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Résumé de l'article

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The Determinants of Regional Price Discrimination in the Telecommunication Industry: An Empirical Study of 31 Provinces and Municipalities in China

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Telecommunication prices are vastly different across regions in China. This paper aims to identify the determinants that affect regional pricing behavior of China telecom operators. Using regional telecommunication data of 31 provinces and autonomous regions in China (excluding Hong Kong and Macao) during 2002–2011, we identified several factors which affect the regional price differences. The findings provide insights on the working of China telecommunication industry and have implications for firms' marketing strategies and government policies.

1. Introduction

China telecommunication market is dominated by state owned enterprises (SOEs), and has been regulated by the central government. The market reform in the industry has led to changes in firms' ownership from solely state-owned companies to publicly traded corporations with majority equity participation of the government. These companies are listed and traded in Shanghai, China and off-shore's equity markets of Hong Kong and New York Stock Exchange. The market reform has introduced more competition, technology upgrading, an increase in economies of scale, and consolidation in the industry. In 2007, there were 6 firms to compete in the Telecommunication industry and in 2008 there were only five. Since 2008, the intra industry rivalry of China telecommunication sector has evolved into an oligopolistic market structure that consists of only three players (China Mobile, China Unicom and China Telecom) as a result of mergers and consolidations (refer to Table 1).

Table 1. Chinese telecom market in 2007, 2009 and 2014

(Revenue in billion RMB/USD)

	2007			2009			2014	
Company names	**Service Types**	**Operation Revenue**	**Market Shares**	**Service Types**	**Operation Income**	**Market Shares**	**Operating Income**	**Market Shares**
China Mobile	Mobile services	258.4/35.4	42.32%	Integrated Services	490.1/71.8	54.93%	641.5/103.4	51.29%
China Unicom	Mobile services	95.8/13.1	15.69%	Integrated Services	159.1/23.3	17.83%	284.7/45.9	22.77%

China Telecom	Land line services	61/8.4	9.99%	Integrated Services	242.9/35.6	27.20%	324.4/52.3	25.94%
China Netcom	Land line services	177.1/24.2	29.00%					
China Railcom	Land line services	16.6/2.3	2.72%					
China Satellite Telecom	Land line services	1.7/0.2	0.28%					

Notes:

1. China Netcom was merged with China Unicom after reconstruction in 2008. China Satellite Telecom was merged with China Telecom; and China Railcom was merged into China Mobile in the same year. 2. Data source: For 2007 and 2009 data, it is based on research of Y.D. Qi (2011). For 2014 data, it is based on the Annual reports of listed companies in Hong Kong Stock Exchange, i.e. China Telecom (0728.HK), China Mobile (00941.HK) and China Unicom (0762.HK).
2. Based on the onshore nominal exchange rate by the end of a corresponding year, i.e. one dollar equals to RMB 7.3037 in 2007, 6.8271 in 2009 and 6.2048 in 2014.

Telecommunication price was regulated by the central government in China. Before Aug. 2014, the regulated price level in the industry was based on the cost level of the industry under the principle of protecting consumers' interests and promoting universal service, especially in poor regions. As a national strategic and life-line industry, this sector has gone through continuous reform; the government policy has been trying to balance among three objectives of free market competition, state industrial development policy and affordability of its citizens, especially in lower income and higher cost regions. Prior to the entry of China in the WTO, the Ministry of Information Industry (MII) was created in 1997 to break up government monopoly, to create a level playing field, to foster free competition, and to reduce market failure. At the same time, the government has been trying to promote universal service, ensure market stability/order, reduce harmful competition, and nurture national champions in this industry (Pearson, 2005; Yu, Berg, and Guo, 2004). To increase competition and to maintain market order at the same time, the government policy increased competition by breaking down the monopoly into several firms but at the same time limiting the number of competitors in the industry. Three telecom firms were divided and allowed to compete in regional markets. China's regional markets are highly segmented not only by local governments' protectionism but also by regional differences in purchasing power, consumer attitudes, and communication technology infrastructue (Cui and Liu, 2000). In this context and under the regulated price cap of the central government, firms competed and charged different prices across regions. Study shows that in this segmented and regulated market firm's strategic choices matter and can make a big difference (Lufeng, 2016). By international comparison, China telecom industry is the most concentrated in the world in terms of market size and population served by each company (refer to Table 2).

