



LUND UNIVERSITY
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**Master programme in Economic Growth,
Innovation and Spatial Dynamics**

The Impact of Internet Consumption on China's Economic Development

Yue Wu

egi12ywu@student.lu.se

Abstract: This thesis explores the impact of Internet consumption development in China through examining the causal relationship between Internet consumption and GDP under a bivariate VAR model, and between Internet consumption and traditional consumption, telecommunication industry, and express delivery industry under a multivariate VAR model using quarterly data from 2006-2013. The causal relationship between variables is investigated by the approach of Granger causality following Toda-Yomamoto procedure. The empirical results indicate a strong bi-directional causality between Internet consumption and GDP, between Internet consumption and traditional consumption, and between Internet consumption and telecommunication industry. Meanwhile, the results also show a unidirectional causality from Internet consumption to express delivery industry. All these test results support the hypothesis that the rapid development of Internet consumption has positive influence on China's economic development, which is consistent with country's current strategy to put domestic consumption as driving force for economic growth.

Key words: Internet consumption, economic development, Granger-causality, traditional consumption.

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1. Introductions

Since 1990s, the diffusion and penetration of the technologies that make up the Internet occurred with great rapidity. In 1991 a computer programmer in Switzerland named Tim Berners-Lee introduced the World Wide Web what we know today: “an Internet that was not simply a way to send files from one place to another but was itself a “web” of information that anyone on the Internet could retrieve”¹. The Internet is profoundly shaping modern society. There is no other time in history that worldwide people communicate with no limit, and have access to information been so pervasive: it provides possibilities that will be impossible without it. Taking Internet as the core infrastructure, technologies diffuse rapidly in modern global economy. Universities and public research institutions, taking their research mission as public dissemination, have made significant contribution on the invention and development of key component of the Internet. Firms have realized the global demand for the infrastructure of the Internet that the upgrade and restructure of business models related to Internet use has led to the improved efficiency and rapid growth of new online business. The Internet is influencing on almost all sectors of the economy, from making hard-to-find data available online to transforming entire markets (OECD Internet Economy Outlook 2012). From the country level, policy makers across governments are increasingly targeted on policies that are associated with the Internet infrastructure, through direct public investment or service programs.

Thus, we share a vision that the Internet Economy, which defined as covering “the full range of our economic, social and cultural activities supported by the Internet and related information and communications technologies” (OECD 2008), has become a hot issue for stimulating sustainable economic growth and prosperity. The Internet Economy could be viewed as a profound economic revolution. North (1998) identified three distinct changes in the economic system to explain the term “economic revolution”:

- (1) a change in the productive potential of a society, which is a consequence of (2) a basic change in the stock of knowledge, and which entails (3) an equally basic change in organization to realize that productive potential.

¹ For more information about Internet history, see:
<http://www.history.com/topics/inventions/invention-of-the-internet>

If the Internet were a national economy, it would rank in the world's top five, only behind the U.S., China, India, and Japan, and ahead of Germany. It contributes to 5-9 percent to total GDP in developed markets; and in developing markets, the Internet economy is growing at 15-20 percent per year (Zwillenberg, Field & Dean, 2014). It is the Internet Economy that greatly expands social production potential through the replacement of traditional resources by network information and knowledge. In addition, Internet has changed the way of knowledge accumulation and reserves essentially, that knowledge generated by the World Wide Web and knowledge in the human brain constitute the knowledge system of the whole society. Furthermore, the Internet Economy has also led to a huge change on organizations in terms of consumer goods' production and management. Although the driving force of consumption are factors with respect to capital accumulation, labor inputs, technical progress, institutional change, the Internet plays the role in changing these factors' impact from the level of depth and breadth, and from the level of time and space. In 1991, certain restrictions on commercial use of the National Science Foundation Network (NSFNET) were loosened, indicating that the Internet opened fully to commercial use eventually in the United States. Due to the U.S. head start, nearly all of the dominant portals and B2C/C2C e-commerce sites were firstly U.S. based. E-commerce in the United States has become very popular and beneficial to both businesses and consumers. Even after the 2000's dot-com bubble burst, Americans have still kept overwhelmingly faith on business potential through the Internet. International electronic commerce companies such as Amazon and eBay have boomed quickly while traditional firms such as Wal-Mart have enhanced its productivity through e-commerce. The B2C/C2C sites could attract consumers relies on the convenience of having a centralized "shopping center" online. The total e-commerce sales for 2013 in U.S. were estimated as \$263.3 billion, with an increase of 16.9% compares to 2012.²

However, its top position was replaced by China recently. Of all aspects of Chinese Internet culture, the most important and yet least been understood is its contentious characteristic. International media stories and survey reports have perpetuated two misleading images of the Chinese Internet: one of Internet control by the government, and the other that Chinese Internet users do nothing but entertainment. This misconception ignored the real picture of China's Internet development. Despite the relatively late start, the development of the Internet in China enjoyed a rapid development. In 2013, China Internet Industry made revenue of 600.41 billion Yuan, with an increase of 50.9% compared to 2012. In the years to come, it will continue to grow steadily and rapidly and is expected to reach 1723.15 billion Yuan in 2017 (iResearch, 2013). The country has world's largest number of Internet users. According to state-affiliated research organization China Internet Network Information Center (CNNIC) survey report, there are 618 million Internet users until the end of 2013, with Internet penetration rate of 45.8%. The Internet users are very active and showing strong

² Data source: Forrester Research Online Retail Forecast, 2012 to 2017 (US).

purchasing power. 302 million, which is 48.9% of total Internet users, participated in online consumption activities. It is popularity of the network, the improvement of family informatization level, and more importantly, the advantages of Internet consumption compare to traditional retailing - low price, rich variety and home delivery, that makes Internet has become a prime platform for consumption.

In 2013, the total transaction amount of China's online shopping market reached 1850 billion China yuan (CNY), an increase of 50.3% compared to 2010 of 1231 billion yuan. In addition, the total transactions in 2013 accounted for 7.89% of country's total retail sales of consumer goods, higher than that of 6.3% in 2012. The Ministry of Commerce forecasts that e-tailing transaction value will exceed 3,000 billion yuan in 2015, accounting for more than 10% of total retail sales. The November 11 sale date, or "1111", was launched in 2009 by Taobao TMall. The 11/11 date traditionally marks Singles Day in China, because of the symbolic solitary look of the 1s, but is likely to take on a new meaning after Taobao's Tmall using this day to start what some media are calling the "shopping carnival". This China's leading e-commerce marketplace just made another record in 2013: total transaction in a day bit 35 billion yuan (USD 5.71 billion), which easily surpassed last year's 19.1 billion yuan.

The continuing upgrade logistics and payment technology also expands the space for Internet consumption development. At the same time, the rise of online shopping has stimulated the significant development of the logistics industry, which in further accelerates logistics industry's pace of transformation and upgrading. In addition to country's support in terms of taxation policies, the booming logistics industry provides a good fundamental platform for network consumption. Furthermore, online payment ways such E-bank and Alipay (a payment product by Alibaba) guarantee the convenience and security of online transaction.

Importantly, the information consumption, including network consumption, has been obtained strongly support by government policies, while the development of Internet technology and the improvement of network speed will be the basis in stimulating information consumption. The state Council announced the "opinions on promoting the information consumption to expand domestic demand" in August 2013 and implemented "Broadband China" strategy long after, which provided the blueprint for Internet infrastructural framework.

Over the past several decades, China has experienced high rate of economic growth, within which, net export and governmental investment has played dominant roles. Nevertheless, with the coming bottleneck of the two engines, domestic consumption is seen as drive force to continue pushing forward the economic development. This crucial turning point has coincided with the arrival of the Internet revolution in China. Besides the traditional way of spending money, online shopping has become a new phenomenon. Seemingly overnight, China has become one of the world's most wired retail markets.

Chinese E-tailing is not just replacing traditional retail transactions but also stimulating consumption that would not otherwise take place. Thus, the main purpose of this paper is to analyze the impact of Internet consumption on China's economic development.

1.1 Research question

The aim of this empirical study is to investigate Internet consumption, being a new consumption patterns, its influence on China's economy. In particular, from the macro-level analysis of the entire country, whether the Internet consumption directly stimulates the continued growth of the national economy. From the meso-level analysis of the industrial sectors's development, whether Internet consumption could spillover positively to other related industries development, such as express delivery and telecommunication industries. From micro-level analysis of household consumption, whether the establishment and flourish of large-scale virtual market could fundamentally change traditional business and consumption behavior.

Be applied into econometric analysis, the Vector Autoregression (VAR) model based causality test was chosen to examine the causal link between the Internet consumption and other economic indicators terms of GDP, traditional retail sales of consumer goods, telecommunication business revenue and total income of express delivery business in China for the period between 2006 and 2013. Questioning in this way the type of study tends to be exploratory. The study expects to answer questions as follow: whether there is a Granger causal relationship between Internet consumption and other variables; and whether there exist bi-directional casual relationship between them.

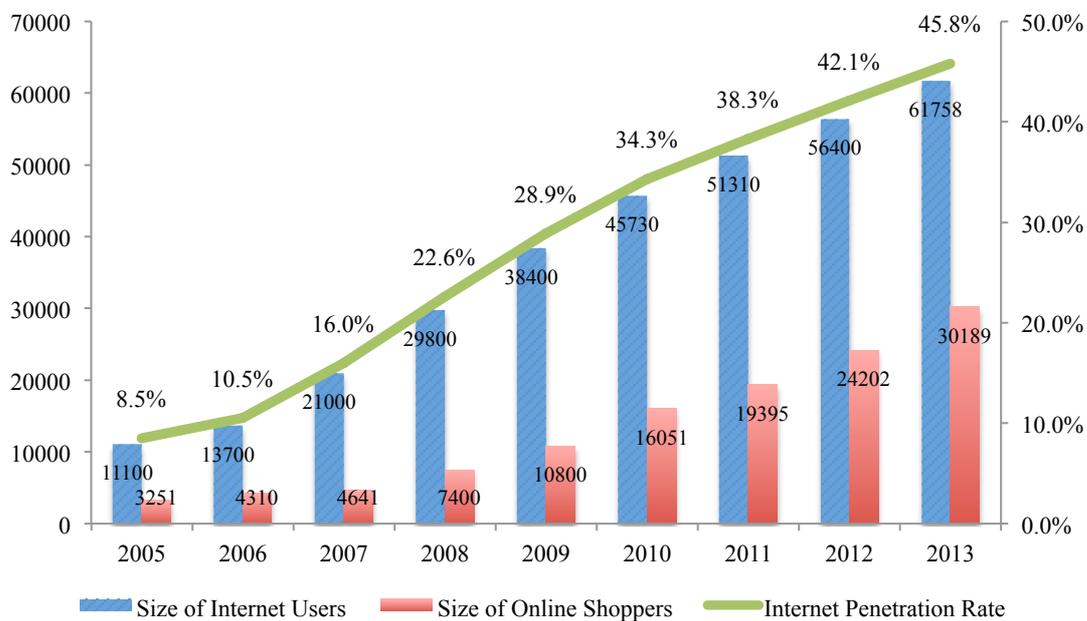
1.2 Outline of the Thesis

Followed by this introduction is the background of Internet consumption development in China in Section 2. Section 3 presents the context of theories of this study. Section 4 provides a brief review of previous research related to Internet consumption. The method part in Section 5 includes methodology of the paper, description of quantitative data, and introduction of a list of time series method this study will use, in terms of VAR model, Unit-root test, Granger Causality, and Impulse Response Functions. This is followed by a series of empirical results in Section 6. The Section 7 will be the discussion of the econometric results, along with the conclusion part of the study in Section 8, which contains summary as well as several aspects of limitations of the study and expectations for further research.

2. Background: Internet Consumption in China

On January 16, 2014, CNNIC released the 33rd Statistical Report with respect to Internet Development in China. Based on the report, by the end of 2013, the total number of Internet Users in China reached 618 million, with 53.58 million new ones. The Internet penetration rate was 45.8%, an increase of 3.7% compared with the end of 2012. During the same time, online consumption has been growing at a high rate. Online shoppers took around 48.9% of total number of Internet users, reached 302 million. Compared to 2012, online shoppers increased by 60 million with a rate of 24.79%. Considering the situation that the growth rate of Internet users slowed down gradually, the application of online shopping still maintained a momentum of significant growth (CNNIC, 2013).

Figure 2.1. Size of Internet users and Online Shoppers (10,000 persons)



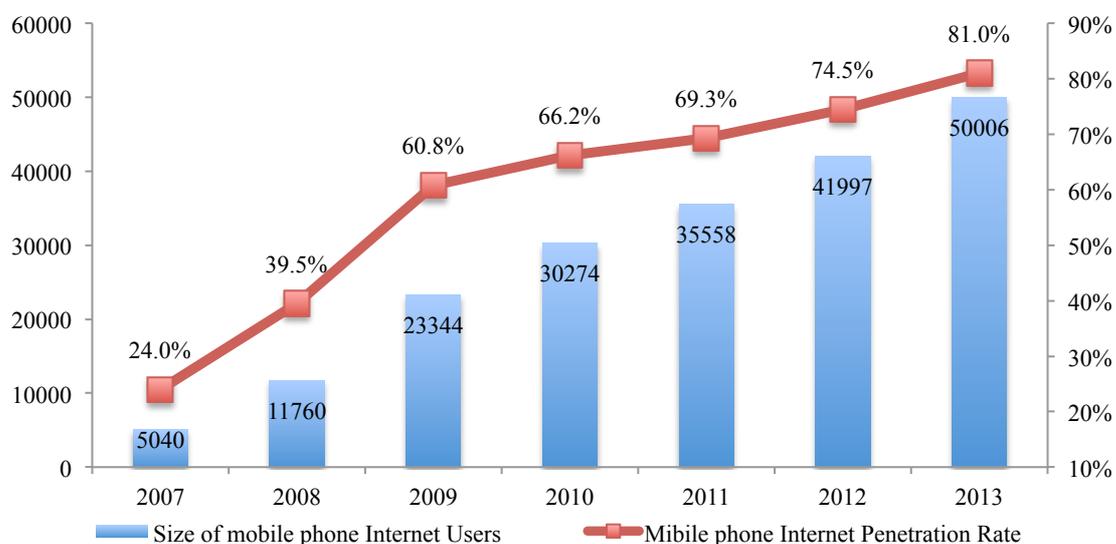
Source: Statistical Report by CNNIC, 15th-33rd

There are also more than half of total Chinese people are non-Internet users. Among non-Internet users with different intentions to use Internet in the future, they do not use Internet for various reasons. Along with the Internet infrastructure construction has been

improved, charges for Internet access and Internet terminals are decreasing gradually, which means that the restrictions in terms of network equipment have weakened. According to the CNNIC survey, the two factors, “too old / too small” or “have little knowledge for computers and Internet”, becomes main reason for non-Internet users’ unwillingness to use Internet in the future. It is either because they do not meet the requirements of Internet skills, or because they do not have enough impetus to learn and grasp knowledge for surfing on the Internet. This indicates that the Internet use has reached saturation gradually in the group of people who are easily to become Internet users, which increase the difficulty for further popularity. Hence, the solutions would not only “lie in the measures of infrastructure construction and downturn of charges”, but also “innovation for the application of Internet, targeted service modes for different groups of people, closer connection between online and offline worlds, and intelligent and easy Internet hardware” (CNNIC 2013).

