricultural sector

The four plains provinces are important agricultural provinces. Henan and Shandong provinces mainly produce wheat, while the southern provinces of Jiangsu and Anhui plant rice. The plains provinces are highly populated; the four provinces we focus on are all among the eight most populous of China's 23 provinces (according to the 2010 China population census).

In primarily agricultural economies like these, grain production is the most important economic activity and counties tend to be fairly self-sufficient. Thus, a political border would not necessarily cause discontinuities of economic activities if it were not along geographic barriers (such as mountains) that can change agricultural productivity abruptly. Fig. 4 shows how geographic conditions and agricultural production change with distance to the coastal/inland provincial border. Since a county on average is 1416 square kilometers (which equals approximately a 38×38 km square), we set the bin length as 20 km and calculate the average of our variables of interest in each bin. The scatterplots of variables against the distance to the provincial border are shown in Fig. 4. Graphs 1 and 2 of Fig. 4 show that there is no discontinuity

[9] China's county-level map is obtained from Global Administration Map (GADM) database, and the information on elevation is from DIVA-GIS.

[10] The port data are obtained from World Port Indicator (WPI).

[11] In China, the provincial capital is usually the largest city in a province. It is also the political and economic center of that province.

Table 1
Comparison between counties in the coast and inland.

	Inland		Coast		Ratio
	mean	sd	mean	sd	
Panel A: All Counties in the Coastal and Inland Provinces					
Industry Employment	14,726	14,923	50,720	57,011	3.44*
Industry Production (m. yuan)	3400	4692	17,781	30,445	5.23*
Exports (m. yuan)	159	284	2891	11,018	18.18*
Number of Firms	57	40	210	235	3.68*
Production Share (SOE)	0.21	0.21	0.12	0.15	0.57*
Foreign Share	0.05	0.09	0.16	0.16	3.20*
Export Share	0.06	0.07	0.12	0.1	2.00*
Export Probability	0.17	0.24	0.19	0.13	1.12
Urban Population	0.13	0.05	0.17	0.06	1.33*
Population (10,000)	75.51	36.29	80.62	31.51	1.07*
Land Area (km2)	1481.52	816.89	1342.71	603.14	0.91*
Distance to Port	454.69	148.92	154.52	93.8	0.34*
Distance to Prov. Capital	165.94	70.2	177.58	87.06	1.07*
Altitude Mean (m)	161.3	193.9	50.7	70.7	0.31*
Altitude Std Dev (m)	77.49	96.12	24.95	36.98	0.32*
Observations	1539		1343		
Panel B: Counties Contiguous to the Border Only					
Industry Employment	10,657	7865	30,652	28,698	2.88*
Industry Production (m. yuan)	2529	2761	9648	15,150	3.81*
Exports (m. yuan)	145	248	746	1318	5.14*
Number of Firms	55	31	153	175	2.78*
Production Share (SOE)	0.17	0.19	0.11	0.14	0.65
Foreign Share	0.05	0.08	0.11	0.14	2.20*
Export Share	0.06	0.07	0.08	0.07	1.33
Export Probability	0.15	0.19	0.14	0.1	0.93
Urban Population	0.14	0.05	0.17	0.06	1.23*
Population (10,000)	72.38	26.13	88.61	27.16	1.22*
Land Area (km2)	1481.54	623.57	1631.00	536.98	1.1
Distance to Port	287.66	85.29	260.18	96.79	0.90*
Distance to Prov. Capital	174.27	52.49	169.35	73.74	0.97
Altitude Mean (m)	46.6	23.7	35.9	15.8	0.77*
Altitude Std Dev (m)	22.7	29.79	12.43	16.36	0.55*
Observations	214		168		

[1] Panel A shows the comparison between coastal and inland counties in the four plains provinces; Panel B limits the sample to counties contiguous to the provincial borders. In the analysis, we exclude provincial capital cities, vice-provincial level cities and centrally administrated cities. *Ratio* is the ratio of coast to the inland, and * indicates that the difference between the coast and the inland is statistically significant at the 1% level, allowing for unequal variances following Satterthwaite's approximation.
[2] The table pools data from different years. *Industry employment* to *exporting probability* are from Annual Survey of Industrial Firms (2000–2007); *Urban Pop. Share* and *Population* are from County Census Yearbook (2000–2007).

in elevation or "ruggedness" (measured by the standard deviation of elevation) across the border. Since geographic conditions do not differ significantly as one crosses the border, we do not expect agricultural productivity to change at the border. Indeed, the third graph shows no discontinuity in grain production across the provincial borders. The last graph in Fig. 4 shows the distribution of the rural (non-urban) population. There are no significant discontinuities in rural population across the provincial border. Combined with the third graph, this suggests that agricultural productivity is similar on both sides of the border. Overall, Fig. 4 shows that this political border would not necessarily cause economic discontinuities in the agricultural sector in the absence of geographic discontinuities.

3.3. Economic discontinuities in the industrial sector

Although agricultural production and population show no evidence of discontinuities across the border, there is a statistically significant difference in manufacturing activities and exports as one crosses the border from the inland to the coastal side. Under China's current political system, economic affairs are largely decentralized to sub-national governments.[12] Different provinces may have different policies on international trade and economic development, and political borders can contribute to domestic market segregation.[13] Since China's economic reform began from the coastal region, coastal provinces were given preferential policies in trade and industry development. Border counties in the coastal provinces tend to have policies that encourage trade and industrial development more than neighboring inland counties, even if they have similar geographic conditions and culture and are similarly distant from the seaport. Border counties in the coastal provinces also benefit more from technology and production spillover from port regions. Thus, there is reason to conjecture that there may be a discontinuity of industrial activities across the borders between coastal provinces and inland provinces.

[12] For example, subnational governments spend about 70% of all fiscal expenditures (Wong 2008).
[13] There has been intensive research on the relationship between China's economic reforms and domestic market segregation.Young (2000) argues that economic reforms increased market segregation, while Holz (2009) did not find that. Nonetheless, there is a consensus that local protection is significant and inter-regional trade costs are high in China (Bai 2004).

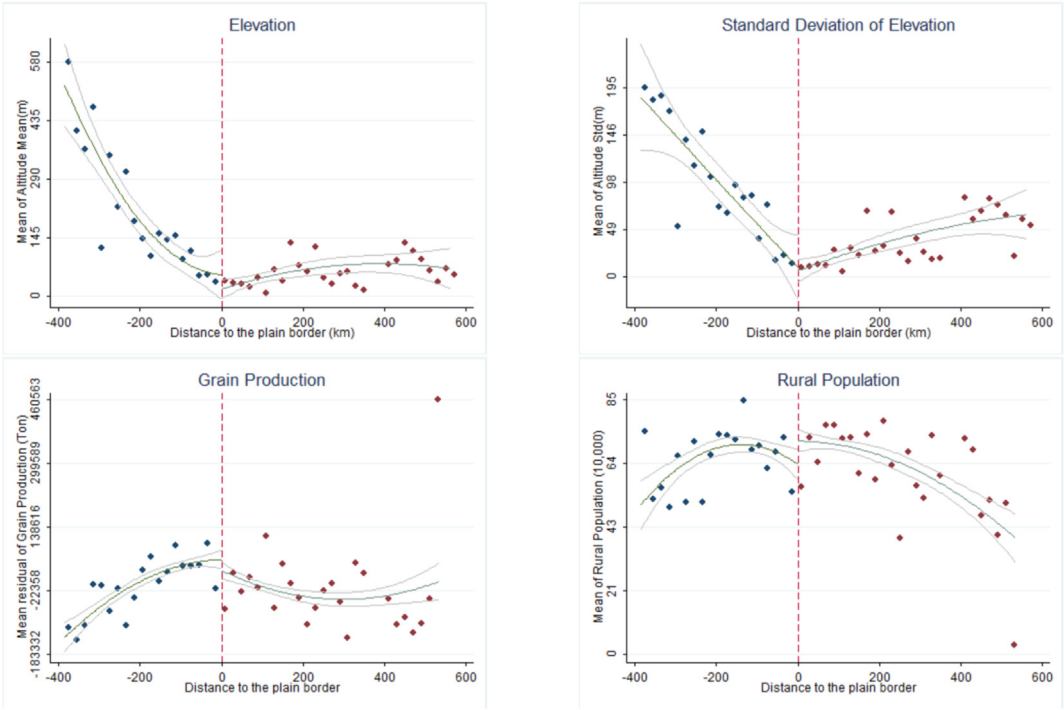

Fig. 4. Geographic and agricultural continuities across the border.

