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Regional Industrial Evolution in China: Path Dependence or Path Creation?

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Abstract

The evolutionary economic geography indicates that regional industrial development is path dependent. The path dependence approach however ignores the external factors, which may create new paths of regional development. Moreover, it does not pay much attention to the role of institutions. Both external factors and institutions are crucial to understand the regional industrial evolution in China. Based on firm level data of Chinese manufacturing industries during 1998-2008, this study examined the industrial evolution through the lens of entry and exit of four digit industries at the Chinese prefectures. Using a measure of co-occurrence based technological relatedness, we apply a logit model to link industry entry and exit to technological relatedness. We find significant evidence that regions branch into new industries which are technologically related to the existing industries and related industries are less likely to exit. Related globalization also encourages the entry of new related industries and discourages the exit of related industries. Further analysis reveals that economic transition has created favorable conditions to allow a larger role of technological relatedness. New industries are more likely to enter regions which are globalized, liberalized and fiscally independent, indicating that economic transition has also generated opportunities for Chinese regions to create new paths of industrial development.

Key Words: Technological Relatedness, Economic Transition, Industrial Evolution, Path Dependence, Path Creation

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Introduction

The integration of evolutionary economics into economic geography has revitalized research interests in the spatial emergence of new industries and industrial evolution of regions (Boschma and Lambooy, 1999; Neffke et al., 2011; Boschma and Minondo, 2012; Isaksen, 2014). Regions often evolve through a process of creative destruction. New industries however do not start from scratch. The emergence of new industries is shaped by a set of technological and institutional competencies accumulated at the local level. Previous experience affects the emergence and performance of new industries (Buenstorf and Klepper, 2009; Klepper and Simons, 2000). Regions are most likely to branch into industries that are technologically related to the existing industries (Boschma and Frenken, 2011; Neffke et al., 2011). This has been confirmed for a region's industrial diversification, the emergence of new industries at the regional level (Neffke et al., 2011; Boschma and Minondo, 2012) and for the emergence of radical fuel cell technology across European regions (Tanner, 2011). Regional industrial evolution is therefore path dependent.

The path dependence approach however only concerns the endogenous factors as regions develop through technologically related diversification or through the combination of existing competence (Isaksen, 2014). However, regions also develop as a result of external linkages such as foreign investments and international trade. External linkages may bring new industries and new knowledge, creating new paths for regional industrial development. New industries may not be related to the existing industries (Henning et al., 2013). In addition, the empirical evidence on the role of technological relatedness is largely from European regions, which operate under the market economies. Firm diversification, spinoffs, labor mobility and social networking are important mechanisms for the process of regional branching(Boschma and Frenken, 2011). Regional institutions clearly play a crucial role for those mechanisms to work. For instance, studying the emerging internet industry in Beijing and Shanghai, Zhang (2013) argues that a region's enduring political institutional embeddedness significantly affects the generation and evolution of their related varieties. The related diversification approach has systematically ignored the possible effect of institutions on the process of regional branching.

This study will examine the role of technological relatedness, globalization and institutions in regional industrial evolution in China. China is a unique case since it has experienced revolutionarily economic and institutional transformations during the past three decades. Questions of how industries come into being and whether industry emergence is embedded in geographical settings have received little attention. A triple process of economic transition, namely, marketization, globalization and decentralization has been observed in China although it is a spatially unbalanced process (Wei 2001; He et al. 2008). The triple process has certainly influenced the spatial emergence of new industries and regional industrial revolution in China. Marketization has brought about the liberalization of economies, facilitating the

knowledge spillovers, labor mobility and industrial linkages and the creation of a large number of privately-owned firms, particularly in the coastal region. In economically liberalized regions, it is expected that technological relatedness drives industrial evolution. In regions with the dominance of state-owned sectors, the emergence of new industries may not necessarily relate to the existing industrial structure.

Chinese regions have actively participated in the globalization process through utilizing foreign investments and trading with other countries. Globalization has not only brought external investments but also new knowledge into regional development. Globalization may create new paths for regional industrial development. However, inflow of external knowledge should be related to some extent to the industrial structure of a region to exert an economic impact (Boschma and Iammarino, 2009). Related globalization is expected to play a larger role in industrial evolution in Chinese regions. Finally, decentralization has granted local governments authorities and incentives to intervene in industrial development. Fiscal decentralization has triggered fierce interregional competition and local protectionism, which has caused the fragmentation of domestic markets and the distortion of regional production away from patterns of comparative advantages (Young, 2000; Poncet, 2005; He et al., 2008). Decentralization therefore may downplay the importance of technological relatedness in regional industrial evolution in China.

Based on firm level data of Chinese manufacturing industries during 1998-2008, this study will first aggregate the firm level data into four digit level industries and then examine the entry and exit of industries in Chinese prefectures. Following Hidalgo et al.(2007), we develop a new measure of technological relatedness based on the co- occurrence analysis of paired industries. New measure of technological relatedness can be calculated at the four digit industry level in cities. This is much improved than that based on input output tables which can only provide linkages of a smaller number of aggregated industries at the national or provincial levels. We then link industry entry and exit to technological relatedness, globalization and institutions at the prefecture level. The linear probability model results indicate that regions do branch into new industries, which are technologically related to the existing industrial portfolio and related industries are more likely to survive in Chinese regions. Related globalization reinforces the path dependent process. Further analysis reveals that institutions matter for the role of technological relatedness. Specifically, in fiscally healthy regions and economically liberalized regions, technological relatedness plays a larger role in industry dynamics. The path dependent approach seems powerful to explain the regional industrial evolution in China. However, economic transition also generates opportunities for Chinese regions to create new paths of industrial development. New industries are more likely to enter globalized, liberalized and fiscally independent regions. Conducive institutions cultivate the development of new industries, which may not be related to the existing industries. Good institutions are keys to path creation in transitional economies like China.

This paper contributes to the literature in several ways. First, it provides empirical evidence on technological relatedness in regional industrial diversification from a

transitional economy, complementary to the evidence from European and American regions. Second, this study stresses that regional institutions play a crucial role in the significance of technological relatedness. Marketization and decentralization not only create favorable conditions to diversify industrial structure but also allow a larger role of technological relatedness in the diversification process. Third, this study finds that globalization may create new paths of industrial diversification or reinforce the path dependence if it is related to the existing industrial structure.

This paper is structured as follows. Following the introduction, the second section provides literature review to link technological relatedness and economic transition to regional industrial evolution. The third part introduces data sources and methods and describes the spatial emergence and exit of industries. This paper then conducts an econometric analysis to test the significance of technological relatedness and institutional proxies and finally concludes with a summary of empirical findings.

Relatedness and Industrial Evolution of Regions

Regions are often subject to a process of creative destruction identified as the key driving force behind industrial development (Neffke et al., 2011). Regions develop new industries to compensate for the decline and death of other industries. The question is how new industries emerge and whether new industries are geographically embedded. Proposing the theory of Window of Locational Opportunity, Storper and Walker(1989) argue that localization of new industries is rather independent from preexisting industrial structures. Scott(2006) however argues that understanding the economic landscape must point to the idea of path dependent economic evolution and recursive interaction. Massey(1984) views regional economies as the historical product of the combination of layers of activities. Recently, Boschma and his co-authors suggest that the spatial emergence of new industries is not an entirely accidental process (Boschma and Martin, 2007; Boschma and Frenken, 2011). New industries build on a set of generic, location specific resources that have the potential to trigger new industries to emerge. This idea of path dependency has been deployed in studies of the persistence of regional economic disparities; of the lock in of regions to particular economic specializations; the revival and reinvention of former local industrial configurations; and of the emergence and self-reinforcing growth of high tech clusters (Martin and Sunley, 2006).