Mobile Internet has been a driving force for the popularity of Internet use in China, for it has relative low technology threshold. China ended 2013 with 500 million mobile Internet users, increased 80 million people. Among all the Internet users, those using mobile phones to access Internet grew from 74.5% to 81%. Of all new Internet users in China, the proportion of those who came online through mobile reached 73.3%, higher than any other mode of Internet access, desktop or laptop. Benefit from country’s mobile network environment’s improvement and smart phones’ popularity, the mobile online shopping has become an important complementary way to the Internet shopping market. In 2013 the number of mobile phone online shopping users hit 144 million, with an annual growth rate of 160.2% (2013 China Internet Shopping Market Research Report, CNNIC). Its size accounted for 47.8% of total online shoppers and will enjoy a rapid growth in the future.

Figure 2.2. Size of Chinese mobile phone Internet users (10,000 people)



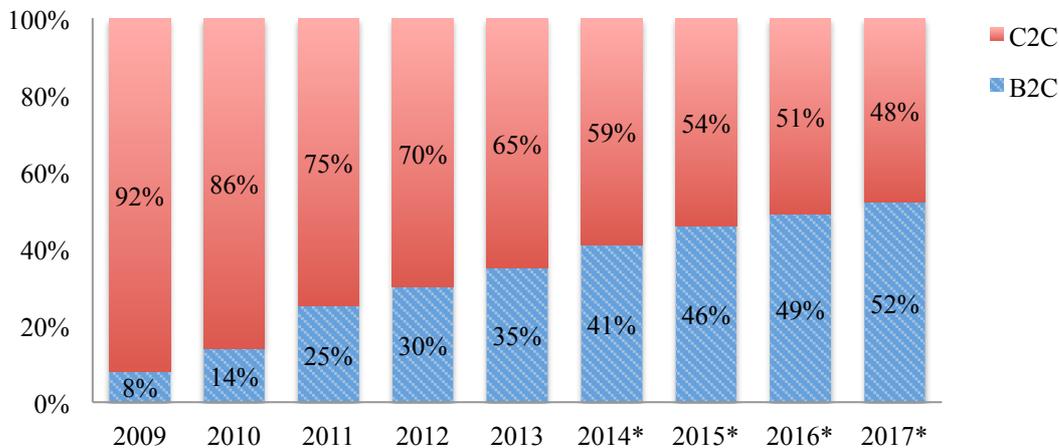
Source: Statistical Report by CNNIC, 15th-33rd.

Chinese Internet perhaps is the best example of the argument that “the beauty of the Internet is that it easily adapts to local conditions” (Zwillenberg, Field & Dean, 2014). Begin with Internet users. China’s Internet users are younger than the Westerners who first logged on about two decades ago, about half of total number of Internet users are at age of between 10 and 29 (CNNIC statistical survey on Internet development, 2013). They are hungry for learning and entertainment and mostly poor (around 25% of total Internet users are students). Thus, the demand from the biggest size of Chinese Internet consumers is one of the main local forces for China’s Internet development.

Another distinct character for China’s development is that most of Internet based firms started with copying Western, especially the U.S. models, have achieved remarkable success after adapting to country’s culture and environment. In the United States large B2C (business-to-consumer) sites dominant e-tailing model, containing not only pure online merchants, such as Amazon, but also brick-and-mortar retailers, such as Wal-Mart and Carrefour. Those offline retailers have their own retail chains in doing e-commerce activities. While in China, third-party transaction platforms dominant e-tailing market. With few major offline retailers developing a comprehensive multichannel strategy, nearly 90 percent of e-tailing is virtual marketplace-based (Appendix 1). The three mega sites are Taobao (www.taobao.com), Tmall (www.tmall.com), and PaiPai (www.paipai.com). They provide third-party platforms for merchants to list their products or set up individual shop fronts, along with services with site-design, payment fulfillment, delivery and logistics, customer service, and IT support. The main advantage for e-merchants is the value of a large group of customers, in addition to the lower pre-investment. Although still in the early stages of growth, China’s electronic retail ecosystem is profitable, logging margins of around 8 to 10 percent of earnings before interest, taxes, and amortization (EBITDA) - slightly higher than those of average physical retailers (Chang, et al, 2013).

Market structure in China is complete different from the Western markets. The share of C2C marketplaces takes 65 percent of total ecommerce market, compared with single-digit only in the United States European market. According to the McKinsey Global Institute (MGI), China has different definition for C2C. C2C in China encompasses sales by small and medium size enterprises (SMEs) and microbusinesses without company registration, while C2C in other countries primarily consists of secondary-market transactions by individuals (Chang, et al, 2013). This difference accounts for much larger share of C2C in China.

Figure 2.3. Structure of online shopping market in China



* Estimates

Source: iResearch 2013

Take Taobao as an example. Taobao, which is owned by Alibaba, was launched to compete to Chinese service of eBay on 2003. It is now the biggest consumer-to-consumer (C2C) platform in the world with 500 million registered members and more than six million individual active sellers. In 2012, together with Tmall, a B2C online platform that also belongs to Alibaba, had 1.1 trillion yuan (\$170 billion) in sales. Its main achievement has been to overcome the biggest barrier for shopping online in China: lack of trust, with a series of innovative service. AliWangWang is an instant messenger that is designed for sellers and buyers to communicate. People can ask questions and get assistance directly, and even get an agreeable dealing about products. Different from eBay that provides a rating system for sellers only, Taobao designed a rating system of both sellers and buyers thus they need to maintain a good reputation in order to keep selling and buying on the platform. In addition, it allows people to pay after they receiving items, just like checking goods before buying in brick-and-mortar shops. And most importantly, Alibaba group introduced a new platform of escrow payment, Alipay, or “Zhifubao” in Chinese in 2004. Cooperated with more than 108 financial institutions, customers firstly pay money to the Alipay, which inform the seller the money was given. After receiving the item, customers can authorize the payment and thus sellers get transfer via Alipay. Taobao’s success brought about tremendous economic and social effects. For those low income and remote people, they have access to broader range of material goods and services at lower prices; and for micro and small businesses, it provide opportunities for doing business at a very low start-up and operational costs, since Taobao offers free listings at the first few years and later low cost for sellers.

Although C2C still dominant the ecommerce market, B2C segment are increasing in popularity as well (Figure 3). By contrast with C2C that the e-commerce activities occur between individuals, B2C refers to e-commerce activities between businesses and consumers. In China B2C e-commerce has four main forms: manufacturers directly offer their products to consumers via companies' websites (e.g. Lenovo); independent merchants set up their own online storefronts (e.g. Suning); e-commerce retailers buy items from manufacturers and offer to consumers (e.g. Jingdong and Yihaodian); and hosted by marketplaces (e.g. Tmall). It is estimated that B2C will eventually take over C2C in 2017. As the hot trend of online shopping, it is found that the websites successfully fed store sales. Brick-and-mortar retailers have advantages with stable customer base and brand reputation to set up online storefronts. Through opening "official flagship stores" in Tmall platform or setting up independent websites, they can tie the brick-and-mortar and virtual stores together. Suning Appliance (www.suning.com), one of the biggest retailers for electronic appliance, is an example that vertical stores expands their market share by making use of online vertical online stores and ranks among top three Chinese B2C companies.

Besides Taobao, Alibaba also owns Chinese largest B2C ecommerce marketplace, Tmall. Tmall ("*Tian Mao*" in Chinese), changed name from Taobao Mall in 2011, was lauched in April 2008 to complement its C2C marketplace. It is able to provide unique "mall experience" for manufactures to set up their own virtual stores on the websites. The principal formats of Tmall is as follow (China Online Retail Sector, 2013):

- “Flagship Stores only sell trademark products for which the store owner holds an exclusive authorization;
- Speciality Stores are used by sellers with exclusive distribution rights to sell in China;
- Virtual Stores reduce costs and cut risk by allowing sellers to test the market before committing to a Flagship Store.”

With over 70,000 brands and 50,000 flagship stores, Tmall model has proven vast successful: in 2013 it took around a half of country's B2C online market share, rose from 35 percent in 2010 (Appendix 2). By comparison, the giant online supplier, Amazon, shares about 20 percent of B2C online market in the United States.

Table 2.1. Differences of e-tailing market between China and the US

		China	U.S.
How large is the market?	Size of e-tailing market (\$ billion)	265	230
	E-tailing as % of retail	>6%	5%
Where do sales happen?	Marketplaces' share of e-tailing (%)*	90%	24%
	C2C 's share of e-tailing	65%	Single-digit
What do online shoppers buy?	Biggest product category	Apparel	Travel
What devices are shoppers using?	Mobile commerce's share of e-tailing	9%	23%
	Smartphone penetration in population	43%	65%
How are products delivered?	Coverage of next-day delivery by major express delivery companies	Mostly in Tier 1 and Tier 2 cities	Almost nationally
How do shoppers pay?	Cash on delivery by independent B2C	Common	Rare
	Third-party payment systems/bank cards	Majority	Majority

*2011 figures, the rest are 2013 figures.

Source: iResearch; McKinsey Global Institute analysis

November 11 was first popularized at universities along China's east coast in 1990s as a way that single college students celebrated bachelorhood as a kind of anti-Valentine's Day. Now the informal holiday that Bloomberg Businessweek described as “arbitrary consumerism” has morphed in a “commercial juggernaut”, with Taobao's “Double 11” promotion day of slashed prices and deals matched by brick-and-mortar promotions. The tremendous successful Singles’ Day promotion already stimulated other major independent B2C operators, such as Jingdong, Amazon China, Dangdang, Vancle, etc., to participate in the Carnival. To make sure the sales go smoothly, the IT support of marketplaces as well as bank payments systems need to eliminate traffic derived from overloaded online transactions, and express delivery firms have to deal with one of the biggest challenge to process delivery all goods in a very short time with no overstock. In a word, “Double 11” has become a major event for almost all e-tailing players in China.

3. Theory

There are two fundamental views of economic life. One is, under the influence of the British classical economists, that human's life and well-being depend on the production of wealth. Man's nature and elementary judgments make him pursue wealth. Therefore, economic theory focuses on the way by which production could be expanded. For example, Say Jean-Baptiste (1776-1832), the French economist who defined his "law of markets" (or "loi des débouchés" in French) with three phases: production, distribution, and consumption, stated that it was production limit "satisfaction of human wants". Since production alone furnishes all means of consumption, therefore "it is the aim of good government to stimulate production, of bad government to encourage consumption" (1971, C.XV, p.142). Another dominated view focuses on, instead of pursuit of production expansion, how to stimulate the desire to consume so that consumption might be "adequate to production". In this way, economic life is no longer the production of wealth, but production of consumption. The main focus of this study is to emphasize the importance of consumption.

As the "father of modern economics", Adam Smith contended that production was the key to a growing economy. Although have not expounded consumption issues systematically, he pointed out the relationship between consumption and production when criticizing mercantilism in which the interest of consumer is almost sacrificed to that of producer:

Consumption is the sole end and purpose of all production; and the interest of the producer ought to be attended to, only so far as it may be necessary for promoting that of the consumer.

(The Wealth Of Nations, Book IV Chapter VIII, v. ii, p. 660)

The raw materials for certain sector could be another sector's production goods. Thus, he believed that products of any sector could get compensation by other sector's production in both physical and value forms. The total amount of production and consumption are identically equal.

Sismondi and Malthus argued the importance of consumption by developing their labor theories. Sismondi, Jean Charles Léonard de, the father of underconsumptionist theory in his 1819 book *New Principles of Political Economy* (or *Nouveaux principes d'économie politique* in French), argued that since workers can only buy a portion of commodities that they produce, economic crises caused by overproduction of industrial commodities without limit:

The accumulation of capital, ... causes the contraction of consumption demand through both substitutes of laborers (and farmers) by machines in the process of centralization of production, ... it results in the increase of commodity products without regard to the scale of consumption demand. ... Consequently, “the superabundance of production, that beyond consumption”, must occur.

(Wood, 1988, p.521)

Therefore, it is necessary to establish equilibrium between production and consumption. Consumption plays an important part in his economic system, that is, the increase of labor demand was put as “being possible and desirable” as a first step, which would indicate the increase in nation wealth, in revenue and in consumption, respectively, consumption was placed in the last and must precede the increase in labor and production. Thomas Robert Malthus, the British economist who is known for his population theory, held similar viewpoint of underconsumptionist theory. Besides, he recognized that workers, the state, and landowners also play roles in consuming.

Marx firstly identified the basic structure of the capitalist mode of production, which belonging to phases of a single process in his work *Grundrisse*, which he finished between 1857 and 1861 but was only published in 1941: (1) production, (2) distribution, (3) exchange, and (4) consumption. The innovation that Marx's conceive of the four-phase cycle as a reproductive system was to join the ends of the system together.

He identified a three-fold relationship of production and consumption. The first is the ideas of “consumptive production” and “productive consumption”, that is, production is at the same time consumption and consumption is at the same time production. Either one is simultaneously its opposite, but the intermediary movement also occurs between the two at the same time. The second is, rather than regarding them as the a sequence, with production and consumption at the bottom and the top, respectively, each singular phase is mutual dependence, and consumption acting as kind of “terminal sink” in a circuit (Alvarado, 2008). The third is that the acts of production and consumption exist in a circular relationship:

Consumption produces production . . . because a product becomes a real product only by being consumed.... the product, unlike a mere natural object, proves itself to be, becomes, a product only through consumption ... only as object for the active subject.

(Grundrisse, Marx, 1973, translated by Nicolaus)

For example, a railway on which no trains run, hence which is not consumed, is only a railway potentially, but not in reality. The ability of consumption is the condition of consumption, thus is the primary means of consumption, which is also the means of productivity development. There is no production without demand, but it is consumption re-creates the demand.

There also have many studies examined the role of consumption based domestic demand on economic growth. Palley (2002) provided a model that highlighted domestic demand rather than exported-led strategies, indicating that developing countries' economic growth should rely on internal market development. In addition, Fong (1986), Huq (1994) and Bello (2001) shared the similar ideas that governments have realized the importance of domestic demand to push forward economic growth and that domestic demand-led growth will replace export-led growth. In recent years, it has attracted increasing concern for both Chinese policy makers as well as scholars that China's economic growth must change the situation of over dependent on external demand. Consumption is the ultimate demand for internal demand, while investment is the derived demand. From long-run perspective, in order to improve the quality of economic development, the economic structure transition needs value the consumer's demand in driving economic growth (Xu & Wen, 2002, Liu, 2012, and Report on the Work of the Government, 2014).