Fig. 5 shows the discontinuities in industrial activities across the border.[14] The share of urban population is higher in the coastal provinces, and there is an abrupt increase across the provincial borders, suggesting that the level of urbanization changes suddenly at the border. The second and the third graphs show that manufacturing output and manufacturing employment are higher on the coastal side than on the inland side of the border. Manufacturing exports are also significantly higher on the coastal side of the provincial border, although the exporting share does not seem to change abruptly across the border. However, the last graph shows that the coastal provinces have a higher share of foreign output, even at their inland border, indicating that foreign firms play a more significant role in coastal counties than in inland counties.

To have a better picture of the distribution of manufacturing activities in the plains provinces, Fig. 6 shows the distribution of manufacturing production in these provinces, with darker blue indicating higher levels of production. Maps are similar for manufacturing exports and the number of manufacturing firms, also showing the same pattern: the coastal provinces have a much higher economic density than the inland provinces. This is not surprising, as coastal provinces have better access to the world market and more trade-enhancing policies. However, the sharp contrast of manufacturing density at the provincial borders is surprising. The density of manufacturing activities (both production and exports) decreases from the coast to inland region, and drops sharply at the provincial borders.

4. The provincial border effect

4.1. Empirical method

The previous section shows that counties in the coastal provinces have significantly higher manufacturing density than those in the inland provinces. Much of this difference occurs at the provincial border, despite similarities in geographic and cultural conditions. In the following analysis, we conduct boundary analyses restricting our sample to counties on either side of the border. After dropping provincial capitals and vice-provincial cities, our sample includes 48 counties adjacent to the provincial borders of the four plains provinces. We begin with a simple empirical model:

$$y_{rt} = \beta_0 + \beta_1 Coast_r + \beta_2 distport_r + \beta_3 elev_r + \beta_4 distcap_r + \\ + \beta_5 south_r + \beta_6 dialect_r + \gamma_t + \varepsilon_{rt} \quad (1)$$

where $Coast_r$ is a dummy variable equal to one if a county is in the coastal province, $distport_r$ is the log of distance to the nearest seaport, and $elev_r$ is a county's average elevation. Although we select the counties contiguous to the provincial borders to minimize geographic differences between the coast and the inland, we include distance to seaport and elevation to control for any remaining differences in access to the world market and costs of trade with other regions. We use dialect as a proxy for culture and control for the dialect spoken at the county level. We also include $distcap_r$, the log of distance (km) to the provincial capital, to measure the spillover effects from economic centers.[15] Finally, we include $south_r$, a dummy variable that equals one for counties on the Anhui-Jiangsu provincial border (the southern provinces), since the southern provinces are generally more developed than the northern provinces,[16] and a county status fixed effect (city districts and county-level cities are more developed than counties). We also include a year fixed effect γ_t. We assume the error terms ε_{it} are independent across counties but correlated within a county. Thus, we cluster standard errors at the county level.

For the dependent variables, we consider the following five variables as measures of industrial development: urban population share, log of

[14] Results are similar when we use a linear approximation and a bandwidth of 200 km. If we reduce the bandwidth to 100 km, we see discontinuities in all variables except the export share. These results are available from the authors on request.

[15] The spillover effect from a large economic center may also be negative. For example, Faber (2014) finds that counties in China connected to large cities through the National Highway Systems experienced a slower economic growth.

[16] Results are qualitatively similar when we divide the border into six segments. These results are available from the authors.

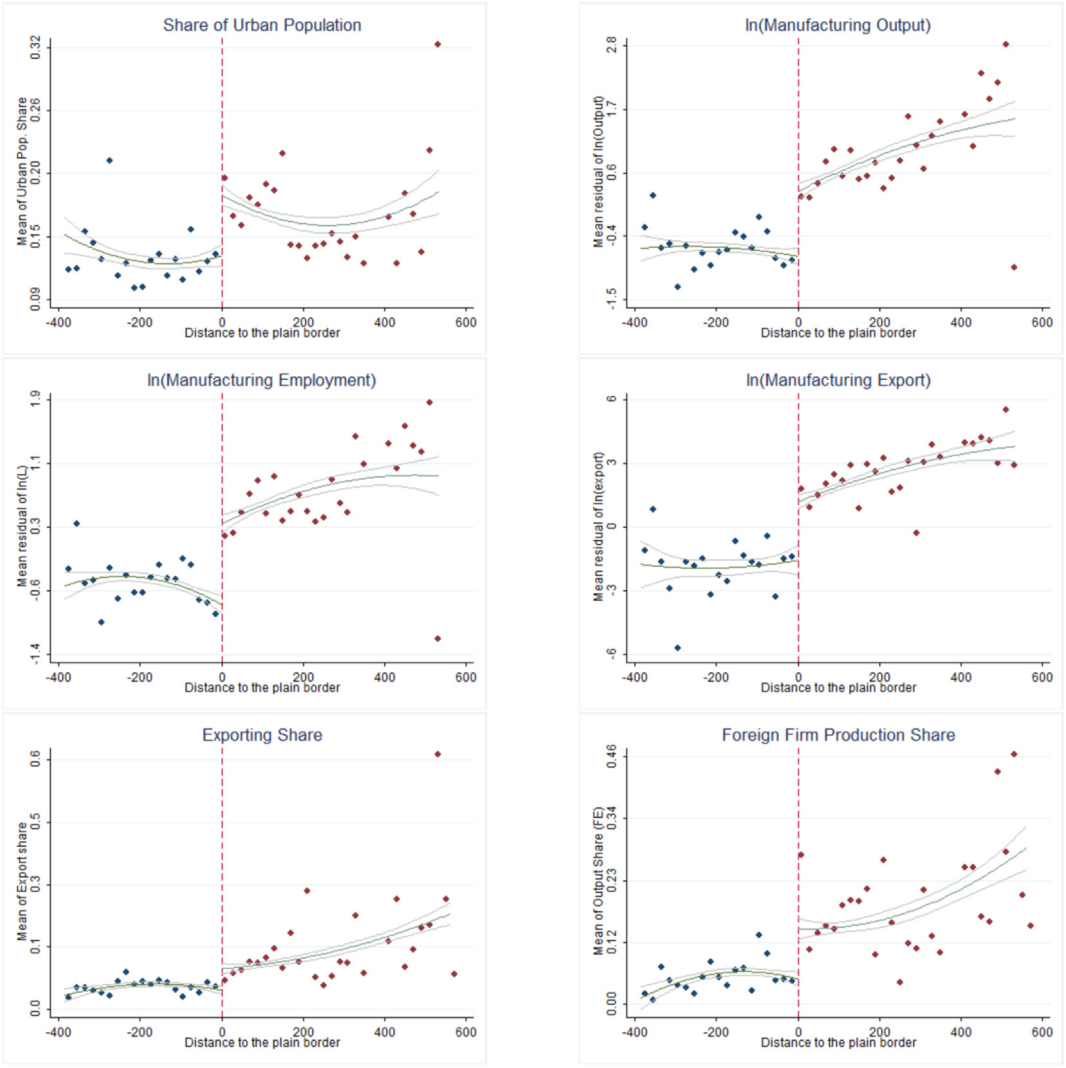

Fig. 5. Economic discontinuities across the border.

manufacturing output, log of manufacturing exports, export share, and the production share of foreign firms. Urban population share measures the level of urbanization, while the log of manufacturing output and exports measure the county's industrial development.[17] Exporting share measures the importance of exports in a county's manufacturing production, while the production share of foreign firms measures the importance of foreign firms in manufacturing production. When running regressions with respect to manufacturing output and manufacturing exports, we also control for population in the regressions to control for scale.

Table 2 presents the results of estimating equation (1), or the effects of the coastal/inland provincial border on industrial development, including only counties contiguous to the provincial border. Crossing the border from the inland to the coast, a county's share of urban population increases by four percent, manufacturing output increases by nearly 80 percent, and manufacturing exports increase by 114 percent. Although the exporting share of manufacturing products does not change much (three percent) across the border, the production share of foreign firms (column 5) increases by 7.6 percent from the inland to the coastal side of the border, suggesting that foreign firms play a somewhat more important role in the coastal than the inland counties, even at the provincial border.

While the approach in Table 2 includes fixed effects for county status and the southern provinces, it does not allow for more disaggregated fixed effects. To address this, we follow the approach of Dube et al. (2010) and construct cross-border county pairs to estimate the border effect within cross-border county pairs.[18] After deleting counties in provincial capitals, we have 43 county pairs along the provincial border in the plains sample.

