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# Determinants of Polarized Sales Distribution in E-market: C2C Mobile Phone Market Scenario of China

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**Abstract:** The factors influencing huge divisions of wealth in society are widely studied by researchers. However, with the rapid development of the Internet, whether polarization or equalization of market shares exists in e-market among sellers springing up online, and how e-commerce affects its formation is still unknown to us. With a seller sample retrieved from Taobao, our study examines the polarization phenomenon and explores the determinants of its formation in the context of online markets. The descriptive analysis suggests a polarized phenomenon exists in e-commerce. Then this study applies quantile regression approach to investigate the factors that influence the formation of polarization in C2C mobile phone market. The results indicate that, a polarized sales distribution is existed; reputation and negative ratio play more important roles, while the number of items has a lower influence gradually. The empirical results can help us find the reason of polarization in C2C e-market.

**Keywords:** Polarization, Sales Distribution, C2C E-commerce, Quantile Regression

## 1. INTRODUCTION

The rich-poor gaps and poverty alleviation have attracted much interest from researchers to understand, mainly from children <sup>[2-4]</sup> to adults <sup>[5-7]</sup>. Different from these studies, which mainly focus on the income and welfare, in this study, we focus on the sales polarization constituted by individual sellers in C2C markets. In C2C e-markets, each individual seller could be considered as a specific citizen in the society, and we would focus on the gaps between top sellers and sellers ranking last across the sales distribution. Although sellers of the same product category share the common keywords and website resource, they have their own reputation, ratio of positive ratings, the number of popularity favorites and so on, which could influence their revenue significantly. Using a data set on mobile phones in Taobao, China, we conduct a comprehensive descriptive analysis to investigate whether the sales of online small business symmetrically across the sales distribution in e-commerce platforms, and also identify the factors that result in the formation in this distribution.

## 2. LITERATURE REVIEW

Over the past two decades, Asian dramatic economies have allowed large numbers of people to move out of poverty. However, it is increasingly clear that while there has been dramatic improvement in the overall rates of poverty in many nations in Asia, there is a large and stubborn problem of people being unable to improve their lives despite the economic growth. For instance, as a group, the world's poor are experiencing diminished poverty polarization, however, within the world's poor the African nations are experiencing increased poverty polarization<sup>[8]</sup>.

The current studies on bridging the gaps between the rich and the poor could be separated into three folds. One is related to alleviating poverty from the perspective of individuals' health. According to a 2008 report from the World Health Organization, it felt that improving living conditions is the key to reducing the health inequalities between rich and poor countries <sup>[9]</sup>. With the relatively difficult living conditions, health problems

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caused by poverty in Asia have been paid attention to by scholars. Sverdlik<sup>[10]</sup> summarized the literature on health in the informal settlements in Africa, Asia and Latin America. Amare and Asfaw<sup>[11]</sup> evaluated the impact of food aid (food-for-work and free food distribution) on rural poverty in Ethiopia and found that participation in both types of food aid programs reduced the incidence of poverty. Utomo et al.<sup>[12]</sup> examined trends and levels in socio-economic inequity of health and identified critical factors constraining efforts to improve the health of the poor. Shubin<sup>[6]</sup> addressed the rich-poor gap by studying care for the poor in rural Russia. Using examples from fieldwork in two Russian villages, this paper stresses the constitutive role of non-representable practices of care which provide the ontological basis for recognizing and understanding the world-views and coping practices of the poor.

