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RESEARCH ARTICLE

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Does the Internet Accelerate the Integration of Domestic Markets? Evidence from China

Abstract This paper employs a hybrid methodology that combines case study and econometric research to examine the impact of the Internet on domestic market integration. There is not much research on this issue in the literature. From the multi-case analysis, this paper firstly obtains two main indications which are clear yet contrary to each other about how the Internet influences the market integration process. To be specific, although the Internet has both the ability and the potential to promote market integration, it is not always effective and could even harm this process due to several constraints. Using a provincial-level panel dataset from 2007 to 2013 in China, this paper empirically investigates whether the Internet plays a positive role in the market integration process. Contradictory to common expectations, we do not find any empirical evidence that the Internet accelerates the integration of domestic markets. Thus, when compared with taking advantage of Internet tools, manmade obstacles to market integration that exist in current trading systems and business models deserve more attention.

Keywords Internet, domestic market integration, multi-case study, econometric analysis

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1 Introduction and Literature Review

In China, Internet has become one of the most prosperous industries, producing pervasive and profound impacts on individual behavior as well as on the social economy. According to the latest report issued by the China e-Business Research Center in the first half of 2015, total online shoppers numbered 417 million, accounting for almost one third of the total population of China, and total online sales amounted to 1.614 trillion yuan, accounting for 11.4% of total retail sales of consumer goods.[1] Besides impacting retail industry, the Internet is also changing industries like finance, media, and education.

Considering the widespread impact of the Internet, the concept of "Internet Plus"[2] has arisen and is gaining ever more recognition. Since March of 2015, Internet Plus action has officially risen to the level of national strategy, which is leading to a push for the reform of traditional industries based on the Internet platform so that higher performance in relevant industries can be realized. Within this context, we are interested in one particular question: what is the impact of the Internet on market integration in the physical world?

A significant amount of literature has recognized that China's domestic market has become more integrated in recent years (Gui et al., 2006; Fan, Li and Liu, 2007; Zhao and Xiong, 2009). The explanations for this integration trend mostly include government factors. It has been demonstrated that market fragmentation can result from local protectionism exerted by government and aimed at protecting vulnerable industries (Lin and Liu, 2004), obtaining higher taxes from state-owned companies (Bai, Du and Tao, 2004) or maintaining social stability (Poncet, 2005), as well as unbalanced development strategies adopted by local governments with a preference toward international business, which may worsen market fragmentation by minimizing the importance of the domestic market (Lu and Chen, 2009; Chen, 2007). As these political obstacles are gradually removed,

[1] Monitoring Report of China's 2015 Online Retailing Market, http://www.100ec.cn/zt/upload_data/bgk/20150915.pdf, China e-Business Research Center, 2015, 09, 15

[2] "Internet Plus" was first put forward in 2012 in the context of China's Internet boom, and refers to the penetration of Internet technology into other industries as well as people's daily lives thus creating new business models and social patterns. Although "Internet Plus" is a unique concept in China, it is rooted in the era of Web 2.0, after which information technology has continually been updated to allow Internet users to have more interaction with companies, creating network effects through "architecture of participation" and significantly improving users' experience (Oreilly, 2007). Web 2.0 provides the technological base for Internet Plus.

the domestic market is moving toward becoming more integrated. However, non-government causes of market fragmentation, such as distance, time, search costs, and market behaviors of wholesalers or chain retailers inside distribution channels are seldom examined (Wang and Zhang, 2012). However, these factors are highly relevant to interregional trade and deserve much more research attention, especially in China which has a particularly vast geographic coverage. Regarding the impact of the Internet on market integration, there is even less discussion, either quantitatively or qualitatively.

Intuitively, since Internet technology makes it much easier for consumers to search for products and price information at a low search cost, while also enabling enterprises to sell products across regions at lower distribution costs through e-commerce, it seems logical that interregional trade will be facilitated and the degree of market fragmentation will be reduced with the development of the Internet. However, there exist several obstacles that prevent the Internet from accelerating market integration, such as administrative regulation and logistics costs. In other words, the Internet is not so universal a key that can break through any market boundary. For example, salt, under current administrative regulations, must be sold regionally which leaves the Internet powerless to integrate the salt market. There may be other circumstances where offline trading systems are so rigid that online transactions have no choice but to conform to them as well. According to observations from our case study, logistics costs are also a major concern for many companies that could suppress interregional trade. In addition to the above obstacles, the Internet may even bring about side effects that could harm the market integration process. Some traditional companies may prefer to maintain segmented markets for better control and higher profit margins. As a result, they may adopt a stricter regional exclusive agent system while establishing their self-owned Internet channel to avoid channel conflicts.

Based on the above discussion, this paper explores whether and how the Internet influences China's domestic market integration. In terms of methodology, we implemented a hybrid research methodology to gain more insights into the topic. First, a case study method was used to help build a hypothesis. This was followed by empirical research where the Internet was the key explanatory variable of interest and the calculated market fragmentation index was the dependent variable. The remainder of the paper is organized as follows. Section 2 develops a full illustration of the "how" and "why"

mechanisms using multi-case analysis; Section 3 describes the methodology and data utilized for econometric analysis; Section 4 reports the results of our estimation; Section 5 provides a robustness check; and Section 6 provides our conclusions and further discussion.