We run the following regression:

$$y_{rjt} = \beta_0 + \beta_1 Coast_{rj} + Z_{rj}\gamma + \eta_{jt} + \epsilon_{rjt} \quad (2)$$

where, as before, β_1 is our variable of interest. $Coast_{rj}$ is a dummy variable equal to one if county r in pair j is in the coastal province. The control variables Z_{rj} are analogous to those in equation (1): distance to seaport, average elevation, dialect, distance to the provincial capital, and county status. In this specification, we control for η_{jt}, the county pair-year two-way fixed effect. In this way, we can estimate the border effect within the pair-year cell. We assume that the error terms ϵ_{rjt} are independent across counties but correlated within a county and correlated within county pairs. Thus, we use two-way clustered standard errors at the county and pair levels.

[17] We log the variables that are not shares.

[18] Note that, as in Dube et al. (2010), a county can be in more than one county pair because it can be adjacent to more than one county on the other side of the border.

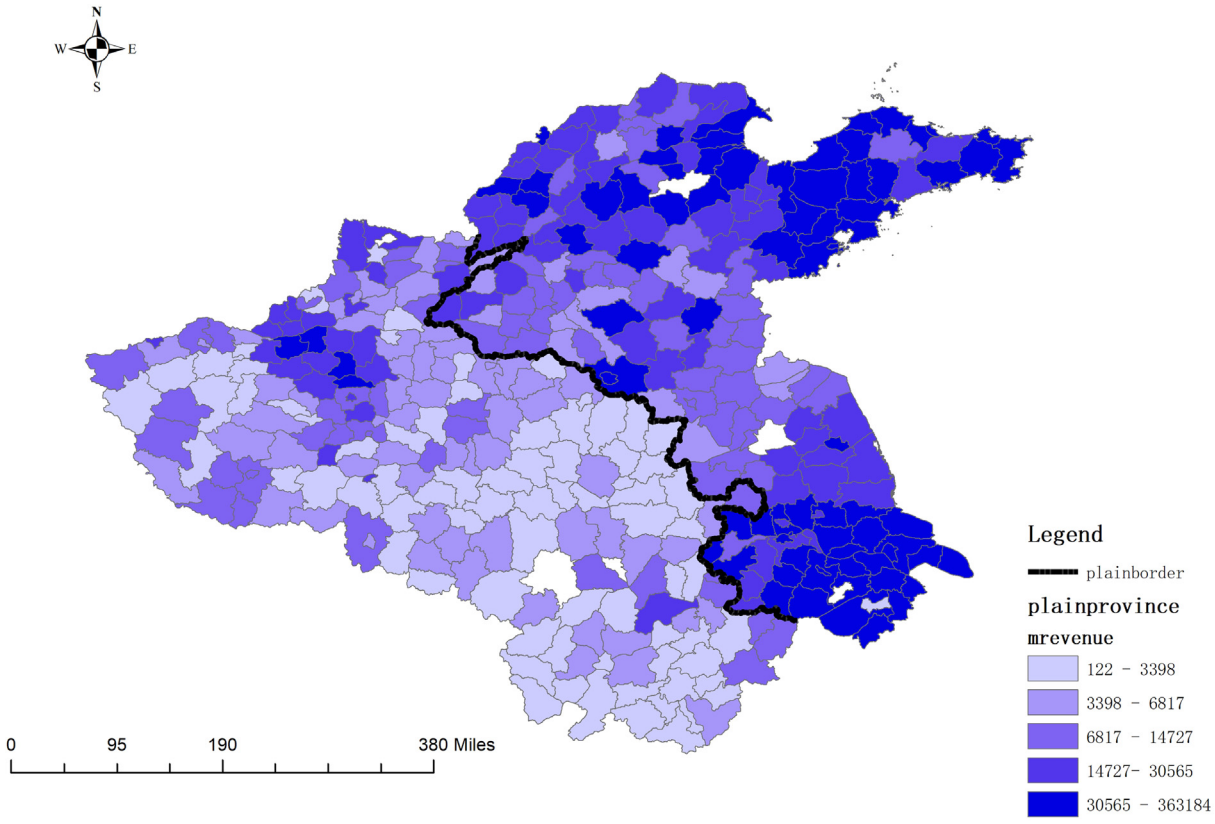

Fig. 6. Manufacturing Output in 2007 *Notes: The graph depicts manufacturing production (measured in million yuan) in each county in 2007.*

Table 2
Border effects of economic development.

	(1) Urban Pop. Share	(2) ln(Output)	(3) ln(Export)	(4) Export Share	(5) Foreign Share
Coast	0.0405***	0.7955***	1.1428***	0.0303	0.0761**
	(0.0125)	(0.2628)	(0.3642)	(0.0194)	(0.0316)
ln(Dist. Port)	0.1009**	−0.7869	−1.0168	0.0288	0.0620
	(0.0384)	(0.7960)	(1.2115)	(0.0559)	(0.1175)
ln(Dist. Capital)	−0.0342**	−0.2360	0.4403	0.0423	−0.0704
	(0.0156)	(0.2579)	(0.4815)	(0.0278)	(0.0471)
Elevation (m)	−0.0004**	0.0024	0.0036	0.0001	0.0009*
	(0.0002)	(0.0031)	(0.0067)	(0.0004)	(0.0005)
Observations	335	331	303	378	378
R^2	0.672	0.753	0.507	0.209	0.214

[1] Sample includes counties contiguous to the provincial border of the four plains provinces. Standard errors in parentheses clustered at county level; $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.
[2] The regressions also control for culture (measured by dialect), *south*, county status and year fixed effects. Columns 2 and 3 also include the log of population to control for scale.
[3] The number of observations varies across the regressions because of missing data on urban population share and population, and counties with values of zero for exports.

We consider the same five variables as dependent variables: urban population share, log of manufacturing output, log of manufacturing exports, export share, and the production share of foreign firms.

Table 3 presents the results of estimating equation (2), or the effects of the coastal/inland provincial border on industrial development within county pairs using only counties contiguous to the provincial border. As in Table 2, development is higher in the coastal counties: the urban population share is three percent higher, manufacturing output is 52 percent higher, exports are 129 percent higher, the export share is 4.5 percent higher, and the production share of foreign firms is eight percent higher. We use the county-pair estimation technique for the remainder of the paper.

Tables 2 and 3 show large discontinuities across the coastal/inland provincial borders, and Table 1 showed large overall differences between the coastal and inland plains provinces. How do the discontinuities at the border compare to the overall provincial gap? We estimate the following equation:

$$y_{rjpt} = \beta_0 + \beta_1 y_{pt} + Z_{rj}\gamma + \eta_{jt} + \varepsilon_{rjt} \quad (3)$$

This regression equation is identical to equation (2) except that we replace the dummy variable $Coast_r$ with y_{pt}, the average value of y

Table 3
Border effects of economic development, county pairs.

	(1) Urban Pop.	(2) ln(Output)	(3) ln(Exports)	(4) Export Share	(5) Foreign Share
Coast	0.0309**	0.5231*	1.2939***	0.0451*	0.0818***
	(0.0124)	(0.2754)	(0.4111)	(0.0263)	(0.0297)
ln(Dist. Port)	−0.0079	−3.1068**	−4.2156**	0.0399	0.0038
	(0.0656)	(1.3064)	(2.0671)	(0.1071)	(0.1951)
ln(Dist. Capital)	−0.0079	0.0816	0.5582	0.0655**	−0.0511
	(0.0221)	(0.2050)	(0.5130)	(0.0319)	(0.0522)
Altitude Mean(m)	−0.0003	0.0034	0.0055	−0.0001	0.0010
	(0.0003)	(0.0081)	(0.0104)	(0.0005)	(0.0008)
Observations	620	606	464	674	674
R^2	0.789	0.883	0.744	0.669	0.601

[1] Sample includes cross-border county pairs as described in the text. Standard errors in parentheses clustered at county and county pair level, $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.
[2] The regressions also control for culture (measured by dialect), county status fixed effect, and pair-year fixed effects. Columns 2 and 3 also include the log of population to control for scale.
[3] The number of observations varies across the regressions because of missing data on urban population share and population, and counties with values of zero for exports.

Table 4
Border gap as a share of provincial gap.

	(1) Urban Pop.	(2) ln(Output)	(3) ln(Exports)	(4) Export Share	(5) Foreign Share
Y_{pt}	0.740***	0.393***	0.450***	0.428*	0.549***
	(0.193)	(0.116)	(0.140)	(0.236)	(0.165)
Observations	620	606	464	674	674
R^2	0.816	0.904	0.745	0.668	0.621

[1] Standard errors in parentheses clustered at county and county pair level, $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.
[2] The regressions also control for distance to the nearest seaport, distance to the provincial capital, elevation, culture (measured by dialect), county status, and pair-year fixed effects. Columns 2 and 3 also include the log of population to control for scale.

in province p and year t.[19] All other controls are as in equation (2). Here, the coefficient β_1 measures the share of the difference between provinces that can be accounted for by the gap between border counties.[20] These results are in Table 4. For convenience, we only reports the results for estimates of β_1.