Table 2. International Comparison by market size (population), industry concentration (No. of firms in the Telecom industry) and population per firm served

Country	Population in Millions	Numbers of firms in the Telecom Industry	Population (in millions) per firm served
US	263	> 20	< 13.15
Canada	29.7	3	9.9
UK	58.8	5	11.76
France	58.5	3	11.7
Germany	81.6	4	20.4
Japan	125	3	25.0
Russia	148	> 4	< 37
Brazil	161	> 10	< 16
India	938	22	43
China	1295	3	432

Source: Y.D. Qi, 2011

Note: Above is a simple market size comparison and assumes that the entire population is provided service, and that each person has exactly one line.

Even though there are only three firms in the industry, they operate across different administrative regions, provinces and municipalities. These regional locations are different with respect to market conditions and local regulations. Hence the pricing competitions are shown basically at regional level. Since these regional markets are so segmented (e.g. via roaming charges) that there are no arbitrage opportunities, the price discrimination becomes possible and persistent. This practice and price differentials across regions have faced many concerns and criticism from consumers. There is little empirical research examining this phenomena of regional pricing differences in China. This paper seeks to fill the gap in the literature by seeking answers to the following questions: what is the extent of price differences across regions in China? Are these differences due to differences in regional living standards? What are the major factors affecting telecommunication price discrimination across regions?

2. Literature Review

According to Nicholson (1999), "A monopoly firm engages in price discrimination, if it is able to sell otherwise identical units of output at different prices." Pindyck and Rubinfeld (2008) have expressed price discrimination as "Ideally, a firm would like to charge a different price to each of its customers". Tirole (1988) states that a producer price-discriminates when two units of the same physical good are sold at different prices, either to the same consumer or to different consumers.

Based on these definitions and firms' price discriminating practices, price discrimination can be classified into the first, second and third degrees of price discrimination. The first-degree is perfect price discrimination; it refers to a situation where a producer succeeds in capturing the entire consumer surplus. The second-degree discrimination is that a producer extracts consumer surplus imperfectly by

using the self-selecting devices. The third-degree discrimination is matching the customers' preferences to price (Tirole, 1988). Among them, the third-degree price discrimination is the most popular one in practice.

Researchers often focus on the relationship between price discrimination and market concentration. Holmes (1989), Borenstein and Rose(1994), and Barron, Taylor and Umbeck (2004) found a negative relationship between them. That means price discrimination will be greater when market competition is more intensive. Gale and Holemes (1993) argued that there was more room for price discrimination in duopoly market than in perfect monopoly market since in a perfectly competitive market there are no barriers for arbitrage opportunities, and thus the price discrimination practice is not sustainable. Price discrimination prevails when there is oligopoly market structure and/or when market can be segmented. Lewis (2008) observed that price discrimination is negatively correlated with market concentration in low-price market segment, whereas price discrimination has a weakly positive relationship with market concentration in high-price market segment. However, there is no consensus regarding market concentration and price discrimination.

In China, researchers of price discrimination in telecommunication market have focused on the following areas. Along the same line as previous studies, researchers like Gan and Niu (2003) have studied three degrees of price discriminations. Concerned about the social and economic impacts of price discrimination, Su (2013) has argued that price discrimination practice limits free competition, distorts free market mechanism, treats customers unfairly, misallocates resources, promotes regional protectionism, and creates barriers for national market integration. On the opposite side, Dai (2008) has argued that price discrimination has income transfers effect and improves the welfare of low income groups in the society. Hence it promotes social fairness.

Focusing on firms and its market conditions, Hu and Qu (2013) studied relationship between firms' price discrimination practice and firms' market power & market segmentation to see whether market arbitrage opportunities are present. Zheng (2007) has argued that pricing based on consumption or demand elasticity is the proper pricing strategies in using price discrimination. Wei (2005) has offered different operational strategies for each of the three degrees of price discrimination. For instance, using auction for selling telephone numbers for the first-degree discrimination in pricing; using discount for call durations, volume and peak time for the second-degree discrimination in pricing; and using branding, services, and products differentiations for the third-degree discrimination in pricing.

Price discrimination is an important tool for telecom firms to earn abnormal profits (Xu, 2013). Dirk, Brooks and Morris (2015) have suggested, after they analyzed the welfare consequences of a monopolist having additional information about consumers' tastes, that the market segmentation and pricing induced by the additional information can achieve every combination of consumer and producer surplus.