However, there are two contradictory make the identity between consumption and production hardly be achieved. The first is the contradiction between vast mass of same product and diverse consumption demand, while the second in the contradiction between production and consumption information in aspects of time and space. According to Adam Smith, every buyer knows the price provided by every seller, and every seller knows information about how much money each buyer wants to pay. Nevertheless, Stigler in his 1961 paper "The economics of information" criticized such "complete information hypothesis" does not exist. In fact manufacturers are difficult to grasp the complex information about market need, while consumers are hard to acquire the whole story about production at the same time. Besides, products have various characteristics due to geographic, historical, and cultural factors, but consumers are not limited within particular area, thus forming special contradiction (Wu, 2000; Huang, 2001; Huang & Cai, 2001; Wang, 2005).

The rise of the Internet economy let people see technological possibility of solving this kind of information bottleneck and expect a bright future. Firstly, networked production made enterprises located in different regions formed as a whole, with the addition of change of traditional single-mode processing pushed by single-piece mode and small-lot mode, providing commodities based on consumer needs becomes possible. Secondly, because of consumers' initiative, they have freedom to choose commodity and convey their preference to the producer through middle part of the market. This is the guiding role of the consumption ability to social reproduction process (He, 2002; Wang, 2005;

Yi, 2006). It is crucial to producers whether the product can be accepted by consumers in terms of quality, variety, price, etc. So after producers obtain such information, they could adjust production scale or product mix, in order to maintain and realize their own interests.

Internet consumption is a process that individuals realize their needs by the mean of the Internet. The network itself is the product - from the moment the consumers access the Internet, this product starts being consumed. For traditional consuming behavior, the end of consumption means the disappearance of consumer goods; while in the network world, it is extra stuff “produced” by consumers, which could be: first, social capital, that is, the social networks formed by Internet communication has potential value; second, human capital, that is, the self added-value achieved through Internet information could transform into wages and other compensation in the real economy; third, turning networking functions into leisure tools; fourth, direct consumption, that is, online entertainment, shopping and other behaviors directly into consumer process (He, 2001).

Different from the traditional consumption, the Internet consumption has breakthrough for traditional theories and shows its own “new economy” feature. Jiang (1999) called Internet economy as “direct economy” in his book “Digital Wealth”. He stated:

The essence of production mode in industrial society is the roundabout production, ... the benefit is obtained through stretching the middle of the chain between production and consumption. ... While the essence of production mode in information society is to close to the target rapidly, ... the benefit is by shortening the intermediate links between production and consumption.

(pp.54)

From perspective of consumer, scholars also believe Internet consumption will be more favorable compared to traditional consumer spending. After analyzing the classical concepts of demand and supply curves in microeconomics, Hagel (1999) identified that price in Internet consumption market is closer to supply curve, which means more surplus value would be transferred to consumers. In economics, the law of diminishing marginal utility means that “first unit of consumption of a good or service yields more utility than the subsequent units, with a continuing reduction for greater amount”.³ In terms of Internet consumption, scholars found that its dynamic process of utility can be divided into two stages: “ascending” and “descending”. That is, the increasing marginal utility of Internet consumption is limited; it still has to comply with the “diminishing” law after a certain critical point (He, 2002, Chu & He, 2003, and Yi, 2006). That consumption has broken the original time and space boundaries by the use of Internet

³ In depth explanation of the law of diminishing marginal utility can be found at: <http://economics-exposed.com/theory-or-consumer-behaviour-3/>

has enhanced network's positive feedback mechanism. He (2002) also claimed that the increasing marginal utility could become one of the cornerstones to build theory of Internet consumption.

This section first highlighted the importance of consumption through reviewing several classical economic theories. Compared to traditional consumption, Internet consumption has its natural advantage to break boundaries of time and space, which also achieve the unity of production and consumption, and increasing marginal utility. It is Internet that people stay at home have chance to spend time on shopping for goods produced far from home. However, there still lack enough theoretical support for influence of Internet consumption on Economic growth. For this paper, it is expected to apply the classical theory regarding the importance of consumption into Internet consumption analysis, to investigate the importance of Internet on China's economic development.

4. Previous Research

Recent years scholars studied the relationship between consumption and economic growth mainly through empirical analyses based on statistic data. Xu and Wen (2002) identified that the correlation coefficient regarding consumption to push forward GDP was 0.755. Li (2005) through analyzing data cross from 1978 to 2004 found that the change of consumption structure at the same time caused the change in industrial structure, thereby affecting economic growth. Later on, Yuan (2007) did dynamic econometric investigation with dataset 1978-2005 and pointed out: firstly a long-run equilibrium between the two; secondly a bidirectional causal relationship revealed by Granger-causality test; and that growth consumption's stimulating role in economic growth was significantly greater than the other way around. By contrast, other scholars found only unidirectional causal relationship from household consumption to economic growth (Jiang & Zang, 2008; Liu, 2012).

Compared with the traditional material consumption, Internet consumption is unique. He Shengming (2004) stated that Internet consumption refers to the process of people realize their needs by the use of the Internet. He pointed it out with three dimensions. Firstly, from the dimensions of the tool, the achievement of Internet consumption is through the media of Internet. As the core of information technology, the network creates a new consuming pattern in order to improve the degree of information of living standard. Secondly, from the dimension of the purpose, Internet consumption is to meet consumer's demand. Under the background of Internet economy, people generate intension "automatically", which becomes the "driving force" for Internet consumption. Thirdly, from the dimension of consuming process, Internet consumption is not static, but a very dynamic process. Although the network to some extent provides immediate consumer services, it mostly offer a series of functional services. Therefore, like cars and phones with functional services that are used within a long-term process, Internet consumption in general experiences a relative long period, which complete through continuous interaction between network and consumers.

4.1 Internet consumption and information

The studies of Internet consumption started from the discussion in the field of information. Wells, William, and Prensky (1996) stated that the lack of information organization and control would be the “enemy” for consumer when making decisions. Because the Internet is viewed as a powerful tool for consumer information search, it is highly interested in understanding the relationship between the use of Internet for information search and consumer’s choice (brick-and-mortar stores vs. Internet). Based on the principles of information economies in which “consumers analyze the relative costs and benefits of an additional search”, Klein (1998) created an Interaction Model of prepurchase consumer information. Costs of search encompass perceived time, access to media and monetary related factors. Benefits of search include encompass extent and duration of search, and the nature of search sources (Shim, Soyeon, et al, 2001).

Other studies found that perceived risk matters. Anastasi (2004) analyzed perceived risk is an important factor for B2C e-commerce activities, which perceived risk has close relationship with degree of informatization. Forsythe and Bo (2003) analyzed online purchase and online patronage behaviors by examining data set from a survey that covered 641 cases and found that many consumers simply used the Internet to gather information and then purchasing in the physical market. To explain this phenomenon, they studied four types of perceived risk that were related to Internet shoppers – financial risk, product performance risk, psychological risk, and time loss risk. All these four types of perceived risks are useful context to explain barriers to online consumption. Reardon and McCorkle (2002) also pointed out the perceived risks during online consuming process, that the reason of consumers shopping online is in order to realize utility maximization.

By the use of structural model, Huang (2000) tested the impact of novelty and complexity of the Internet information on consumer’s online shopping desire. As a result, the novelty has positive effect for successfully changing consumer’s attitudes and transmitting information, while that the complexity of information may restrain consumer’s shopping desire indicates importance of consumer-oriented information design.

4.2 Internet consumption and economy

As the Internet has been widely used in the business world, scholars began to focus on the impact of the Internet being a kind of information tool for economic activities. Choi, Stahl & Whinston (1997) first presented issues of electronic commerce from an

economics perspective in their book “The Economics of Electronic Commerce”. The book analyzed the characteristics of digital products that distinct from physical products in the Internet economic era; and more importantly, explained E-commerce, such a new business model, its impact on corporate profits and economic growth from empirical perspective, and makes a prediction for its development prospect. Another classical book, “Information Rules: A Strategic Guide to the Network Economy” (Varian & Shapiro, 1999) identified the particular cost structure of information products namely “high fixed costs with low marginal cost”. In addition, the book also pointed out the competition policy and direct intervention of government, that is, “do not expect the government’s role will disappear”. The two books are the groundbreaking explorations of the Internet economic laws, with Varian and Shapiro (1999)’s own words, “the goal is to present insights from economics research and from our own experience applying economics in the network economy in a form suitable for the managers and policy makers who have to make strategic choices involving information technology”.

The idea is that Internet consumption has a better future compared to traditional consumption can be expected because it is able to solve the information bottleneck. The network will eventually result in a new consumer’s paradise with no friction, low transaction costs, as well as perfect market information (Chen, 1998). Chinese scholars also put weight on explaining the relationship between the Internet Consumption and economic development. Firstly, Internet consumption has economic effect on consumers. The development of Internet technology helped consumption freed from restrictions of time and space, largely reducing the cost of resource flows. Consumers can find themselves in the forefront of the consuming market (have access to goods that are difficult to buy in traditional market) and enjoy shopping sites through intimate humane care and personalized services (Jiang, 2012).

Internet consumption has changed traditional business management mode at the same time. Both large and small enterprises have set up their own websites, which shortened the distance to consumers and reduced intermediated links, thereby saved large amount of corporate management costs, transaction costs, inventory cost, and promotion and marketing costs. (Yang, 2007; Jin, 2011). In addition, after obtaining goods and services with satisfactory, customers will evaluate for the seller, which could be reference for others. Hence, the accumulation of good word-of-mouth effect encourages manufacturers to invest more on material resources, human resources, and financial capital, forming virtuous Matthew Effect⁴ (Jiang, 2012).

The rise of Internet consumption makes more people starting the business on the Internet. Wang & Zhang (2013) analyzed the contribution of college students’ employment by

⁴ Matthew Effect: or accumulated advantage, according to the definition by Wikipedia, is the phenomenon where “the rich get richer while the poor get poorer”. For more information, see online: http://en.wikipedia.org/wiki/Matthew_effect

Taobao. It has become popular among college students to open Taobao online shop before their graduation, or work in online customer services. The Internet consumption marketplace provides a low starting point of entrepreneurial platform to students not only for developing their practical ability, but also at same time for accumulating working experience for future. Under the support and encouragement by national policy, Internet consumption provides more direct and indirect jobs, which will drag down the unemployment rate and realize high level of employment (Jiang, 2012). In addition, since the interactive relationship between information based consumption and knowledge economy (Yan, cited by He Shengming, 2001), the increasing marginal utility of the Internet consumption could penetrate into all areas to improve the quality of human resource, which then form a huge impact on economic and social development (He Liancheng, cited by He Shengming, 2001).

What along with the rapid economic growth is the substantial natural resources consumption, the deterioration of environment, the low productivity, and the irrational economic structure, seriously restraining the quality of China's economic and social development, as well as international competitiveness. The country has accelerated its process of industrial upgrading, Internet consumption thus becomes China's new growth engine when its economy transforming of economic structure from extensive to intensive. Through complete competition and adequate sharing of information online, the allocation of resources could be optimized (Zhao, 2013). Firstly, Internet consumption not only directly promotes the boom of new industries such as e-commerce, high and new technology industries, but also the growth of traditional industries such as logistics industry (Lin 2012). Taking logistics industry as an example. Under the government's unified planning, the country has established logistics system contains three level of logistics city, and each city is a combination of Logistics Park, Logistics Center, and Distribution Center (Ji, 2012). Therefore, the role of logistics industry in the national economy has become increasingly important. Meanwhile, the government has access to large amount information for both domestic and international market, in terms of supply and demand status and competitive conditions. By grasping the current economic dynamics, the relevant government department that release policy information timely is able to guide country's macroeconomic development (Lin, 2012).

However, because the issue of Internet consumption is relative new, much of studies focused on consumer psychology and behavior, perceived risk, and influential factors of Internet consumption, but few focused on its economic effect. Secondly, most of analyses are descriptive: there is lack of empirical study. Thirdly, even if the study chose the empirical and quantitative way, the examination used GDP as single indicator to represent country's economy, which was too general and ignored details of Internet consumption's contribution. All of these call for more comprehensive consideration.

5. Methods and Data

This section aims to introduce the methodology, discuss the data, and outline econometric analysis techniques.

5.1 Methodology

Internet consumption has become a habitual consumption patterns of Chinese individuals, however, much research focused on consuming behavior or consuming psychology, or on the Internet economy as a whole, it still lacks relevant theoretical research related to the impact of Internet consumption on country's economic and social development. Thus, questioning in this way makes this type of study tend to be exploratory. This study is expected to enrich academic evidence of Internet consumption in economic field. Secondly, previous analyses of China's network consumption are mainly from the perspective of qualitative analysis, or, from perspective of quantitative but taking GDP as the only indicator. This paper intends to do empirical analysis and adding more indicators into consideration.

The variables considered in the study are the following: total transactions of the Internet consumption (total amount of B2C and C2C), GDP, traditional retail sales of consumer goods, telecommunication business revenue, and total income of express delivery business. All variables cover the period from 2006 to 2013, quarterly. GDP reflects country's economic development, comparing the relationship between Internet consumption and GDP will provide a full picture of Internet consumption's contribution. In order to present the impetus to other industries, two close related industries, telecommunication industry and express delivery industry are chosen. Furthermore, the situation of traditional consumption influenced by Internet consumption would also be a necessary aspect to be taken into consideration.

Vector Autoregression (VAR) model based Granger causality test is employed in order to analyze the causal relationship between the chosen variables. Granger causality was

developed in 1960s and has been widely used in economics since then. The causality was defined as: “a variable y_t is said to Granger cause x_t if x_t can be predicted with greater accuracy by using past values of the y_t variable rather than not using such past values, when all other terms remaining unchanged” (Asteriou & Hall, 2007, C15, pp.322). Granger-causality test has been widespread adopted in studying the relationship between consumption and economic growth, and more narrowly, the relationship between energy consumption and economic growth. While this would be a new attempt to apply it into analyzing Internet consumption. That whether the boom of Internet consumption is a stimulus for economic development or whether Internet consumption has already taken precedence over economic development has aroused curiosity and interest among policy analysts for recent years. Through investigating the direction of causality would have significant policy implications. For example, the finding of causality running one-way from Internet consumption to GDP signifies that Internet consumption has become a stimulus for GDP growth, implying the expansion of Internet consumption market may positive influence on economic growth. By contrast, a unidirectional causality running from GDP to Internet consumption signifies that policies regarding stimulating Internet consumption may be implemented with little or no positive effect on GDP. The empirical test in this paper includes two steps: first is a bivariate causality test between Internet consumption and GDP; and the second is a multivariate test between Internet consumption and traditional consumption, telecommunication industry, as well as express delivery industry.

In addition, it would be better to test for cointegration if we want to provide more robust and meaningful results. In economics the linear combination u_t is often motivated by economic theory and referred to as a long-run equilibrium relationship.⁵ The intuition is that $I(1)$ time series with a long-run equilibrium relationship could not deviate too far from the equilibrium because economic forces will act to restore the equilibrium relationship.