From Table 4, the border gap is approximately 74 percent of the overall difference in urban population share between coastal and inland provinces, 39 percent of the difference in manufacturing production, and 45 percent of the difference in manufacturing exports. The gap between border counties is also 43 percent of the difference in the export share and 55 percent of the difference in the production share of foreign firms between provinces overall.

Tables 2 and 3 show evidence of large manufacturing discontinuities at the provincial borders. This large divide between the coastal and inland is unlikely to be explained by geography or culture, as the previous section established that these do not change abruptly at the provincial border. Results in Table 4 further show that the border gap is a large fraction of the overall difference between coastal and inland provinces. That is, a county on the coastal side of the border is more similar to counties in the same province than to a neighboring county on the inland side of the border, even though the counties are comparably distant from the coast. These results suggest that provincial-level policies may have shaped the economic geography of these counties and contributed to the gap across the provincial border.

5. Heterogeneity in the border effect

While the previous sections establish a provincial border effect in the plains regions, there are reasons to suspect that the border effect may not be constant. In this section, we examine two such possibilities: that the border effect is weaker for the state-owned sector, and that it varies when there is a geographic border (specifically, mountains) in addition to the political border. Our findings in this section provide further evidence that provincial differences in policy contribute to the change in economic activity at the border. In Section 8, we also consider heterogeneity over time, since our time period includes China's accession to the World Trade Organization.

5.1. State and non-state owned sectors

China's economic reforms and openness started by allowing non-state sectors to grow. The state sector remains under the direct control of the government, and state-owned firms are fairly evenly distributed across the country.[21] However, the development of non-state and foreign sectors is less directly controlled by the state, and since economic

[19] Excluding counties contiguous to the coastal/inland border from the provincial average does not significantly change the results, except for export share; see Appendix A.

[20] To see this, compare a border county r_1 in the coastal province p_1 with a border county r_2 in the inland province p_2, $\beta_1 = \frac{y_{r_1 p_1 t} - y_{r_2 p_2 t}}{y_{p_1 t} - y_{p_2 t}}$, which is the ratio of the border county gap to the provincial gap.

[21] In the planned economy era, regional balance was a major focus as China developed its state-owned sector. Moreover, China's manufacturing investment tended to be directed toward the inland regions for national defense reasons. Thus, the distribution of state-owned firms was more affected by national interests than by market factors, and state-owned firms are distributed fairly evenly across the country as a result.

Table 5
Border effect of economic development by ownership sector.

	(1) ln(Output)	(2) ln(Exports)	(3) Export Share
Panel A: State Sector			
Coast	0.1037	−1.0111	−0.0167*
	(0.4702)	(0.8382)	(0.0086)
Observations	606	606	620
R^2	0.663	0.587	0.541
Panel B: Private Sector			
Coast	0.4492	3.2685***	0.0559**
	(0.3185)	(0.6528)	(0.0210)
Observations	606	606	674
R^2	0.867	0.730	0.665
Panel C: Foreign Sector			
Coast	4.5535***	3.3421**	−0.1210
	(1.0914)	(1.3181)	(0.0859)
Observations	606	606	452
R^2	0.758	0.730	0.621

[1] Standard errors in parentheses clustered at county and county pair level, $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.
[2] The regressions also control for distance to the nearest seaport, distance to the provincial capital, elevation, culture (measured by dialect), county status fixed effect and county pair-year fixed effects. Columns 1 and 2 also include the log of population to control for scale.
[3] We use $ln(1+y)$ in Columns 1 and 2 to avoid missing values due to zeroes.

reform began, the coastal provinces have experienced higher growth in non-state sectors than have the inland provinces. China's incremental reforms have meant that the private sector was first allowed to grow in special economic zones, typically in the coastal region. This "one step ahead" advantage has led to coastal provinces having more favorable policy environments for the non-state sector. As a result, we expect to see a larger discontinuity in non-state sectors than in the state sector.

In Table 5, we divide industrial output into the state-owned, private, and foreign sectors, and run regression (2) for each sector separately. Again, our sample includes only counties contiguous to the provincial borders in the four plains provinces. In Panel A, the state sector only, the manufacturing discontinuity is not statistically significant for manufacturing output or manufacturing exports. The export share is higher on the *inland* side of the border. However, for the (domestic) private sector shown in Panel B, manufacturing exports are significantly higher on the coastal side of border. Manufacturing output is also higher on the coastal side, although the effect is not statistically significant. The export share is also higher on the coastal side of the border, indicating that private firms on the coastal side of the border participate more in international trade than do their neighbors on the inland side of border. In the foreign sector, as shown in Panel C, manufacturing output and exports are much higher on the coastal side of the border, but the discontinuities across the border are not significant for exporting share. As expected, Table 5 shows larger economic discontinuities in the non-state sector (i.e., the private and foreign sectors) than in the state sector. China's incremental reform strategy allowed for policies promoting economic development and international trade in the coastal region, leading to the development of a non-state economy and increases in foreign investment and international trade. The effects of these policies are concentrated in the non-state sector, since the distribution of state-owned firms, which predates China's economic reform, resulted from policies focused on self-sufficiency and regional equality. This provides some evidence that the differences in policies and openness since economic reform have contributed to the economic discontinuities at the coastal/inland border.

5.2. Plains borders vs. mountain borders

In the previous section, we consider only counties contiguous to the borders of the plains provinces, to avoid confounding factors that could also cause economic discontinuities, such as differences in geographic conditions and culture. When there is no geographic barrier, and cultures are similar, economic discontinuities across the borders are more likely to be due to policy differences. However, preferential policies also need favorable locations to function as intended.[22] Previous research, such as Démurger et al. (2002a), has emphasized the importance of geographic conditions and preferential policies, but has not examined the interaction of these two forces. In this section, we examine the entire border between the coastal and inland regions, including the mountainous parts of the border, to determine how geographic conditions interact with the border effect.

Fig. 7 depicts the entirety of the border between the coastal and the inland provinces of China. Some parts of the coastal/inland border are in the plains regions, and other parts are in the mountainous regions. Note that the four provinces of our plains sample are among the areas with the lowest elevation (shown in lightest blue). As before, we construct county pairs following Dube et al. (2010), and delete county pairs involving counties in provincial capitals. This results in 190 cross-border county pairs; the median county elevation is 342 m. We define "mountain county pairs" as pairs in which at least one county has an average elevation over 500 m (shown in darkest blue in Fig. 7). We then run regression 2 on the entire sample, the mountain sample, and the non-mountain sample. The results are shown in Table 6.

For the entire sample (Panel A), the border effect is positive for all of the dependent variables, as in Table 3, which included only the four plains provinces. The estimated border effects for export share and the production share of foreign firms are statistically significant. Perhaps surprisingly, the results are similar for the mountain (Panel B) and non-mountain (Panel C) samples, although the coefficient estimates are larger for the mountain sample. These results do not suggest that the border effect varies significantly with geography.

6. Robustness of the provincial border effect

6.1. Human capital and local infrastructure

In the main analysis, we use only counties contiguous to the provincial borders of four plains provinces to examine the effect of political borders on the distribution of manufacturing activity. Since these border counties are similar in geography and culture, the economic discontinuities are more likely to be explained by policy differences. However, there may be other local differences that contribute to economic discontinuities. Here we examine the effects of two such factors: local human capital and local infrastructure. Human capital is an important factor in determining economic growth, and if counties on the coastal side of the border have a higher level of human capital, they will have more manufacturing production and employment. We follow Mankiw et al. (1992) and use school enrollment rates as a measure of human capital. Since better infrastructure can facilitate trade, we use the length of railways and paved roads as proxies for local infrastructure. Adding these control variables into equation (1), we obtain the estimates in Table 7.

[22] For an example, one need only look at Guangdong province on the southeast coast, the first province to implement the opening-up policy. While its total GDP has increased to be the largest in China since economic reform, this growth is unevenly distributed across the province; for example, Shenzhen's GDP per capita is more than seven times that of Meizhou, a city in north Guangdong. Most of Guangdong's growth, in the Shenzhen area, is due to the development of the Pearl River Delta, which is adjacent to Hong Kong and very accessible to the world market. Despite having the same province-level policies, Guangdong's mountainous north and west regions are among the poorest and least developed regions in China.