In short, with high fixed cost, low marginal cost and network effect, telecommunication companies have certain pricing power. At the same time, price discrimination would provide more options for customers. However, none of these

studies has studied regional pricing discrimination and its determinants. To this end, our study aims to fill in this gap.

3. Data and Measurement

In this research, our data sample are from 31 provinces and autonomous regions in China during 2002–2011 (without Taiwan, Hong Kong and Macau). All the data come from the Industry and Economic Database in China, Ministry of Industry and Information Technology publications, *Annual Report of China Communications Statistics*, *China Statistical Yearbook*, and *Provinces' & Autonomous Regions' Statistical Yearbook.*

To measure the telecom price index P_{it} and the regional price discrimination index ΔP_{it}, we adopted the approach from Wang and Zhao (2003) to measure P_{it} and from Hosken, McMillan, and Taylor (2008) to measure ΔP_{it}.

$$P_{it} = \alpha + \sum_{i=1}^{I} \beta_i Region_i + \sum_{t=1}^{T} \varphi_t Year_t + \varepsilon_{it} \quad (1)$$

where P_{it} is telecom price index for region i in year t and P is a price level indicator. α is the model intercept, β_i is the regional coefficient, $\emptyset_i$ is the time coefficient, and ε_{it} is an error term. Based on the regression equation (1), the panel data regression was conducted. The results are reported in Table 3. In the computation, Beijing=0 and year 2002=0 for these two independent dummy variables of "*Region*" and "*year*".

Table 3. Regression Results

Variable	Coefficient
constant	0.95***
Region	-0.19***
Year	-0.378***
adjR^2 : 0.35, F-statistic : 86.71	

*** P < 0.01; ** P < 0.05; * P < 0.01

Based on estimated $\hat{\alpha}$, $\hat{\beta}_i$ and $\hat{\varphi}_t$ in Model (1), we calculated predicted values: $\hat{P}_{it}$

$$\hat{P}_{it} = \hat{\alpha} + \sum_{i=1}^{I} \hat{\beta}_i Region_i + \sum_{t=1}^{T} \hat{\varphi}_t Year_t) \quad (2)$$

Based on formula (2), the regional telecom price differences across 31 provinces and autonomous regions during 2002–2011 are calculated using formula (3).

$$\Delta P_{it} = P_{it} - \hat{P}_{it} \quad (3)$$

We used ΔP_{it} to measure the regional price discrimination index. The results for each region and year are shown in Table 4. From Table 4, it is clear that the year 2007 is a turning point, when the price level was declining in almost all regions across China. Interestingly, so is the case for national level prices as shown in the bottom row. Please note the "national" values in this row are not the average of all regions in above columns, rather it is calculated based on China as a whole for each year respectively. Shanghai was the laggard one to catch up with this trend. The 2007 is the first year after the industry consolidation from 7 to 6 companies. The competition put downward pressure on the price from that year onward and consumers benefitted from this development. To verify the above results, we also conducted a robustness test for measuring the regional price discrimination index by an alternative approach in which we used Beijing in the year 2002 as the benchmark, (refer to equation number 4). The calculated results is shown in Table 5.

$$\Delta P_{B2} = P_{it} - P_{Beijing2002} \quad (4)$$

Results presented in table 5 confirm an overall declining price level across regions despite an increase in the industry concentration from seven firms in 2006 to three in 2009. The overall price decline might have been contributed by technology upgrading, network effect, diminishing marginal cost, and liberalization of the market. In order to study regional pricing discrimination and its determinants, we used regional price discrimination index (i.e. data in Table 4 and 5) as dependent variable to identify factors that contribute to the regional price variations.

Table 4. The regional telecom price discrimination index (ΔP_{it}) by region and year