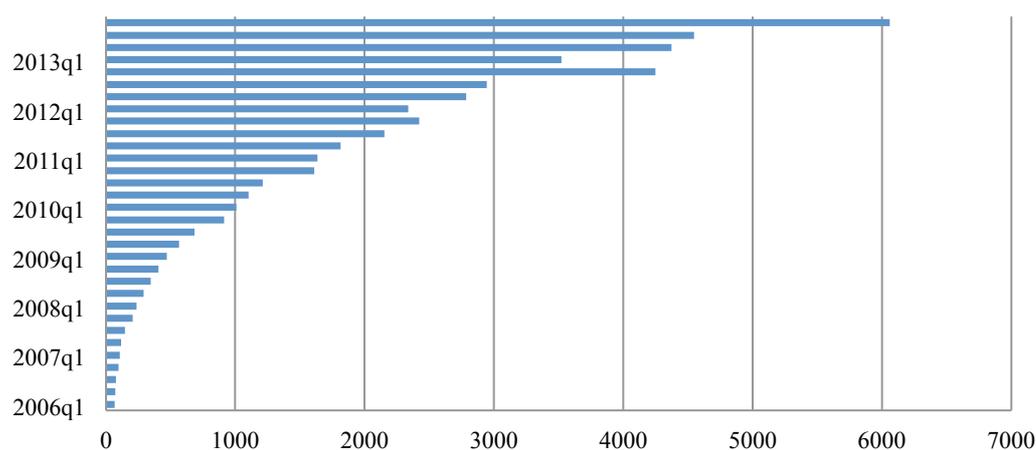
5.2 Quantitative Data

This study employs quarterly data covering the period from 2006 to 2013. This particular period was chosen simply because the required data was not available for earlier periods. The choice of quarterly date is considering seasonal effect for Internet consumption behavior, since most online business are closed during Spring Festival in the beginning of the year and the “11.11 Carnival” in the end of every year. What should be figured out at the beginning is how to measure the scale of country’s Internet consumption. Internet economy could be divided into 4 levels from low to high – infrastructure level, application base level, intermediate service level, and business

⁵ See section 5.3.5, cointegration.

application level (Whinston, 2000). In a broad sense, the network consumption covers all expenses including computer hardware equipment costs, network costs, and online shopping costs. In a narrow sense Internet consumption refers only to the form of consumer buying goods purchased through the network, including B2C and C2C segments.

Figure 5.1. Total transactions of the Internet consumption (100 million yuan), 2006q1-2013q4



Source: Development Research Center of the State Council; iResearch Consulting Group.

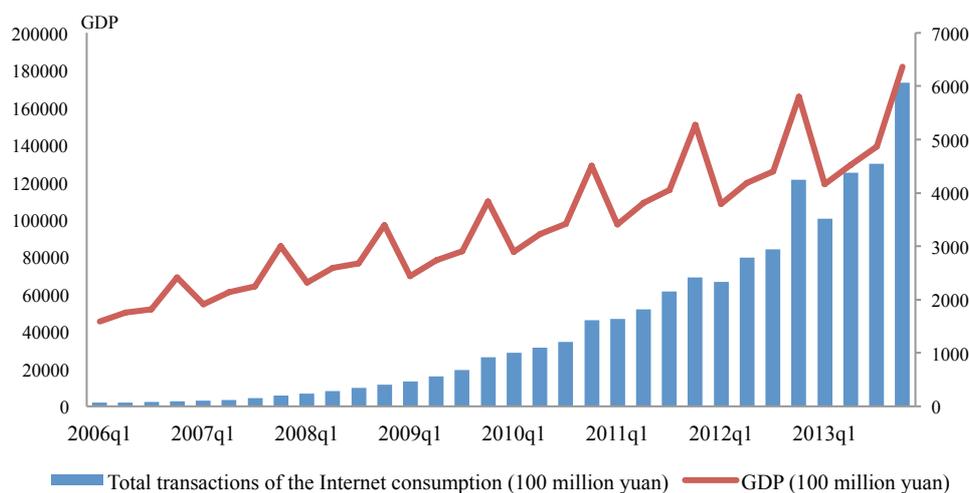
Internet consumption is closely related to E-commerce, which contains three main modes: B2B (Business-to-Business), that is, commerce transactions conduct between business, such as Alibaba; B2C (Business-to-Consumer), that is, business that sells products or provides services to end-user consumers, such as Amazon and Jingdong; and C2C (Consumer-to-Consumer), that is, the both sides of supply and demand are mostly individuals, such as Ebay and Taobao. This paper will study the Internet consumption from narrow perspective – using total transactions of B2C and C2C to represent total transactions of the Internet consumption. The data was obtained from Development Research Center of the State Council and iResearch Consulting Group. During period of 2006 and 2013, the total amount of B2C and C2C increased 60 times, reached 18, 500 million yuan from 313.4 million yuan. Because of the “11/11” Crazy Online Shopping Festival (e.g. 35 billion yuan of Tmall & Taobao, and 10 billion yuan of Jingdong), the total transactions in the fourth quarter last year set a new record with 6060.3 million yuan, compared 4249.3 million yuan in the same time of 2012, a growth rate of 42.6%.

The test takes other four related economic indicator into consideration to investigate their relationship with Internet consumption, which are listed below:

- **GDP** – is the main and the most frequently used indicator. GDP directly reflects country’s economic strength and market scale. It is expected to get the result that

Internet consumption and GDP had a positive relationship during the period: the higher GDP level means greater Internet consumption potential; and in turn the rise of Internet consumption could stimulate national productivity. The data on this variable was from National Statistics Bureau.

Figure 5.2. China's Gross Domestic Product (100 million yuan), 2006q1-2013q4

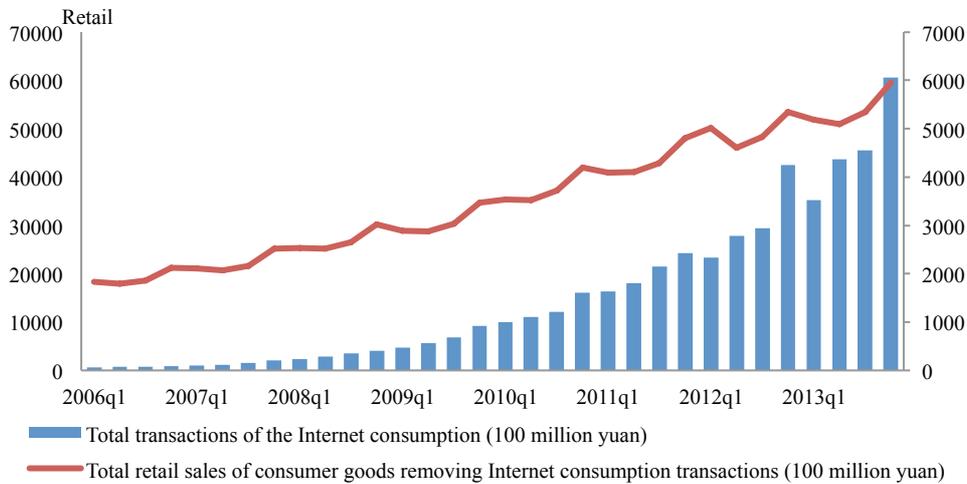


Source: National Statistics Bureau;

Development Research Center of the State Council; iResearch Consulting Group

- **Traditional retail sales of consumer goods.** This is presented by total retail sales of consumer goods removing total transactions of the Internet consumption. It is a trend that Internet consumption has taken more and more weight on total retail sales of consumer goods. Removing Internet consumption transactions from total retail sales basically has three concerns: one is I want to examine whether the expansion of Internet consumption stimulated development of traditional retail industry; or on the contrary, shrank traditional retail market scale; the third is to try to avoid correlation between variables for later econometric test.

Figure 5.3. Traditional retail sales of consumer goods (100 million yuan), 2006q1-2013q4

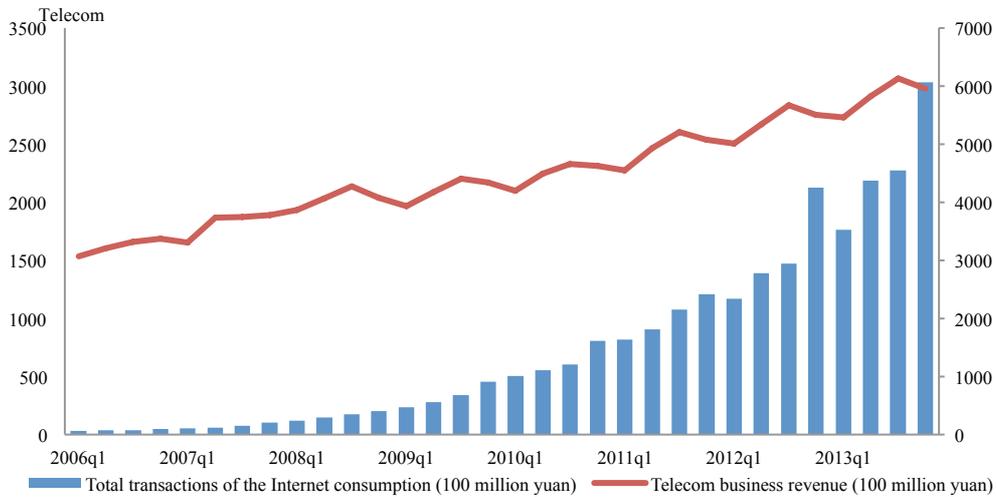


Source: National Statistics Bureau;

Development Research Center of the State Council; iResearch Consulting Group

● **Telecommunication business revenue.** The prosperity of related industries should also be taken into consideration. Consumption level as an important external factor has been used in analyzing the development of telecommunication services frequently (Zhang, 2007). The growth rate of three dominant telecom operators' revenue (China Mobile, China Unicom, and China Telecom with market share of 66%, 20% and 14%, respectively) far exceeded country's GDP growth over a long period. In the year of 2013, telecom operating revenues were RMB 1.349 trillion, with 7.5% growth rate compared that of 2012, among which, core services revenue was RMB 1.169 trillion, increased 8.7%. For the study chosen data was core services revenue because for the total telecom operating revenues, the calculation methods were different before and after 2011. Similar object to that of considering total retail sales of consumer goods, the reason to add this indicator is to know whether the convenience and low price of online consumption inspired individuals' more enthusiasm on getting access to telecom services such as Internet broadband and mobile Internet services. The data was obtained from National Statistics Bureau and Ministry of Industry and Information Technology of People's Republic of China (MIIT).

Figure 5.4. Telecommunication business revenue (100 million yuan), 2006q1-2013q4

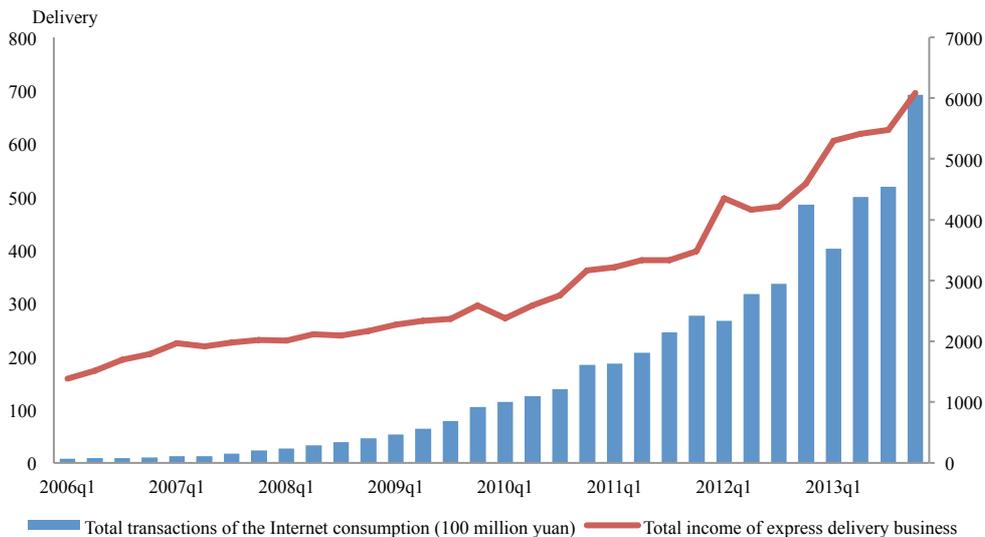


Source: National Statistics Bureau;

Ministry of Industry and Information Technology of People's Republic of China (MIIT)

- **Total income of express delivery business.** Express delivery industry perhaps is the most closely related and representative one to the Internet consumption. The data was obtained from State Post Bureau. It is the total express service revenue of national postal business and large-scale enterprises. It is expected to get the result that the Internet consumption and express delivery business promoted mutually during the period.

Figure 5.5. Total income of express delivery business (100 million yuan), 2006q1- 2013q4



Source: State Post Bureau;

Development Research Center of the State Council

5.3 Econometric Techniques

This section contains the details of the methods applied for time series test.

5.3.1 Vector Autoregression (VAR) model

The Vector Autoregression (VAR) models were first proposed by Sims (1980), who demonstrated that VARs provide “a flexible and tractable framework for analyzing economic time series” (Watson, 1994). It is quite common in economics that some variables are not only explanatory variables for a given dependent variable, but are also explained by the variables that they are used to determine. According to Sims, if there is simultaneity among a series of variables, then all variables should be treated as endogenous. A VAR is an n-equation, n-variable linear model, in which each variable is thus explained by its own lagged values, plus current and past values of the remaining n-1 variables. The first order of a simple bivariate model is given by:

$$y_t = \beta_{10} - \beta_{12}x_t + \gamma_{11}y_{t-1} + \gamma_{12}x_{t-1} + u_{yt}$$
$$x_t = \beta_{20} - \beta_{21}y_t + \gamma_{21}y_{t-1} + \gamma_{22}x_{t-1} + u_{xt}$$

where both y_t and x_t are assumed stationary, and u_{yt} and u_{xt} are uncorrelated white-noise error terms.

5.3.2 Unit Root Test

This study will follow standard time series test procedures in order to analyze the dynamic relationship between total Internet consumption transactions, GDP, traditional retail sales of consumer goods, telecommunication business revenue, and total income of express delivery business. A key concept dealing with time series dataset is that of stationary. A time series is covariance stationary when it has these three characteristics (Asteriou & Hall, 2007, C13, pp.267):

- 1) Exhibits mean reversion in that it fluctuates around a constant long-run mean;
- 2) Has a finite variance that is time-invariant;
- 3) Has a theoretical correlogram that diminishes as the lag length increases.

Stationarity is important because, if the time series is non-stationary, all results based on

the classical regression analysis could not be valid. The inaccuracy due to heteroskedasticity (i.e., time-varying variances) or unaccounted for serial correlation, will lead to so called “spurious” results. To identify whether time series is stationary, basically there are two tests could be used in unit-root test: (Augmented) Dickey-Fuller (ADF) test (1981) and Phillips-Perron (PP) test (1988).