The evolutionary turn in economic geography has proposed that regional industrial evolution is a path dependent process, whereby new industries grow out of preexisting industrial structures through technologically related localized knowledge spillovers (Boschma and Frenken, 2011). Since the important contribution of Boschma(2005), there has been an increasing awareness that cognitive proximity is more important than geographical proximity for knowledge spillovers. Technological relatedness occurs when firms in a region operate within technologically related industries that have overlapping knowledge bases (Boschma and Frenken, 2011). Local knowledge spillovers are more likely to occur within regions hosting a large number of technologically related industries. Technological relatedness is therefore an important enabling factor for the creation of new industries and formation of new regional

industrial paths (Neffke et al., 2011). Empirically, technological relatedness has been found to exert influence on industrial clustering (Boschma and Weterings, 2007; Delgado et al., 2010), employment growth (Bishop and Gripaios, 2010; Hartog et al., 2012), spinoff dynamics (Heebles and Boschma, 2011), productivity growth (Quatraro, 2010) and regional growth (Frenken et al., 2007; Boschma and Iammarino, 2009; Boschma et al., 2012).

Considering the importance of technological relatedness, a new stream of literature has investigated the industrial evolution of regions and proposed the regional branching process (Neffke et al., 2011; Boschma et al. 2012; Essletzbichler, 2013). They demonstrate that regions introduce new technologies, products and industries through a process of creative destruction (Martin and Sunley, 2006; Boschma and Frenken, 2011; Essletzbichler, 2013). Technological relatedness acts as the main driver of this diversification process, in which a new sector spawns from related sectors (Klepper and Simons, 2000) or from the recombination of capabilities from multiple related sectors (Klepper, 2002). Regions tend to expand and diversify in sectors that are strongly related to their current activities. Klepper and Simon(2000) show that successful television producers are experienced radio producers prior to entering the television industry, indicating a high level of complementarity in competences and routines between the two industries. Boschma and Wenting(2007) confirm that technological relatedness to the regional knowledge base plays a large role in the localization of the British car industry. In Sweden, industries are more likely to enter regions with technologically related industries and that existing industries are more likely to exit regions where other industries are not technologically related (Neffke et al.,2011). In Spain, regions tend to diversify into new industries that use similar capabilities as existing industries in the regions (Boschma et al., 2012). In the United States, technological relatedness is found positively related to metropolitan industry portfolio membership and industry entry and negatively related to industry exit (Essletzbichler, 2013). Analyzing the emergence of nantechnology based sectors at the regional level, Colombelli et al.(2014) support the idea that the technological competences accumulated at the local level are likely to shape the future patterns of technological diversification.

The notion of technological relatedness has put a renewed vision of the role of agglomeration externalities on performance of firms, industries and regions. The empirical evidence largely comes from the developed economies including European regions and United States. However, this approach of regional industrial evolution puts too much emphasis on the role of existing industries and the local knowledge bases. Furthermore, it has systemically ignored the possible effect of institutions on the economic evolution of regions. One can question the influence of technological relatedness in the developing and transitional economies, which are seeking any development opportunities, but lack perfect market systems.

Globalization, Institutions and Industrial Evolution of Regions in China

The path dependent approach of regional industrial evolution largely focuses on the endogenous factors (Isaksen, 2014). This is reasonable for mature and developed

economies, which are supported by knowledge intensive sectors with good market systems. For developing economies, external factors such as globalized forces often play a crucial role for regional industrial development. For transitional economies which are transforming from a commanding economy to market driven economies, institutions are critical to allow the role of technological relatedness (He and Pan, 2010). Building new industries in regional economies is a complicated matter and cannot be ascribed to the regional composition of knowledge bases alone. There are several ways for regions to create new paths of development, including recombinant innovation based on existing industrial or technological diversity (Frenken et al., 2012), investment and technology transfer from outside the region (Bathelt et al., 2004) and technological change and endogenous transformation of firms in the region (Todtling and Tripple, 2005). New industries brought by external linkages may not relate to the existing regional industries (Henning et al., 2013; Isaksen, 2014).

China has actively engaged into the process of globalization since the beginning of economic reform. By now, China has been the top player in the global market. Globalization is an important catalyst for transformation in transition economies, providing financial resources, technologies, knowledge, management skills and markets, which are necessary to transform and restructure the obsolete industrial systems inherited from the commanding economy (He et al., 2008). Global-local linkages can be established through many different channels, including trade exchanges, inward and outward FDI and involvement in global production networks and technological alliances (Boschma and Iammarino, 2009). Those external linkages often bring new knowledge and competence into a region, creating new industries and breaking regional lock-in (Bathelt et al., 2004).

Practically, foreign investments and exports are two critical ways to channel new knowledge into Chinese regions. On the one hand, foreign investments may come with new industries, creating new regional industrial path. For instance, more than 30 Chinese cities can produce automobiles, which are often introduced by foreign joint ventures. On the other hand, foreign investments in China have considerable knowledge spillover effects within the same industry and across industries through the effects of demonstration and competition, labor mobility and business linkages (Cheung and Lin, 2004; Liu, 2008). Exporting activities expose Chinese regions to the global market. Exporters are found to take advantage of industrial linkages through deeper division of labor to foster the formation of industrial clusters (Fujita and Hu, 2001). Exporters also benefit from information spillovers derived from labor mobility, spatial agglomeration, technological imitation and the diffusion of exporting experience (Trevor et al., 2007). Regions heavily engaged into the globalization process are more likely to have new knowledge of industries. Following the same logic in evolutionary economic geography, Boschma and Iammarino(2009) further argue that the inflow of external knowledge should be related to some extent to the industrial structure of a region to exert a significant economic impact. They provide empirical evidence that extra-regional knowledge lead to employment growth in Italian regions when the knowledge originates from related sectors but not similar to the sectors that are already present in the regions. Knowledge spill over from one

sector to another only when the sectors are complementary in terms of shared competences (Bunnell and Coe, 2001). Related variety is needed to enable effective external connections. We expect that Chinese regions would be more likely to develop new industries when they are heavily engaged into the globalization process. And related global linkages would further facilitate the spatial emergence of new industries in Chinese regions.

Along with the globalization process, China has undergone the gradual process of marketization and decentralization, which has resulted in considerable spatial variations in institutions. Institutional frameworks have direct impacts on the type of industries in which regions specialize and on the role of technological relatedness (Hall and Sockice, 2001). In the literature of evolutional economic geography, the influence of institutions on technological relatedness has been ignored. The goal of China's economic reform is to build a market oriented economy that allows market forces into play. In the commanding economy, there were literally no well-functioning markets. Factor mobility was strictly limited and market competition among firms was not present. There were no channels for knowledge spillovers. Since the late 1970s, China has gradually embraced market system, creating markets for factors and goods. Many state-owned enterprises were sold out and non-state-owned sectors have developed quickly. Marketization allows labor mobility, facilitate industrial linkages and revitalize entrepreneurship in China, generating favorable conditions to stimulate knowledge spillovers among firms and creation of new industries (He and Pan, 2010). The process of marketization is however regionally unbalanced (Han and Pannell, 1999). Some regions, particularly the coastal region, are more economically liberalized, with strong market forces in their economic systems. Empirical studies find strong inter-plant business linkages and business networks in economically liberalized regions such as Zhejiang, Jiangsu and Guangdong (Yang and Liao, 2010; Wei et al. 2010; Zhu and He, 2013). The wide distribution of industrial clusters in the coastal provinces provides strong evidence that technological relatedness does play a critical role in regional industrial development. However, in the large inland regions with a significant share of state-owned sectors, local governments heavily intervene in economic development, downplaying the importance of market forces. In the less liberalized regions, industrial linkages are relatively hard to establish and knowledge spillover effects are also marginalized. In those regions, new industries are often introduced by personal networks or governmental interventions (Qiu, 2005) and may not be related to the existing industrial structure. As a consequence, the expected positive role of technological relatedness in regional industrial evolution depends on the extent of marketization in Chinese regions.