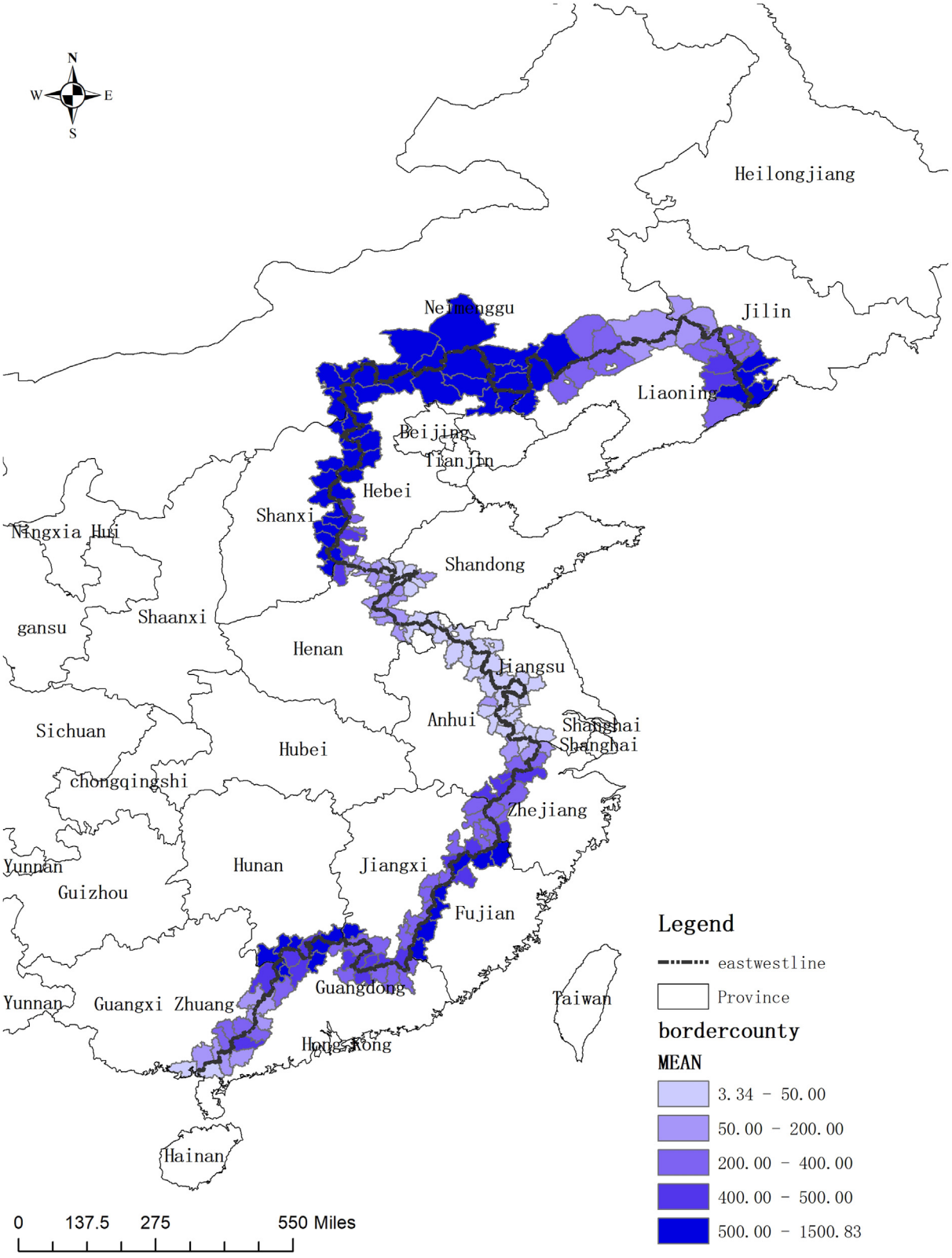

Fig. 7. Counties contiguous to the coastal/inland borders.

Adding these local control variables does not substantively change our main results. The coefficients on the dummy variable *Coast* remain positive and statistically significant for all dependent variables except the export share, and the magnitudes of the coefficients are similar to Table 3. These results show that large economic discontinuities still exist after controlling for local variables. Thus, economic discontinuities across the coastal/inland border are unlikely to be due to local factors like education and infrastructure, increasing our confidence that the border discontinuities are caused by policy differences at the provincial level.

Table 6
Border effect of economic development by geography.

	(1) ln(Output)	(2) ln(Exports)	(3) Export Share	(4) Foreign Share
Panel A: Entire sample				
Coast	0.043	0.912	0.040***	0.087***
	(0.150)	(0.764)	(0.013)	(0.019)
Observations	2516	2516	2662	2662
R^2	0.872	0.698	0.723	0.661
Panel B: Mountain sample				
Coast	0.152	1.668	0.043**	0.104**
	(0.188)	(1.357)	(0.020)	(0.021)
Observations	1084	1084	1098	1098
R^2	0.887	0.707	0.674	0.713
Panel C: Non-mountain sample				
Coast	0.199	0.852	0.033*	0.067***
	(0.212)	(0.838)	(0.018)	(0.024)
Observations	1432	1432	1564	1564
R^2	0.842	0.638	0.761	0.642

[1] Standard errors in parentheses clustered at county and county pair level,$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.
[2] The regressions also control for distance to the nearest seaport, distance to the provincial capital, elevation, culture (measured by dialect), county status fixed effect and county pair-year fixed effect. Columns (1) and (2) also include the log of population to control for scale.
[3] We use $ln(1 + y)$ in Column (2) to avoid missing values due to zeroes.

Table 7
The Coastal/Inland Border Effect (with controls).

	(1) Urban Pop.	(2) ln(Output)	(3) ln(Exports)	(4) Export Share	(5) Foreign Share
Coast	0.0295**	0.7107*	1.0073*	0.0182	0.1198***
	(0.0134)	(0.3556)	(0.5842)	(0.0190)	(0.0358)
ln(human capital)	−0.0566**	0.3142	−2.4541**	−0.0224	0.0958
	(0.0269)	(0.4246)	(1.0193)	(0.0510)	(0.0878)
lnroad	−0.0097	−0.0009	0.4808*	0.0136**	−0.0442***
	(0.0065)	(0.1161)	(0.2421)	(0.0059)	(0.0107)
lnrail	0.0042	0.1410	0.0791	−0.0091	0.0034
	(0.0029)	(0.1158)	(0.1751)	(0.0083)	(0.0086)
Observations	620	606	464	606	606
R^2	0.808	0.893	0.767	0.693	0.683

[1] Standard errors in parentheses clustered at county level,$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.
[2] human capital(hc): number of primary and middle school students per 10,000 population. Road: length (in kilometer) of paved road. Rail: length (in kilometer) of railway.
[3] The regression equations also control for distance to the nearest seaport, distance to the provincial capital, elevation, culture (measured by dialect), county status fixed effect and county-pair fixed effect. Columns 2 and 3 also include the log of population to control for scale.

6.2. The "false" border effect

Are the effects we found really provincial border effects? If economic activities change discontinuously from county to county, we could find economic discontinuities in the main analysis even if provincial borders have no effect. In this section, we check whether economic activities change abruptly across a hypothetical provincial border. Specifically, we construct false borders to check whether there are similar economic discontinuities away from the provincial border (that is, between counties on the inland border and adjacent inland counties, and between counties on the coastal border and adjacent counties in the coastal provinces). In other words, we shift the provincial border toward the inland, and toward the coast, and look for similar effects with these "false" provincial borders.

Fig. 8 shows how we choose the comparison groups. We use counties adjacent to the border counties on either side of the border as our comparison group. In the figure, the dark pink counties are contiguous to the border and the light blue ones are the comparison counties for this analysis. The borders between the dark pink and light blue counties are our "false borders". The first comparison is between inland counties contiguous to the provincial border and inland counties contiguous to the border counties. The second comparison is between coastal counties contiguous to the borders and coastal counties contiguous to the border counties. In both cases, we run equation (2) to identify any economic discontinuities across the false borders. To avoid confusion, we replace the variable *Coast* with the variable *East* to indicate counties on the eastern (coastal) side of the border.[23]

Panel A of Table 8 shows the effects of the false border in the inland region. The coefficients on the dummy variable *East* are small and statistically insignificant in all cases except for the share of urban population. The results show that there are no economic discontinuities in manufac-

[23] In our previous analysis, *Coast* identified counties in the coastal provinces. In these falsification tests, either all counties are in the coastal provinces (Panel B), or no counties are (Panel A). Regardless, throughout the paper, the dummy variable indicates the counties on the eastern/coastal side.