2 Mechanism Analysis Based on Multiple Cases

Considering there is neither existing theoretical analysis nor empirical studies that investigate the impact of the Internet on China's market fragmentation, prior to conducting the econometric analysis, we first analyzed the "why" and "how" mechanisms with the multi-case study method, which is considered more appropriate for revealing undetected issues than statistical analysis (Siggelkow, 2007).

2.1 Case Selection and Data Collection

Case selection is one of the most significant but difficult procedures in case study research (Yin, 2014). Compared to the principle of "statistical sampling" in statistical analysis, the "purposive sampling" principle is more appropriate when selecting cases (Mao and Li, 2014) to make sure that all cases to be analyzed are representative (Eisenhardt, 1989). We selected four cases according to three criteria. Firstly, the cases had to be offline enterprises that were taking positive Internet Plus action. Enterprises that are either exclusively engaged in off-line business or on-line business do not match our research objective, as there will be no ability to compare what the enterprise was like before and after Internet Plus action was put into practice. Secondly, the enterprises had to be an enterprise dedicated to domestic trade. This is in accordance with the representativeness requirement of case studies, since our major interest is to study market fragmentation in China's market. Thirdly, we tried to combine different actors with different channel roles, such as brand manufacturer and retailer, wholesaler and regional agent, in our multi-case analysis. In this way, we could avoid providing a biased hypothesis to a certain extent and could improve the external validity of our case study.

During the data collection process, the *semi-structured* method was used to conduct in-depth conversations with senior executives and managers who were in

charge of or played important roles in sales transactions. In addition to first-hand data collected from the interview, which is the most important data source, extra data was collected from sources such as newspapers, websites, research papers, and corpoate image videos. When necessary and feasible, we also visited the headquarters of certain enterprises and listened to their product presentations. During the semi-structured interviews, questions were designed to cover two main dimensions. In the first dimension, interviewees were asked to introduce the positive activities adopted through Internet Plus. In the other dimension, interviewees were asked about his or her attitude towards these Internet Plus actions, from which we could infer the effect of the Internet on the real economy. After that, additional random questions were asked by our research group in order to get comprehensive and in-depth information. All procedures during our survey conformed to the basic rules of case studies, such as taking extensive notes, transcribing the audio material in time, constructing a case database and using triangulation methods (Miles and Huberman, 1994; Yin, 2014).

2.2 Case Analysis and Discussion

We investigated four enterprises in total, denoted by A, B, C, and D respectively. The brief introduction of each sample and the main information about Internet Plus that we collected during the survey are given in Table 1. According to both within-case and cross-case analysis, clearly, there are two contrary main indications on how the Internet influences the integration of domestic markets.

On the one hand, the Internet could accelerate the integration of domestic markets by eliminating natural isolation between different regional markets, such as obstacles generated by geographic segmentation, information blocks etc. During the initial stages of the Internet Plus era, all of the four enterprises that we investigated chose e-commerce as an entry point to implement Internet Plus actions, as long as logistics could reach the targeted market and logistic costs were affordable. In addition, through e-commerce, most enterprises witnessed significant sales increases, since they could reach more consumers in a wider market scope at a relatively low cost when compared with opening new stores in the offline market. For example, enterprise B has been concentrated on the Beijing market since its establishment, planned to expand its business nationwide

Table 1 Brief Introduction to Enterprises and the Main Information Collected

	Enterprise A	Enterprise B	Enterprise C	Enterprise D
Profile	Established in 1955, the enterprise presently plays mixed roles including manufacturer, wholesaler, and regional sales agent. The main business is supplying fresh foods and processed products of livestock and poultry as brand manufacturer and wholesaler, as well as acting as sole agent for other brands in the fields of sugar, liquor, and tobacco.	Established in 1957, the enterprise presently plays professional roles as wholesaler and regional agent for brand manufacturers and upstream suppliers. The main products are grocery and fast moving consumer goods (FMCG).	Established in 2008, the enterprise is an independent marketing branch of a large brand manufacturer, acting as a general agent who plays the leading role in the distribution system. The main products are organic green agricultural products consisting of fresh foods as well as intensive processed products.	Established in 1993, the enterprise now plays mixed roles as brand manufacturer and retailer. The main products are fashionable underclothes and household necessities such as bedding linen. The enterprise began to take on a multi-brand strategy in 2004 and presently possesses more than 10 brands.
Data Source	Conversation with the deputy chief of marketing department; information from newspapers, official website, research literature, and corporate image videos.	Conversations with deputy general manager, secretary of the Party committee, director of general office; information from official websites and corporate image videos.	Conversations with chairman, secretary of the Party committee and deputy general manager; information from official websites; site visit to headquarters.	Conversations with vice president and director of president office; information from official websites and newspapers; site visit to headquarters.