Year/Region	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Beijing	-0.021	0.372	0.298	0.206	0.075	-0.074	-0.133	-0.192	-0.249	-0.282
Tianjin	-0.048	0.241	0.168	0.145	0.017	-0.067	-0.092	-0.102	-0.138	-0.156
Liaoning	-0.051	0.316	0.213	0.138	0.068	0.011	-0.026	-0.067	-0.130	-0.158
Shanghai	0.273	0.509	0.440	0.359	0.214	0.102	0.046	0.028	-0.015	-0.066
Jiangsu	0.163	0.392	0.299	0.181	0.071	0.007	-0.039	-0.066	-0.112	-0.137
Zhejiang	0.060	0.281	0.130	0.076	0.026	-0.028	-0.066	-0.088	-0.129	-0.153
Fujian	-0.045	0.214	0.060	0.018	-0.024	-0.069	-0.077	-0.105	-0.145	-0.171
Shandong	0.023	0.376	0.215	0.089	-0.012	-0.060	-0.102	-0.123	-0.163	-0.186
Guangdong	0.053	0.303	0.096	0.023	-0.037	-0.059	-0.096	-0.126	-0.172	-0.194
Hainan	-0.046	0.328	0.117	0.078	0.004	-0.044	-0.095	-0.117	-0.149	-0.166
Hebei	-0.018	0.263	0.116	0.061	0.020	-0.051	-0.100	-0.131	-0.168	-0.182
Shanxi	0.040	0.310	0.150	0.116	0.073	-0.013	-0.080	-0.105	-0.145	-0.174
Jilin	-0.059	0.205	0.053	0.005	-0.076	-0.113	-0.134	-0.153	-0.194	-0.213
Heilongjiang	-0.089	0.213	0.094	0.050	-0.005	-0.076	-0.109	-0.135	-0.169	-0.194
Anhui	-0.075	0.318	0.190	0.129	0.064	0.011	-0.044	-0.088	-0.123	-0.148
Jiangxi	-0.090	0.259	0.092	0.022	-0.008	-0.065	-0.109	-0.146	-0.167	-0.180
Henan	0.004	0.280	0.089	0.032	-0.032	-0.087	-0.124	-0.149	-0.173	-0.190
Hubei	0.022	0.325	0.175	0.081	0.041	-0.021	-0.073	-0.093	-0.138	-0.161
Hunan	-0.069	0.257	0.154	0.092	0.012	-0.051	-0.091	-0.105	-0.150	-0.174
Neimenggu	-0.072	0.244	0.095	0.052	-0.020	-0.106	-0.149	-0.161	-0.184	-0.214
Guangxi	-0.035	0.252	0.028	-0.021	-0.040	-0.077	-0.118	-0.139	-0.164	-0.181
Chongqing	0.070	0.297	0.171	0.093	-0.005	-0.086	-0.106	-0.123	-0.160	-0.183
Sichuan	0.001	0.373	0.214	0.095	0.021	-0.043	-0.083	-0.123	-0.164	-0.186
Guizhou	-0.160	0.146	0.088	0.025	-0.028	-0.073	-0.108	-0.146	-0.179	-0.225
Yunnan	-0.063	0.218	0.100	0.041	-0.005	-0.095	-0.128	-0.146	-0.177	-0.191
Xizang	0.397	0.662	0.453	0.326	0.207	0.076	-0.003	-0.022	-0.103	-0.130
Shaanxi	0.040	0.310	0.150	0.116	0.073	-0.013	-0.080	-0.105	-0.145	-0.174
Gangsu	0.002	0.251	0.125	0.057	0.011	-0.060	-0.114	-0.145	-0.176	-0.201
Qinghai	-0.020	0.267	0.208	0.132	0.085	0.009	-0.101	-0.097	-0.173	-0.199
Ningxia	-0.101	0.228	0.140	0.077	0.010	-0.069	-0.105	-0.130	-0.170	-0.184
Xinjiang	-0.089	0.230	0.107	0.078	-0.006	-0.077	-0.115	-0.162	-0.188	-0.198
China	0.013	0.309	0.176	0.084	0.016	-0.041	-0.088	-0.115	-0.154	-0.177

Table 5. The regional telecom price discrimination index (ΔP_{B2}) by region and year