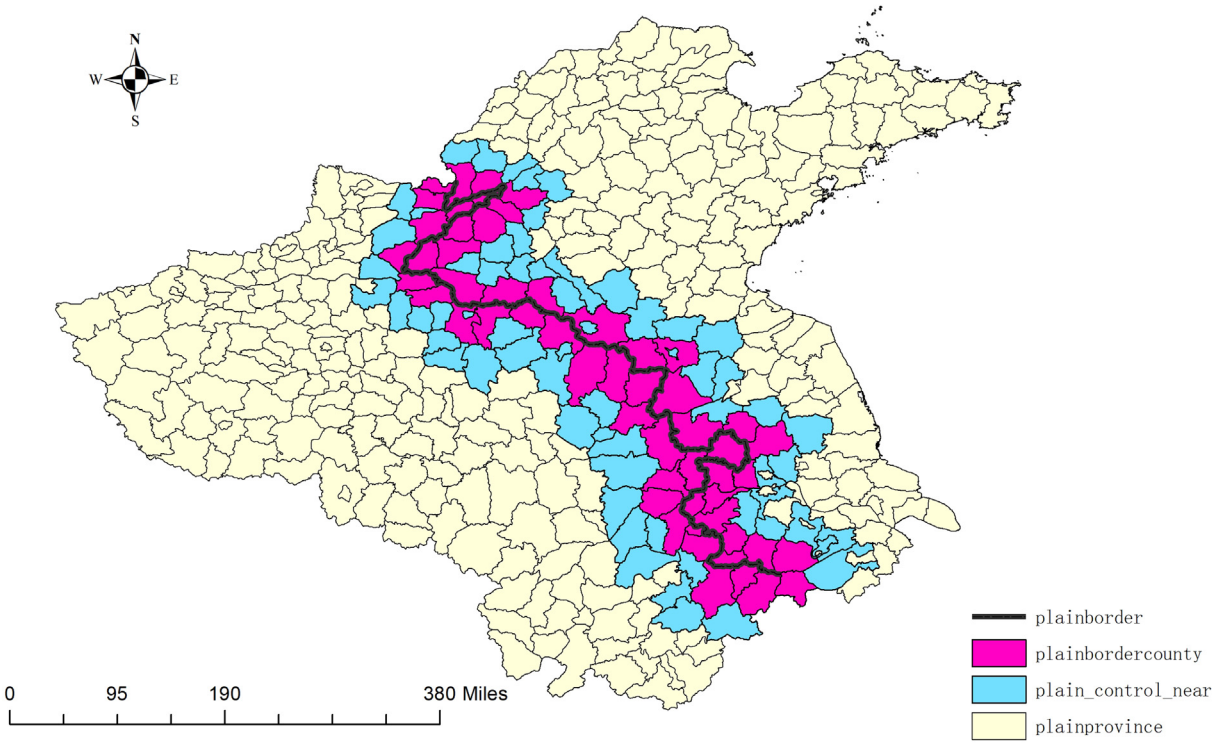

Fig. 8. Bordering counties and comparison counties.

Table 8
The effects of false borders.

	(1) Urban Pop.	(2) ln(Output)	(3) ln(Exports)	(4) Export Share	(5) Foreign Share
Panel A: The Effects of the False Border in the Inland Region					
East	0.0332***	0.2754	0.3042	−0.0147	−0.0205
	(0.0104)	(0.1716)	(0.3465)	(0.0112)	(0.0229)
Observations	424	412	294	710	710
R^2	0.806	0.894	0.852	0.633	0.543
Panel B: The Effects of the False Border in the Coastal Region					
East	−0.0098	−0.0762	−0.1578	−0.0085	0.0151
	(0.0093)	(0.1420)	(0.1990)	(0.0160)	(0.0195)
Observations	592	592	572	782	782
R^2	0.881	0.928	0.835	0.667	0.682

[1] Standard errors in parentheses clustered at county and county pair level, $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.
[2] The regression equations also control for distance to the nearest seaport, distance to the provincial capital, elevation, culture (measured by dialect), county status fixed effect and county pair-year fixed effect. Columns 2 and 3 also include the log of population to control for scale.

turing output, exports, export share, or the production share of foreign firms across the false border in the inland provinces. However, there seems to be a large difference in the urban population share for adjacent counties in the same inland province. Panel B shows the effects of the false border in the coastal provinces. The coefficients on the dummy variable *East* are statistically insignificant for all regressions, suggesting that there is no economic discontinuity across the false border in the coastal provinces. Together, these results imply that the provincial border effect identified in earlier sections is exactly that: an economic discontinuity at the provincial border.

7. Preferential policies and the border gap

The previous analysis identifies economic discontinuities across the coastal/inland provincial border, and suggests that different policies between the coastal and inland provinces have contributed to the discontinuities. In this section, we use a proxy for policy differences to help explain the border effect.

China's economic reform and openness began from the coastal region. Early reforms and trade liberalizations, such as the opening up of special economic zones, the open cities, and the coastal development strategy, all aimed to open up the coastal region to the world economy. The coastal regions have received many preferential policies in international trade, including the protection of private property rights, tax incentives, and land use policy for foreign firms (Wang, 2013). Today, all regions in China have opened to international trade, but the coastal region still enjoys more trade-promoting policies. All of the special economic zones are in the coastal region, and there are more National Development Zones (NDZ) in the coastal provinces. Many reform and opening-up policies are implemented in the coastal region first; in short, the coastal provinces have considerable policy advantages over the inland provinces.

Table 9
Preferential policies and the border effect.

	(1) Urban Pop.	(2) ln(Output)	(3) ln(Exports)	(4) Export Share	(5) Foreign Share
NDZ	0.0091***	0.1175***	0.1409	0.0033	0.0172***
	(0.0019)	(0.0416)	(0.1010)	(0.0042)	(0.0058)
PDZ	−0.0005***	−0.0045	0.0068	0.0003	−0.0005
	(0.0001)	(0.0028)	(0.0096)	(0.0002)	(0.0003)
Observations	620	606	464	674	674
R^2	0.822	0.889	0.744	0.659	0.612

[1] Standard errors in parentheses clustered at county and county pair level, $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.
[2] The regression equations also control for distance to the nearest seaport, distance to the provincial capital, elevation, culture (measured by dialect), county status fixed effect and county pair-year fixed effect. Columns 2 and 3 also include the log of population to control for scale.

While it is hard to measure the openness level of a province precisely, we use the number of NDZs as a proxy for preferential policies. The NDZs include Economic and Technology Development Zones (ETDZ), High-tech Industrial Development Zones (HIDZ), and Export Processing Zones (EPZ). While these three types of NDZs have different functions, they are authorized by the central government and they all provide preferential economic policies such as tax benefits, preferential land policies, and the protection of private property (Wang (2013)). We use the number of NDZs within a province as a measure of preferential policies authorized for the province by the central government. The distribution of NDZs is concentrated in the coastal regions: in 2000, there were 62 NDZs in the 20 inland provinces and 99 NDZs in the 11 coastal provinces, and there continue to be more NDZs in the coastal region today. In our sample, there were three NDZs in Anhui and Henan throughout our sample period (2000–07). In contrast, the number of NDZs in Jiangsu increased from eight in 2000 to eleven in 2007, while the number in Shandong increased from eight to ten.

In addition to NDZs, there are also many provincial-level economic development zones (PDZs) authorized by provincial governments. These zones also enjoy preferential policies, but to a lesser extent. More importantly, they do not represent preferential policies granted by the central government. From 2000 to 2007, the number of PDZs increased substantially for all of the plains provinces except Henan. The number of PDZs in Jinagsu increased from 32 to 171, while the number increased from 47 to 134 in Shandong. For the inland provinces, the number of PDZs increased from five to 79 in Anhui, and from six to eight in Henan.

To examine the relationship between preferential policies and manufacturing activity, we run equation (2) but replace the dummy variable *Coast* with the number of NDZs and PDZs. The results are shown in Table 9.

We find that the number of national development zones is strongly correlated with the urban share of population, manufacturing output, and the share of production by foreign firms. However, with the exception of the urban population share, the number of provincial development zones does not have a statistically significant effect once we control for the number of NDZs.

From the results in Table 9, the gaps in preferential policies between the coastal and the inland provinces predict a 5.7 percent difference in the urban population share between the coast and the inland,[24] 73.6 percent difference in manufacturing output, and 10.8 percent difference in the production share of foreign firms. These differences are fairly large relative to the results in Table 3.

Of course, there is another interpretation of the number of NDZs, which is that they can be seen as a measure of the strength of spillover effects.[25] If provincial borders prevent spillover effects of NDZs, the counties in provinces with more NDZs will benefit more from NDZ spillovers than counties in provinces with fewer NDZs. Thus, the border gap can also be interpreted as the different level of spillover effects from these special economic zones. However, given the lack of geographic or cultural barriers at the provincial border, policy differences would seem to be one of the most likely explanations for spillover effects that cannot cross a border.