(*To be continued*)

(*Continued*)

	Enterprise A	Enterprise B	Enterprise C	Enterprise D
Activities about Internet Plus	As a wholesaler, as well as regional agent for many different brands, the enterprise has a self-built website selling liquor and cosmetics goods. In the year 2014, the growth of sales revenue through e-commerce was 500 million yuan. As a brand manufacturer involved in procuring and processing fresh foods, however, the enterprise sells very little through online channels, except for packaged food, due to the expensive logistic costs to distribute fresh goods.	The enterprise launched its online business in 2012 and the following three years witnessed continuous sales increases in both business-to-business (B2B) and business-to-consumer (B2C) transactions. Three e-commerce subsidiaries had already been established by the year 2014. The deputy general manager confirmed the Internet to be a new and powerful driving force for sales promotion, especially for the expansion from the local to national market.	The enterprise gained access to online business in 2013 by collaborating with large e-commerce platforms, followed by a 100 times growth of sales revenue in 2014. In 2015, the enterprise started online-to-offline (O2O) business based on a self-built sales website, which was regarded as a turning point in their marketing strategy. The market scope was expected to enlarge tremendously under the drive of the O2O strategy. Some offline stores are equipped with e-commerce systems which allow tourists to place orders online to facilitate their shopping. However, the enterprise was inclined to exclude any online agent and kept the online channel in its own hands, in order to protect the offline regional agency system.	The enterprise established an official online mall based on a self-built website in 2000, which was oriented to increase sales volume of several low-priced sub-brands. The enterprise still kept the online mall as a market segment for low-priced brands. Thus, the self-owned sales website was merely taken as a complementary sales channel. This is the same with the enterprise's e-store on the *Tmall* platform.

(*To be continued*)

(*Continued*)

	Enterprise A	Enterprise B	Enterprise C	Enterprise D
Attitude towards Internet Plus	The deputy chief of the marketing department held a relatively negative attitude towards online sales, emphasizing the mismatch of e-channel and fresh foods sales because of the high cost of logistics. Besides, some brands with strict regional exclusive agency systems withdrew the delegated authority from the online market to avoid the cross-region flow of goods and to maintain the current segmented regional market. The attitude towards the Internet was definitely negative.	The enterprise would not transit to pure e-commerce in the future because many brand owners were inclined to withdraw some of the delegated authority from the online market, for the sake of protecting offline regional agency systems. As a wholesaler with self-owned logistic facilities, the biggest advantage would always lie in offline business. The attitude towards the Internet was positive but prudent.	The chairman and the deputy general manager both emphasized that the online business would always be rooted in offline business, which was the greatest strength of the enterprise's O2O strategy. E-commerce was actually pulled by the offline business, which could not be impacted as much by the Internet since the online channel is exclusively owned by the brands. The attitude towards the Internet was positive but prudent.	When being interviewed, the vice president and the director of president office both showed a prudent attitude towards online business. They both regarded it as a feasible method to increase sales in the existing market and/or to launch a product into a niche market such as low-priced products, and/or to attract new customers that frequently shop online. However, most of the revenues were generated by more than 3,000 offline retail terminals. The enterprise does not pay much attention to online sales and largely depends on offline stores to integrate regional markets.

relying on e-commerce. Enterprise C has equipped its offline stores with e-commerce, so that tourists from elsewhere can place their orders online and receive parcels at home through logistic services, making it more convenient for tourists to buy souvenirs, and thus facilitating the free flow of goods across regions. All of these actions contribute to market integration, which is in line with the essence of the Internet that breaks through the limitations on trade of space and time, allowing buyers and sellers to reach a deal more flexibly. Meanwhile, cases A, B and C show that brand manufactures will usually control online channels exclusively in-house due to the concern that online channels may threaten the segmented market as maintained by traditional regional exclusive agency systems. This concern, from another angle, reveals the potential of the Internet to integrate markets. The Internet Plus activities, with different orientations such as sales increase or nationwide expansion, are all inclined to expand market scope either by increasing the consumption density in the existing market or by attracting new consumers from other regions. There is little doubt that the Internet has encouraged numerous enterprises to enlarge their market border in a similar path as that mentioned above. As more enterprises integrate their own markets within wider markets it is quite possible that the national market of certain commodities will become more integrated.