Finally, economic transition has resulted in considerable power decentralization from the central to the local, which now is primarily responsible for local economic development. The devolution of power to local governments would improve economic efficiency in producing local public goods and augment economic growth (Oates, 1993). Meanwhile, China has introduced a tax sharing system since 1994, introducing a clear distinction between national and local taxes and determining that value added tax is a major indirect tax to be collected by the central government and

shared by local governments. The introduction of TSS has fundamentally altered China's central-local fiscal relations (Zhang, 1999; Wong, 2000). It has substantially raised the central share in revenue and reduced that of local governments (Lin and Yi, 2011). Regional decentralization has triggered serious interregional competition, resulting in local protectionism and rational imitation strategy of industrial policies (Zhao and Zhang, 1999). The economic oriented evaluation system for local officials and a judicious combination of local autonomy and fiscal incentives have created an institutional framework encouraging local governments to duplicate industries which could rapidly improve local revenues or promote local economic growth. Industrial duplication would cause the fragmentation of domestic markets and the distortion of regional production away from patterns of comparative advantages and technological competence (Young, 2000; Poncet, 2005). Moreover, to attract new industries, local governments often provide investors a variety of subsidies including income tax breaks, rebates of value added tax and import duties for equipment purchases, low priced land for SOEs and firms located in special development zones and cash payments to firms based on factors such as export performance (Barbieri et al. 2012). New industries attracted by favorable policies may not relate to the existing industries. Under fiscal decentralization, regions with difficult budget have stronger incentives to attract any industries without considering the existing competence and knowledge bases. As a consequence, regional decentralization may downplay the importance of technological relatedness in industrial evolution of regions and the emergence of new industries in China.

To summarize, the evolutionary turn in economic geography has suggested that regions would diversify into industries related to the existing portfolio of industries and regional industrial evolution is a path dependent process (Frenken and Boschma, 2007; Boschma and Frenken, 2011; Neffke et al., 2011). Technological relatedness is a crucial enabling factor for the creation of new industrial variety in developed economies. However, China has transforming its economy through a triple process of marketization, globalization and decentralization, creating considerable spatial variation of institutions. Globalization may bring new industries and new knowledge into Chinese regions, creating new regional paths. The process of marketization would create conditions to enable the role of technological relatedness while regional decentralization may downplay the impact of technological relatedness in industrial evolution in China. This paper will investigate the emergence of new industries and the exit of industries in Chinese prefectures and test the significance of technological relatedness, globalization and institutions.

Data Sources and Methods

Data used in the empirical analysis are from the Annual Survey of Industrial Firms (ASIFs) provided by State Statistical Bureau in China. The dataset includes all state-owned industrial enterprises and non-state-owned enterprises with sales revenues greater than 5 million Yuan. Industries in this dataset include mining, manufacturing, and electricity, gas and water production. The dataset provides detailed information on enterprises' identification, starting year, location, industry

code, total employees, total shipments, exported shipments, intermediate inputs, among others. Annual data are available during 1998-2008. This study focuses on manufacturing industries since they enjoy more freedom in locational choices compared with extractive industries. There is some inconsistence in reporting information about enterprises in different years. Following Brandt et.al (2012), we use the legal person as the base to match industrial enterprises though years. Enterprises with the same legal person but different names are treated as different enterprises. Enterprises with the same code but different names are treated as different ones. We then construct the panel data during 1998-2008.

Based on the cleaned firm level data, we compute four digit manufacturing industry data for all 337 prefectures using the number of firms, gross industrial output and total employment. There are 424 four-digit manufacturing industries. No prefectures host all 424 industries. During 1998-2008, some prefectures gain new industries while other lose industries. We define industry entry and exit as follows. If industry *i* is not in prefecture *r* in year *t* but in prefecture *r* in year *t+c*, then industry *i* is a new entry for prefecture *r*. Correspondingly, if industry *i* is in prefecture *r* in year *t* but disappears in year *t+c*, then industry *i* is an exit. There could be potential selection bias since the dataset does not cover the small manufacturing firms. However, in terms of output, the included firms can account for more than 90%. Moreover, the official statistics of Chinese industries in a variety of statistical yearbooks are derived from this dataset. We believe that it is sufficient to investigate the regional industrial entry and exit using the dataset.

Measurement of Technological Relatedness

The key variable in this study is inter-industry technological relatedness, which is often derived from the hierarchical structure of the standard industrial classification system. This relatedness measure however can be questioned (Neffke et al., 2011). Another measure of relatedness is based on similarities in upward and downward linkages in input-output tables (Fan and Lang, 2000). However, input-output tables are typically for the national level and have a smaller number of industries. To measure the inter-industry technological relatedness at the prefecture level, we follow the co-occurrence analysis, which measures the relatedness between two industries by assessing the conditional probability of two industries located in the same location. Hidalgo et al.(2007), Bryce and Winter(2009) and Neffke et al.(2012) develop a similar co-occurrence based measure of relatedness.

Following Hidalgo et al.(2007), we derive the inter-industry technological relatedness between four-digit manufacturing industry i and j as the minimum of the pairwise conditional probabilities of a prefecture specializing in an industry given that it specializes another.

$$Relatedness_{ij} = \min\{P(RCA_i|RCA_j) + P(RCA_j|RCA_i)\}$$

$$\text{Where, RCA} = \begin{cases} 1, LQ \geq 0.5 \\ 0, LQ \leq 0.5 \end{cases}$$

LQ is the employment location quotient of four-digit industries in the prefectures,

standing for revealed comparative advantage. Typically, LQ should take the value of 1 to indicate industrial specialization. This study uses 0.5 to imply the revealed comparative advantage. Chinese industries are less agglomerated than those in Europe and USA due to local protectionism and industrial duplication (Lu and Tao, 2009). Correspondingly, Chinese regions are also less specialized. The new measure of technological relatedness can portray a more complex picture of industrial linkages in China (Figure 2).

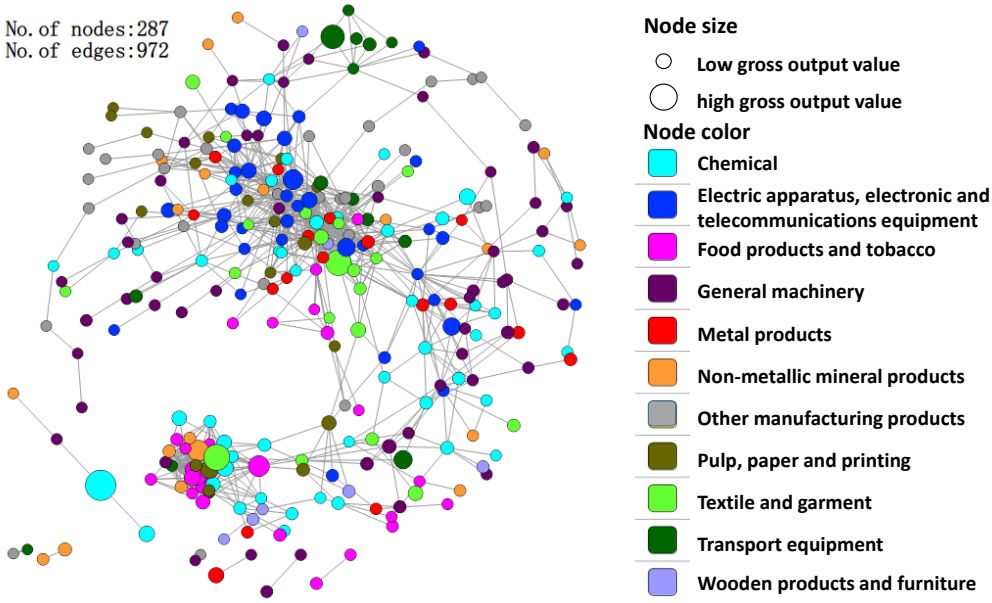

Figure 2 Industry Relatedness in China, 1999

In this study, we examine the impact of inter-industry technological relatedness at the prefecture level on the emergence of new industries and exit of existing industries. We define the weighted technological relatedness of four-digit manufacturing industry i at prefecture r as follows,

$$R_{ri} = \sum_{J} Relatedness_{ij} * E_{rj} / \sum_{j} E_{rj}$$

Where r stands for prefecture, i stands for four-digit manufacturing industry which a firm belongs to, j is for other four-digit manufacturing industries. E is employment. Relatedness is expected to positively associate with industry entry but negatively related to industry exit. We further define the related globalization by weighting the relatedness with the share of employment of foreign firms and the employment of exporters in the prefectures.

$$RFDI_{ri} = \sum_{J} Relatedness_{ij} * EFDI_{rj} / \sum_{j} EFDI_{rj}$$

Where r stands for prefecture, i stands for four-digit manufacturing industry which a firm belongs to, j is for other four-digit manufacturing industries. EFDI is employment of foreign firms in prefectures.

$$REXP_{ri} = \sum_{J} Relatedness_{ij} * EEXP_{rj} / \sum_{j} EEXP_{rj}$$

Where r stands for prefecture; i stands for four-digit manufacturing industry which a firm belongs to, j is for other four-digit manufacturing industryies EEXP is employment of exporters in the prefectures.