Another is related to bridging the rich-poor gaps with the help of political and economic means. Nikoloski<sup>[13]</sup> adopted a cross-country perspective to analyze the short term effects of currency, banking and debt crises on the poverty headcount ratio and the poverty gap, and suggested that currency crises most significantly exacerbate both the incidence and depth of poverty in the short run. Meisami et al.<sup>[14]</sup> examined the impact of the various components of human capital on income inequality, and poverty in Islamic countries. The results indicated that enhancing the components of human capital in the Muslim world, would reduce poverty and change income distribution toward equality. David and Marouani<sup>[5]</sup> analyzed in depth the interactions of growth and poverty in Syria, which undertook reforms to reduce the government's involvement in the economy, and found that agricultural and land-policy reforms had a negative impact on poverty, despite their positive effect on productivity. On the assessment of empirical economic models using a cross-country data set, Ardic<sup>[15]</sup> found that the majority of studies ignored the inherent heterogeneity that can actually lead to different regression models for different countries. And an effective way had been provided to overcome it.

Also, a gap of knowledge and research exists between developed and developing countries, which has been studied by scholars. Neufeld et al.<sup>[16]</sup> Focused on global spending on health care research, and found that a rich-poor gap still persisted in health research investment. Developing countries should increase their spending on medical research. Although developing countries increase in spending, their foreign government aid to the countries had fallen. In the area of biotechnology research, a gap has recently emerged between private life science companies and public research institutions. As a result, a rich-poor gap is rapidly widening between cutting-edge research in the developed world and publicly sponsored research being undertaken in the developing world<sup>[17]</sup>. Freeman and Robbins<sup>[18]</sup> reflected on the author's view on AuthorAID, a global program to provide developmental editing help to authors from developing countries who want to publish their science and policy writing in competitive journals that influence program and policy locally, regionally and globally. According to the authors, regional and local journals play a similar role, engaging policy makers and a wider public through mass media.

Although prior studies have identified and investigated the rich-poor gaps from the perspective of health, politics, economy, and research, there are no empirical studies on the sales polarization among sellers in C2C e-commerce, the influencing factors of whose formation is unknown to us. In this study, we are interested in examining the polarization or equalization phenomenon in C2C e-commerce, as a supplement to the existing studies on the poverty-business literature. In addition, we take an initiative to investigate the factors influencing the polarization which differentiate sellers across the sales distribution, and also help to bridge the rich-poor gaps and alleviate poverty on the Internet.

### 3. RESEARCH METHODOLOGY

#### 3.1 Data description

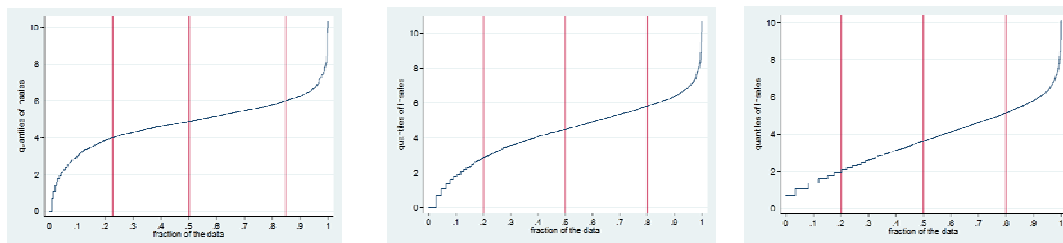
Our data for this study were collected from Taobao (www.taobao.com), which is the largest online C2C e-market in China. It provides databases of sellers' transaction volumes, reputation, customer reviews, and other information consisting of evaluations of products and sellers. We collect the data for this study using mobile phone sellers available on Taobao. Our sample consists of all seller information for three years: October 2011, October 2012 and March 2014. According to a descending order of sales, we collected all sellers for three years which could be searched for. At each period, 8896, 8652 and 9642 sellers could be searched on Taobao, respectively. Using a crawler program written in Java, the following information has been extracted on every seller listed in his/her homepage: quantity of items, seller's overall reputation, percentage of negative ratings, sales for the past 30 days, popular favorites of the store, and lifetime of sellers. Table 1 presents the variable definition, description, and explanation of measurement.

#### 3.2 Descriptive analysis of sales distribution

In C2C e-commerce, it may indicate that top sellers may sell more products, earn reputation faster and dominate more resource than niche sellers. As an initial exploration of the data, we conduct the following descriptive analysis on the category of mobile phones across the three periods to examine the sales distribution pattern.