On the other hand, according to our multi-case analysis, the positive effect of the Internet on market integration cannot take place unconditionally but is subject to several constraints as mentioned above. Against our expectations, these factors may create an opposing effect, making the Internet a driving force to market fragmentation in some instances. First, if there are artificial obstacles to interregional trade, such as local protectionism, administrative monopoly, and sales systems designed to maintain a segmented market, the Internet will not be adequate to create market integration.[3] Second, whether a company is going to take advantage of the Internet to expand its market or increase sales depends on the strategy orientation of the company as well as the balance between benefits

[3] For example, in the salt or cigarette market in China, the commodity must be sold, according to the existing law, by designated enterprises within designated administrative districts and cross-region sales are absolutely forbidden. This is the same even with online sales, demonstrating that the Internet is sometimes helpless to bring about market integration when facing manmade obstacles like government regulations. However, since obstacles of this kind are not due to enterprises' self-directed behaviors and are irrelevant to our case studies centered around "Internet Plus," we do not focus much on this point in this paper.

and costs. For the former, when facing market fragmentation, a company's strategy orientation is affected by its resources, capabilities and top managers' affective traits (Pi, Song, and Lan, 2013). For example, enterprise D, whose business is already nationwide, regards its self-owned e-commerce website and e-store on the *Tmall* as a supplementary marketing channel for certain low-priced sub-brands. Whether this will be supportive of market integration is not clear. For the latter, if the initial investment in and continuous management costs of Internet-based channels, as well as any accompanying logistic costs, exceed the expected benefits, any rational company will not take on Internet Plus action, and this is especially true with regard to companies dealing in fresh foods. This is supported by evidence from enterprise A, who engages in supplying fresh foods and processed products of livestock and poultry and therefore sells very little through online channels considering the expensive logistic costs to distribute fresh goods. However, it is still cost-effective to distribute packaged goods. Third, since the competition in the Internet era is extremely fierce, the profit margins of companies may be impaired and they are likely to implement stricter regional exclusive agency systems to maintain high profit margins in the offline market. Even though they are pushed to establish online distribution channels in the Internet Plus era, they will usually control it by themselves to reduce the shock of the online channel to offline agency systems. In our case study, both enterprise A and enterprise B, being agents for brand suppliers, reported that their delegated authorities were either withdrawn by the brand suppliers from online markets or were confined to rather limited types of merchandise. Enterprise C, as an upstream brand supplier, developed regional selling agents solely in the offline market, and excluded any intermediary selling directly online. The cases of enterprise A, B, and C have a common outlook that the Internet is sometimes powerless to accelerate market integration. In some extreme situations where the brand owners tend to keep segmented markets across different administrative regions, the development of the Internet and e-commerce could possibly strengthen this tendency for increased control of offline channels.

According to our case study, despite the positive activities complying with the Internet era, traditional enterprises adept in offline business generally took a prudent attitude towards Internet strategies and regarded "online" activities as complementing, rather than replacing, "offline" activities. Assuming a particular commodity, the Internet usually signifies an enlarging market. Nevertheless,

whether it promises a more integrated market compared to before depends on several factors. On the one hand, the Internet may accelerate the integration if the main obstacle between different regional markets is generated by natural factors. On the other, whether the Internet can fully play a positive role in market integration is subject to several constraints. If market fragmentation is caused artificially, or the costs of Internet Plus action are too expensive for firms to bear, then the Internet may not be sufficient to bring about market integration and could even aggravate market disintegration by encouraging traditional companies to adopt stricter regional exclusive agency systems to avoid the shock of online channels to offline channels. Therefore, whether the Internet accelerates market integration needs to be further examined by empirical research.

3 Methodology and Data

In this section, we will establish econometric models as equation (1) to investigate the impact of the Internet on market integration:

$$seg_{it} = c + Int_{it}\alpha + CV'_{it}\beta + \varepsilon_{it}, \quad (1)$$

where the dependent variable, seg_{it}, is a proxy of market fragmentation for province i in year t; the independent variable, Int_{it}, is a measure of Internet development; CV_{it} is a vector of control variables, i.e., a set of market fragmentation determinants other than the Internet such as economic development; and ε_{it} is a white noise error term.

Firstly, we will discuss how to measure the degree of market fragmentation, *seg*, in subsection 3.1, and we will then proceed to the selection and operationalization of independent variables and control variables in subsection 3.2. In subsection 3.3 we will list the data source as well as the descriptive statistics of variables. Finally, in the last subsection we will discuss the econometric approach adopted in this paper.

3.1 Dependent Variable

There are four methods to measure the dependent variable, i.e., market fragmentation degree denoted as *seg*. The first is *production method*, which is based on the analysis of economic structure. The more similar each province becomes in the aspect of GDP structure or industry structure, the more

fragmented the market will be as a result of fierce competition among duplicative industries (Young, 2000; Bai et al., 2004). The second is *border effects method*, the key of which is to compute the bilateral trade flows between provinces. If interprovincial trade flow grows and accounts for a larger proportion of local GDP, the market is deemed to be more integrated as a whole (Naughton, 2000; Poncet, 2003; Poncet, 2005). The third method is based on the evaluation of business cycles, commonly called *business cycle method*. It is assumed that in an integrated domestic market provinces will be closely related and share similar trends regarding output and price movement during the business cycle (Xu and Voon, 2003; Holz, 2009). In turn, close economic correlation among these regions is an indication of market integration. The fourth method is *price approach*, derived from the *law of one price* theory (Parsley and Wei, 1996).[4] The theory behind this method is that an integrated market features a free flow of factors and products and will arbitrage away any price difference. Therefore, a smaller variation of prices across provinces signifies a more integrated market and vice versa.