Year/Region	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Beijing	0.000	0.019	-0.061	-0.160	-0.301	-0.462	-0.525	-0.589	-0.650	-0.686
Tianjin	-0.229	-0.323	-0.401	-0.425	-0.563	-0.654	-0.681	-0.691	-0.731	-0.750
Liaoning	-0.232	-0.242	-0.353	-0.433	-0.509	-0.570	-0.610	-0.654	-0.722	-0.752
Shanghai	0.116	-0.035	-0.108	-0.195	-0.352	-0.472	-0.533	-0.552	-0.597	-0.652
Jiangsu	-0.002	-0.160	-0.260	-0.387	-0.505	-0.575	-0.624	-0.652	-0.702	-0.730
Zhejiang	-0.113	-0.280	-0.442	-0.500	-0.554	-0.612	-0.653	-0.676	-0.721	-0.746
Fujian	-0.226	-0.351	-0.518	-0.562	-0.607	-0.656	-0.665	-0.695	-0.737	-0.765
Shandong	-0.152	-0.177	-0.351	-0.486	-0.595	-0.646	-0.691	-0.714	-0.757	-0.782
Guangdong	-0.120	-0.256	-0.479	-0.557	-0.621	-0.646	-0.685	-0.717	-0.767	-0.791
Hainan	-0.227	-0.229	-0.456	-0.498	-0.577	-0.630	-0.684	-0.708	-0.742	-0.760
Hebei	-0.196	-0.298	-0.457	-0.516	-0.560	-0.637	-0.689	-0.722	-0.762	-0.777
Shanxi	-0.134	-0.248	-0.421	-0.457	-0.503	-0.596	-0.668	-0.694	-0.738	-0.769
Jilin	-0.241	-0.362	-0.525	-0.577	-0.664	-0.703	-0.726	-0.746	-0.791	-0.811
Heilongjiang	-0.273	-0.353	-0.480	-0.528	-0.587	-0.663	-0.699	-0.727	-0.763	-0.790
Anhui	-0.258	-0.240	-0.378	-0.443	-0.513	-0.570	-0.629	-0.676	-0.714	-0.741
Jiangxi	-0.274	-0.304	-0.483	-0.559	-0.590	-0.652	-0.699	-0.739	-0.761	-0.775
Henan	-0.173	-0.281	-0.486	-0.547	-0.616	-0.676	-0.715	-0.742	-0.767	-0.786
Hubei	-0.153	-0.232	-0.394	-0.494	-0.537	-0.605	-0.660	-0.682	-0.730	-0.755
Hunan	-0.251	-0.305	-0.416	-0.483	-0.569	-0.637	-0.679	-0.695	-0.743	-0.769
Neimenggu	-0.255	-0.320	-0.480	-0.526	-0.603	-0.696	-0.742	-0.755	-0.779	-0.812
Guangxi	-0.215	-0.311	-0.552	-0.604	-0.625	-0.665	-0.708	-0.731	-0.758	-0.776
Chongqing	-0.102	-0.262	-0.398	-0.481	-0.587	-0.674	-0.696	-0.714	-0.754	-0.779
Sichuan	-0.176	-0.180	-0.352	-0.480	-0.559	-0.628	-0.671	-0.714	-0.758	-0.782
Guizhou	-0.349	-0.425	-0.487	-0.555	-0.612	-0.660	-0.698	-0.739	-0.774	-0.824
Yunnan	-0.245	-0.347	-0.474	-0.538	-0.587	-0.684	-0.719	-0.739	-0.772	-0.787
Xizang	0.250	0.130	-0.094	-0.232	-0.359	-0.500	-0.585	-0.606	-0.693	-0.722
Shaanxi	-0.291	-0.333	-0.513	-0.603	-0.662	-0.695	-0.723	-0.737	-0.765	-0.783
Gangsu	-0.175	-0.311	-0.447	-0.521	-0.570	-0.646	-0.705	-0.738	-0.771	-0.798
Qinghai	-0.198	-0.295	-0.358	-0.440	-0.491	-0.572	-0.690	-0.687	-0.768	-0.796
Ningxia	-0.286	-0.337	-0.432	-0.499	-0.571	-0.656	-0.694	-0.722	-0.765	-0.780
Xinjiang	-0.273	-0.334	-0.467	-0.497	-0.589	-0.665	-0.705	-0.756	-0.784	-0.794
China	-0.163	-0.250	-0.393	-0.491	-0.565	-0.626	-0.676	-0.705	-0.747	-0.772

4. Regional Pricing Discrimination and its Determinants

In order to identify determinants for regional telecom price discrimination, we used factors from both demand and supply side of the telecom market into consideration. Regional per capita GDP (GDPP) and price elasticity (El) are indicators of consumers' affordability and sensitivity towards prices. The market power (MP) is an indicator of firm's pricing power and their operational cost and efficiency. The following multiple regression time-series and cross-section regression models are used:

$$\Delta P_{it} = a + \beta_1 MP_{it} + \beta_2 El_{it} + \beta_3 GDPP_{it} + \varepsilon_{it} \quad (5)$$

$$\Delta P_{B2} = a + \beta_1 MP_{it} + \beta_2 El_{it} + \beta_3 GDPP_{it} + \varepsilon_{it} \quad (6)$$