**Table 1. Description of Key Variables**

Variable	Description and Measure
Sales	Monthly sales of seller $i$
Item_Num	The total number of products listed in seller $i$ 's homepage
Reputation	Buyers' overall evaluation score of seller $i$ ,
Neg_Ratio	The ratio between negative ratings and overall ratings
Favorites	The number of customers who put seller $i$ as their favorites, as a popularity index
Lifetime	The years that seller $i$ opened his/her e-shop in Taobao



**Figure 1 Sales Distribution of All Sellers in 2011, 2012, 2014 (from left to right)**

Starting with sellers in descending order of sales, we first describe the sales of all sellers in different percentiles  $Q^L$  (from 10% - 90%) by calculating the absolute number of sales in each year. Figure 1 plots this distribution for these three periods, and the results suggest that sales actually become more concentrated on top sellers, which indicates a polarized phenomenon. For mobile phone sellers, about 78% of them have sold 60% sales in 2011, while 60% of them have contributed 60% sales in 2012. Especially in 2014, nearly 45% of the sellers could finish 60% sales. Less than 10% of sellers could sold over 40% of the total sales. This demonstrates a polarization scenario in which the distribution becomes more asymmetrical, which indicates a sharper peak and a slimmer tail.

#### 3.3 Empirical models

This study adopted the quantile regression model to investigate the formation of the identified shift in the

antecedents influencing sales in these three years. Although OLS regression methodology could find the factors that influence sales, the estimation results could only infer the mean effect of factors on the sales, which could not make sure that the noise is normally distributed. However, quantile regression methodology investigates how the antecedents influence the whole sale distribution curve, so we could find and assess the different impacts of antecedents of sales at different quantiles.

Prior studies have investigated the antecedents to product sales in e-commerce context. In C2C markets, trust between consumers and sellers is an important factor influencing customers' purchasing decisions, while sellers' reputation is a significant indicator to present their trust. As previous studies found, sellers' reputation with positive and negative ratings would have a significant impact on sales <sup>[19-23]</sup>, hence we select sellers' overall *Reputation* and *Neg\_Ratio* (ratio of negative rating) in our model to test their influences on sales. Furthermore, as Tucker and Zhang <sup>[24]</sup> stated that popularity information would affect the distribution of customer choices, we put *Favorites* as a popularity index in our model to test whether the number of customers who put a seller as their favorites would affect the seller's sales. In prior studies, Zhou and Duan <sup>[25]</sup>, as well as Duan et al <sup>[26]</sup>, found that product age in their models to control for product diffusion. Similarly, we also consider the years that sellers opened their e-shops in Taobao *Lifetime* as a control variable. The total number of products listed in seller's homepage *Item\_Num* is a complementary variable to *Sales*, which control for the influence on sales caused by a large number of products.

Wooldridge <sup>[27]</sup> states that it is better to use a natural logs model analysis so that dependent variables will satisfy the classical linear model assumption more closely. Then we apply a natural log transformation on some variables in our model. For *Sales*, *Item\_Num*, *Reputation* and *Favorites* with high orders of magnitude, we adopt logarithm of them in a comparable way with other variables in our model. Therefore, our quantile regression model could be expressed as follows:

$$\ln(Sales+1)=\beta_0(\gamma)+\beta_1(\gamma)\times\ln(Reputation+1)+\beta_2(\gamma)\times\ln(Favorites+1)+\beta_3(\gamma)\times\ln(Item\_Num) \\ +\beta_4(\gamma)\times Neg\_Ratio +\beta_5(\gamma)\times Lifetime +\varepsilon(\gamma)$$

By looking into the estimations of  $\beta_1$ - $\beta_5$ , over a series of quantiles  $\gamma$ , we could derive the influences of antecedents on the formation of polarized sales distribution.