However, the co-occurrence based measure of technological relatedness is not without limitation since other factors besides relatedness may partly determine the number of co-occurrences (Neffke et al., 2012). For example, if industries are very large, they are likely to be found in many firms, and, therefore, they will also more frequently co- occur with other industries. To reduce the impact of other factors, we use a higher standard for co-occurrence based relatedness. At the four digit industry level, we are confident that two industries with higher probabilities of co-location are more likely to be technologically related.

Regional Industrial Evolution in China

Based on four digit industry data, we compute the number of industry entries and industry exits for all Chinese prefectures. The average number of industry entry and exit per prefecture is further derived and shown in Table 1. During 1998-2008, China has observed considerable industrial restructuring. There has been an industrial diversifying process and observed more industrial entries than industrial exits in different years. For instance, in 2008, on average, there are 18.22 four digit industries entering Chinese prefectures but 16.64 industries exiting. The coastal region is rather dynamic, seeing many more industry entries and exits. The western region experiences slower industrial restructuring process, with fewer new entries and exits.

Table 1 Average Number of New Entries and Exits in Chinese prefectures

Year	Number of industry entries	East	Mid	West	Number of industry exits	East	Mid	West
1999	13.71	18.72	16.57	7.56	8.80	12.31	10.10	5.05
2000	8.36	13.61	8.12	4.49	11.18	11.82	13.99	8.44
2001	15.50	21.93	16.28	9.93	10.07	16.22	10.55	4.95
2002	10.93	16.49	12.07	5.73	8.43	12.19	9.49	4.68
2003	17.30	25.30	19.98	8.99	12.71	16.22	16.35	7.08
2004	25.96	40.16	27.42	13.85	14.71	20.63	18.32	7.24
2005	11.62	14.12	15.74	6.39	8.65	10.84	10.92	5.14
2006	11.83	15.34	14.62	6.89	5.40	6.66	6.50	3.53
2007	11.97	14.09	15.26	7.70	4.97	6.02	5.91	3.40
2008	18.22	21.82	24.94	10.05	16.64	31.23	12.99	8.31

Industrial diversification however differs in Chinese prefectures. Figure 1 shows the Theil index based on the employment of four digit manufacturing industries in 1998

and 2008 in Chinese prefectures. In 1998, prefectures were industrially diversified in the coastal region, particularly the Jing-Jin-Ji area, Shandong, Jiangsu, Shanghai and Zhejiang. Inland regions however are rather industrially specialized. Ten years later, the central region has considerably improved its diversification of industries, especially Jiangxi, Anhui, Henan and Chongqing. The coastal region has also become more diversified. This is more phenomenal in Liaoning, Fujian, Guangdong and Guangxi. The remarkable spatial variation in the industrial diversification is the result of industry entry and exit.

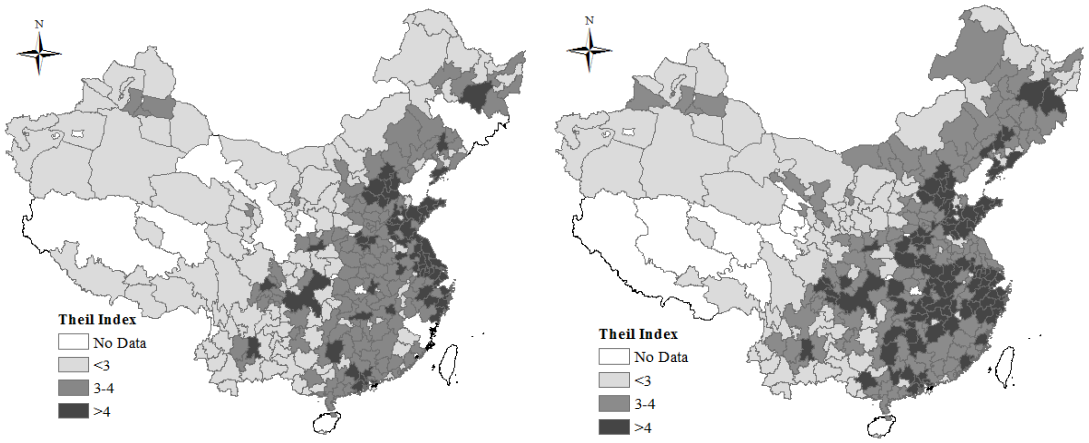

Figure 1 Industrial Diversification of Chinese Prefectures (Left 1998, Right 2008)

To further understand the spatial industrial diversification process in China, we map the number of industry entries and industry exits during 1998-2003 and during 2003-2008 at the prefecture level (Figure 2 and Figure 3). An industry not present in 1998 but in 2003 is considered an entry while an industry reported in 1998 but not in 2003 is an exit. The same logic is for the period of 2003-2008. China entered the WTO in 2001 and has been actively engaged into the globalization process, signifying the new stage of economic development. Since then, a large number of foreign direct investments have flowed into China and exports have seen exponent growth. The globalization may facilitate the industrial restructuring process. To see the effect of globalization, we divide the time period into two stages using the year 2003 as the critical year. New industries largely entered the coastal provinces, such as Shandong, Zhejiang and Fujian provinces during 1998-2003. Many new industries moved into the central region and the northeast China during 2003-2008. On the one hand, China's regional policies have shifted to help the revitalization of central region. On the other hand, the regional shift of industries can be accredited to the further development of globalization and marketization, which push the traditional industries into the inland region (He and Wang, 2012).

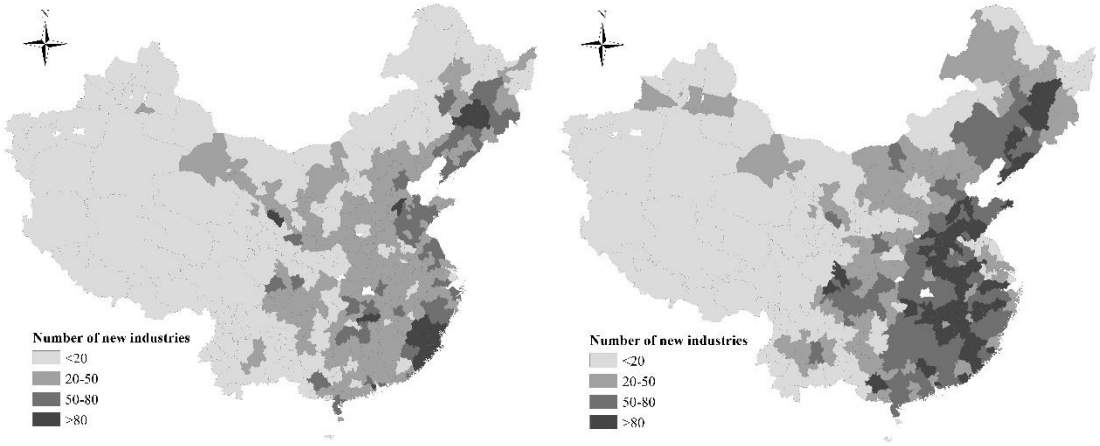

Figure 2 Number of Industry Entries (Left 1998-2003, Right 2003-2008)

In terms of industry exit, the period of 1998-2003 saw more exits than the period of 2003-2008. During 1998-2003, many industries exit from the coastal and central provinces, particularly Heibei, Jiangsu, Hunan, Hubei and Heilongjiang. The higher exit rate of industries in this period may be related to the entry of WTO, which has brought international competition into the domestic markets. Before the accession of WTO, industries in the central region were less exposed to the international competition. Less competitive industries are more likely to fail in front of foreign direct investments and imports. During 2003-2008, the coastal and central regions still observed more industry exits than the west. Industry exit has however slowed down. Overall, both industry entry and industry exit show strong spatial variations in the two time periods, indicating that localized forces play a role in industrial dynamics. There are also strong east-west divide, matching with the spatial divide of the globalization and marketization in China. Global forces and market forces can shed essential lights on regional industrial evolution in China.