Where market power: $MP = (p - mc)/mc$ (7)

P is telecom price index charged in regional market and *mc* is the associated marginal cost. The lower the marginal cost, the higher will be the value of *MP*. The firms with higher *MP* can indicate its strong pricing power due to its lower marginal cost. If a firm's marginal cost is lower relative to its rivals, it will be more competitive and has stronger pricing power in the market place. That is, by lowering the prices it can push their competitors off the edge. Here we adopted a methodology by Wang and Chen (2007) to measure the market power in model (7). Market power (*MP)* can be negatively or positively correlated with regional price differences or the price discrimination index (ΔP). For instance, for a negative correlation between MP and ΔP_{it}, it means firms have more room to lower its prices in the opposite directions of the market power. While in the case of positive correlation, *MP* and ΔP are moving in the same direction. For instance, with the higher *MP* and the higher discrimination pricing index (ΔP), firms can gain more surplus over the marginal cost by leveraging its pricing power.

Where price elasticity: $El = \dfrac{\Delta q}{q} \Big/ \dfrac{\Delta p}{p}$ (8)

q is the total telecom revenue or telecom traffic volumes, and Δq is a change of total revenue or volume; *p* is telecom price, and Δp is a change of telecom prices. If the underlying telecomm services or products are price elastic, *El* should be negatively correlated with regional price difference or price discrimination index. It means when price increases, the demand will drop in terms of sales revenue or traffic volumes; and firms will have less room to charge higher prices in a price elastic market.

The regional GDP per capita (GDPP) is an indicator of regional living standard or income level or a regional market potential. GDPP and ΔP can be positively or negatively correlated. For instance, for a positive correlation, the higher or lower the GDPP and higher or lower will be ΔP, when facing an income elastic demand where producers have a limit on pricing power to gain consumer surplus. On the other hand, for a negative correlation, GDPP and ΔP move in the opposite direction. For instance, the higher (lower) the regional GDP per capita (GDPP), the lower (higher) will be the price discrimination (ΔP). In this case, for instance, it may suggest that in

a high GDPP area, the market is more competitive; there are more rivalries and substitute services around like free WiFi or more PC usage; it becomes more difficult for producers or firms to charge higher prices. While for the lower GDPP area, the market is less developed and there are few substitutes for consumers; and firms can charge higher prices.

Based on the panel data in Table 4 (ΔP_{it}) and Table 5(ΔP_{B2}), the econometric results from regression models (5) and (6) are shown in table 6.

Table 6. Regression Results for Models (5) & (6)

Variable	Coefficient (5)	Coefficient (6)
Constant	0.07***	-0.519***
El	-1.31***	-1.58***
MP	-0.040*	-0.046**
GDPP	-2.46E-06***	-1.44E-06*
adjR2	0.11	0.09
F-statistic	12.64	8.88

*** P < 0.01; ** P < 0.05; * P < 0.01

From Table 6, we identified three determinants—price elasticity, market power, and per capita of GDP—for regional price discrimination in China's telecommunication market. This result shows that price elasticity El, market (pricing) power MP and GDP per capita GDPP are all negatively correlated with regional price discrimination index (ΔP). ΔP is most sensitive to El of the market demand and to a lesser degree to firms' MP and regional living standard or local consumers' affordability GDPP. Please note these three coefficients cannot be compared with one another since measurement for El and MP is between zero and multiples, while GDPP is in Chinese yuan (RMB in thousands).

The negative correlation between price elasticity (El) and regional price discrimination index (ΔP) indicates firms' pricing is driven more by demand price elasticity, i.e. the higher EL and lower ΔP. The negative correlation between market power (MP) and regional price discrimination index (ΔP) suggests that when firms have higher market power, their larger profit margin or lower marginal cost allows them to use less discrimination in pricing and pass along consumer surplus to users. While when firms have lower market power, their price is closer to the marginal cost and profit margin is lower, and they need to use price discrimination in every possible way to squeeze out profit from consumer surplus.