Of the four methods mentioned above, both *production method* and *business cycle method* yield unconvincing conclusions owing to inherent logic defects, as what they focus on is only a poor reflection of market conditions (Fan, Li and Liu, 2007). *Border effects method* is subject to the limitation of being unable to separate the effects of other factors such as factor endowment, economies of scale, substitution elasticity between products, etc. (Gui et al., 2006). The last method, *price approach*, has the merit of directly reflecting market conditions by capturing as much price information as possible. It can also be used to conduct empirical studies. Hence, price approach has received much more recognition and has been more widely applied(Parsley and Wei, 2001; Fan and Wei, 2006； Wang and Zhang，2012), and has also proved the most suitable method for our

[4] Although empirical research in this paper is based on *law of one price*, the law itself is not our focus but works as a benchmark to help infer the offline market fragmentation status which is the main concern of this paper. In other words, we are studying the relationship between offline market fragmentation and the Internet rather than the relationship between *law of one price* and the Internet. Readers who are interested in the latter may refer to the works by Brynjolfsson & Smith (2000), Baye, Morgan & Scholten (2004, 2006), Morgan, Baye & Scholten. (2004), and Ellison & Ellison (2014), which examine the difference between online and offline price levels and price dispersion, and explore whether online markets conform to the *law of one price* and the reasons why *law of one price* fails as well as what factors may determine the degree of online price dispersion.

study. The detailed process to calculate the market fragmentation index is as follows.

First, we calculate the difference of price in its natural log form for every two provinces that are geographically adjacent, and take on the absolute value

$$| \Delta Q_{ijt}^{k} | = | Q_{ijt}^{k} - Q_{ij,t-1}^{k} | = | \ln(P_{it}^{k} / P_{j,t}^{k}) - \ln(P_{i,t-1}^{k} / P_{j,t-1}^{k}) |, \quad (2)$$

where i and j represent the neighboring provinces, t indexes time and k refers to a specific product category of which the price P is examined.

We then transform the above equation into the following form:

$$| \Delta Q_{jit}^{k} | = | \ln(P_{it}^{k} / P_{i,t-1}^{k}) - \ln(P_{jt}^{k} / P_{j,t-1}^{k}) | . \quad (3)$$

We can then use the price index reported by the National Bureau of Statistics to compute price differentiation.

Next, we deduct the average price differentiation of all provinces in year t within category k to remove good-specific fixed effects (Parsley and Wei, 2001), which refers to the variation exclusively caused by category k's own nature. Equation (3) develops into equation (4) as follows:

$$\Delta q_{ijt}^{k} = | \Delta Q_{ijt}^{k} | - | \overline{\Delta Q_{ijt}^{k}} | . \quad (4)$$

Based on equation (4), we can get the variances of price differentiation across all of the product categories in a certain year between province i and j.

$$\mathrm{var}(\Delta q_{ijt}) = \mathrm{var}(\Delta q_{ijt}^{k}) \Big|_{k} . \quad (5)$$

Finally, we compute the market fragmentation index for province i in year t by averaging variances of price differentiation.

$$seg = \overline{\mathrm{var}(\Delta q_{ijt})} \Big|_{k} . \quad (6)$$

The larger the *seg* is, the more fragmented the market is. Since *seg* is very small in magnitude, for the convenience of estimation, we multiply it by 1,000 for the following analysis.

3.2 Independent Variables and Control Variables

In view of data availability, the independent variable, *Int*, is measured in two alternative ways. One is Internet penetration rate, the data of which can be taken directly from public reports, and is denoted as *Int-pen*. The other is percentage of Internet users in total population which is calculated by ourselves, denoted as

Int-pop. We incorporate *Int-pen* and *Int-pop* into the econometric model separately to see if the results are consistent, which constitutes part of the robustness test for this study.

According to the existing literature on market fragmentation (Chen et al., 2007; Fan, Li and Liu, 2007; Lu and Chen, 2009; Chen and Li, 2013), the following variables are included as control variables: The engagement of government (*Govern*), measured as ratio of fiscal expenditure to local GDP; levels of nationalization (*Soe*), the share of employment in state-owned commerce in total employment; economic development compared with the rest of country (*Econ*), measured as ratio of local per capita GDP to national per capita GDP; trade openness (*Open*), the ratio of value of imports and exports of goods of foreign-funded enterprises to gross domestic product;[5] the square of *open* (*Open2*), for the reason that some empirical studies have already identified the nonlinear impact of openness on market fragmentation (for instance, Chen et al., 2007). Therefore, the econometric model described in equation (1) can be transformed into the following form:

$$Seg_{i,t} = a_1 \cdot Int_{i,t} + a_2 \cdot Govern_{i,t} + a_3 \cdot Soe_{i,t} + a_4 \cdot Econ_{i,t} + a_5 \cdot Open_{i,t} + a_6 \cdot Open2_{i,t} + \varepsilon_{i,t}, \quad (7)$$

3.3 Data Sources

The prime source of data for our study is the China Statistical Yearbook published by the National Bureau of Statistics. This source provides detailed data on various price indexes that can be used to calculate market fragmentation indexes. Specifically, following Zhao and Xiong (2009), we used the consumer price index (CPI) instead of the retail price index (RPI),[6] for the reason that the

[5] As the original figures of the imports and exports are reported in US dollars, we have converted them to Chinese currency units at the exchange rate for each year.