The three possible forms of the ADF test are given by the following equations:

$$\Delta y_t = \gamma y_{t-1} + \sum_{i=1}^p \beta_i \Delta y_{t-1} + u_t$$

$$\Delta y_t = \alpha_0 + \gamma y_{t-1} + \sum_{i=1}^p \beta_i \Delta y_{t-1} + u_t$$

$$\Delta y_t = \alpha_0 + \gamma y_{t-1} + \alpha_2 t + \sum_{i=1}^p \beta_i \Delta y_{t-1} + u_t$$

where y_t is the variable of interest, α_0 is a constant in the random-walk process, α_2 is the non-stochastic time trend, u_t is the error terms. The theory that supporting the DF and ADF tests is based on the assumption that the error terms are statistically independent and have a constant variance. The difference between the three regressions is whether the model contains constant or/and trend. What we need to examine is whether γ is equal to 1 (unit-root). The null hypothesis $H_0: \gamma = 1$, and the alternative hypothesis $H_1: \gamma < 1$. If $\gamma = 1$ then the series contains a unit root and is non-stationary, while if $\gamma < 1$ therefore the series is stationary. In term of determining the lag length it is called for a testing down procedure removing the lags that statistically insignificant.

Phillips-Perron (PP) test model is the AR(1) process:

$$\Delta y_{t-1} = \alpha_0 + \gamma y_{t-1} + e_t$$

Different from ADF test that correcting serial correlation by adding lagged differenced terms on the right hand side, PP test makes a Newey-West correction to the t-statistic from the AR(1) regression to account for serial correlation in error terms (Asteriou & Hall, 2007, C16, pp.346).

5.3.3 Granger-Causality

Causality in econometrics is a concept that refers to the ability of one variable to do prediction. With a simple VAR model, two variables, y_t and x_t , affect each other with

distributed lags. There are four possible relationships: 1) y_t causes x_t ; 2) x_t causes y_t ; 3) there is a bi-directional causality; and 4) the two variables are independent. Granger (1969) developed a relatively simple test procedure, that “ y_t is said to Granger cause x_t , if x_t can be predicted with greater accuracy by using past values of the y_t rather than not using such past values, holding all other terms constant” (Asteriou & Hall, 2007, C15, pp.322). In other words, we can jointly test if the estimated lagged coefficient $\sum_{i=1}^n \beta_i$ and $\sum_{j=1}^m \gamma_j$ are different from zero with F-statistic. The Granger-Causality test is easy to carry out and be applied in empirical studies; however, traditional Granger-Causality has its limitations. One is the two-variable Granger-Causality test without considering other factor’s effect might be biased. The other one is since time series data are usually non-stationary, when the variables are integrated, the F-test procedure is not valid, as the test statistics do not have a standard distribution (Gujarati, 1995). Enders (2004, p.285-287) proved that only when the two-variable VAR has lagged length of two periods and only one variable is non-stationary, could it be transformed into first differential form.

For this study, Granger causality test will be considered and will follow the Toda and Yamamoto (1995) procedure to avoiding integration and complexity, including setting up a VAR model in levels of times series (by e.g. the ADF test) and determining lag length (by considering information criteria). The estimation VAR model formulated as follow:

$$y_t = \alpha_1 + \sum_{i=1}^n \beta_i x_{t-i} + \sum_{j=1}^m \gamma_j y_{t-j} + e_{1t}$$

$$x_t = \alpha_2 + \sum_{i=1}^n \theta_i x_{t-i} + \sum_{j=1}^m \delta_j y_{t-j} + e_{2t}$$

What should be notice is about the maximum order of integration for the group of time-series. If one of the two series is $I(0)$ and the other is $I(1)$, then the integration order should be 1. Toda and Yamamoto (1995) suggested that one could estimate a $(k + d_{max})$ order of VAR model, where d_{max} is the maximal order of integration, and then jointly test k order lagged coefficients. For the null and the alternative hypotheses as: $H_0: \sum_{i=1}^n \beta_i = 0$ or x_t does not Granger-cause y_t ; $H_1: \sum_{i=1}^n \beta_i \neq 0$ or x_t does Granger-cause y_t . We will test the null hypothesis for “ y_t does not Granger-cause x_t ”. In each case, a rejection of the null implies there is Granger causality.

5.3.4 Impulse Response Functions (IRFs)

Another interest for VAR model is impulse response functions. Impulse response traces out the “response of current and future values of each of the variables to a one-unit increase in the current value of one of the VAR errors”.⁶ An impulse response refers to the reaction of dynamic system in response to some external shocks.

5.3.5 Cointegration

Cointegration is dealing to economic model using non-stationary time series data. The idea is that if there is a long run relationship between two series, then no matter the changes of variable over time, there will be a common trend to link them together. That is, two non-stationary series ($I(1)$) can be cointegrated at same level and their linear combination thus be stationary ($I(0)$), denoted by:

$$\theta_1 y_t + \theta_2 x_t = u_t \sim I(0)$$

where θ_1 and θ_2 is the coefficients vector. Different from Engle - Granger test which work in a bivariate model with at most one cointegrating vector, VAR based Johansen approach allows for more than one cointegrating relationship for multiple equations. Johansen approach takes its starting point in the VAR model of order k given by

$$Z_t = A_1 Z_{t-1} + A_2 Z_{t-2} + \dots + A_k Z_{t-k} + \mu_t$$

where Z_t is an $n \times 1$ vector of variables that are integrated at first differences order – commonly denoted $I(1)$, A_k represents a matrix of VAR parameters with k lags, μ_t is vector of error terms. This VAR can be re-written as

$$\Delta Z_t = \mu + \Pi Z_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta y_{t-i} + \epsilon_i$$

Where

$$\Pi = \sum_{i=1}^k A_i - I \text{ and } \Gamma_i = - \sum_{j=i+1}^k A_j$$

The Π matrix contains information regarding the long-run relationships. If the

⁶ VARs. Boston College. Available online: https://www2.bc.edu/~iacoviell/teach/0809/EC751_files/var.pdf

coefficient matrix Π has reduced rank $r < n$, then we can decompose $\Pi = \alpha\beta'$ where α contains the information about the speed of adjustment to equilibrium coefficients while β' will be the long-run matrix of coefficients (Asteriou & Hall, 2007, C17, pp.368). Thus, based on the multiple-equation approach we can obtain estimates for both cointegrating vectors, while with the simple equation we only have a linear combination of the two long-run relationships.

An important aspect in the model formulation is whether an intercept and/or a trend should be added into either the short-run or the long-run model, or both models. Johansen (1992) suggests that the joint hypothesis of both the rank order and the deterministic components need to be tested, applying the so-called Pantula principle (Asteriou & Hall, 2007, C17, pp.373). The Pantula principle involves the estimation of three models, starts from the most restrictive model which includes intercept in cointegration equation (CE), but no intercept or trend in VAR model, to the least restrictive hypothesis with intercept in both CE and VAR, linear trend in CE, but no trend in VAR. Through comparing test statistic to critical value, this model selection procedure stops when the first time the null hypothesis of no cointegration is not rejected.

If there exists cointegration relationship between `lnet_consum` and other economic indicators we use in this study, we can use Error Correction models (ECM) to test causality:

$$\Delta y_t = \alpha_0 + b_1 \Delta x_t - \pi \hat{u}_{t-1} + e_t$$

which will now have the advantage of including both long-run and short-run information. Long-run causality of x_t to y_t will be tested by checking t-test, where the null hypothesis of Granger causality as $H_0: \pi = 0$ or x_t does not Granger-cause y_t ; and short-run causality of x_t to y_t will be tested by conducting F-test, where the null hypothesis of Granger causality test as $H_0: b_1 = 0$ or x_t does not Granger-cause y_t . Testing causality of y_t to x_t follows the same procedure.

6. Empirical Results

6.1 Descriptive Statistics

All variables are transformed into natural logarithmic form in order to minimize the fluctuations in the data series. It is evident from Table 6.1 that Standard Deviation (Std. Dev.) of *total Internet consumption transactions* (lnet_consum) is the highest and that of *telecommunication business revenue* (ltele) is the lowest, with 1.4094 and 0.1927, respectively. Mean values of all 5 variables are positive. Besides, all variables except variable of *total income of express delivery business* (ldelivery) have negative values of Skewness means their distributions are skewed to the left, which implying more observations on the right. Relative low Kurtosis values of lnet_consum and *traditional retail sales of consumer goods* (ltra_consum) indicate that the two series have distributions with a lower peak and thicker tails, compared to series of lgdp, ltele, and ldelivery. Generally data series do not have extreme deviation problems from distribution.

Table 6.1. Descriptive Statistics for time series of concern (2006q1-2013q4)

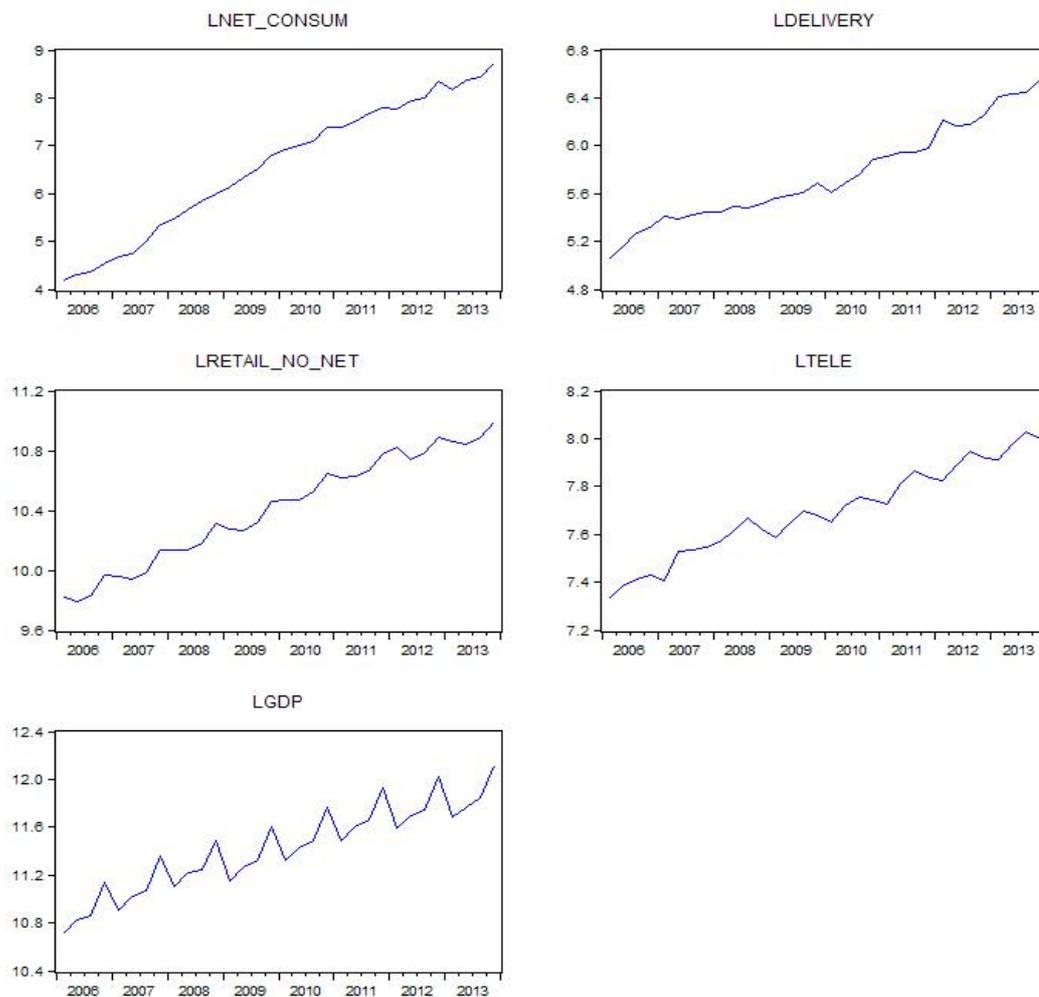
Series	lnet_consum	lgdp	ltra_consum	ltele	ldelivery
Mean	6.5774	11.4199	10.4097	7.6959	5.7561
Minimum	4.1897	10.7214	9.7945	7.3358	5.0645
Maximum	8.7095	12.1104	10.9938	8.0282	6.5446
Std. Dev.	1.4094	0.3589	0.367	0.1927	0.4054
Variance	1.9863	0.1289	0.1347	0.0371	0.1643
Skewness	-0.2621	-0.0906	-0.1554	-0.0730	0.3826
Kurtosis	1.7647	2.2196	1.7409	2.0789	2.0917
Observations	32	32	32	32	32

Note: the variables are ln(Internet Consumption), ln(GDP), ln(Traditional Retail Sales of Consumer Goods), ln(telecommunication business revenue), and ln(Total Income of Express Delivery Business).

6.2 Unit Root Tests

Ocular inspection of logarithmic form of data series shows fluctuate upward trend for all variables. Among five data series, `lnet_consum` enjoyed the most dramatic increase during the period. A stationary time series is one whose statistical properties such as variance, mean, autocorrelation, etc. are all constant over time. However, ocular inspection graph below shows all these data series do not seem to fulfill stationary properties in their level form, because neither of them has long run mean, nor constant along with time during the period. But still, plots of the data series are not convincible enough to tell whether these five series are stationary or not, and at which differences level they fulfill all properties and could thus be stationary.

Figure 6.1. Ocular Inspection of logarithmic variables



In this way, a formal unit-root test becomes necessary in order to determine the order of integration. Generally the test for the number of unit roots follows these steps:

- Step 1, if Y_t (e.g. \lnet_consum) is stationary. If it is, then $Y_t \sim I(0)$;
 Step 2, if not, take first differences of Y_t as $\Delta Y_t = Y_t - Y_{t-1}$ and do the whole regression again to test if ΔY_t is stationary. If it is, then $Y_t \sim I(1)$;
 Step 3, if not, take second differneces of Y_t as $\Delta^2 Y_t = \Delta Y_t - \Delta Y_{t-1}$ and do the whole regression again to test if $\Delta^2 Y_t$ is stationary. If yes, then $\Delta^2 Y_t \sim I(2)$;
 ...

The two unit-root tests, augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test, are applied for determining the order of integration. The test results showed in Table 6.2 indicate that for \lnet_consum and $ldelivery$ series at order level, the null hypothesis of unit-root cannot be rejected in either the ADF or the PP test even at 5% level of statistical significance, which is consistent with earlier ocular inspection result. When adding the first differences, for both series we can reject null hypothesis of non-stationary at 5% level of statistical significance. In terms of other three series: $lgdp$, $ltra_consum$, and $ltele$, they are trend stationary at their level form. Therefore, all five series, \lnet_consum , $lgdp$, $ltra_consum$, $ltele$, and $ldelivery$ did not integrated into the same differences level, which means we cannot do cointegration test by dataset of this paper.

Table 6.2. Results of Unit-root Test

Variable	Specification	ADF test			PP test		
		Lags	Statistic	Critical	Lags	Statistic	Critical
\lnet_consum	Constant & Trend	1	-0.739	-3.580	2	-1.447	-3.576
D1. \lnet_consum	Constant no Trend	0	-7.894	-2.986	2	-7.819	-2.986
$lgdp$	Constant & Trend	1	-5.418	-3.580	2	-7.521	-3.576
$ltra_consum$	Constant & Trend	1	-4.765	-3.580	2	-3.789	-3.576
$ltele$	Constant & Trend	1	-5.038	-3.580	2	-4.163	-3.576
$ldelivery$	Constant & Trend	1	-1.288	-3.580	2	-1.694	-3.576
D1. $ldelivery$	Constant no Trend	0	-6.559	-2.986	2	-6.740	-2.986

Note: D1. means taking the first differenced level of variable \lnet_consum or $ldelivery$;

PP test lag order was set to the default of two lags;

All critical values are at 5% significance level.