#### 4. EMPIRICAL RESULTS

We estimate the quantile regression models using the sales observations for a series of percentiles including  $10^{th}$ ,  $20^{th}$ ,  $50^{th}$ ,  $70^{th}$ ,  $90^{th}$  in 2012 and 2014, during which the has been identified a polarized phenomenon by our descriptive analysis mentioned above. As a comparison, we also conduct the OLS regression and the results are shown in the first row of Table 2 for comparative purposes. The results of different quantiles are worth special notice, which could interpret the formation of the polarized sales distribution.

To facilitate the explanations of the quantile regression results shown in Table 2, Figure 2 provides quantile plots for the independent variables in our model. We plot each quantile regression estimator of these variables for  $\gamma$  percentiles ranging from  $10^{th}$  and  $90^{th}$ . From the results, most estimators are significant across all quantiles with narrow confidence intervals, which shows good overall model fits.

*Reputation* has a positive and significant impact on *Sales* in the OLS regression result, while the results of the quantile regression further indicate that the value of the estimated coefficient on sellers' reputation varies over the sales distribution. The coefficient of *Reputation* ( $\beta_1$ ) indicates a trend with a rapid rise. *Reputation* has a more and more important impact on sales of sellers who have a higher historical transaction volume.

On the contrary, the coefficient of *Item\_Num* ( $\beta_3$ ) demonstrates a continuous and steady downward tendency

across the sellers with a descending order of their sales. The total number of products listed in seller's homepage has a lower influence on sales gradually as sellers went on who ranked in a descending order of sales.

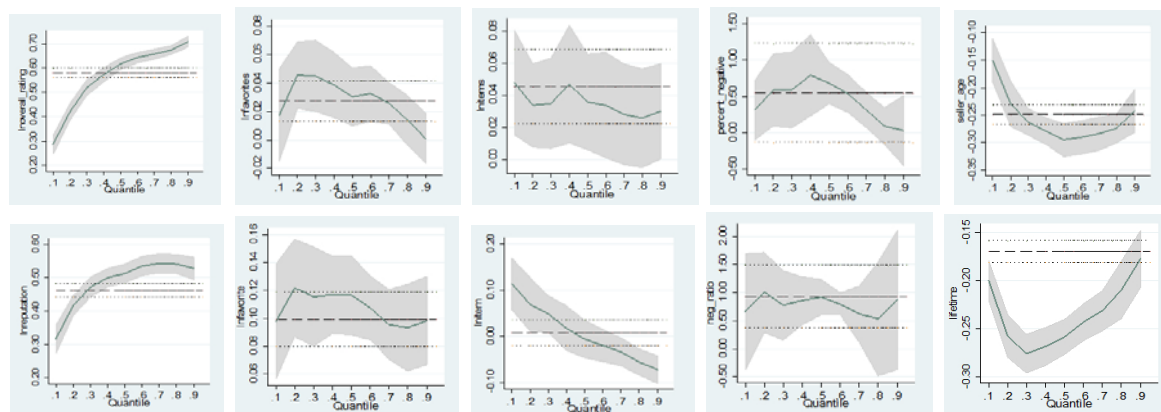
The OLS regression estimates presented in this study demonstrate a significant and positive relationship between popularity information and product sales. The quantile regression results also reveal similar results. Compared with lowest- and highest-sale quantiles, *Favorites* plays the most important role in the 30<sup>th</sup>-sale quantile.

Our OLS empirical results demonstrate that the ratio of negative ratings is a key determinant on sales. The quantile regression results also reveal similar results for the high-sale quantiles. This is consistent with Ye's findings [28], which suggested that negative ratings also promote sales.

Although the OLS regression results indicate that a negative and significant effect of *Lifetime* on the sales, the quantile regression results reveal an interesting phenomenon that the influence of *Lifetime* on *Sales* ascended first and then descended as sellers went on who ranked in a descending order of sales. This suggests that *Lifetime* is more important for the highest and lowest- quantile sellers.