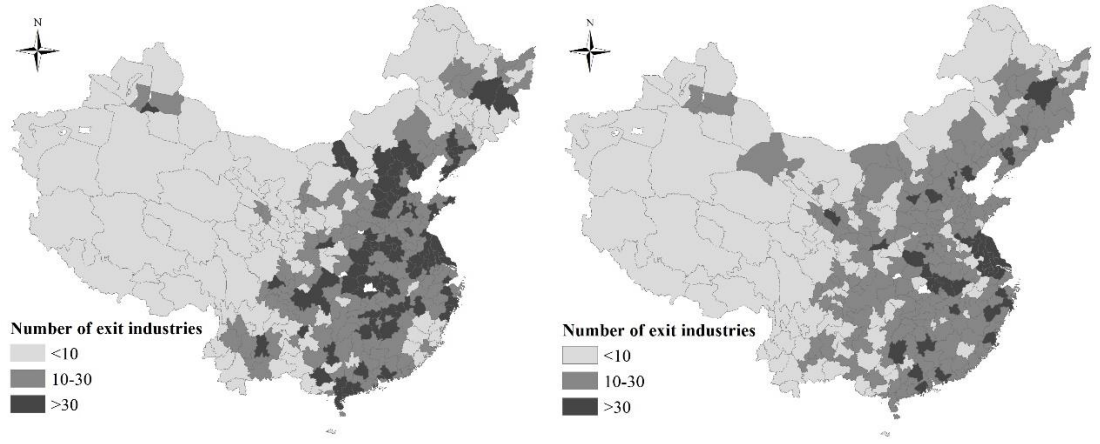

Figure 3 Number of Industry Exits (Left 1998-2003, Right 2003-2008)

Relatedness and Regional Industrial Evolution in China

Regions would branch into industries which are technologically related to the existing industrial structures. To examine the influence of relatedness on industry dynamics, we first examine the relationship between the average relatedness of Entry

and Non-entry industries. Entry is defined as an industry which is not in a prefecture in the previous year but in a prefecture in the current year. Non-entry refers to an industry which is not in a prefecture in the previous and current years. We make the scattered plots, with the y axis for the average relatedness of entries and the x axis for the average relatedness of non-entries. The line indicates that y is equal to x. Each dot indicates one prefecture. If a dot is located in the left side of the line, then the average relatedness of entry is stronger than that of non-entry and vice versa. Figure 4 shows that almost all dots are located in the upper left of the line during 1999-2008, suggesting that entry has stronger relatedness than non-entry. Put it another way, industries with strong technological relatedness with the industry portfolio is more likely to enter a prefecture.

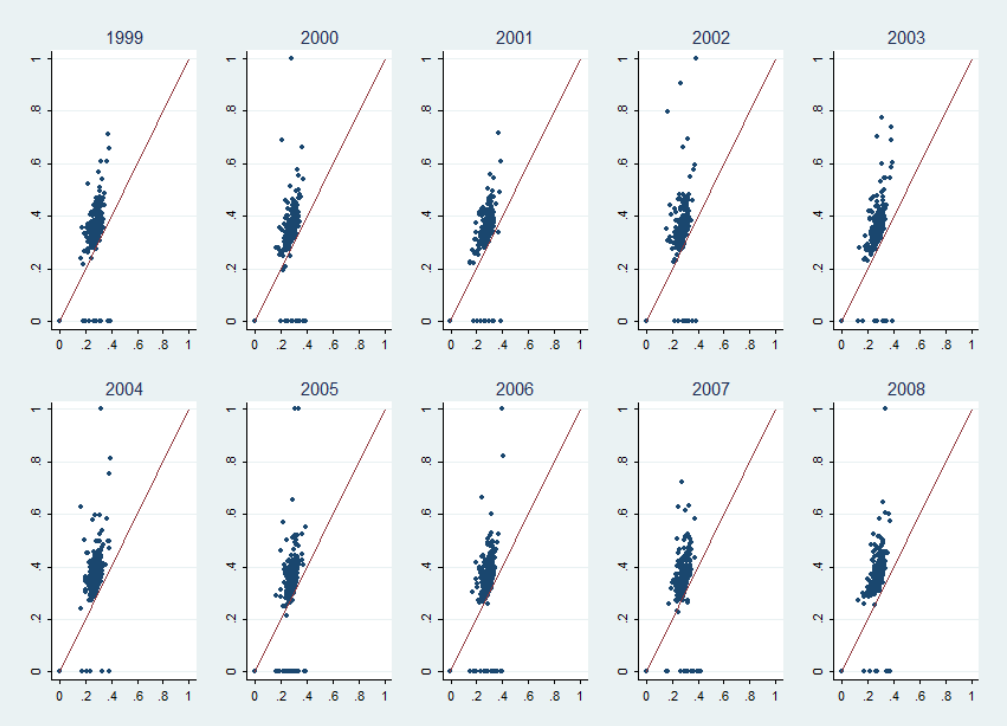

Figure 4 Relationship between Average Relatedness of Entry Industries and Nonentry Industries

In the same way, we examine the relationship between relatedness and industry exits. Exit is defined as an industry that is in a prefecture in the previous year but not in a prefecture in the current year. Non-exit refers to an industry that is in a prefecture in the previous and current years. In Figure 5, the y axis is the average relatedness of exiting industries while the x axis stands for the average relatedness of non-exits. The line indicates that y equals x. Most of the dots are now located in the right side of the line, indicating that exiting industries hold weaker relatedness with the existing industrial portfolio than non-exits. It is clear that industries are more likely to exit if they do not enjoy strong localized technological relatedness. Figure 4 and Figure 5 provide preliminary evidence to support the role of technological relatedness in regional industrial evolution in China.