6.3 VAR model Specification and Granger Causality test

Granger causality test following Toda-Yomamoto procedure that calls for VAR($k+d_{\max}$) model, where k is the optimal lag length and d is the maximum order of integration for time series. After determining the order of integration for each variable, and thus the maximum one order $d_{\max}=1$ for Granger-Causality test, the next move is to select optimal lagged length k by use of Akaike Information Criterion (AIC), Hannan-Quinn Information Criterion (HQIC) and the Schwartz Bayesian Criterion (SBC). Ocular inspection of each logarithmic variable (Figure 6.1) also indicates a trend of outstanding increase in the fourth quarter and then fell down in the first quarter of next year, so it will be logical to consider adding dummy variable into VAR model as an exogenous variable to estimate the influence of the fourth quarter every year. A new dummy variable called `seasonal_effect` taking the fourth quarter as 1 and other quarters as 0 is created.

6.3.1 Bivariate VAR model Specification and Granger Causality test

The study firstly chose indicator of GDP to get a general idea of relationship between the Internet consumption and Chinese economic growth. After looking into the result of information criterion tests (Table 6.3), the bivariate VAR model contains either 3 or 4 lags, i.e. $k=3$ or 4. Thus the final VAR ($k+d_{\max}$) model that will be tested is VAR(4) or VAR(5). To make sure VAR model is better specified and does not suffer series problems with respect to normality and residual autocorrelation, normality test and Lagrange-multiplier test are necessary to be done.

Table 6.3. Selection-order criteria for Bivariate VAR model

Lag	AIC	HQIC	SBIC
0	0.263205	0.321387	0.45352
1	-5.07207	-4.9557	-4.69144
2	-5.24652	-5.07198	-4.67558
3	-5.85377	-5.62105*	-5.09251*
4	-5.88949*	-5.59859	-4.93792

Note: Sample period: 2007q1 – 2013q4.

** indicates lag order selected by the criterion in STATA.*

Hence, the form of VAR(4) model to be tested for Granger Causality looks like this (but with 4 lags of each variable):

$$lnet_consum_{t-1} = \gamma_1 + \alpha_1 lnet_consum_{t-1} + \beta_1 lgdp_{t-1} + \mu_1 seasonal_effect_{t-1} + \varepsilon_t^{lnet_consum}$$

$$lgdp_t = \gamma_2 + \alpha_2 lnet_consum_{t-1} + \beta_2 lgdp_{t-1} + \mu_2 seasonal_effect_{t-1} + \varepsilon_t^{lgdp}$$

where γ_i denotes a vector of constants, α_i, β_i, μ_i are the coefficients to be estimated, and ε_t^i is the residuals. The obtained result of bivariate Toda-Yamamoto Granger Causality Wald test is presented in Table 6.4. The variables listed in the columns and the rows are dependent variables and independent variables, respectively. If p-values of the Wald test are less than the 0.05 (or 0.10) significance level, then we can reject the null hypothesis of “ x_t does not Granger-cause y_t ”. As with the expectation, that “lagged $lnet_consum$ did Granger cause lagged $lgdp$ and lagged $lgdp$ did Granger cause lagged $lnet_consum$ ” formed a bi-directional Granger causality at 10% significance level.

Table 6.4. Results of Bivariate Granger Causality test (Toda-Yamamoto procedure)

	Independent Variable	
	$lnet_consum$	$lgdp$
$lnet_consum$	-	0.067*
$lgdp$	0.034	-

Note: The table contains p-values of Granger Causality Wald test. The statistic significance generally chose 0.05 level, for those figure with *, the significance level is 0.10.

6.3.2 Multivariate VAR model Specification and Granger Causality test

Then the test narrowed down into several specific economic indicators to investigate the multivariate Granger Causality. Following the same procedure with former bivariate Granger Causality test, it is VAR ($k+d_{max}$) that needed to be specified at the beginning. This time, the study follows the Information Criterion AIC (Table 6.5), which suggested the VAR model include four lags and thus final model for multivariate test would be VAR(5).

Table 6.5. Selection-order criteria for Multivariate VAR model

Lag	AIC	HQIC	SBIC
0	-5.52944	-5.41307	-5.14881
1	-13.2045	-12.8554	-12.0626
2	-13.8871	-13.3053	-11.9839
3	-13.4785	-12.664	-10.8141
4	-14.1433*	-13.0961	-10.7177

Note: Sample period: 2007q1 – 2013q4.

* indicates lag order selected by the criterion in STATA.

Hence, the form of VAR(5) model to be tested for Granger Causality looks like this (but with 5 lags of each variable):

$$lnet_consum_t = \gamma_3 + \alpha_3 lnet_consum_{t-1} + \theta_3 lretail_no_net_{t-1} + \varphi_3 ltele_{t-1} + \delta_1 ldelivery_{t-1} + \mu_3 seasonal_effect_{t-1} + \varepsilon_t^{lnet_consum}$$

$$lretail_no_net_t = \gamma_4 + \alpha_4 lnet_consum_{t-1} + \theta_4 lretail_no_net_{t-1} + \varphi_4 ltele_{t-1} + \delta_4 ldelivery_{t-1} + \mu_4 seasonal_effect_{t-1} + \varepsilon_t^{lretail_no_net}$$

$$ltele_t = \gamma_5 + \alpha_5 lnet_consum_{t-1} + \theta_5 lretail_no_net_{t-1} + \varphi_5 ltele_{t-1} + \delta_5 ldelivery_{t-1} + \mu_5 seasonal_effect_{t-1} + \varepsilon_t^{ltele}$$

$$ldelivery_t = \gamma_6 + \alpha_6 lnet_consum_{t-1} + \theta_6 lretail_no_net_{t-1} + \varphi_6 ltele_{t-1} + \delta_6 ldelivery_{t-1} + \mu_6 seasonal_effect_{t-1} + \varepsilon_t^{ldelivery}$$

where γ_i denotes a vector of constants, $\alpha_i, \theta_i, \varphi_i, \delta_i, \mu_i$ are the coefficients to be estimated and ε_t^i is the residuals. Table 6.6 presents the result of multivariate Toda-Yamamoto Granger Causality Wald test. The result table contains two parts: bivariate Granger Causality Wald test that only taking two variables into the test, e.g. $lnet_consum$ to $ltra_consum$, $lnet_consum$ to $ldelivery$, etc.; and multivariate Granger Causality Wald test, that is, based on the estimation of multivariate VAR model covered all variables $lnet_consum$, $ltra_consum$, $ltele$, and $ldelivery$.

Table 6.6. Results of Granger Causality test (Toda-Yamamoto procedure)

Bivariate					
	Independent Variable				
	lnet_consum	$ltra_consum$	$ltele$	$ldelivery$	All
lnet_consum	-	0.052*	0.075*	0.372	-
$ltra_consum$	0.001	-	0.013	0.038	-
$ltele$	0.527	0.015	-	0.000	-
$ldelivery$	0.000	0.669	0.909	-	-
Multivariate					
	Independent Variable				
	lnet_consum	$ltra_consum$	$ltele$	$ldelivery$	All
lnet_consum	-	0.022	0.014	0.904	0.002
$ltra_consum$	0.000	-	0.000	0.004	0.000
$ltele$	0.000	0.000	-	0.000	0.000
$ldelivery$	0.000	0.000	0.000	-	0.000

Note: The table contains p-values of Granger Causality Wald test. The statistic significance chose 0.05 level, for those figure with *, the significance level is 0.10.

Because the aim of the test is to estimate the relationship between `lnet_consum` and other indicators, here we only focused on the first column and the first row of results for both Bivariate and Multivariate test. For both test, if taking `lnet_consum` as independent variable, then for each of three Granger Causality test, one can reject the null hypothesis of “the lagged `lnet_consum` did not Granger cause the lagged `ltra_consum`”, so did and `ldelivery`. Nevertheless, we cannot reject the null of “the lagged `lnet_consum` did not Granger cause the lagged `ltele`” with Bivariate VAR model at 0.05 significance level ($0.527 > 0.05$), which failed the hypothesis.

Another aspect we are looking into is to take `lnet_consum` as dependent variable, to see whether other independent variables Granger caused it, and thereby there existed bi-directional feedback between each two variables. As a result, within the Bivariate Granger Causality test, lagged `ltra_consum` and `ltele` Granger caused the lagged `lnet_consum` individually (at 10% significance level), indicating that time series of `lnet_consum` and `ltra_consum`, and `lnet_consum` and `ltele` had bi-directional feedback (causality among the variables). After considering all variables into the VAR model, one can reject the null hypotheses of “lagged `ltra_consum` did not Granger caused lagged `lnet_consum`” and “lagged `ltele` did not Granger caused lagged `lnet_consum`” at 5% level. However, there is no evidence to show Granger causality in the direction from `ldelivery` to `lnet_consum`. In order to ensure the VAR model is well specified and does not suffer problems in terms of normality or autocorrelation, additional tests are necessary. As a result, related tests indicate that there is no problem for the VAR model with normality, skewness, kurtosis or series autocorrelation of residuals.

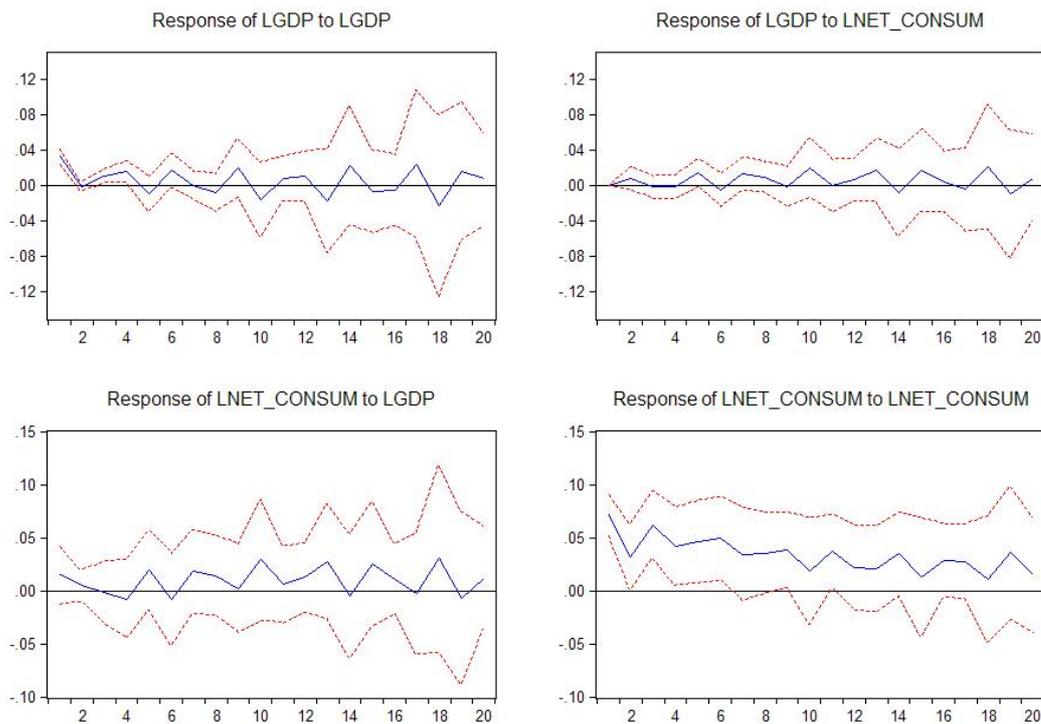
6.4 Impulse Response Functions (IRFs)

One shortcoming for VAR model based Granger causality test is that it cannot tell whether they have positive or negative relationship. The dynamic structure of VAR model with lags makes the obtained coefficient difficult to interpret because e.g. in the certain period $t-1$, it is possible to have positive coefficient while in the period $t-2$, the coefficient changes into negative. To overcome this criticism, the advocates of VAR model estimate so-called Impulse Response Functions (IRFs). The IRFs is applied to study the effect of a unit change in a structural shock on a variable, as well as the persistency of a shock, which might provides useful information about relationship between Internet consumption and other variables in the short term. The test will follow the VAR ($k+d_{\max}$) model that was used for former Toda-Yomamoto Granger Causality.

6.4.1 IRFs of Bivariate VAR model

Following bivariate VAR(4) model used in Granger Causality test, Figure 6.2 is the result of IRFs between two variables: `lnet_consum` and `lgdp`. The upper right graph indicates within 20 unit shocks, although there exists one unit delay due to lag choice of the variable, the shock to `lnet_consum` has a slight fluctuate positive effect on `lgdp`. Seasonal effects could explain the frequent fluctuations especially during the end of each year. Comparatively, the lower-left graph shows more apparent positive response of `lnet_consum` to the shock in the `lgdp`. The results indicate that the impact of GDP on Internet consumption was stronger than the other way around. Again, seasonal effect should be taken into consideration.

Figure 6.2. Impulse Response Functions of Bivariate VAR model



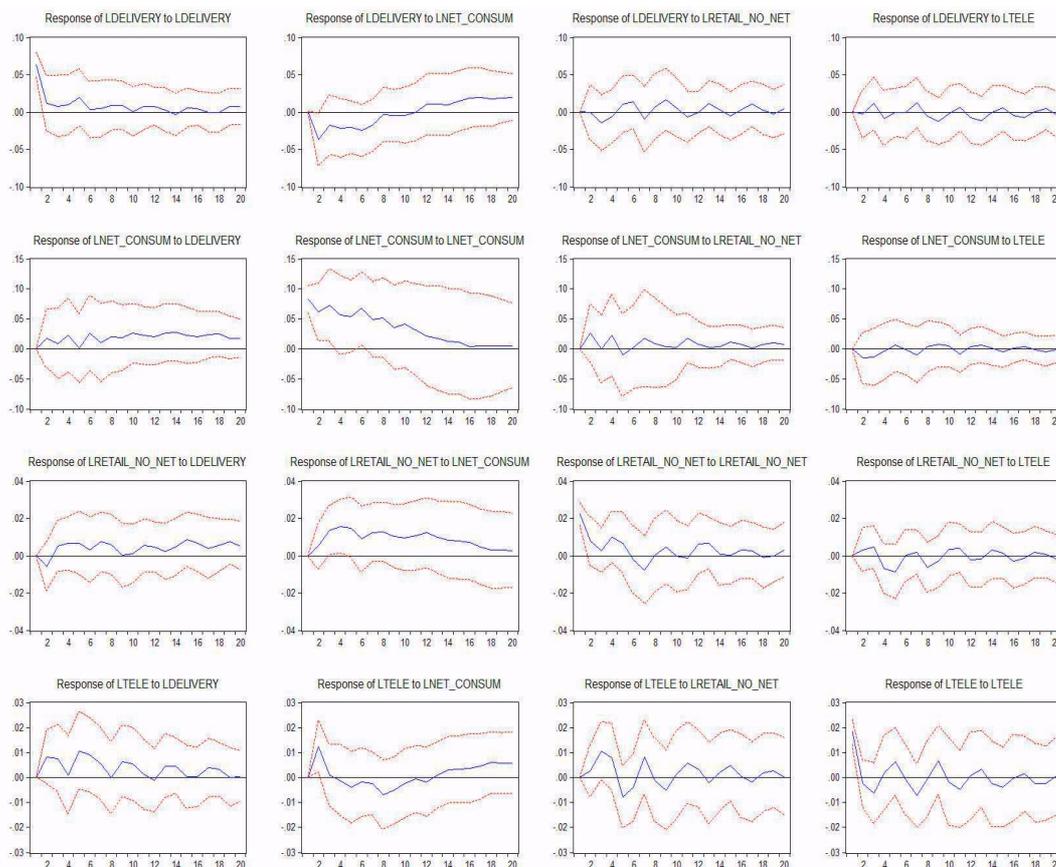
6.4.2 IRFs of Multivariate VAR model

Similarly, Impulse Response functions for `lnet_consum`, `ltra_consum`, `ltele`, and `ldelivery` based on the multivariate VAR model formed in the section of 6.3.2. The second column of Figure 6.3 shows the response of other variables to a shock in `lnet_consum`. The shock to `lnet_consum` has a negative impact on `ldelivery`, after 8-10

periods, it turns into positive impact and this kind of positive impact will become significant steadily. The shock to `lnet_consum` has a general positive impact on `ltra_consum`, but the impact will be weakened after around 16 units of shocks. Shock to `lnet_consum` has a positive effect on `ltele` at first and develops into a negative between 3 to 11 shocks, later it again into a positive.