**Table 2 OLS and Quantile Regression Results**

		$\beta_1$	$\beta_2$	$\beta_3$	$\beta_4$	$\beta_5$	R-Square
2012	OLS	0.499 (0.026)***	0.289 (0.022)***	0.310 (0.026)***	12.889 (3.292)***	-0.303 (0.020)***	0.4903
	Q10	0.286 (0.021)***	0.018 (0.015)	0.047 (0.013)***	0.313 (0.408)	-0.151 (0.012)***	0.1195
	Q20	0.420 (0.011)***	0.045 (0.010)***	0.034 (0.016)**	0.590 (0.376)	-0.229 (0.014)***	0.2132
	Q50	0.617 (0.015)***	0.030 (0.010)***	0.036 (0.012)***	0.685 (0.115)***	-0.294 (0.013)***	0.3316
	Q70	0.657 (0.013)***	0.025 (0.011)***	0.028 (0.012)***	0.313 (0.075)***	-0.283 (0.013)***	0.3484
	Q90	0.707 (0.013)***	0.001 (0.009)	0.030 (0.011)***	0.032 (0.157)	-0.242 (0.014)***	0.4213
	OLS	0.462 (0.010)***	0.099 (0.010)***	0.008 (0.014)	0.930 (0.282)***	-0.169 (0.005)***	0.3057
2014	Q10	0.316 (0.018)***	0.097 (0.026)***	0.114 (0.025)***	0.657 (0.204)***	-0.200 (0.017)***	0.1137
	Q20	0.416 (0.017)***	0.121 (0.021)***	0.069 (0.045)***	1.003 (0.334)***	-0.257 (0.013)***	0.1939
	Q50	0.513 (0.011)***	0.117 (0.016)***	-0.006 (0.019)	0.917 (0.258)***	-0.258 (0.009)***	0.2884
	Q70	0.543 (0.012)***	0.091 (0.018)***	-0.034 (0.021)	0.614 (0.434)	-0.231 (0.012)***	0.3086
	Q90	0.528 (0.015)***	0.098 (0.019)***	0.072 (0.016)***	0.868 (0.634)	-0.177 (0.016)***	0.3155



**Figure 2** Quantile Plots for Independent Variables (up: 2012; bottom: 2014; from left to right: reputation, favorites, item\_num, negative ratio, lifetime)

## 5. DISCUSSIONS AND CONCLUSIONS

This study analyzed a controversial research question: the impact of e-commerce on narrowing the gap between rich (sellers in the top) and poor (sellers in the tail). We found that the emergence of e-commerce accelerated the accumulation of sellers' revenue, instead of giving new entrants opportunities to take a share of the profits. Therefore, this study investigated the determinants that drive new small online stores operating on a shoestring budget could not improve their quality of life rapidly in C2C e-commerce. It helps broaden the existing research by taking the underlying mechanism of polarization in e-commerce into account. We conduct a descriptive analysis which provides a comprehensive understanding of the polarization by differentiating the levels of sellers' sales. Then the analytical results provide effective methods of improving sales for new mom-pop e-stores.

Our results reveal that, across the sellers with a descending order of their sales, sellers' reputation and the ratio of negative ratings with a trend of rapid rise, then flattening out indicate that they have a more important impact on sales of sellers who have a higher historical transaction volume, which leads to the Polarized Sales Distribution in E-market, and expand the digital divide between the rich and poor in the C2C e-market.

We conclude by addressing the limitations of our study and discussing future research topics. Firstly, our analysis is restricted to the product category of mobile phones. Although this restriction does not necessarily introduce bias to the empirical results, similar findings should be interpreted as applying to other categories in C2C e-market to improve external validity. Secondly, we only used the data during one year with 2 periods to detect the polarized sales distribution, and future studies could use longitudinal data or panel data to intensively investigate the polarization in e-commerce. Moreover, the formation of polarization may be influenced by other cultural, historical or psychological factors that can be incorporated into future studies. Further research should include more determinants of polarized sales distribution across different marketing channels.

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