[6] Since the market fragmentation index can be calculated using different price indexes, it is not surprising that the value of the fragmentation index based on CPI differs from that based on RPI as calculated by Chen et al. (2007). What matters, however, is the trend of the fragmentation index over time rather than the numerical value itself. No matter which price index is used, a similar declining trend of fragmentation index is observed. To ensure robustness, we also ran the regression with the fragmentation index based on RPI as an independent variable and obtained similar econometric results that the Internet does not accelerate market integration. Readers who are interested in details may ask us for the estimation results.

CPI contains services covering every aspect of the daily life of people in addition to 8 major categories of goods, while the RPI does not include services at all. Considering the growing dominance of the service industry in GDP and the increasing importance of services in the daily life of people, we determined that it was better to take services into account and thus CPI would be the better indicator. The calculated fragmentation index at a national level from year 2002 to 2013 is plotted in Figure 1, which clearly exhibits a declining trend over time indicating that the domestic market is moving toward integration. The results are consistent with the findings of Zhao and Xiong (2009), Fu and Qiao (2011), and Chen et al., (2011). The China Statistical Yearbook also provides data on fiscal expenditure, imports and exports value, as well as gross domestic production at the provincial level.

Data on the Internet penetration rate and number of Internet users are taken from the Statistical Report on Internet Development in China，published by the China Internet Network Information Center. The employment data of state-owned businesses are obtained from the *China Labor Statistical Yearbook*. Due to a lack of data on the Internet penetration rate before 2007, we exploit balanced panel data consisting of 31 provinces from years 2007 to 2013, which resulted in 217 observations in total.

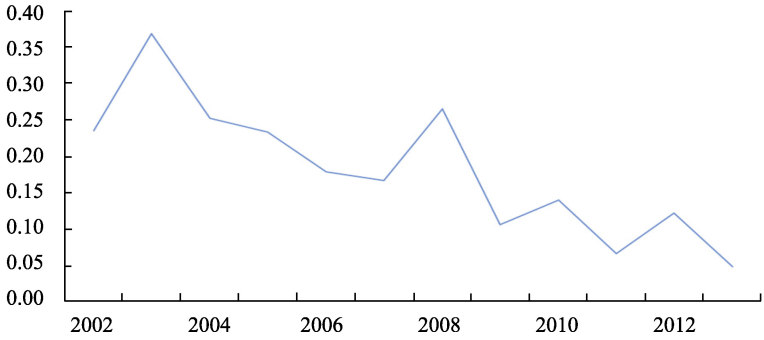

Figure 1 Market Fragmentation Index at National Level from 2002 to 2013

Table 2 displays the descriptive statistics and correlation matrix for independent and dependent variables. As expected, *Int-pen* and *Int-pop*, *open* and *open2* are highly correlated with each other. Most independent variables show correlations in the expected direction.

Table 2 Descriptive Statistics and Correlations Matrix (n = 217)

Variable	Mean	S.D.	1	2	3	4	5	6	7	8
1. *Seg*	.141	.168	1.000							
2. *Int-pen*	.336	.156	–.194***	1.000						
3. *Int–pop*	.330	.149	–.202***	.996***	1.000					
4. *Govern*	.242	.184	.205***	–.124*	–.121*	1.000				
5. *Soe*	.481	.199	.299***	–.732***	–.740***	.318***	1.000			
6. *Econ*	1.106	.560	–.107	.699***	.664***	–.351***	–.510***	1.000		
7. *Open*	.149	.237	–.033	.549***	.512***	–.281***	–.422***	.764***	1.000	
8. *Open2*	.078	.210	–.028	.420***	.379***	–.176***	–.285***	.639***	.942***	1.000

Notes. ***, ** and * denote significance at the 1%, 5%, and 10% confidence level, respectively.

3.4 Econometric Approach

Before proceeding to run any regression, we used F-statistic, the LM test, and the Hausman test to pre-select the right model for panel data among pooled OLS (POLS), fixed-effects (FE), and random-effects (RE). As often happens in panel data analysis, POLS was rejected in every situation. We then performed the Hausman test to see whether FE or RE was a better fit for our data set. When running the FE model, we added a set of year dummy variables to control for time effects, which is in line with the descending trend of the market fragmentation index, as shown in Figure 1. Specifically, since the domestic market itself is moving toward integration thanks to several reforms initiated by the government, which cannot all be captured in one model, there exists a problem of omitted variable bias. Meanwhile, both *Int-pen* and *Int-pop* increase with time while the other variables do not exhibit obvious upward or downward trends. In this situation, without control of the time effect, *Int-pen* and *Int-pop* will absorb most variations and become biasedly estimated. Using a time-fixed effects model can fix this problem to a certain degree. Results show that the Hausman test rejects the RE model and the F-test rejects the null hypothesis that all year dummies are equal to zero. Therefore, FE with time fixed effects is the preferred model.