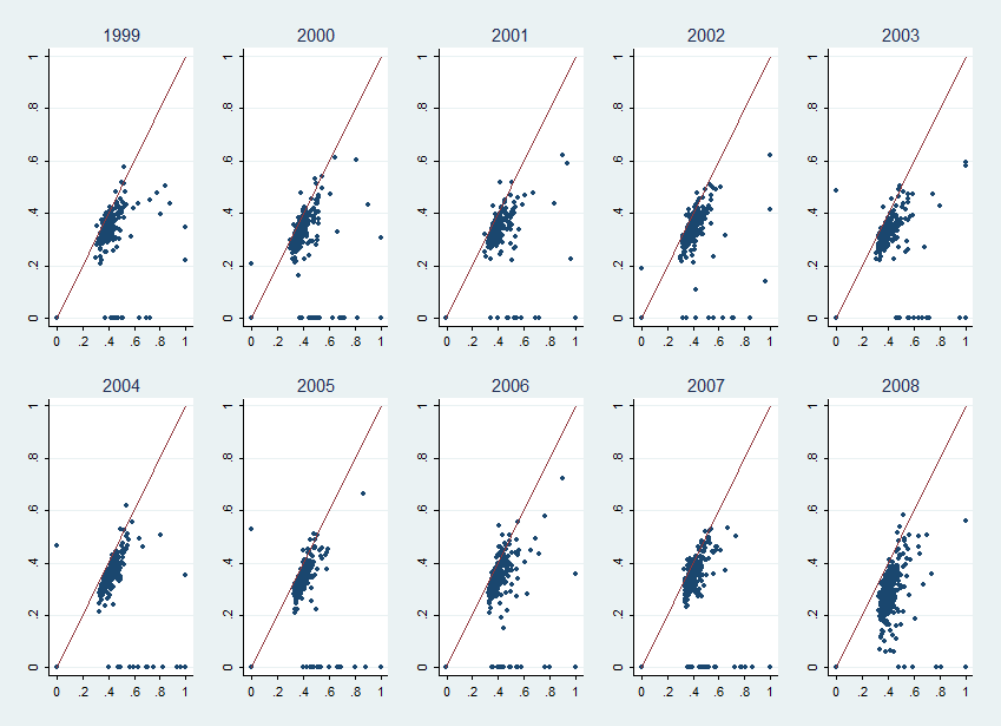

Figure 5 Relationship between Average Relatedness of Exit and Nonexit Industries

Model Specifications and Variables

The descriptive analysis provides evidence to show that regions attract new industries which are technologically related to the existing industries while those less related are more likely to exit. We conduct an econometric analysis to test the importance of technological relatedness, globalization and institutions on industry entries and exits of Chinese regions.

We define the following logit model：

$$\begin{aligned}\mathrm{ENTRY}_{ri}(EXIT_{ri}) &= \beta_0 + f_1(R_{ri}, FDIR_{ri}, EXPR_{ri}, WRri) \\ &+ f_2(GLO_r, LIB_r, DLANDri, DEXP_{ri}) \\ &+ f_3[(R_{ri}, FDIR_{ri}, EXPR_{ri}) \times (GLO_r, LIB_r, DLANDri, DEXP_{ri})] + \alpha_r \\ &+ \alpha_i + \varepsilon_{ri}\end{aligned}$$

Where ENTRY_{ri} is a dummy variable, 1 for industry entry (industry i enters prefecture r) , $EX\ IT_{ri}$ is also a dummy variable, 1 for industry exit (industry i exits prefecture r). We perform the model for two periods of 1998-2003 and 2003-2008. If industry i is not in prefecture r in 1998 (or 2003) but in prefecture r in 2003 (or 2008), then industry i is a new entry, ENTRY_{ri} will be granted unity. If industry i is in prefecture r in 1998 (or 2003) but disappears in 2003 (or 2008), then industry i is an exit and $EXIT_{ri}$ will be given the unity.

The key variable in the models is R_{ri}, defined as the technological relatedness of industry i with all other industries in prefecture r. R_{ri} is expected to have a positive coefficient in the entry equation but a negative coefficient in the exit equation. We also expect cross-regional knowledge spillovers to influence industry dynamics. Technological relatedness in the neighboring prefectures may foster the entry of new

industries. To test the spatial dependence of regional industrial evolution, we include the largest technological relatedness of industry i in the prefectures which share the common borders (WR_{ri}).

As argued that external linkages would bring new industries and new knowledge into regions. Regions actively participating in the process of globalization would be more likely to develop new industries and expect fewer industry exits. To quantify the extent that a prefecture is engaged in the process of globalization, we compute the share of gross industrial output by foreign firms and share of exports in gross industrial output. We then take the average share of both variables (GLO_r) to measure the globalization participation of Chinese prefectures. We also believe if globalization is technologically related to the existing industrial portfolio, it would play a more significant role. To test the hypothesis, we introduce two more variables to measure the FDI relatedness ($FDIR_{ri}$) and Export relatedness ($EXPR_{ri}$). Both variables are expected to have positive coefficients in the entry equation but negative coefficients in the exit equation.

This paper also argues that marketization and fiscal decentralization conditions the role of technological relatedness. Following the existing studies, we use the ratio of non-state-owned enterprises in the gross industrial output (LIB_r) to quantify the extent of marketization. We introduce the ratio of fiscal revenue and fiscal expenditure ($DEXP_r$) and the ratio of land leasing fee and fiscal revenue ($DLAND_r$) to measure the impact of fiscal decentralization. The fiscal decentralization has substantially raised the central share in revenue and reduced that of local governments. With fiscal decentralization, local governments have strong motive to secure extra-budget revenues. One of the major extra-budget revenues is the land leasing fee that is under the direct control of municipal and county governments (Lin, 2007). We will introduce the interactions between LIB_r (or $DEXP_r$, $DLAND_r$) and R_{ri} in both equations to see the impacts of institutions on the significance of technological relatedness.

In addition, we control the two-digit industry dummies and province dummies. All variables are summarized in Table 2.

Table 2 Definition of Explanatory Variables

Variables	Definitions
R_{ri}	Technological relatedness of industry i with all other industries in prefecture r
WR_{ri}	The largest technological relatedness of industry i in neighboring prefectures
GLO_r	The average of share of gross industrial output by foreign firms and the share of exports in gross industrial output in prefecture r
$FDIR_{ri}$	FDI relatedness of industry i with all other industries in prefecture r
$EXPR_{ri}$	Export relatedness of industry i with all other industries in prefecture r
LIB_r	Ratio of non-SOEs in gross industrial output in prefecture r
$DEXP_r$	Ratio of fiscal revenue and fiscal expenditure in prefecture r
$DLAND_r$	Ratio of land leasing fee and fiscal revenue in prefecture r

Empirical Results

Correlation analysis shows that explanatory variables are only moderately correlated. There is no serious concern about collinearity issue in the model estimations. Since the dependent variable is a dummy, we apply the logit model to identify the significance of the explanatory variables. Logit regression results for industry entry and exit equations are reported in Table 3 and Table 4, respectively. All models are significant and perform well.

In the industry entry models, relatedness (R) has significant and positive coefficients, indicating that an industry is more likely to enter a prefecture when it is strongly and technologically related to the existing industries. In the exit models, R has a significant and negative coefficient, suggesting that an industry is less likely to exit when it is technologically related to existing industry structure. The findings evidently suggest that technological relatedness is an enabling factor to generate related variety in Chinese prefectures. This is consistent with the expanding literature based in American and European regional data in evolutionary economic geography(Neffke et al., 2011; Boschma et al. 2012; Essletzbichler, 2013). The evidence of significance of technological relatedness from a transitional economy provides important complementarity to the existing literature. China is not a fully liberalized economy, with considerable governmental intervene in economic development at both the central and local levels. With fierce interregional competition, governments often target industries which do not fit the local competence and the pattern of comparative advantage. They also encourage the development of so called strategic industries, which are often innovation based and technology intensive industries and totally new to some Chinese regions. Given this institutional framework, relatedness still plays a significant role in regional diversification process. Our findings suggest that regional industrial development is a path dependent process and is determined by historical layers of economic activities even in transitional economies (Scott, 1989; Massey, 1984; Martin and Sunley, 2006).

Moreover, the importance of relatedness is not just confined to regions themselves. There are also cross-regional knowledge spillovers in industrial development. In entry models, WR holds a positive and highly significant coefficient, implying that technological relatedness in neighboring regions (WR) would stimulate the emergence of new industries. In the exit models, WR has a negative but insignificant coefficient. There are several possible channels for the cross-regional spillover effects. First, Chinese regions are often engaged into an imitation behavior by copying the successful industrial development strategy in the neighboring regions. Thun(2004) for instance has argued that decentralization will lead local governments to duplicate industries that could rapidly improve local revenues or growth through a process of rational imitation. Second, technologically related industries often build regional business networks, which has been observed in the Pearl River Delta, Yangtze River Delta and Jing-Jin-Ji area (Wei et al., 2010; Yang and Hsia, 2007). Moreover, successful entrepreneurs may expand their business into neighboring regions by taking advantage of the geographical proximity. Cross regional knowledge

spillovers help create regional production networks, improving industrial productivity at the regional level. This will broaden the geographical scope of path dependence in industrial development.