8. WTO accession and the border effect

Thus far, we have shown that large economic discontinuities exist across the coastal/inland border, and we argue that preferential policies in trade and openness at the provincial level can explain much of the border gap. Since our data encompass China's accession to the World Trade Organization (WTO), in this section, we examine how trade liberalization affects the border gap.

China's trade liberalization began in the coastal region and was gradually extended to other regions. In 1980, China set up four special economic zones (SEZs) to began opening up its economy. The four SEZs are Shenzhen, Zhuhai, Shantou and Xiamen. They are all coastal cities (not in the four plains provinces we focus on) and are both geographically and culturally close to Hong Kong and Taiwan. The success of the SEZs led to the opening up of 14 coastal cities in 1984. Hainan province was set up as a new special economic zone in 1988 and Pudong New Area in Shanghai was established in 1990 and was granted more favorable opening up policies. In 1988, China launched a "coastal development strategy" to encourage coastal provinces to fully participate in the international economy (Yang (1991)). The aim was to create a multi-level opening up structure, with the coastal region more involved in international trade. But after its accession to the WTO in December 2001, China transitioned to a more comprehensive opening-up strategy, opening all regions to international trade and actively participating in global production.

We are interested in China's WTO accession for two reasons. On the one hand, WTO accession can be seen as an external trade liberalization. Trade theory predicts that external integration will cause production to move to regions with better access to the world market. Hanson (1998) finds that after Mexico's trade liberalization in 1980s, Mexico's manufacturing center had shifted from its capital region to the northern border regions. In China, since its economic reform in 1978, the coastal regions have grown much faster than the inland regions. WTO access could lead manufacturing production to further agglomerate in

[24] The mean number of NDZs in the inland provinces is three, while the mean in the coastal provinces is 9.26. Since the coastal provinces have 6.26 more NDZs, and one more NDZ is associated with 0.91 percent increase of urban population share, the gap in preferential policies implies a difference of 5.7 percent in urban population share.

[25] None of the border counties in the sample has an NDZ.

Table 10
WTO effects on the border.

	(1) Urban Pop.	(2) ln(Output)	(3) ln(Exports)	(4) Export Share	(5) Foreign Share
Coast × *WTO*	0.0118**	0.193*	−0.449	−0.0320***	0.0280*
	(0.00469)	(0.105)	(0.339)	(0.00941)	(0.0164)
Observations	606	674	522	674	674

[1] Standard errors in parentheses clustered at county and county pair level, $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

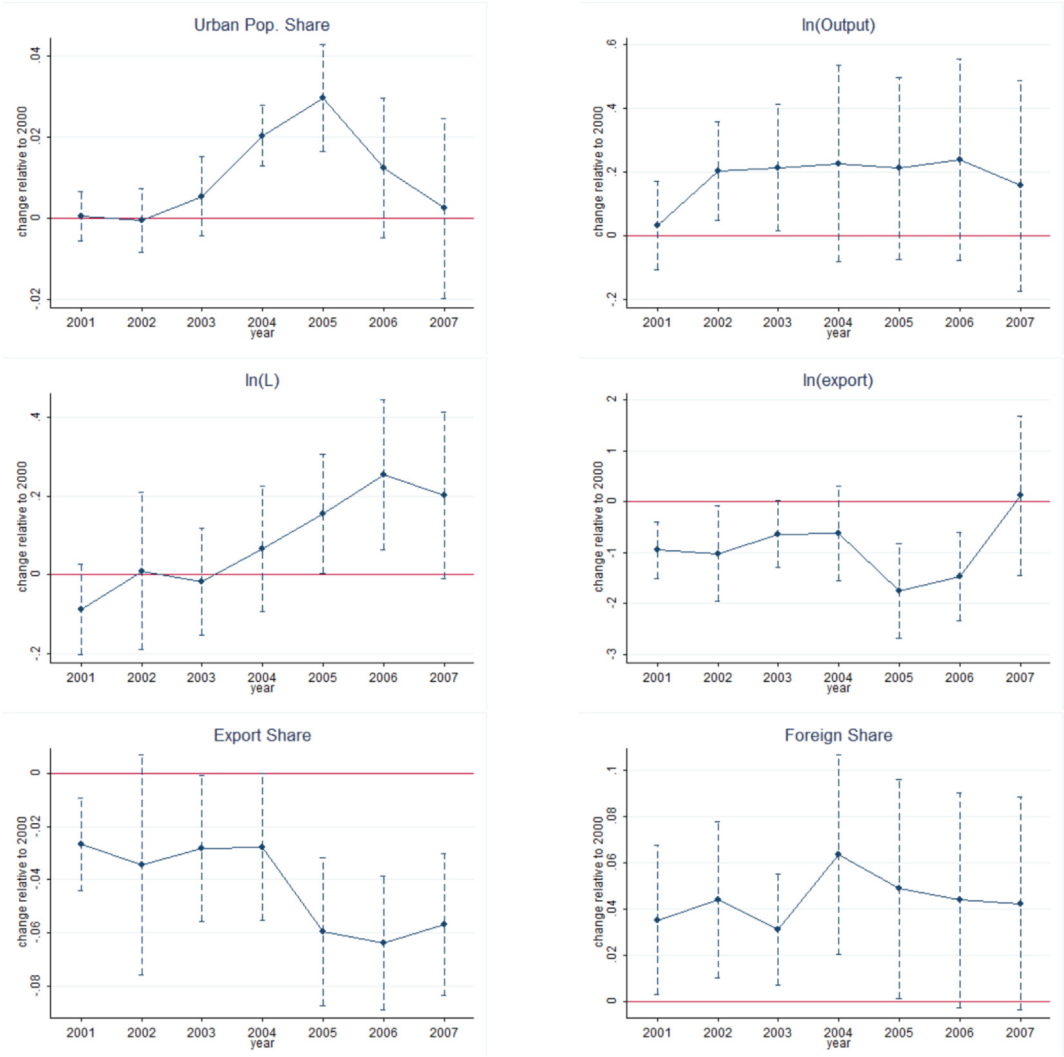

Fig. 9. Trends of the Border Effect.

the coastal region.[26] On the other hand, the WTO accession marked China's transition from a partial opening up to a more comprehensive openness strategy, opening all regions to economic and trade liberalization. As a result, WTO accession would decrease the policy advantage of the coastal region and encourage the inland region to participate more in international trade. Furthermore, regional development policies were launched to help develop inland China. The Western Development Project was launched in 2000 to help the western provinces attract FDI and develop their economies. The Rise of the Central China Project was implemented in 2004 to accelerate the development of the central provinces, including the inland provinces Anhui and Henan included in our main analysis. Thus, overall policy differences between the coastal and inland regions should have decreased since China's WTO accession, which could reduce border discontinuities in export-related activities.

To examine the effect of WTO accession on the border gap, we incorporate an interaction term between the coastal counties and China's membership in the WTO (2002 and later) and run the following regression equation:

$$y_{rjt} = \beta_0 + \beta_1 Coast_{rj} \times WTO_t + \eta_r + \gamma_{jt} + \varepsilon_{rjt} \quad (4)$$

We include county fixed effects η_r and pair-year fixed effect γ_{jt}. The results are shown in Table 10. Counties on the coastal side of the

[26] For example, Coşar and Fajgelbaum (2016) show that external trade liberalization leads to agglomeration in coastal regions in China.

border experienced higher growth in urban population share, suggesting a faster process of structural change. Manufacturing output also grew faster on the coastal side of the border, indicating an agglomeration in the coastal region because of its better access to the world market. In column 5, we also find that foreign sectors (measured by production share of foreign firms) grew faster in the coastal region, reflecting that foreign firms were more likely to choose production in the coastal region. Meanwhile, we find that manufacturing exports seem to grow faster on the inland side of the border, although this difference is not statistically significant. The exporting share also increased faster on the inland side of the border. This may be because China opened its inland regions after 2002, reducing the policy advantages of the coastal regions and allowing the inland regions to catch up with the coast in international trade.

To see the trend of the border gap from 2000 to 2007, we also run the following regression:

$$y_{rjt} = \beta_0 + \sum_{2001}^{2007} \beta_t Coast_{rj} \times Year_t + \eta_r + \gamma_{jt} + \varepsilon_{rjt} \quad (5)$$

where $Year_t$ is an indicator variable for year. We plot the coefficients of the interaction terms with 95% confidence interval in Fig. 9.