The second row of Figure 6.3 is the response of the Internet consumption growth to a shock brought by other variables. With 1 unit delay, generally the shock to `ldelivery` has a relative long and positive effect on `lnet_consum`, implying that the development of delivery industry stimulates the enthusiasm of Internet consumption. In addition, the shock to `ltra_consum` has weak positive impact on `lnet_consum`, whereas there is no obvious evidence to show that a shock to `ltele` has effect on `lnet_consum`, which is consistent with the result in section 6.3.2. Different from the results showed in Figure 6.2, this time, Internet consumption had more dramatic impact on other variables, compared to others' on Internet consumption.

Figure 6.3. Impulse Response Functions of Multivariate VAR model



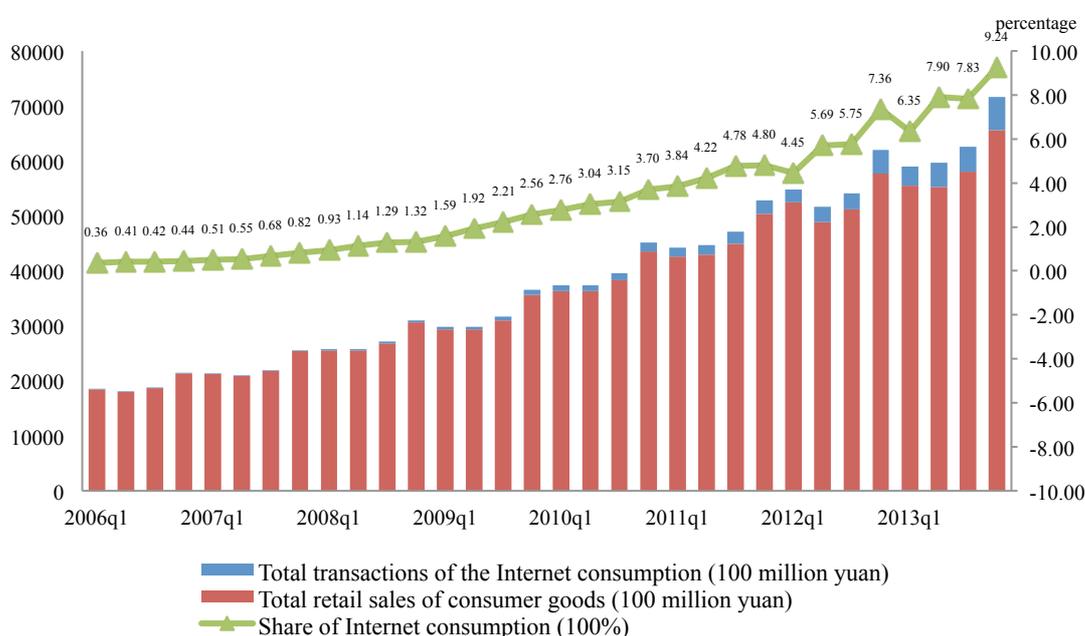
7. Discussion

The numbers mentioned in sections of introduction and background, the review of the literature showed that Internet consumption has already become a new force to drive the China's continuing economic growth. In terms of this empirical study with quarterly time series dataset from 2006q1 to 2013q4, a simple bivariate Internet consumption and GDP VAR model based Granger causality test following Toda-Yomamoto approach firstly revealed that there was a strong evidence of bi-directional causal relationship between Internet consumption and economic growth (at a 5% level of significance) from a very broad perspective. A study by Chen (2013) used the similar approach and got the result of unidirectional causation coming from the whole Internet economy to GDP within the period of 2003 and 2010 with yearly data. However, according to the AIC chosen by Stata, this kind of relationship contains delay with 4 units of period. Considering other influential factors for GDP, one year delay could be seen a very short period. In addition, since Granger causality test does not contain the information about the sign of their relationship, the later IRFs became a good way to solve this problem and provided result about how the response of Internet consumption/GDP to the shocks to the other one within 20 units of shocks. Through looking at figure 6.2, it became clear that the shock to Internet consumption has a positive effect on GDP, and vice versa, which provides a positive signal to policy makers to encourage Internet consumption market's further development. Seasonal effect became one important factor when doing both explanation and prediction. For Internet consumption, the celebration of "11/11" Online Carnival in the fourth quarter of every year makes it reasonable, hence the boom of Internet consumption plus to other influential factors such as taxation or year-end settlement methods for majority organizations contribute to higher GDP growth level.

We then move on to three industries close related to Internet consumption. A multivariate model including Internet consumption, traditional retailing, telecommunication services, and express delivery industry was employed to show causality between Internet consumption and these three related industries. The study chose "total retail sales of consumer goods but removing total transactions of the Internet consumption" to represent traditional retailing industry. As one important part of GDP, the total retail sales of social consumer goods reflects the degree of purchasing

power and the size of the retail market in China. Determined by the conditions terms of commodities' supply and, demand that has the ability to pay, it is the indicator to study social production and living standard. Although Internet consumption has been increasing its weight in total retail sales of consumer goods, it did not shrink the traditional retail market. Granger causality tests performed in this study suggest the statistically significant causal relationship between Internet consumption and traditional retailing. Besides, the results of IRFs support the hypothesis that an external shock to Internet consumption has a positive impact on traditional retailing sector. In turn, the shock to traditional retailing at the same time positively influence on Internet consumption. More and more traditional retailers are now doing their business on the Internet marketplaces as well. The cooperation between online and offline consumption hence has enlarged China's consumption market. Being the world's largest retail market after the United States, according to the Ministry of Commerce, the total retail sales of consumer goods in China doubled to 23.4 trillion yuan in 2013, from 10.8 trillion yuan in 2008. Thus, the expansion of retailing market is keeping up with China's course of economic rebalancing that moving towards a consumption-driven economy.

Figure 7.1. Total retail sales of social consumer goods (100 million yuan), 2006q1-2013q4



Source: National Statistics Bureau;

Development Research Center of the State Council; iResearch Consulting Group

It is widely known that the prosperity of Internet consumption relies on Internet based infrastructural construction and the popularity of Internet use, but the importance of Internet consumption to further improvement of Internet infrastructure has been

neglected. For this study, both bivariate and multivariate VAR models indicate the existence of a bi-directional causation for Internet consumption and telecommunication service sector ($l_{net_consum} \leftrightarrow l_{tele}$) at generally 5% level of statistical significance.⁷ This indicates that the Granger test results not only support the view of telecommunication services sector's fundamental role, but also reveal the stimulation to it by individual and household seeing advantages of online shopping. The government implemented a series of policies in order to strengthen the construction of network infrastructure continuously, which laid foundation to better Internet access. The China's government is now trying to narrow the gap between China and developed countries in terms of broadband network infrastructure development, through forming a moderately in-advance broadband network development landscape. The "Broad-band China" issued by the State Council of the People's Republic of China on 17 August, 2013 has become a national strategy, of which by 2020 broadband networks will cover all urban and rural areas, household penetration of fixed broadband will reach 70%, and the penetration of 3G users will reach 85%, etc. The World Bank statistics shows that in developing countries every 10% growth in broadband access results in 1.4% growth in GDP. The broadband network is boosting a new round of e-commerce development. It is estimated that in 2015 the size of online retail will hit 3 trillion yuan (\$490 billion).⁸

Internet consumption's indirect role in helping country's economic growth by stimulating other related industries reflects not only on telecommunication services, but also on express delivery services. The relationship between Internet consumption and express delivery industry has been revealed by previous studies in terms of analyzing the contribution of express delivery industry's development to China's economy. Firstly, as the shrink of China's export industry, many express delivery enterprises would not be survive without the volume supplement by e-commerce (Liang, 2011; Du, 2013). The Granger causality tests in section 6.3.2 suggest a unidirectional causality coming from Internet consumption to express delivery industry ($l_{net_consum} \rightarrow l_{delivery}$) at 5% statistical significance level. This combines with the result in IRFs, which the shock of Internet consumption eventually has a positive impact on express delivery industry after several periods, indicates a stimulation role of Internet consumption for express delivery sector. However, neither bivariate nor multivariate VAR model based test found statistical significant evidence of causal relationship from express delivery industry to Internet consumption, to support what Du (2013) stated in her study: "express delivery industry has become part of the e-commerce transaction process, ... and its value for e-commerce is irreplaceable".

At a time when the role of investment in pushing forward economic growth is

⁷ For the bivariate model of l_{net_consum} and l_{tele} , the Granger causality of $l_{tele} \rightarrow l_{net_consum}$ is statistically significant at 10% level.

⁸ The full introduction to "Broadband China" Strategy can be found at: http://file.eu-chinapdsf.org/Internet/PUB/Activity4/Results%203/Broadband%20China%20introduction_Yu%20Xiao_hui.pdf

weakening and exports are declining, boosting Internet related consumption would help expand domestic demand and ensure stable growth in the long run. Establishing a long-term system to promote Internet consumption is exactly what China is doing right now, as the country shifts to a new growth structure. The Chinese government has allowed e-commerce to develop without much intervention. For example, as a larger number of people choose to start their business through online marketplace, China's e-commerce industry has been a catalyst for small and micro scale entrepreneurial activity with more than 90 percent of retail e-commerce shops owned by individuals. However, those who employed in the field are not covered in the social security with pension plans, medical and unemployment insurance since the system do not include Internet sector. Therefore the government is now considering making online shop owners and employees to enjoy the benefit of social security. In addition, through continuing construction of broadband and 3G+ infrastructure; stimulating human capital and R&D inputs on technological innovations; and encouraging investment in express delivery services as well as logistics infrastructure, the Internet consumption market is expected to be prosperous continuously.

8. Conclusion

8.1 Summary

The rapid growth of Internet consumption in China has attracted more and more attention recent years. In 2013 China overtook the U.S. and became the largest market of online consumption. Traditional economics has been successful in explaining fairly accurately and effectively people's consumptive activities in the industrial age, but with the approach of the information age, it has met with tremendous challenge from Internet consumption, especially in the field of Internet economy. Theoretical analyses show that Internet consumption is a complex process of "production and consumption". In order to investigate Internet consumption's influence on China's economic development, the paper chose quarterly dataset from 2006 to 2013 with following variables besides Internet consumption: GDP, traditional consumption, telecommunication industry, and express delivery industry. By choosing both the bivariate and multivariate VAR model based Granger-causality tests and IRFs test, the empirical test results satisfied with hypotheses that stated in the introduction section.

Specifically, from the macro-level of the entire country, Internet consumption has played a positive role in stimulating China's economic growth. From the meso-level of the industrial sectors' development, Internet consumption has pushed forward other related industries prosperity and upgrading, such as express delivery and telecommunication industries. From micro-level analysis of household consumption, the flourish of large-scale virtual market has not hindered traditional consumption, but in turn promoted its development. Hence, the enlargement of both traditional and Internet consumption market responses China's strategy to turning country gravity from investment to consumption. Moreover, the bidirectional causation between Internet consumption and telecommunication industry could be evidence for the interpreting Chinese government's polices regarding telecommunication and network infrastructure construction.

8.2 Limitations of the Study and Directions for Future Research

Although this study has been prepared and processed very carefully, several limitations however need to be acknowledged.

Firstly, such an explorative study means it has defect of providing measurement without theory. This kind of danger had been pointed by Koopmans in 1947. He stated “the decision not to use theories ... limits the value to economic science and to the maker of policies” (p.172). Actually this defect cannot be avoided at the very beginning of study in any new field, but more proper models and approaches would be developed and summarized along with the accumulation of theoretical and empirical findings.

Secondly, the result of unit-root test indicated that based on current dataset, we failed to find evidence of a long-run equilibrium relationship through cointegration approach (all variables did not cointegrate in same order level, which is, $I(1)$). Although the quarterly data made the time series more comprehensive, the period that covered from 2006 to 2013 is just a short time period: the more comprehensive analysis needs to extend time series dataset. However, for this study it was difficult to cross a longer period because: firstly is the absence of available for quarterly data of total transactions of Internet consumption before 2006; and secondly the figure 7.1 shows that in the first quarter of 2006 the total transactions of online consumption only represented 0.36% of total retail sales of consumer goods, which means during that time Internet consumption was not a hotspot for China’s economic growth.

Thirdly, employment should be one of the most important contributions for Internet consumption, since the collective data shows that network entrepreneurs and employees are nearly 10 million on Taobao platform recent years. However, it is rather difficult to do quantitative analysis within econometrics models. E.g. this study was thinking to combine the dataset of unemployment rate with employment created by opening and being employed by online shops on the Taobao platform, but Chinese unemployment rate published by government authority was stable at 4% to 4.3% level within years with no change.

Fourthly, the study did not do the cross sectional analysis, neither. A report published by McKinsey Global Institute in March 2013 revealed that “e-tailing actually seems to spur incremental consumption in China, especially in lower-tier cities where there is pent-up demand for choice in merchandise that physical retail stores have not yet managed to deliver”, which should be a very interesting perspective to discuss about, however, the lack of available data made it was not done for this study. To fulfill this, it calls for designing a comprehensive questionnaire and then collecting a large amount of valid

feedback to cover as much cities as well as rural areas. This is impossible to finish by one person within a short time.

Finally, this study chose three industries and investigated their relationship to Internet consumption development. Although the test results are satisfied with expectations, the further study needs to cover more related industries in order to make the model more comprehensive.