Table 3 Logit Regression Results for Entry Equations

Variable	*1998-2003*			*2003-2008*		
	Model1	*Model2*	*Model3*	*Model1*	*Model2*	*Model3*
R	7.94***	7.13***	7.53***	8.43***	5.71***	5.77***
WR	2.57***	2.30***	2.79***	4.06***	3.60***	4.18***
GLO	0.32***	0.25**	-0.04	0.60***	0.52***	-0.58***
FDIR		1.45***			3.13***	
EXPR		-0.12			0.73***	
LIB	0.85***	0.90***	1.36***	0.48***	0.54***	0.26*
DEXP	2.21***	2.16***	1.96***	2.22***	2.21***	1.99***
DLAND	0.35***	0.36***	-0.43	0.40***	0.40***	0.43***
GLO*R			1.87*			5.39***
LIB*R			-2.53***			1.07*
DEXP*R			1.18			1.22*
DLAND*R			3.85***			-0.12
Industry dummies	Included	Included	Included	Included	Included	Included
Province dummies	Included	Included	Included	Included	Included	Included
Cons	-3.35***	-3.35***	-3.20***	-4.77***	-4.84***	-4.10***
LR chi2	12789.61	12859.68	12815.5	20668.3	21036.68	20741.12
Pseudo R2	0.2	0.2	0.2	0.24	0.24	0.24
Log likelihood	-2.60E+04	-2.60E+04	-2.60E+04	-3.30E+04	-3.30E+04	-3.30E+04
Number of observers	95359	95359	95359	106016	106016	106016

Note: *** significant at 1% level, ** significant at 5% and * significant at 10% level.

However, Chinese regions can create new paths of industrial development by actively utilizing foreign investments or exporting activities. The variable GLO has a significant and positive coefficient in the entry models but a significant negative coefficient in the exit models, indicating that new industries are more likely to enter when Chinese regions have more foreign firms and more exporting activities. In the globalized regions, industries are also less likely to fail. Foreign investments often bring new knowledge and new industries to the regions and also spillover knowledge to local entrepreneurs, breaking the regional lock in (Bathet et al., 2004; Boschma and Iammarino, 2009). Exporting activities build international linkages, introducing new knowledge to facilitate the development of new industries. These external linkages foster the emergence of new industries in Chinese regions, which may or may not be related to the existing industrial structure. In transitional economies like China, globalization could provide an alternative way to go beyond the history to develop local industries, creating new path of regional industrial development.

Table 4 Logit Regression Results for Exit Equations

Variable	*1998-2003*			*2003-2008*		
	Model1	*Model2*	*Model3*	*Model1*	*Model2*	*Model3*
R	-13.41***	-11.89***	-6.02***	-14.39***	-10.97***	-5.44***
WR	-1.27	-1.18	-1.97	-1.09	-0.33	-1.68
GLO	-0.81***	-0.78***	0.98**	-1.67***	-1.68***	0.31
FDIR		-1.43***			-4.42***	
EXPR		-0.80**			-1.28***	
LIB	0.05	0.04	0.04	-0.31***	-0.46***	-0.45*
DEXP	-2.61***	-2.58***	-1.54***	-2.16***	-2.17***	-0.57**
DLAND	-0.28*	-0.28*	1.16**	-0.09	-0.11*	0.09
GLO*R			-10.06***			-12.54***
LIB*R			-0.11			-0.2
DEXP*R			-5.93***			-9.48***
DLAND*R			-8.20***			-0.9
Industry dummies	Included	Included	Included	Included	Included	Included
Province dummies	Included	Included	Included	Included	Included	Included
Cons	2.28***	2.32***	0.86***	2.71***	2.97***	1.19***
LR chi2	5000.7	5044.09	5102.7	7032.01	7277.41	7243.91
Pseudo R2	0.14	0.15	0.15	0.19	0.2	0.2
Log likelihood	-1.50E+04	-1.50E+04	-1.50E+04	-1.50E+04	-1.50E+04	-1.50E+04
Number of observers	30143	30143	30143	34752	34752	34752

Note: *** significant at 1% level, ** significant at 5% and * significant at 10% level.

Meanwhile, Boschma and Immarino(2009) argue that regional absorptive capacity may not be sufficient to transform extra-regional knowledge into regional growth and suggest that related variety is crucial. We also find that globalization could further nurture the development of new industries and discourage the industry exits if foreign firms are strongly related to the existing industrial structure. Relatedness helps globalization to create new industries and sustain industries for Chinese regions. This is particularly true during 2003-2008. In the period of 2003-2008, the magnitude of coefficient on FDIR and EXPR is larger than that in the period of 1998-2003. When interactions between R and proxies for economic transition are included, GLO turns negative or insignificant, but GLO*R has a positive coefficient in the entry models. In the exit models, GLO turns positive or insignificant, but GLO*R is negative and significant. This further confirms the importance of related globalization in China's regional industrial evolution. There are several channels to support the role of related FDI. First, there could be spinoffs, through which former employees in foreign firms start their own business, which is related to activities of foreign firms. Second, foreign firms may stimulate the entry of downstream and upstream industries to form the localized business networks (Yeung et al., 2006). Third, foreign firms extend their business along the value chain (He et al., 2011). The importance of related exporting activities is weaker. EXPR is only significant in the period of 2003-2008. This is related to the nature of exporting activities from China. Most of the exporting is through orders

set by multinational retailers such as Walmart, Carrefour, Auchan and Tesco. The channeled exporting limits knowledge spillover. Related globalization can discourage the industrial exit in the second period. This is consistent with Boschma and Iammarino(2009) which argue that the inflow of external knowledge should be related to some extent to the industrial structure of a region to affect industrial dynamics.

The above findings suggest that regional industrial evolution in China has the favor of both path dependence and path creation. As a transition economy, institutions play a crucial role in regional industry development. In particular, the duel process of marketization and decentralization provides an institutional framework to understand industrial dynamics in China. Statistical results show that economic liberalization fosters the emergence of new industries in Chinese regions. Industries are also less likely to exit in economically liberalized region during 2003-2008. Marketization liberalizes the economic system and allows market force to play its role in allocating resources, creating favorable conditions for the entrepreneurs to start new business. Moreover, LIB*R is positive and significant during 2003-2008, indicating that technological relatedness plays a larger role in encouraging industry entry in more economically liberalized regions. Industries are technologically related to existing industries are more likely to enter the more economically liberalized regions. In transitional economies, market based institutions allows a more crucial role of technological relatedness in regional industrial evolution, leading to path dependence of regional industrial development. This anchors the argument in He and Pan (2010) which report that economic transition has created conditions to allow a larger role of externalities in stimulating city-industry growth. In less liberalized regions, governmental intervene weakens the importance of technological relatedness, which may attract new industries unrelated to the existing industries, creating new path of regional industrial development. The new path however is not necessarily sustainable since new industries may not fit the pattern of comparative advantages and do not share the local knowledge bases and local competence. Economic liberalization however is not conducive to sustain related industries, as shown by the insignificance of LIB*R in the exit models when all interactions included. This is due to the fact that economic liberalization has also intensified market competition, which makes less competitive firm and industry survival more difficult.