The border gap in manufacturing output and employment appears to increase after WTO accession. The gap in the foreign share of production seems to increase after 2004, while the gaps in manufacturing exports and export share seem to decrease after 2004. The trade liberalization associated with WTO accession, combined with regional policies to support disadvantaged regions, appear to have caused both the agglomeration of production in the coastal region and a decrease in the border discontinuities of export-related variables.

9. Conclusion

This paper documents large economic discontinuities between the coastal and inland regions of China. Using provincial borders in the plains regions, we show that the economic discontinuities we identify are not due to geographic barriers or cultural differences. Further analysis shows that the economic discontinuities are stronger in the private and foreign sectors than in the state sector, and there are few differences between mountain and non-mountain regions. We also use a proxy for preferential policies and the timing of China's accession to the WTO to show that trade openness can account for much of the economic discontinuities across the border dividing the coastal and inland regions. Two falsification exercises show that no similar discontinuities in manufacturing or export activity occur at "false" borders only slightly removed from the provincial borders.

The results in this paper support the idea that subnational (provincial) policies can cause regional disparities for regions with similar geographic conditions. For an economically decentralized country like China, the results show that place-based policies not only increase economic growth in regions granted preferential policies, but may also increase inequalities across regions. The results in this paper also suggest that place-based policies should focus on places that would benefit from the policy, not places within certain political boundaries. More generally, these results suggest that the border discontinuities created by place-based policies can be as significant as those created by geographic barriers.

Declaration of competing interest

The authors have no affiliation with any organization with a direct or indirect financial interest in the subject matter discussed in the manuscript.

Appendices

A. The Border Effect as a Share of Provincial Gap

In estimating equation (3), we use the provincial-level gap to explain the border county gap. Since border counties are also used to calculate provincial level Y_{pt}, there may be a concern about simultaneity. Here we exclude counties contiguous to the borders and use the remaining counties to calculate the provincial mean Y_{pt}^{NB}.

Table A.1
Border Gap as a Share of the Provincial Gap

	(1) Urban Pop.	(2) ln(Output)	(3) ln(Exports)	(4) Export Share	(5) Foreign Share
Y_{pt}^{NB}	0.684***	0.371***	0.417***	0.336	0.512***
	(0.184)	(0.108)	(0.134)	(0.212)	(0.155)
Observations	620	606	464	674	674
R^2	0.812	0.904	0.744	0.659	0.619

[1] Standard errors in parentheses clustered at county and county pair level, $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.
[2] The regressions also control for distance to the nearest seaport, distance to the provincial capital, elevation, culture (measured by dialect), county status, and pair-year fixed effects. Columns 2 and 3 also include the log of population to control for scale.

Table A.1 shows results using this new measure of provincial average. We find that the border effect can explain 68.4% of the difference in the share of urban population between coastal and inland provinces, 43.1% of the difference in manufacturing output, 37.1% of the difference in manufacturing output, and 51.2% of the difference in the production share of foreign firms. It also accounts for 33.6% of the difference in exporting share, although the effect is not significant. The results are quantitatively similar to the results in Table 4.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.regsciurbeco.2021.103700.

Author statement

Hao Guo: methodology, investigation, formal analysis, validation, resources, data curation, writing, visualization. Jenny Minier (corresponding author): conceptualization, methodology, formal analysis, resources, writing, supervision, visualization.

References

Acemoglu, Daron, Robinson, James A., 2013. *Why Nations Fail: The Origins of Power,* Prosperity, and Poverty. Crown Business.

Acemoglu, Daron, Dell, Melissa, 2010. Productivity differences between and within countries. Am. Econ. J. Macroecon. 2 (1), 169–188.

Alder, Simon, Shao, Lin, Zilibotti, Fabrizio, 2015. Economic reforms and industrial policy in a panel of Chinese cities. J. Econ. Growth 1–45.

Bai, Chong-En, Du, Yingjuan, Tao, Zhigang, Y Tong, Sarah, 2004. Local protectionism and regional specialization: evidence from China's industries. J. Int. Econ. 63 (2), 397–417.

Coşar, A. Kerem, Fajgelbaum, Pablo D., 2016. Internal geography, international trade, and regional specialization. Am. Econ. J. Microecon. 8 (1), 24–56.

Dell, Melissa, Olken, Benjamin A., 2020. The development effects of the extractive colonial economy: the Dutch cultivation system in java. Rev. Econ. Stud. 87 (1), 164–203.

Dell, Melissa, Pablo, Querubin, 2018. Nation building through foreign intervention: evidence from discontinuities in military strategies. Q. J. Econ. 133 (2), 701–764.

Démurger, Sylvie, Sachs, Jeffrey D., Thye Woo, Wing, Shuming, Bao, Chang, Gene, 2002. The Relative Contributions of Location and Preferential Policies in China's Regional Development: being in the right place and having the right incentives. China Econ. Rev. 13 (4), 444–465.

Démurger, Sylvie, Sachs, Jeffrey D., Woo, Wing Thye, Bao, Shuming, Chang, Gene, Mellinger, Andrew, 2002. Geography, economic policy, and regional development in China. Asian Econ. Pap. 1 (1), 146–197.

Dube, Arindrajit, William Lester, T., Reich, Michael, 2010. Minimum wage effects across state borders: estimates using contiguous counties. Rev. Econ. Stat. 92 (4), 945–964.

Faber, Benjamin, 2014. Trade integration, market size, and industrialization: evidence from China's national trunk Highway system*. Rev. Econ. Stud. rdu010.

Hanson, Gordon H., 1998. Regional adjustment to trade liberalization. Reg. Sci. Urban Econ. 28 (4), 419–444.

Holmes, Thomas J., 1998. The effect of state policies on the location of manufacturing: evidence from state borders. J. Polit. Econ. 106 (4), 667–705.

Holz, Carsten A., 2009. No Razor's Edge: reexamining Alwyn Young's evidence for increasing interprovincial trade barriers in China. Rev. Econ. Stat. 91 (3), 599–616.

Jin, Hehui, Qian, Yingyi, Weingast, Barry R., 2005. Regional decentralization and fiscal incentives: federalism, Chinese style. J. Publ. Econ. 89 (9–10), 1719–1742.

Kanbur, Ravi, Zhang, Xiaobo, 1999. Which Regional Inequality? The evolution of rural–urban and inland–coastal inequality in China from 1983 to 1995. J. Comp. Econ. 27 (4), 686–701.

Li, Hongbin, Zhou, Li-An, 2005. Political Turnover and Economic Performance: the incentive role of personnel control in China. J. Publ. Econ. 89 (9–10), 1743–1762.

Liu, Yuyun, Xu, Xianxiang, Xiao, Zekai, 2015. "The pattern of labor's cross-dialect migration. Econ. Res. J. 50 (10), 134–146.

Ma, Sen, 2017. The Effects of Cultural Similarity on Foreign Direct Investment and Productivity of Domestic Firms: Identification from Borders of Chinese Dialect Zones. Unpublished manuscript.

Mankiw, N Gregory, Romer, David, Weil, David N., 1992. A contribution to the empirics of economic growth. Q. J. Econ. 107 (2), 407–437.

Pinkovskiy, Maxim L., 2017. Growth discontinuities at borders. J. Econ. Growth 22 (2), 145–192.

Poncet, Sandra, 2005. A Fragmented China: measure and determinants of Chinese domestic market disintegration. Rev. Int. Econ. 13 (3), 409–430.

Shen, Liren, Dai, Yuanchen, 1990. The creation, origins, and failings of dukedom economies in China. Econ. Res. J. 3 (10).

Tan, Qixiang, 1987. China Historical Map, vol. 8. SinoMaps Press.

Wang, Jin, 2013. The economic impact of special economic zones: evidence from Chinese municipalities. J. Dev. Econ. 101, 133–147.

Wong, Christine, Bird, Richard, et al., 2008. "China's Fiscal System: A Work in Progress," China's Great Economic Transformation, pp. 429–466.

Xu, Baohua, et al., 1999. Chinese Dialect Dictionary, vol. 5. Zhonghua Book Company.

Xu, Chenggang, 2011. The fundamental institutions of China's reforms and development. J. Econ. Lit. 49 (4), 1076–1151.

Yang, Dali L., 1991. China Adjusts to the World Economy: the Political Economy of China's Coastal Development Strategy. Pacific Affairs, pp. 42–64.

Young, Alwyn, 2000. The Razor's Edge: distortions and incremental reform in the People's Republic of China. Q. J. Econ. 115 (4), 1091–1135.

Zhou, Li-An, 2007. Governing China's Local Officials: an analysis of promotion tournament model. Econ. Res. J. 7, 36–50.