In addition, considering the fact that panel data consist of cross-sectional data as well as time-series data, potentially heterogeneous and correlated errors across province-pairs for the same year, and autocorrelation of residuals within certain provinces for consecutive years, might be widespread. Thus we applied a modified Wald test, the Pesaran test, and the Wooldridge test sequentially to examine the above issues. It became clear that every model suffered the problem of heteroskedasticity and contemporaneous correlation, but not serial correlation, which would lead to a biased estimator if using normal estimation methods. Therefore, panel corrected standard errors (PCSE) was employed throughout to estimate parameters.

4 Empirical Results

Table 3 reports the results of regressions that investigate the impact of the Internet on China's market integration. All of the four models are estimated by

PCSE plus time fixed effects as selected by the above procedures.[7] The main differences across the models lie in the choice of Internet proxy, i.e., *Int-pen* or *Int-pop*, and whether the squared term of *open* is included.

The results show that either the coefficients of *Int-pen* or those of *Int-pop* are significantly positive in both linear and curvilinear models, coherently indicating that the Internet does not accelerate market integration, and may even prevent market integration. Considering models (1) and (2), where the market fragmentation index is regressed on all independent variables in a linear form with *Int-pen* and *Int-pop* as the proxy for Internet development respectively. Both coefficients of *Int-pen* and *Int-pop* are positive and significant at the 5% confidence level. Next we consider (3) and (4), which are extensions of models (1) and (2) due to the addition of the squared term of *open* corresponding to the curvilinear relationship between trade openness and market fragmentation. As we can see from Table 3, the coefficients of *Int-pen* and *Int-pop* are significant at the levels of 5% and 10% respectively. The coefficients of *Int-pen* and *Int-pop* remain significantly positive. Considering the improvement in model significance and goodness-of-fit compared with linear regression, the curvilinear model is preferred in this study. Comparing empirical results in Table 3 with earlier discussions on mechanism analysis, where we revealed mixed effects of the Internet on market integration, we find that negative effects of the Internet predominate over the positive ones and become the more significant effects. These results seem counterintuitive, but they are still reasonable given that nowadays the main obstacle to market integration derives from factitious factors rather than natural factors, which are beyond the ability of the Internet to address. In addition, as we have analyzed before, the function of the Internet is subject to the constraints of companies' strategy orientation, logistics costs, and so on. Furthermore, the Internet may also stimulate companies to strengthen offline regional exclusive agency systems, resulting in a more segmented market.

Regarding control variables, most of them performed well and had the expected sign. Although *Govern* failed to reach significance throughout but the positive sign of coefficient coincides with the findings of Poncet (2005), who explained that with an increase in fiscal expenditure, the government will tend to block the local market to prevent nonnative firms from taking advantage of the

[7] To make the table more compact, we do not display the regression results for year dummies, most of which were statistically significant.

Table 3 Regression Results

Dependent variable: Seg	(1)	(2)	(3)	(4)
Constant	.0083	–.0005	–.062	–.0638
	(.0783)	(.0821)	(.0982)	(.0989)
Int-pen	.4826**		.4016**	
	(.2133)		(.2027)	
Int-pop		.5088**		.4104*
		(.229)		(.2181)
Govern	.1627	.1694	.1682	.1744
	(.1373)	(.138)	(.135)	(.1358)
Soe	.2137*	.2147*	.3160**	.3083*
	(.1255)	(.1254)	(.1601)	(.1573)
Econ	–.0683*	–.0648*	–.0692*	–.0638*
	(.0388)	(.037)	(.0395)	(.0371)
Open	.0094	.0146	.3918*	.3748
	(.0626)	(.0629)	(.2338)	(.2358)
Open2			–.3700**	–.3479*
			(.1825)	(.1807)
Year dummies	YES	YES	YES	YES
Groupwise heteroskedasticity	15,482.65***	15,343.45***	15,077.38***	12,769.70***
Cross sectional independence	3.928***	3.880***	3.721***	3.677***
Autocorrelation	.005	.004	.000	.001
Model significance	9.21	9.47*	14.89**	16.75**
R-squared	.2727	.2747	.2885	.2883
N	217	217	217	217

Notes. (1) Panel-corrected standard errors in parentheses.