Regional decentralization, particularly fiscal decentralization, has significant effects in industrial dynamics of Chinese regions. Fiscal decentralization has created great incentives for local governments to pursue revenues through the development of industries. DEXP and DLAND have positive and significant effects on industry entry and negative effects on industry exit. New industries are more likely to enter regions with better fiscal situation, which are also easier to sustain industries. The positive significance of DEXP*R and DLAND*R in the entry models implies that fiscally healthy regions do attract technologically related industries. The negative and significant coefficients on DEXP*R and DLAND*R in the exit models suggest that better fiscal situation also discourages industry exit. With heathy fiscal situation, local governments can use subsidies, tax waiver and other incentives to choose new industries based on the local competence and comparative advantages. Industries which

are related to the existing industrial portfolios are more likely to be selected. For regions with considerable fiscal deficit, local governments are hard to grant economic incentives to new businesses. They are not in the position to select new industries based on the existing knowledge and competence. Technological relatedness would play a weaker role to attract industry entry in those regions. Correspondingly, industries, particularly those are technologically related to the existing industrial structure, are less likely to exit from the regions with healthy fiscal situation, which can provide subsidies to keep industries, even less productive firms (He and Yang, 2015). Fiscal decentralization has triggered the interregional competition in attracting business. Fiscally healthy regions would have more chance to develop new industries, especially those to some extent linked to the current industries. Path dependent process would occur only when local governments are in a better position to select industries based on their regional capabilities and competence. Fiscal hardship however has discouraged Chinese regions to develop related industries, downplaying the importance of technological relatedness.

Robustness Checks

We further check the robustness of technological relatedness. First, we define the industry entry and exit by 1 year rather than 5 years and create the annual data. Second, in the measurement of relatedness, we apply LQ=0.5 to indicate revealed comparative advantage. We then apply LQ=1.0 for industries with revealed comparative advantages to derive the measurement of relatedness. To reduce the impact of endogenity, we lagged all variables by one year. We also apply the new measurement of relatedness based on LQ=1 to the five year entry and exit models. All checks confirm the importance of technological relatedness, globalization and institutions in regional industrial evolution. The interaction terms provide more robust evidence to support the moderating role of marketization and decentralization (Table 5 and Table 6).

Table 5 Logit Regression Results with Annual Data

Variable	*Entry Model*			*Exit Model*		
	Model1	*Model2*	*Model3*	*Model1*	*Model2*	*Model3*
R	7.27***	5.97***	7.71***	-6.20***	-5.43***	-2.01***
WR	2.66***	2.47***	2.68***	-1.62***	-1.53***	-1.83***
GLO	0.78***	0.75***	0.65***	-0.96***	-0.96***	0.29*
FDIR		1.68***			-0.65***	
EXPR		0.13			-0.38***	
LIB	0.48***	0.50***	0.70***	-0.19***	-0.21***	-0.31***
DEXP	1.93***	1.90***	2.00***	-1.13***	-1.12***	-0.07
DLAND	0.28***	0.27***	0.18***	-0.19***	-0.19***	0.04
GLO*R			0.61			-5.40***
LIB*R			-0.98***			0.24
DPT*R			-0.33			-4.47***
DLAND*R			0.47***			-0.99***
Industry dummies	Included	Included	Included	Included	Included	Included

Province dummies	Included	Included	Included	Included	Included	Included
Year dummies	Included	Included	Included	Included	Included	Included
Cons	-4.74***	-4.75***	-4.83***	0.05	0.07	-1.02***
LR chi2	48182.01	48544.55	48199.71	19502.11	19565.05	19974.14
Pseudo R2	0.15	0.16	0.15	0.1	0.1	0.1
Log likelihood	-1.30E+05	-1.30E+05	-1.30E+05	-8.70E+04	-8.70E+04	-8.70E+04
Number of observers	812925	812925	812925	288627	288627	288627

Note: *** significant at 1% level, ** significant at 5% and * significant at 10% level.

Note: Measurement of R is based on LQ equal to 0.5.

Table 6 Logit regression results with annual data and revised measurement of relatedness

Variable	*Entry Model*			*Exit Model*		
	Model1	*Model2*	*Model3*	*Model1*	*Model2*	*Model3*
R	9.11***	7.55***	9.01***	-7.83***	-6.64***	-1.71**
WR	3.64***	3.50***	3.76***	-2.44***	-2.32***	-2.87***
GLO	0.81***	0.79***	0.86***	-1.03***	-1.04***	-0.37**
FDIR		2.31***			-0.87***	
EXPR		-0.04			-0.79***	
LIB	0.46***	0.47***	0.69***	-0.18***	-0.19***	-0.44***
DEXP	1.94***	1.91***	1.73***	-1.25***	-1.24***	0.29**
DLAND	0.29***	0.28***	0.15***	-0.21***	-0.21***	0.15***
GLO*R			-0.3			-4.15***
LIB*R			-1.42***			1.11**
DEXP*R			1.29***			-9.01***
DLAND*R			0.93***			-2.14***
Industry dummies	Included	Included	Included	Included	Included	Included
Province dummies	Included	Included	Included	Included	Included	Included
Year dummies	Included	Included	Included	Included	Included	Included
Cons	-4.86***	-4.90***	-4.85***	0.20*	0.24**	-0.86***
LR chi2	46132.9	46536.33	46168.83	19112.96	19220.64	19670.85
Pseudo R2	0.15	0.15	0.15	0.1	0.1	0.1
Log likelihood	-1.30E+05	-1.30E+05	-1.30E+05	-8.70E+04	-8.70E+04	-8.70E+04
Number of observers	812925	812925	812925	288627	288627	288627

Note: *** significant at 1% level, ** significant at 5% and * significant at 10% level.

Note: Measurement of R is based on LQ equal to 1.0.

Summary and Discussions

The evolutionary economic geography considers regions to evolve through technologically related diversification, indicating that regional industrial development is path dependent. Meanwhile, we argue that the path dependent approach only concerns the endogenous factors but ignore the external influence, which may create new path of regional industrial development. Moreover, path dependence approach does not pay much attention to the role of institutions. Both external influence and institutions are crucial to understand the regional industrial evolution in transitional

economies like China.

Based on firm level data of Chinese manufacturing industries during 1998-2008, this study examined the industrial diversification through the lens of entry and exit of four digit industries at the Chinese prefecture level. Chinese regions have undergone considerable industrial diversification, particularly in the coastal and central regions. During the studying period, many industries enter and exit from the coastal and some part of the central regions. Inland regions however are less dynamic in terms of development of industrial variety. Using technological relatedness based on the co-occurrence analysis of paired industries, we find significant evidence that Chinese regions branch into new industries which are technologically related to the existing industries. Related industries are more likely to survive in Chinese regions. We also confirm that related globalization further encourage the entry of new related industries. Further analysis reveals that economic transition has created conditions to allow a larger role of technological relatedness. Specifically, in fiscally healthy regions and economically liberalized regions, technological relatedness plays a larger role in determining industry dynamics. The significance of technological relatedness implies that regional industrial evolution in China is path dependent.

However, economic transition has also generated opportunities for Chinese regions to create new path of industrial development. Statistical results suggest that new industries are more likely to enter regions which are globalized, liberalized and fiscally independent. Globalization could bring new industries and new knowledge to Chinese regions. Marketization nurtures market forces and inspires local entrepreneurship, encouraging the emergence of new industries. Fiscal decentralization creates incentives for local governments to attract new industries, which can quickly generate local revenues and promote economic growth. In a transitional economy like China, good institutions cultivate the development of new industries, which may not be related to the existing industries. With institutional changes, regional industrial evolution in China is also a path creating process.

There are a number of directions to expand the current research. First, this study only examined the impact of general institutions. More is demanded to analyze the impact of specific institutions on regional industrial evolution such as governmental efficiency, corruption, governmental intervene, protection of intellectual property rights, contract enforcement and industrial policies such as five-year industrial plans, subsidies, and the establishment of industrial parks. Second, one would be interested in the agents of industrial structural diversification in Chinese regions. We could analyze the industrial attributes of new entries or exits and even the characteristics of entry and exiting firms in different regions and study the responses of different industries and firms to relatedness and the regional institutions. Third, we could also compare the industrial diversification process for different regions. Regions differ in many aspects such as physical location, economic development, industrial structure, governmental intervene and external linkages, which may shape the industrial diversification process. Finally, we can compare the efficiency and sustainability of related and unrelated industrial diversification in Chinese regions. Unrelated industries which may be brought by external linkages or governmental intervene may

not fit the local competence and comparative advantages. This may challenge the sustainable development of unrelated industrial diversification in China.

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