Reference

- Alvarado, Rafael (2008). A Political Economy of Web 2.0. Available online: <http://transducer.ontoligent.com/?p=7>
- Anastasi, Joe (2004). The new forensics: investigating corporate fraud and the theft of intellectual property. John Wiley & Sons.
- Asteriou, D., and Hall, S. G. (2007). Applied Econometrics: a modern approach using eviews and microfit. New York: Palgrave Macmillan.
- Babin, Barry J., William R. Darden, and Mitch Griffin (1994). "Work and/or fun: Measuring hedonic and utilitarian shopping value." *Journal of consumer research*.
- Bello, W. (2001). "Creative destruction: next phase of the global economy." *Journal of Focus on Trade*, No. 65, Transnational Institute, Amsterdam.
- Chang, Elsie, Y. Chen, and R. Dobbs (2013). "China's e-tail revolution." *McKinsey Global Institute*. Retrieved June 17, 2013.
- Chen, Lihui (1998). "The Internet and Social Organization Remodeling: an ongoing profound social change". *Journal of Social Studies*, no.4: 11-28.
- Chen, Fangyu (2013). "The study of Chinese Internet consumption development and its impact on economic development." *Journal of Capital University of Economics and Business*. March 2013.
- Childers, Terry L., Christopher L. Carr, Joann Peck, and Stephen Carson (2002). "Hedonic and utilitarian motivations for online retail shopping behavior." *Journal of retailing* 77, no. 4: 511-535.
- China Online Retail Sector (2013), Australian Trade Commission, October 2013.

Choi, Soon-Yong, Dale O. Stahl, and Andrew B. Whinston. (1997). "The economics of electronic commerce." (p. 11) Indianapolis: Macmillan Technical Publishing.

Chu, Erming, and He, Shengyuan (2003). "Internet economy based consumption theory innovation." *Journal of Consumption Economy*, March 2003, pp. 57-60.

CNNIC statistical survey on Internet development, 2013. Available online:
<http://www1.cnnic.cn/IDR/ReportDownloads/201404/U020140417607531610855.pdf>

Du, Yan (2013). "The research on the action mechanism of express industry to the increment of national economy." *Journal of Beijing University of Posts and Telecommunications*, 3rd June, 2013.

Enders, Walter (2004). "Applied Econometric Time Series." NY: John Wiley & Sons.

Fong, C. O. (1986). Structures and Investment Opportunities in the Malaysian Economy. July, Routledge.

Forsythe, Sandra M., and Bo Shi (2003). "Consumer patronage and risk perceptions in Internet shopping." *Journal of Business Research* 56.11: 867-875.

Gujarati, Damodar. N. (1995). Basic econometrics. Tata McGraw-Hill Education.

Gupta, Alok, Bo-Chiuan Su, and Zhiping Walter (2004). "An empirical study of consumer switching from traditional to electronic channels: A purchase-decision process perspective." *International Journal of Electronic Commerce* 8.3: 131-161.

Hagel, John (1999). "Net gain: expanding markets through virtual communities." *Journal of Interactive Marketing*, 13.1: 55-65.

He, Shengming (2002). "Explanation on the theory of Internet consumption." *Journal of Huaiyin Teachers College Social Science*, Vol.245.

He, Shengming (2004). "Institutionalized process of Internet consumption". *Journal of Academic Exchange*, October 2004, 41-47.

Huang, Ming-Hui (2000). "Information load: its relationship to online exploratory and shopping behavior." *International Journal of Information Management*, 20.5: 337-347.

Huang, Zongjie (2001). "Internet Economy." *China Financial and Economic Press*, August 2001.

Huang, Zongjie, and Cai Jiuhui (2001). "Theoretical studies of consumption in the Internet economy." *Journal of Chengdu University of Information Technology*, Jun.2001, Vol.16, No.2.

Huq, A. (1994). *Malaysia's Economic Success*, Kuala Lumpur: Pelanduk Publications.

Jumbe, Charles BL (2004). "Cointegration and causality between electricity consumption and GDP: empirical evidence from Malawi." *Energy economics*, 26.1: 61-68.

Ji, Wanggang (2012). "Economics in online shopping." Available online: <http://wenku.baidu.com/view/bfca5fb8c77da26925c5b011.html>

Jiang, Qiping (1999). "Digital Wealth". The Ocean Press, pp.54.

Jiang, Tao, and Zang, Xuheng (2008). "Cointegration analysis of Chinese household final consumption and economic growth." *Journal of Macroeconomic Management*, No. 5, pp. 49-51.

Jiang, Xuehui (2012). "Economic effects of online shopping." *Journal of Chongqing University of Science and Technology (Social Science Edition)*, No.3.

Jin, Yijie (2011). "Study of relationship between Internet economy and China's national economy." *Journal of Shanghai Normal University*, March 2011.

Klein, Lisa. R. (1998). "Evaluating the potential of interactive media through a new lens: search versus experience goods." *Journal of Business Research*, 41, 195–203.

Koopmans, Tjalling C. (1947). Measurement without theory. *The Review of Economics and Statistics*, 29, 3, 161-172.

Li, Aiping (2005). "Chinese household consumption structure changes since 1978 and its impact on economic growth." *Journal of Inner Mongolia University*, No. 7, pp. 25-40.

Liang, Peng (2011). "Empirical study on the relationship between logistics industry and economic growth." *Journal of Dongbei University of Finance and Economics*, November 2011.

Lin, Mei (2012). "Impact of Internet economy on China's economic development." *Journal of Finance and Economics*, No.23.

Liu, Yucong (2012). "Chinese residents' consumption and economic growth - Empirical research based on the dynamic relationship." *Journal of Xiamen Radio & Television University*, May 2002, No.2, pp.32-40.

Lynch, Patrick D., Robert J. Kent, and Srini S. Srinivasan (2001). "The global internet shopper: evidence from shopping tasks in twelve countries." *Journal of Advertising Research* 41, no. 3: 15-24.

Marx, Karl (1973). *Grundrisse. Foundations of the Critique of Political Economy*. Translated With a Foreword by Martin Nicolaus. Random House.

Menon, Satya, and Barbara, Kahn (2002). "Cross-category effects of induced arousal and pleasure on the internet shopping experience." *Journal of Retailing* 78.1 (2002): 31-40.

North, Douglass C (1998). "Institutions, ideology, and economic performance." *The revolution in development economics* 2: 95.

OECD (2008). "The Seoul Declaration for the Future of the Internet Economy", Ministerial session, 18 June 2008, Available at: <http://www.oecd.org/internet/consumerpolicy/40839436.pdf> (accessed 29 March 2012).

Oliver, Richard L., Roland T. Rust, and Sajeev Varki (1997). "Customer delight: foundations, findings, and managerial insight." *Journal of Retailing* 73, no. 3: 311-336.

Palley, T. I. (2002). *A New Development Paradigm Domestic Demand-Led Growth: Why it is Needed and How to Make it Happen? Foreign Policy in Focus*. Discussion Paper, September 2002.

Park, Sung Youl (2009). "An Analysis of the Technology Acceptance Model in Understanding University Students' Behavioral Intention to Use e-Learning." *Journal of Educational Technology & Society*, December 2009, no. 3.

Peña-López, Ismael (2012). "OECD Internet Economy Outlook 2012."

Reardon, James, and Denny E. McCorkle (2002). "A consumer model for channel switching behavior." *International Journal of Retail & Distribution Management* 30.4: 179-185.

Report on the Work of the Government, 2014. Available online: http://news.xinhuanet.com/english/special/2014-03/14/c_133187027.htm

Say, Jean Baptiste (1971). "A Treatise on Political Economy: or the Production, Distribution, and Consumption of Wealth, translated by CR Prinsep and Clement C." Biddle, New York, Augustus M. Kelley, [1880] (1971).

Shim, Soyeon, Mary Ann Eastlick, Sherry L. Lotz, and Patricia Warrington (2001). "An online prepurchase intentions model: The role of intention to search: Best Overall Paper Award—The Sixth Triennial AMS/ACRA Retailing Conference, 2000.11 Decision made by a panel of Journal of Retailing editorial board members." *Journal of retailing* 77, no. 3: 397-416.

Soopramanien, Didier GR, and Alastair Robertson (2007). "Adoption and usage of online shopping: An empirical analysis of the characteristics of "buyers" "browsers" and "non-internet shoppers." *Journal of Retailing and Consumer Services* 14, no. 1: 73-82.

Smith, Adam (1776). "The Wealth Of Nations", New York: Modern Library, Book IV Chapter VIII, v. ii, p. 660.

Statistical Report on Internet Development in China (2013). China Internet Network Information Center, available online:
<http://www.cnnic.cn/hlwfzyj/hlwxzbg/hlwtjbg/201401/P020140221599048456830.pdf>

Stigler, George J (1961). "The economics of information." *Journal of political economy*: 213-225.

Teo, Thompson SH, and Yon Ding Yeong (2003). "Assessing the consumer decision process in the digital marketplace." *Omega* 31, no. 5: 349-363.

Varian, Hal R., and Carl Shapiro (1999). "Information rules: a strategic guide to the network economy." *Harvard Business School Press, Cambridge*.

Wang, Aicheng, and Zhang, Jingxue (2013). "The impact of Internet consumption on Chinese economic growth." *Journal of Technology Information*, 20th December: 158-161.

Wang, Fenge (2005). "Comparative analysis between traditional and Internet consumption." *Journal of Economist*, No.8.

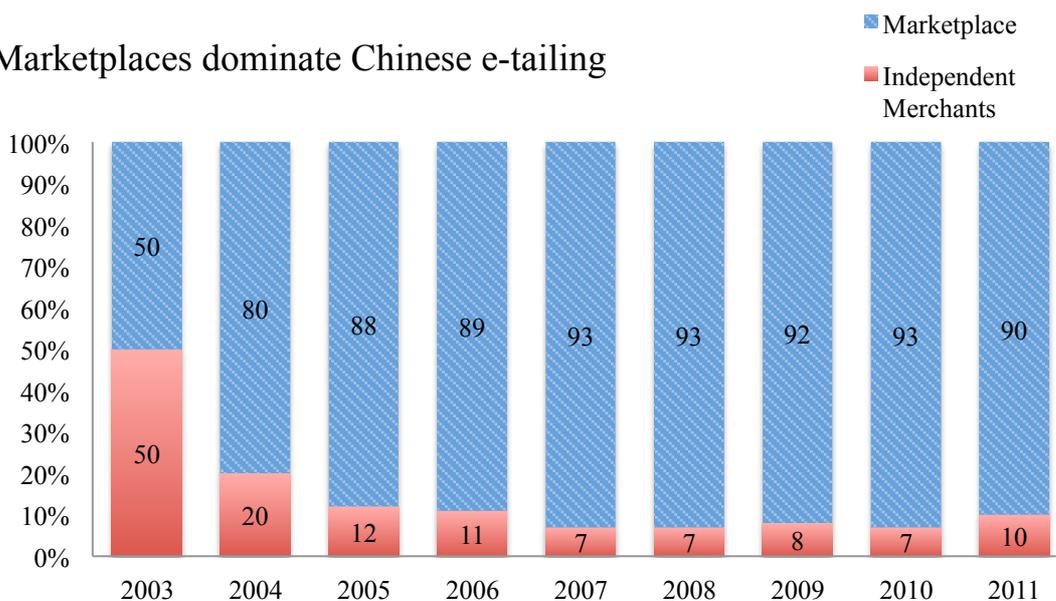
Watson, M. W. (1994). Vector Autoregressions and Cointegration. *Handbook of Econometrics*, 4, 2843-2915.

Wells, William D., and Prensky David (1996). "Consumer Behavior, 5th." *John Wiley & Sons* 55: 139-144.

- Whinston, Andrew. B. (2000). *Measuring the Internet economy*. Center for Research in Electronic Commerce, University of Texas at Austin.
- Wood, John Cunningham, ed. (1988). *Karl Marx's economics: critical assessments*. Vol. 1. Psychology Press.
- Wu, Jiapei (2000). "Internet economy and its impact on economic theory." *Journal of Academic Research*, No.1.
- Xu, Yongbing, and Wen, Hui (2002). "Empirical Analysis of changes in household consumption and economic growth." *Journal of South University of Technology*, No.3, pp.12-17.
- Yang, Rongchun (2007). "Economic analysis of college students' Internet consumption." *Journal of Chongqing University of Posts and Telecommunications (Social Science)*, Vol.19, No.3, May 2007.
- Yi, Xing (2006). "A study of theory and practice of cyber information in China." *Journal of Central China Normal University*, May 2006.
- Yuan, Zhiying (2007). "Dynamic econometric analysis of China's consumption and economic growth." *Journal of Today's Hubei*, No. 5, pp. 15-23.
- Zhang, Xiufang (2007). "Statistical analysis of China's telecom business revenue." Available online:
http://wenku.baidu.com/link?url=bO_S9UBqKyGY11tT3lkXxDx07Zlv79VMkE4qpJ8IqN4UImoHKimYUshAYWOie3cZMF25ZiYyc-jLML7DGmJSa_4BrToC3PE1O2Izx_B3a
- Zhao, Min (2013). "Impact of Internet consumption on the national economic development." *Journal of Economic Study*, No.46.
- Zwillenberg Paul, Field Dominic & Dean David (2014). "The connected world: Greasing the Wheels of the Internet Economy". The Boston Consulting Group, January 2014.
- 2013 China Internet Economy Report (Brief Edition), iResearch Consulting Group.

Appendix 1

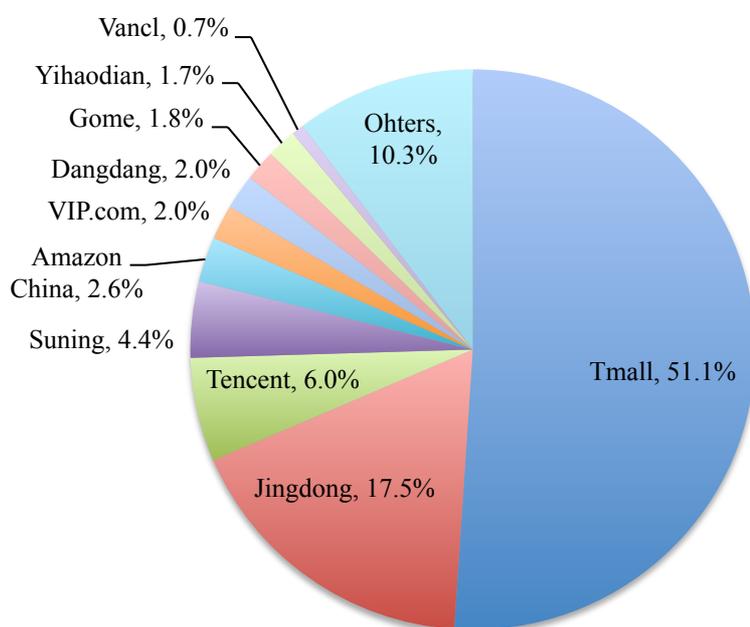
Marketplaces dominate Chinese e-tailing



Source: iResearch; McKinsey Global Institute analysis

Appendix 2

Transaction volume of China's B2C e-tailing sites in 2013, by share



Source: iReserach 2013