(2) ***, ** and * denote significance at the 1%, 5% and 10% confidence level, respectively.

spill-over effects of expenditure on infrastructure. The coefficient of *Soe* was consistently positive and significant at 10% level in regressions (1), (2) and (4) and at 5% in regression (3), indicating that a higher proportion of employment in state-owned economies will significantly aggravate market fragmentation. The reason is that state-owned commerce not only provides the local government with greater incentives, but also an increased ability to implement local protectionism policies to maximize fiscal revenues and maintain social-economic

stability. The empirical studies by Chen and Li (2013) and Fan, Li and Liu (2007) have also confirmed this. *Econ* played a significantly negative role in fragmenting domestic markets in all of the four models, as was suggested by Fan, Li and Liu (2007) where the less developed provinces usually have increased incentives to protect local industry from external competition by imposing more obstacles to interprovincial trade. As for trade openness, *Open* was statistically insignificant in both linear regressions, but became significantly positive in the curvilinear regression (3) while *Open2* was always significantly negative in regression (3) and (4), which confirms the findings of Chen et al. (2007) that an inverted-U relationship exists between market fragmentation and the level of economic openness. Specifically, negative effects on market integration dominate when trade openness is at a relatively low level. When past a certain level, however, it will promote the integration of the market. Overall, the results in Table 3 indicate that the Internet does not promote market integration.

5 Robustness Checks

We applied two methods to test the robustness of our results.

First, as pointed out before, we used two alternative ways to measure the development of the Internet, namely the Internet penetration rate (*Int-pen*) and share of Internet users in total population (*Int-pop*). As is shown in Table 3 and Table 4, either result based on *Int-pen* (Models 1, 3, 5, and 7) or *Int-pop* (Models 2, 4, 6, and 8) are remarkably similar, and coherently and clearly reveal the positive correlation between the Internet and market fragmentation, which enhances our confidence in the reliability of results.

A second robustness test was to repeat the analysis using different estimation methods. As mentioned earlier, it was necessary to control time effects since *seg* has a clear decreasing trend over time. In models (1)–(4), we employed a time fixed effects model to capture time effects. For a robustness test, we did this in another way by including variable *Trend* that equals 1 for year 2007, 2 for 2008, through to 7 for 2013. The results are reported in Table 4. First both *Int-pen* and *Int-pop* are significantly positive, which is consistent with the results of the time fixed effects model. In addition, the coefficient of *Trend* is significantly negative, which on the one hand supports the declining trend of market disintegration as shown in Figure 1 and on the other hand confirms the existence of time effects,

once again. The variable *Trend* absorbs most variations of market conditions, and most control variables become insignificant, but the coefficient signs remain the same as those in the time fixed effects model.

Table 4 Robustness Test Results

Dependent variable: *Seg*	**(5)**	**(6)**	**(7)**	**(8)**
Constant	.2120*	.2055*	.174	.171
	(.122)	(.1233)	(.1345)	(.1349)
Int-pen	.4129**		.3357*	
	(.1929)		(.1837)	
Int-pop		.4391**		.3531*
		(.2091)		(.2025)
Govern	.214	.2195	.2269	.2307*
	(.1411)	(.1421)	(.1383)	(.1392)
Soe	.0224	.0241	.0638	.0621
	(.1499)	(.1503)	(.1685)	(.1682)
Econ	–.0770**	–.0744**	–.0774**	–.0739**
	(.0386)	(.0373)	(.039)	(.0373)
Open	–.0082	–.0041	.2608	.2464
	(.0612)	(.0616)	(.2181)	(.2216)
Open2			–.2631	–.2447
			(.1665)	(.1673)
Trend	–.0465***	–.0479***	–.0411***	–.0421***
	(.0143)	(.0149)	(.0151)	(.0159)
Groupwise heteroskedasticity	1.4e5***	1.5e5***	1.3e5***	1.4e5***
Cross sectional independence	6.425***	6.192***	5.244***	5.095***
Autocorrelation	.463	.365	.501	.333
Model significance	16.71**	15.63**	15.88**	16.38**
R-squared	.1792	.1809	.1877	.1881
N	217	217	217	217

To summarize, our findings that the Internet does not accelerate, and may even oppose market integration, are robust since they are unaffected by either the alternative definition of the dependent variable or by the alternative choice of estimation method.

6 Conclusions

This paper examines the impact of the Internet on China's domestic market integration process. As the issue has seldom been studied before, we conducted a multi-case study to reveal why and how the Internet could influence market integration. On the one hand, the Internet can contribute to the integration of the domestic market by removing natural barriers to interprovincial trade, allowing individual merchants to enlarge their trading area at lower costs. On the other hand, the Internet cannot overcome artificial obstacles such as constrained trading systems and government intervention, and may even aggravate market fragmentation through encouraging companies to strengthen offline regional exclusive agency systems with the intent of maintaining high profit margins derived from segmented markets. Based on panel data consisting of 31 provinces from 2007 to 2013, we then conducted an empirical analysis and found no evidence that the proxy variables of the Internet were negatively correlated with the market fragmentation index. Further, we tried two different ways to test the robustness of the results and found that the results were robust. Thus, we conclude that the Internet does not accelerate market integration. The main implication of our study is that government should take a much more prudent attitude toward the Internet as a policy tool to achieve market integration than was originally thought. As long as the artificially imposed obstacles exist to interregional trade, Internet factors such as e-commerce will play a rather limited role in promoting market integration even if it did increase the selling networks of enterprises. Therefore, in pursuit of a more integrated national market, the innovation of business models and improvement in trading systems should be given significant attention in order to avoid the Matthew Effect of market fragmentation that could take place between offline and online systems.

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