The negative correlation between regional GDP per capita and regional discrimination index indicates price discrimination is higher in poor region and lower in rich region although the value of GDPP's coefficient seems low due to the variable scale. It suggests that firms charged lower prices or practiced less price discrimination in rich regions but the opposite is the case in poor regions. This indicates firm can capture higher consumer surplus in a poor region.

The negative sign of the coefficients of El and MP indicates that the first degree discrimination seems not to be the case in the richer region. Rather firms reacted to

the price elasticity of the demand and did not leverage their market power. It indicates low price discrimination may lead to a higher propensity to spend for customers in richer regions. In richer and more developed market, consumers seem to benefit more and firms' cannot capture higher consumer surplus.

Further, the negative sign of the coefficients of GDPP suggests that when the industry concentration increases, its impact on poor and rich regions is different. The reduced number of operators (firms) and competition in this sector or an increase market concentration has less impact on rich region but has negative impact on poor region. In other words, firms seems to be able to exercise their market power or to charge higher prices over their marginal cost in poor regions but have to pass along the operational efficiency gain to consumers in the rich regions, despite MP is negatively correlated to ΔP on the aggregate level.

As the market consolidated from seven to three companies (China Mobile, China Telecom and China Unicom), the result does not show that producers have captured the entire consumer surplus when the industry concentration increased. Yet the impact on the richer and poorer regions is different although the overall price level declined since 2007 (refer to Tables 4 & 5).

5. Conclusions

Our findings suggest that China telecom market is very price elastic. The overall price level has declined since 2007 even though the industry has become more concentrated. That being said, firms can exercise their market power or pricing power more in poor regions but not in rich regions despite the government regulating telecom prices.

The finding of this research may provide insights for government policy makers and businesses. Since Aug. 2014, the government telecom pricing regulation has shifted from cost based benchmark (by setting price cap) to a market guided policy, i.e. to rely on market demand and supply. Under this new policy initiative, policy-makers need to pay more attention to protect consumers' welfare in poor regions. Furthermore, policy-makers need to take variation/differences of regional ICT network infrastructure into their policy considerations. Because ICT new market ecosystem is shaped by rapid development of technology (Xia, 2016), growth and expansion is accompanied by mobile virtual network operation (MVNOs), apps market (e.g. QQ, Wechat, Alipay, etc.), and info services (e.g. Baidu, Sohu, Sina, etc.). As a result, it has changed the competition game and the market landscape. The big three telecom firms can maintain their providers' role of network infrastructure, network safety and public service obligation under the current government licensing policy. At the same time, this new ecosystem opens door and lowers the entry barriers for domestic and foreign entrepreneurs and private firms to compete in this industry, especially in areas of MVNOs, apps market and information services. This opens up a new vista of good opportunities for people living in rural and underdeveloped region in China. To ensure policy goals of universal service, free competition and a balance in the country's regional economic development, policy makers need to attract more investments and business opportunities to build rural area ICT network infrastructure to lower the

access cost for the Internet and telecom services. This will also bring more business opportunities for domestic and foreign firms.

Currently China telecommunication market is still protected from the foreign competition and is dominated by three players. For the big three China telecom firms, sooner or later they will face more competition in the domestic market as the sector will be open to domestic private and foreign competition to fulfill WTO agreement. With the upcoming new technologies, they will have no choice but to get ready for the global competition although these firms currently are very profitable in the home market. For "going global" and internationalization, China telecom companies (such as competing in Hong Kong market) have to adapt their pricing strategies when a host country's business environment is different, the market power is lower, and their profitability is challenged. For foreign telecom companies who want to enter the Chinese market, they need to pay attention to regional conditions, for instance, price elasticity, local competition and market fragmentations, as well as regulation risks at both central and local government levels other than just viewing China as one huge market. Foreign firms also need to choose their entry strategies carefully with regards to which regional market they will enter, how they will enter, as well as which segment of ICT ecosystem they can position their products and services successfully in this newly and evolving competitive ICT ecosystem in China.

Our findings have implications for firm's pricing strategies. As China's development moves westward (more underdeveloped regions) and faces the potentially higher demand for e-commerce and e-finance in rural areas as well as rapidly evolving new ICT ecosystem, the future research needs to look into other pricing factors such as available substitute services, level of regional ICT infrastructure and degree of regional protectionism. From a comparative perspective, China is a transition economy. It will be interesting to see how China's experience differs from that of other big emerging markets like India, Brazil, South Africa, and Indonesia.

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